

U.S. Banking Deregulation, Small Businesses, and Interstate Insurance of Personal Income

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ABSTRACT

We estimate the effects of deregulation of U.S. banking restrictions on interstate personal income insurance for the period 1970 to 2001. Interstate income insurance occurs when personal income reacts less than one-to-one to state-specific output shocks. We find that insurance improved after banking deregulation, with a larger effect in states where small businesses are more important and on proprietors' income than on other components of personal income. Our explanation centers on the role of banks as a prime source of small business finance and on the close intertwining of the personal and business finances of small business owners.

SINCE THE 1970S, THE STRUCTURE OF THE U.S. banking industry has changed considerably following the deregulation of restrictions on branching and interstate banking. The ensuing wave of consolidation has increased the average bank's size and allowed banks to expand into new geographical markets by operating larger branch networks or bank holding companies. Because banks play a central role in the allocation of capital in the economy and are the prime source of finance to small businesses, we examine if these changes in bank market structure have had real effects for small business owners.¹ In particular, we examine whether interstate personal income insurance is higher after deregulation, where by income insurance, we refer to the extent to which,

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¹ We define small businesses as those having less than 100 employees. Based upon this definition, small businesses comprise an important part of the economy. In the average state, businesses with less than 100 employees made up 58% of total employment in 1978. (The Small Business Administration defines small businesses as having less than 500 full-time equivalent employees.)

in a given state, state-specific personal income fluctuates with state-specific shocks to output. In states that are financially integrated with other states, agents may trade claims on output (e.g., equity or direct investments) across state borders, sharing state-specific risks with residents of other states and hence partly insulating personal income from fluctuations in state-level output. However, through transactions with intermediaries such as banks, agents may also share output risks *indirectly* as the banks assume some of the risk and then share this risk with agents in other states. We therefore posit that interstate income insurance may have improved with deregulation as banking deregulation has improved integration of previously separated bank markets.

We estimate the effect of banking deregulation on income insurance using annual state-level data for the period 1970 to 2001. Our primary findings are as follows. First, we establish that banking deregulation has a positive effect on income insurance overall using four alternative measures of deregulation—two measures of *intrastate* banking deregulation and two measures of *interstate* banking deregulation. Based on regressions that do not control for other potential determinants of risk sharing, the marginal effect of deregulation is in excess of 10 percentage points, which means that a state-specific output shock is smoothed by 10% or more on average after deregulation. Second, we find that the impact of deregulation is larger in states in which small businesses are more prevalent: In states with many small businesses, the improvement in income insurance is on the order of 20 percentage points. Our results suggest that bank consolidation within deregulated states is an important driver of the disproportionately large effect for small businesses. When we explore whether other contemporaneous developments in financial markets may explain the estimated increase in risk sharing, we find that the higher impact of deregulation on risk sharing in states with more small businesses continues to hold. Finally, we provide additional evidence for our hypothesis by showing that the impact of banking reform is considerably larger for proprietors' income than for other components of personal income.

The informational opaqueness of small businesses without an established reputation for quality prevents them from raising arm's-length finance in public markets. However, banks can mitigate such informational asymmetries through repeated interaction and monitoring (Diamond (1984, 1991) and Rajan (1992)). When a bank provides finance to a firm, it shares risk with the firm's owners by bearing a part of the firm's output risk; in contrast, when a business is entirely owner-financed, the owner bears all output risk himself and cannot insure his personal income from shocks to his business. This is consistent with Agronin (2003), who finds that income insurance is lower in states where proprietors' income makes up a larger share of personal income. We document that states with many small businesses exhibit a lower average level of income insurance.

The banking reforms under study consist mainly of two types of deregulation, namely, intrastate deregulation, which allows banks to branch statewide, and interstate deregulation, which allows the formation of multistate bank holding companies. While this description may suggest that *interstate deregulation*

should be the main determinant of *interstate risk sharing*, intrastate banking deregulation may also affect risk sharing between states, if it allows for better risk sharing between small firms and their banks or among unaffiliated banks located in different states. We discuss these dimensions in turn.

Because intrastate banking deregulation has removed barriers to competition among banks, banking deregulation may have improved the insurance of personal income by increasing the availability of small business finance, whether to new or existing borrowers. Alternatively, banking deregulation may have altered banks' pattern of lending, such that they allow small business owners to further the separation of their personal finances from those of their firm. This latter channel would point to the importance of bank–borrower relationships for the efficiency of the capital allocation process. In a valuable bank–borrower relationship, the bank may have incentives to offer (self-enforcing) implicit contracts that facilitate insurance, for example, through the continued extension of credit during bad times (Allen and Gale (2000) and Boot (2000)). Each of these two channels would work to lower the correlation between output and personal income. Thus, intrastate banking deregulation is likely to be particularly relevant for small business lending. Intrastate mergers create larger banks that are typically more integrated in national markets than small local banks. For example, a large bank has extensive nation-wide (indeed, world-wide) operations compared to a small town community bank. Furthermore, banks share the risk with other banks and financial institutions by borrowing and lending in national interbank and money markets, that is, banks may borrow and lend out-of-state in order to help stabilize income of small business owners.² Hence, banking deregulation may affect income insurance without explicit multistate cross-ownership between banks.³

Along the interstate dimension, banking reform has affected interbank risk sharing as a result of mergers and acquisitions across state borders and the formation of multistate bank holding companies that manage capital and liquidity at the consolidated level (Houston, James, and Marcus (1997)). Further, interstate banking deregulation had effects on the average size of banks with similar effects as those discussed for intrastate banking deregulation.

The disproportionate increase in income insurance that we find for states with many small businesses is striking. We conjecture that deregulation may

² For example, banks in an agricultural state can stabilize income in that state by borrowing in the face of adverse weather shocks.

³ Banking deregulation may have affected interstate income insurance in other ways that are not necessarily related to small businesses. One channel may work through the capital income of households. Personal income may be smoothed through households' capital income if changes in the size of bank organizations smooth income streams earned by owners of securities issued by banks. Banks are owned, perhaps indirectly, by individual stock holders who ultimately bear the risk of the banks' operations. When stockholders live out-of-state, this results in interstate income insurance. Alternatively, multistate bank organizations may disperse the effect of state-specific shocks to the banking industry itself throughout the organization. For example, following losses in one state, layoffs and cost cuttings may be extended to subsidiaries and branches in other states. Further, if bank finance makes it easier for firms to raise external nonbank finance, banking deregulation may have helped smooth dividends paid by such firms.

have altered the pattern of banks' small business lending in three ways: (1) by improving the efficiency of banks' operations; for example, by leading to better screening or monitoring of small business borrowers, (2) by making banks less financially constrained with more leeway for sharing risk with small businesses; and (3) by improving efficiency of interbank capital allocation, that is, improving banks' ability to share risks among themselves, the benefits of which are passed on to small business borrowers. We discuss the empirical evidence underlying these conjectures in Section III.

U.S. banks have reported small business lending as part of their Call Reports only since 1993.⁴ Hence, we cannot directly test for changes in banks' small business lending following deregulation. However, we provide evidence that state-specific personal income is smoothed more following deregulation and that this improvement in income insurance is stronger in states with a relatively high prevalence of small businesses. We also demonstrate that proprietors' income is less procyclical following deregulation. These patterns are consistent with our hypothesis that banks' small business lending is important for the insurance of small business owners' income and that this channel of income insurance became more effective following deregulation.

Other papers document the real effects of branching deregulations in the United States. In an important contribution, Jayaratne and Strahan (1996) show that state-level per capita growth has increased in states that deregulated, both when measured in terms of personal income and state GDP.⁵ Our findings are closely related to those of Jayaratne and Strahan as both papers identify banking deregulation as an impetus for an economic process with significant real effects at the macro level. In this paper, however, we identify banks' insurance role in the financing of small businesses as a potential channel of welfare gain from bank integration. In addition, Petersen and Rajan (1994) find evidence that small businesses in the United States benefit from lending relationships. Our results complement theirs by pointing to the value of bank relationships in small business finance.

Our paper is also related to research on the integration of U.S. states. Morgan, Rime, and Strahan (2004) find that consolidation into multistate bank holding companies has lowered state-level output volatility and made state business cycles more similar across states. Asdrubali, Sørensen, and Yosha (1996) study income insurance through cross-regional holdings of debt and equity ("capital market income smoothing") and through the super-regional system of taxes and transfers ("federal government income smoothing").⁶

⁴ The Federal Deposit Insurance Corporation collects and stores Reports of Condition and Income (usually referred to as "Call Reports"), submitted by all insured national and state nonmember commercial banks and state-chartered savings banks on a quarterly basis. Call Reports data are a widely used source of timely and accurate financial data regarding a bank's condition and the results of its operations. For coverage of small business lending in the Call Reports, see, for example, Wolken (1998).

⁵ They also demonstrate that branching deregulation is exogenous to state-level growth, that is, states did not tend to deregulate in the expectation of an imminent economic upturn.

⁶ Atkeson and Bayoumi (1993) are the first to bring up the issue of income insurance across U.S. states through private capital markets. See also Crucini (1999) for another early paper on risk

The rest of the paper is organized as follows. Section I discusses the premises for our hypothesis that the effect of banking deregulation on interstate income insurance is particularly strong for small business owners. Section II briefly presents the history of banking deregulation in the United States. Section III discusses in more detail the channels through which deregulation may affect the insurance of state-specific personal income, and Section IV considers robustness issues. Section V describes our data, Section VI presents our measure of interstate income insurance, and Section VII presents the empirical results. Section VIII concludes.

I. Small Business Finance and U.S. Evidence

Our hypothesis that personal income insurance has improved with banking deregulation through its effects on banks' small business lending builds on two fundamental observations: (1) Small firms depend heavily on bank-intermediated finance, and (2) the financial position of business owners is closely intertwined with that of their businesses.⁷ In the following, we discuss these observations and their relation to our hypothesis.

It is well established empirically that bank-intermediated finance is one of the main sources of small business funding in the United States. For example, Berger and Udell (1998) present evidence from the 1993 National Survey of Small Business Finance (NSSBF), which demonstrates that small businesses rely heavily on commercial bank finance from their very first years. According to the survey, bank debt constitutes 16% of total assets for "infant" firms (0 to 2 years old), and 31% of total assets for "adolescent" firms (3 to 4 years old). For older firms, the ratio is 17% on average. This compares to total equity stakes of 48%, 39%, and 52%, respectively (Berger and Udell (1998), Table 1, p. 620). Overall, commercial bank debt is the most important external source of finance for small businesses.⁸

An important characteristic of small business finance is the intertwining of business owners' financial position with that of their businesses. Funds provided by the principal owner (mostly in the form of equity) are the *most* important source of financial capital, amounting to 35% of all funding. Further, outside finance often has personal commitments attached. Avery, Bostic, and Samolyk (1999) report that of the small firms that have loans, 80% have loans with personal commitments.⁹ Ang (1992) reports that about 40% of small business loans and 60% of loan dollars are guaranteed and/or secured by

sharing across U.S. states. Sala-i-Martin and Sachs (1992) suggest that the U.S. federal government provides substantial income insurance to states through procyclical taxes and countercyclical transfers. That paper, and many following it, focus on U.S. states as members of a successful currency union (the United States) that should be studied as a model for the formation of currency unions such as the European Monetary Union.

⁷ Ang (1992), Berger and Udell (1998), and Avery, Bostic, and Samolyk (1999).

⁸ The most common form of small business debt supplied by commercial banks—constituting 56% of total small business debt—is that of lines of credit. The next most important loan types are mortgage and equipment loans, at 15% and 10%, respectively (Berger and Udell (1998)).

⁹ That is, loans with either personal collateral or a personal guarantee attached. In the case of personal collateral, the creditor holds a prioritized claim on specific assets of the borrower and

personal assets. Berger and Udell (1998) find that 90% of commercial bank debt is secured.

Note that the 1993 NSSBF also documents the importance of insider sources of funding, especially equity, other than the owner, such as family, friends, and other people involved in the business. Such equity is the second most important source of funding, constituting 13% of total assets (Berger and Udell (1998)). Trade credit is the third most important source of funding.

The above observations are consistent with the notion that agency conflicts rooted in asymmetries of information are severe for small businesses. As noted above, the interpretation of our results centers on the dependency of small businesses on bank-intermediated finance.¹⁰ It is precisely because the average small business has no real substitutes for bank finance other than the owner's own funds or funds raised from family and friends that part of the efficiency gains from banking deregulation are likely to work through small businesses. Through the requirements of partial self-financing, collateral, and guarantees, and through monitoring and repeated interaction over time, banks may mitigate problems of adverse selection and moral hazard.¹¹

We conjecture that banking deregulation is likely to have improved personal income insurance by increasing the availability of small business loans or by altering the lending pattern of banks. Consider an entirely self-financed sole proprietorship. In this case, the small business owner bears all the firm's output risk himself—shocks to the surplus created in the firm will be transferred one-to-one to the owner's personal income. However, when the owner obtains external finance, the linkage between his personal finances and those of the business is relaxed and the covariation of personal income with output may fall. Banks may share risk with the owner when the business hits hard times by allowing the borrower to fall behind with payments of interest and installments, thereby avoiding initiation of formal bankruptcy procedures or liquidation of assets.¹² Banks may also share risk by absorbing part of the losses that result when a business defaults. Furthermore, the availability of external finance may help small business owners smooth their income to the extent that it facilitates diversification of the owners' sources of income: External finance may facilitate accumulation of savings outside the business; for example, in housing or financial investments, generating a stream of future income that is less than perfectly correlated with the success of the business.

controls the use of the assets. A personal guarantee is a more general claim on personal wealth that places fewer restrictions on the guarantor's use of his wealth. The figures are based on the 1987 and 1993 NSSBF and the Survey of Consumer Finances.

¹⁰ Although venture and angel finance are substitutes for some small firms, the above studies show that in terms of magnitude, these sources do not represent a real alternative to bank finance for the average firm.

¹¹ See, for example, Leland and Pyle (1977), Bester (1985), Besanko and Thakor (1987), and Holmstrom and Tirole (1997).

¹² In a study of U.K. firms in distress, Franks and Sussman (2005) find that banks typically attempt to rescue firms rather than initiate immediate liquidation. However, banks often contract lending during distress. While the U.K. may differ from the United States due to differences in bankruptcy laws, this direct evidence is at least suggestive of the potential for such behavior in the United States.

II. The History of U.S. Banking Deregulation

Banks' ability to operate branch networks and holding company structures has been subject to state legislation since the 1920s.¹³ Many states imposed restrictions on these banking activities both within and across state borders. During the 1980s and 1990s, however, such restrictions were gradually lifted in almost all states.

Until the 1980s, most states imposed some form of intrastate branching restrictions. Typically, these restrictions either completely prohibited branching within the state or restricted the geographical area in which a bank could open branches; for example, branching might be allowed in the county of the head office only. In 1985, statewide branching was limited in 26 states. Even in the second half of the 1990s, several states still maintained branch banking restrictions.¹⁴

Branching restrictions took two main forms: The first was directed at the ability of banks to branch through mergers and acquisitions, preventing a bank or a bank holding company from acquiring another bank and converting it into a branch. A bank holding company may establish a group of subsidiary banks as a substitute for a branching network, but with several drawbacks. Subsidiary banks must operate separate boards and be individually capitalized, which restricts loan limits. Also, the holding company structure incurs certain administrative costs associated with regulatory filing requirements (Amel and Liang (1992)). Thus, a branching network can realize economies of scale that a holding company structure cannot.¹⁵ The second form of branch banking regulations imposed limits on the opening of new (*de novo*) branches, protecting existing banks from entry by outside banks.

Differences in states' willingness to allow branch networks led to the development of very differently structured banking systems across states. For instance, while some states allowed only unit banking, other states permitted statewide branching. Branching restrictions, especially on *de novo* branching, often took the form of home office protection laws, prohibiting a bank from establishing a branch in an area in which the principal (home) office of another bank was located without the written consent of that bank. Areas with home office protection were typically small towns or rural areas with a population below a certain number.¹⁶ Such laws gave many small community banks home turf, shielding

¹³ The McFadden Act of 1927 essentially prohibited intrastate branching by subjecting the branches of national banks to state authority. The Douglas Amendment to the Bank Holding company Act of 1956 further restricted interstate expansion by barring bank holding companies from acquisitions in another state unless specifically authorized by that state.

¹⁴ See Table I.

¹⁵ In fact, several states also prohibited the formation of (intrastate) multi-bank holding companies during the first half of the sample. Except for Missouri all states had removed such prohibitions by 1985.

¹⁶ For example, in Connecticut, home office protection applied to *de novo* branching but not to branching through mergers and acquisitions. In 1986, statewide branching was allowed only in towns with a population of 100,000 or more. In 1987, the limit was lowered to 60,000 and it was completely removed in 1988. In 1977, Minnesota permitted two detached facilities in the municipality of the principal office or within 25 miles of the principal office, unless such location

them from competitive pressures. At the same time, banks' inability to diversify their portfolios geographically created a close interdependency between the local economy and the health of local banks.

When states began relaxing branching restrictions, branching by mergers or acquisitions was often authorized earlier than *de novo* branching. In fact, as many as 10 states did not permit statewide *de novo* branching well into the 1990s.¹⁷ Considerable consolidation therefore occurred—predominantly through mergers and acquisitions. Many bank holding companies jumped at the opportunity to convert their organization into a branching network (e.g., MacLaughlin (1995)), and hence the number of small community banks dropped significantly as they were attractive buy-out targets. At the beginning of our sample, the share of assets held by very small banks—banks with less than 25 million 1982-dollars in assets—was 35%. At the end of our sample this fraction had dropped to 0.6%.¹⁸ As a result, banks' average size increased. Increased competitive pressure, geographic diversification, and scale economies on both the loan and deposit side affected loan losses and the cost of capital, and in turn loan interest rates. Jayaratne and Strahan (1998) find that relaxation of intrastate branching restrictions was a source of large improvements in the efficiency of bank lending, allowing better run banks to capture a larger share of local markets. Low-cost banks grew faster than underperforming banks following deregulation, and state-level average loan losses and operating expenses fell.¹⁹ Large banks pursued branching aggressively but some community banks also engaged in branching in order to stay competitive (Wirtz (2005)).

There is evidence that consolidation spurred new branching in local bank markets. Berger et al. (1999) demonstrate that mergers and acquisitions explain 20% of subsequent *de novo* entry in metropolitan markets and 10% in rural markets, consistent with the suggestion that the reduction in small business lending due to consolidation has been replaced in part by lending of new entrants. For example, Wirtz (2005) reports that many smaller banks have branched into the previously unbanked communities in the states of Montana and North Dakota.

Interstate banking restrictions were also common in many states. Entry by bank holding companies chartered in other states was only gradually permitted by individual states during the 1980s. Maine was the first state to allow entry by

was in a municipality with a population less than 10,000 and different from that of the principal office, in which case written consent from incumbent banks was required. While the limit on the number of branches was later relaxed, the home office protection rule for municipalities of less than 10,000 population is still in place today.

¹⁷ Kroszner and Strahan (1999) analyze the determinants of bank deregulation and find that states with financially more unstable banks tended to deregulate earlier. Also, states with many small firms deregulated earlier, consistent with our hypothesis that deregulation-induced competition may be particularly important for small firms.

¹⁸ Authors' calculations from Call Report data.

¹⁹ Jayaratne and Strahan show that efficiency gains were passed on to borrowers as banks' average interest income per loan fell, finding only small statistically insignificant increases in bank profitability after deregulation.

out-of-state bank holding companies in 1978. Typically, acquisitions by out-of-state bank holding companies were limited to banks from same-region states and subject to reciprocity, with entry permitted only if the acquiring bank's home state allowed entry by banks from the target state, although some states were open to nationwide entry. Reciprocity was often a regional phenomenon with states in, say, the northeastern region of the United States allowing mutual entry. As in the case of branch banking, most states permitted entry only by mergers and acquisitions (as opposed to *de novo*) in the early phases of deregulation.²⁰

MacLaughlin (1995) documents that the deregulation of intrastate branching restrictions impacted market structure more quickly than the deregulation of interstate banking restrictions. However, banks' responses to interstate deregulations picked up considerable speed in the late 1980s, although bank holding companies tended to expand intraregionally, rather than cross-regionally.

Interstate branching was finally permitted on a nationwide basis with the Riegle–Neal Interstate Banking and Branching Efficiency Act. This law became effective June 1997, although states had the opportunity to opt in at an earlier date. Given the date of this act falls at the very end of our sample, we do not consider interstate branching deregulation in our empirical analysis.

III. Channels of Improvements in Personal Income Insurance

Banking deregulation is likely to have improved interstate income insurance by increasing the *level* of bank intermediated finance to small businesses or by changing the *pattern* of supply. In particular, improved integration of bank markets caused by changes in banks' reach, organization, and size, is likely to have affected banks' costs and ability to share risks. In this section, we discuss the empirical evidence on which we base our conjecture that changes in the pattern of lending play an important role for the effect of deregulation on the smoothing of personal income.

A. Geographical Diversification and Bank Efficiency

Geographical diversification improves banks' ability to bear (idiosyncratic) credit risk. Diversified banks are likely to operate with fewer financial constraints and are less sensitive to local recessions, increasing their ability to share risk with their borrowers. Demsetz and Strahan (1997) show that better diversification in large bank holding companies permits operation with higher leverage and more business loans in the portfolio. This is also related to bank

²⁰ For example, in 1987 Alabama allowed reciprocal entry by out-of-state bank holding companies from the states of AR, DC, FL, GA, KY, LA, MD, MS, NC, SC, TN, VA, and WV. Acquired banks had to be at least 5 years old and could not branch across county lines for 7 years after acquisition. *De novo* entry was prohibited. Furthermore, acquiring holding companies had to hold at least 80% of their deposits in the region. In 1988, this group was expanded to include TX and, in 1995, Alabama allowed national interstate banking on a nonreciprocal basis.

size: Larger banks facilitate income insurance through geographical diversification of their loan portfolios, whereas the lending behavior of smaller banks will be more closely tied to the health of the local economy.

Deregulation is likely to have altered the lending behavior of banks if incumbent banks in previously protected markets were operating inefficiently and deregulation permitted the entry of better managed banks. If entering banks were superior in the screening of potential borrowers' prospects and lend to firms with higher net present value projects, more high-quality borrowers would have been financed. Jayaratne and Strahan (1996) argue that average bank efficiency improved after deregulation and show that losses on banks' loan portfolios fell, suggesting that poorly operating banks were either absorbed or squeezed out of the market.

B. Internal Capital Markets in Bank Holding Companies

Banks that belong to a multibank organization may establish internal capital markets, reallocating capital among subsidiaries, and thereby share risks with borrowers at a lower cost. Houston and James (1998) show that unaffiliated banks are more cash-flow-constrained than banks affiliated with a holding company. Ashcraft (2006) argues that banks affiliated with a holding company have better access to external funds, and further, that stand-alone banks face more severe financial constraints than affiliated banks. As a consequence, in states where stand-alone banks have more market share, aggregate lending is relatively more affected by monetary policy contractions. Thus, multistate bank holding companies may enjoy the largest benefits from the interaction of geographical diversification and internal markets.

C. Bank Size and Risk Sharing among Banks

There is reason to believe that bank size may be related to income insurance. Kashyap and Stein (2000) argue that small banks are at an informational disadvantage in wholesale markets compared to larger banks, which are less opaque and better able to overcome problems of asymmetric information. They show that small banks do not use uninsured funds to smooth the effect of monetary policy contractions.²¹ Ostergaard (2001) finds evidence that these frictions are significant at the state level and that bank lending in states dominated by small banks is more closely tied to banks' internal generation of capital. This implies that larger banks may have an advantage in the sharing of risks with counterparties in national money and capital markets. It also suggests that larger banks have greater flexibility in their transactions with small business owners. A shift in the size distribution away from small community banks toward larger banks may therefore increase the scope for income insurance.

²¹ "Small banks" refers to those in the bottom 95% of the size distribution.

D. Changes in the Supply of Credit to Small Businesses

An improvement in interstate income insurance would also be consistent with a general increase in the availability of small business finance following deregulation, for example, because loans enable new investment or the accumulation of other assets, leading to greater cross-state ownership of claims. Call Report data on small business loans by U.S. banks do not exist prior to 1993 and we know of no direct evidence on banks' small business lending prior to this date. Jayaratne and Strahan (1996) study the effect of deregulation on *total* bank loan growth and find only weak positive effects. It appears that deregulation did not shift the overall supply of loans significantly, although we know little about potential changes in portfolio composition.

Several studies use post-1993 data to address whether mergers and acquisitions affected the volume of small business lending. Their findings are possibly informative about the effects of the reorganization that took place in the 1980s.²² Generally, the evidence does not support the notion that small business lending contracted despite consolidation in the banking industry and the fact that larger banks typically carry fewer small business loans on their books than do smaller banks. On the other hand, there is little evidence to support the opposite conclusion, that small business lending tended to increase.

E. Competition and Lending Relationships

Consolidation in the banking industry altered competition between banks and, in turn, the costs and benefits to firms involved in banking relationships. Through the lending process, banks acquire information about borrowers. An informed bank can use its information monopoly to extract rent from the borrower (Sharpe (1990), Rajan (1992)). Competition between lenders limits the sustainability of implicit contracts and the sharing of intertemporal surplus between borrowers and lenders as found by Petersen and Rajan (1995). However, Boot and Thakor (2000) argue that increased competition may induce banks to invest relatively more in relationships because the return on relationship lending improves relative to the return on transaction lending. If consolidation lowered competition in deregulated states, it may have improved the value of bank-borrower relationships and banks' willingness to share risks. Alternatively, if deregulation increased competition, relationships may have been adversely affected.²³ Whether deregulation had an impact on income insurance through changes in competition between banks is ultimately an empirical question. Our results suggest that potentially detrimental effects on income insurance, if they exist, are of second-order importance.

²² See Peek and Rosengren (1998), Strahan and Weston (1998), Goldberg and White (1998), and DeYoung (1998).

²³ Considering the effect of interstate branching deregulations starting in 1994, Dick (2003) reports that concentration at the regional level increased, whereas concentration at the urban (MSA) level remained unchanged. See also the discussion in Black and Strahan (2002) on the effect of competition on business creation.

IV. Alternative Explanations for the Increase in Income Insurance

In this section we examine alternative explanations for the increase in income insurance that we document. In particular, we explore potential factors other than banking deregulation that may have helped improve the integration of capital markets.

A. Changes in Lending Technology

Petersen and Rajan (2002) document that the nature of small business lending by banks has changed since the 1970s. Technological advances in computers and communications equipment and the advent of intermediaries specializing in the collection and processing of firm-specific information have enabled banks to substitute hard for soft information in the lending process. This has helped advance the use of data-based lending decisions involving systematic and periodic assessment of borrowers through information about firms' accounts, their use of trade credit, and the like. While small business lending has traditionally involved the processing of intangible (soft) information, necessitating that lending decisions be made in close geographical proximity to the location of the borrower, the use of new technology has allowed banks to lend at a greater distance. Petersen and Rajan show that the distance between banks and their small business borrowers has been steadily increasing since the 1970s.²⁴

Banks that lend at greater distances help integrate capital markets and improve the sharing of risks. They may also benefit bank-dependent borrowers such as small business owners. Lending across state borders improves interstate insurance because of portfolio diversification effects, as banks bear output risk from borrowers residing in different states. Also, firms are able to borrow from a wider range of banks, which directly affects the availability and cost of finance. Further, obtaining a loan from a distant reputable bank may improve a borrower's access to other (nonbank) sources of finance (certification effect).

The trend of increased distance in lending documented by Petersen and Rajan is found for the years that we use in our study. Hence, if technological change is correlated with deregulation, it may be the case that we are measuring the effect of technological change on income insurance rather than the effect of deregulation. If so, we need to allow for changes in lending technology in our empirical specification.

Kroszner and Strahan (1999) argue that banking deregulation and technological change are correlated. Specifically, they argue that deregulation occurred when the benefits enjoyed by private interest groups (small banks and insurance firms) in favor of banking restrictions were eroded by, among other things, technological innovations that altered the costs and benefits of the restrictions. The ability to lend without soft information would be one such innovation. For the improvement in income insurance to be driven by changes in technology rather than deregulation, the cross-sectional pattern of technological change

²⁴ They estimate that a firm that began borrowing from its lender in the 1990s was approximately 35% further away from its lender than an otherwise identical firm that started borrowing in the 1980s.

must coincide with the pattern of deregulation. Essentially, states should deregulate only *after* banks had already started lending to out-of-state borrowers and branching restrictions were less binding.

It is plausible, however, that banking consolidation and technological change are related rather than separate trends. If lending procedures based on hard information involve economies of scale, banks need a certain size to reap the benefits, which in turn necessitates consolidation. That is, consolidation may precede technological change. For example, there are fixed costs in association with auditing borrowers and collecting information from them, acquiring and installing systems to process and store this information, acquiring information from data providers external to the bank, training employees to work with the system, etc. This is consistent with the observation that large banks tend to lend at greater distances than small banks (Berger et al. (2005)).

B. Development of National Mortgage Markets and Expansion in Credit Card Debt

Consumer credit markets have developed considerably during our sample period. Credit card loans have become widely available and the securitization of mortgage debt has accelerated since 1980 when government-sponsored enterprises were authorized to engage in the issuance of mortgage-backed securities. It is possible that the deepening of these markets (partly) explains our results.

In principle, borrowing in credit markets helps smooth consumption rather than personal income (Asdrubali, Sørensen, and Yosha (1996)). However, small business owners may use consumer credit for some firm-related expenditures. Also, they may substitute sources of funds by, say, using credit card debt as a buffer during a credit crunch. However, according to the 1993 NSSBF, credit card debt makes up only 0.14% of all finance (equity and debt), while bank debt, the largest external source of finance, constitutes 19% of all finance (Berger and Udell (1998), Table 1).²⁵ Hence, the data do not seem to support the hypothesis that greater availability of unsecured credit card debt may be driving our results, because small business owners do not use consumer credit as a source of finance on a scale that may explain the magnitude of income insurance we measure. Furthermore, for this conjecture to be warranted, the improved access to credit card debt would have to be correlated with the *cross-sectional* pattern of deregulation, which seems unlikely.

Another major development, the emergence of national mortgage markets, may also have facilitated income insurance. The securitization of mortgage loans entails the pooling of risk and increases capital flows between states as households hold these claims through intermediaries such as insurance companies, pension, and mutual funds, etc. This implies that securitization may be contributing to the overall positive trend in income insurance that we observe.

The evolution of a liquid secondary market for mortgages has helped shift interest rate risk from banks and other institutions originating mortgages to

²⁵ The number includes both the firm's and the owner's credit card debt when used for firm purchases.

investors in capital markets, improving the financial flexibility of these institutions.²⁶ To the extent this has had a stabilizing effect on the supply or cost of finance collateralized by real estate, small business owners have benefited too as mortgage loans are a source of small business finance.²⁷

For securitization to explain the disproportionate increase in income insurance in states with more small businesses, mortgage debt must have been a sufficiently flexible source of finance for small business owners that it has enabled significant income smoothing. However, the use of mortgage finance does not seem pervasive enough to explain the considerable increase in income insurance we measure. Berger and Udell (1998) report that mortgage debt used for business purposes constitutes on average 14% of debt to financial institutions, which amounts to only 4% of all funding and 7% of all debt (Berger and Udell (1998), Table 2). Also, these figures are from the 1993 NSSBF, which is close to the end of our sample where the effect from securitization is likely to be strongest.

If, on the other hand, consolidation improved the ability of banks to benefit from securitization, and these benefits were passed on to bank-dependent borrowers, this would constitute a causal effect of deregulation and would be consistent with our hypothesis. However, one cannot entirely rule out that banks reaped benefits from securitization for reasons unrelated to deregulation. If this is the case, the trend in securitization should be part of our empirical specification.

V. Data

We use a panel of variables for the 50 U.S. states minus Delaware and South Dakota for the period 1970 to 2001.²⁸ Below, we describe the main sources of data and the methodology used to construct the variables used in the analysis. As all our measures are in per capita terms, we generally omit the term “per capita” for the sake of brevity. Growth rates of real per capita variables are calculated as the first differences of the natural log of per capita-level values.²⁹

State Gross Domestic Product: We use Bureau of Economic Analysis (BEA) data for gross state product, which is defined as the value added of the industries of a state, deflated by the consumer price index to obtain real per capita state gross domestic product, which for brevity we refer to simply as “gross state product” (GSP).

²⁶ See, for example, Pennacchi (1988).

²⁷ A negative correlation between mortgage rates and the volume of securitization is often found in empirical work; see, for example, Kolari, Fraser, and Anari (1998). However, Heuson, Passmore, and Sparks (2001) argue that this relationship may be an effect of reverse causality.

²⁸ We exclude Delaware and South Dakota from the sample due to laws that provide tax incentives for credit card banks to operate there. As a result, the banking industry in these two states grew much faster than in other states in the 1980s.

²⁹ We deflate output using the consumer price deflator rather than the output deflator because we want to measure the purchasing power of output.

Personal Income: We use BEA state-level personal income deflated by consumer prices to obtain real per capita personal income by state.³⁰ Measures of the components of personal income, proprietors' income, wages, and dividends, interest, and rental income are also taken from the BEA.

Intrastate Branching Restrictions: We measure the direct effect of branching deregulation using two indicator variables: $D^{m\&a}$ equals one in years in which *state-wide* branching by mergers and acquisitions is permitted, and D^{novo} equals one in years in which *state-wide* de novo branching is permitted. These definitions follow Jayaratne and Strahan (1996) and Kroszner and Strahan (1999). Deregulation dates come from Amel (1993) and Kroszner and Strahan (1999), updated from individual states' codes and bills available from the state legislatures; see Table I.

Interstate Banking Restrictions: We measure the direct effect of interstate banking deregulation by the indicator variable D^{inter} , which equals one in years in which entry by out-of-state bank holding companies is permitted (by mergers and acquisitions). We further define the variable D^{reci} , which takes into account the fact that most states allowed entry by banks from only neighboring states and on a reciprocal basis. We define D^{reci} as the fraction of (outside) states in the sample from which entry is de facto allowed, taking into account whether the reciprocity constraint for each individual outside the state is binding or not. The variable, therefore, takes fractional values between zero and one, where the value of one means that banks from any other state are able to enter, and the value of zero means that banks from no other states are able to enter.³¹ Information on deregulation dates and reciprocity rules is available from Amel (1993) and our own updates from individual states' codes and bills available from the state legislatures.

Small Business Employment: We measure the degree of importance of small businesses in a state as the proportion of people employed in small business establishments relative to total employment in 1978, the earliest date available. (Data for the share of small businesses in the population of *firms* is only available from 1988.) We split states into three equal-sized groups according to this measure ("high," "low," and "middle") and say that small businesses are relatively more prevalent in a state if the state belongs to the "high" group. By *small* we refer to establishments with a number of employees less than 100.

³⁰ Interstate smoothing of earnings can occur by commuting across state borders. The BEA takes into account commuters' income in the construction of personal income data. Therefore, our measure incorporates this type of interstate income insurance. The same feature holds for distributed profits, interest, and rent, which occur when residents of one state hold securities of corporations and property in other states.

³¹ For example, in 1978, Maine allowed national reciprocal entry but no other state allowed entry; hence, de facto, no out-of-state banks were allowed entry. In 1982, New York allowed reciprocal entry and Alaska allowed national nonreciprocal entry. Hence, de facto New York and Maine allowed entry from only two outside states, whereas Alaska allowed entry from 49 outside states. If reciprocal entry is permitted from specific states only, we count whether the reciprocity constraint binds for each individual state: D^{reci} equals the number of states with de facto entry divided by the number of states in the sample minus one.

Table I
Year of Banking Deregulation

Amel (1993), Kroszner and Strahan (1999), and authors' updates from individual states' state codes available from the state legislatures. For states that deregulated before 1960 the date is listed as 1960. *** indicates that states did not deregulate until the end of the sample period, 2001.

States	Statewide Branching through M&As Permitted	Interstate Banking Permitted	Statewide de novo Branching Permitted
Alabama	1981	1987	1990
Alaska	1960	1982	1960
Arizona	1960	1986	1960
Arkansas	1994	1989	1999
California	1960	1987	1960
Colorado	1991	1988	1997
Connecticut	1980	1983	1988
Delaware	1960	1988	1960
District of Columbia	1960	1985	1960
Florida	1988	1985	1988
Georgia	1983	1985	1998
Hawaii	1986	1995	1986
Idaho	1960	1985	1960
Illinois	1988	1986	1993
Indiana	1989	1986	1991
Iowa	1997	1991	***
Kansas	1987	1992	1990
Kentucky	1990	1984	2001
Louisiana	1988	1987	1988
Maine	1975	1978	1975
Maryland	1960	1985	1960
Massachusetts	1984	1983	1984
Michigan	1987	1986	1988
Minnesota	1993	1986	***
Mississippi	1986	1988	1989
Missouri	1990	1986	1990
Montana	1990	1993	1997
Nebraska	1985	1990	***
Nevada	1960	1985	1960
New Hampshire	1987	1987	1987
New Jersey	1977	1986	1996
New Mexico	1991	1989	1991
New York	1976	1982	***
North Carolina	1960	1985	1960
North Dakota	1987	1991	1996
Ohio	1979	1985	1989
Oklahoma	1988	1987	2000
Oregon	1985	1986	1985
Pennsylvania	1982	1986	1989
Rhode Island	1960	1984	1960
South Carolina	1960	1986	1960
South Dakota	1960	1988	1960
Tennessee	1985	1985	1990

(continued)

Table I—Continued

States	Statewide Branching through M&As Permitted	Interstate Banking Permitted	Statewide de novo Branching Permitted
Texas	1988	1987	1988
Utah	1981	1984	1981
Vermont	1970	1988	1970
Virginia	1978	1985	1986
Washington	1985	1987	1985
West Virginia	1987	1988	1987
Wisconsin	1990	1987	1989
Wyoming	1988	1987	1999

**Table II
Definition of Variables**

$PINC_{it}$	The growth rate of (real) personal income (per capita) in state i in period t .
$\widetilde{PINC}_{it}$	$PINC_{it}$ minus its mean across states minus its mean across time.
GSP_{it}	The growth rate of (real) gross state product (per capita) in state i in period t .
$\widetilde{GSP}_{it}$	GSP_{it} minus its mean across states minus its mean across time.
INC_{it}	The growth rate of (real) personal income components (per capita) in state i in period t .
$\widetilde{INC}_{it}$	INC_{it} minus its mean across states minus its mean across time.
$D^{m\&a}$	An indicator variable that equals one in years in which statewide branching by mergers and acquisitions was permitted.
D^{novo}	An indicator variable that equals one in years in which statewide de novo branching was permitted.
D^{inter}	An indicator variable that equals one in years in which entry by out-of-state bank holding companies was permitted.
D^{reci}	The fraction of (outside) states in the sample from which entry is de facto allowed, taking into account whether the reciprocity constraint for each individual outside state is binding or not.
TECH	Bank lending technology, measured as the log of the value of bank loans scaled by the number of bank employees in state i at date t .
MBS	The ratio of the cumulative outstanding volume of mortgage backed securities issued by Government Sponsored Enterprises scaled by U.S. GDP (divided by 10^6 for scaling).
α_i	A state fixed effect.
ν_t	A time fixed effect.

The data come from the Geospatial and Statistical Data Center, University of Virginia library.³² Employment is paid employment, which consists of full- and part-time employees, including salaried officers and executives of corporations. Included are employees on sick leave, holidays, and vacations; not included are proprietors and partners of unincorporated businesses.

³² See <http://fisher.lib.virginia.edu/collections/stats/cbp/state.html>.

Proprietors' Income: This component of personal income is the current production income (including income in kind) of sole proprietorships, partnerships, and tax-exempt cooperatives. Corporate directors' fees and the imputed net rental income of owner-occupants of farm dwellings are included in proprietors' income, but the imputed net rental income of owner-occupants of non-farm dwellings is included in rental income of persons. Proprietors' income excludes dividends and monetary interest received by nonfinancial businesses and rental income received by persons not primarily engaged in the real estate business; these income items are included in dividends, net interest, and rental income of persons, respectively. The data come from the BEA.

Cumulative Mortgage-Backed Securities: Mortgage-backed securities are net issues of federally related mortgage pool securities by the Government National Mortgage Association, Fannie Mae, Freddie Mac, and the Farm Service Agency. The data come from the *Flows of Funds Accounts* of the United States ("Agency- and GSE-Backed Mortgage Pools," Table F.210).

Lending Technology: We define TECH, a measure of banks' use of hard information, as the value of state-level bank loans per employee similar to Petersen and Rajan (2002). The data come from Call Reports.

Table II provides the definition of the variables used in the regressions.

VI. Measuring Income Insurance

We measure the degree to which personal income is insured between U.S. states. Our measure builds on the method of estimating risk sharing through capital markets developed by Asdrubali, Sørensen, and Yosha (1996). The following set of assumptions are standard in the risk-sharing literature. A representative consumer of each region maximizes lifetime expected utility from consumption. If utility functions are of the Constant Relative Risk Aversion variety and all regions have a common intertemporal discount factor, the optimal risk-sharing allocation satisfies $C_{it} = k_i C_t$ for all t and all realizations of uncertainty, where C_{it} and C_t denote state-level and aggregate consumption, respectively. The constant k_i is independent of time and the state of the world and reflects the relative value of state i 's endowment stream including initial wealth.

Because our focus is on the interconnection of small business owners' personal finances with the finances of their firms, we examine income insurance (smoothing). If full risk sharing is achieved via income smoothing, then $INC_{it} = k_i INC_t$, where INC_{it} and INC_t denote state and aggregate personal income per capita, respectively. If income is fully insured, the income of different states may be at different levels but since the constant k_i is independent of time, full income insurance implies that all states have identical growth rates of income. This implication forms the basis of our empirical estimations.

Let $PINC_{it}$ and y_{it} denote the *growth rates* of state personal income and GSP, respectively. Under full income insurance all states have the same growth rate of income: $PINC_{it} = PINC_{jt}$ for all states i and j at all dates t . Equivalently, $PINC_{it} - \overline{PINC}_{.t} = 0$, where $\overline{PINC}_{.t}$ is the period t average across all states. The

interpretation is that average income growth cannot be insured through cross-state income diversification while $y_{it} - \bar{y}_{it}$, the idiosyncratic component of output, can be fully insured.³³ We also refer to $(y_{it} - \bar{y}_{it})$ and $(\text{PINC}_{it} - \overline{\text{PINC}}_{it})$ as state-specific output and state-specific personal income, respectively.

We prefer that our measure of risk sharing be robust to long-lasting differences in income and output growth. States with a high immigration of retirees, such as Florida, may see income growing faster than output when retirees—who do not produce output but do receive income—move in. We therefore consider output and income in state i adjusted for state-specific means, that is, we study how much $\widetilde{\text{PINC}}_{it} = \text{PINC}_{it} - \overline{\text{PINC}}_{it} - \overline{\text{PINC}}_i$ co-varies with $\tilde{y}_{it} = y_{it} - \bar{y}_{it} - \bar{y}_i$, where for any variable x_{it} we define $\bar{x}_i = \frac{1}{T} \sum_{t=1}^T x_{it}$, with T denoting the number of years in our sample, and $\bar{x}_t = \frac{1}{N} \sum_{i=1}^N x_{it}$, with N denoting the number of states in our sample.

Rather than testing if risk sharing is perfect, we define a measure of income insurance that takes the value of zero if income moves one-to-one with output (no income insurance), that is, if $\widetilde{\text{PINC}}_{it} = \tilde{y}_{it}$, and the value of one if income does not co-move with output (full income insurance). More precisely, we measure the amount of income insurance by the estimated coefficient β in the panel data regression

$$\tilde{y}_{it} - \widetilde{\text{PINC}}_{it} = \beta \tilde{y}_{it} + \epsilon_{it}. \quad (1)$$

The coefficient β declines with the degree of pass-through of state-specific output growth to state-specific income growth. A value of $\beta > 0$ implies income insurance, and the more positive is β , the less state-specific income co-moves with state-specific output. We interpret a value of one as perfect income insurance. We multiply the estimated β -value (and other parameters) by 100, and therefore refer to β as the percentage of risk shared.

In order to examine if income insurance changes with banking deregulation, we allow the coefficient that measures the amount of income insurance to vary by state and over time, in other words, we estimate the relation

$$\tilde{y}_{it} - \widetilde{\text{PINC}}_{it} = \mu_i + \nu_t + \beta_{it} \tilde{y}_{it} + \epsilon_{it}, \quad (2)$$

where

$$\beta_{it} = \beta_0 + \beta_1 x_{it}, \quad (3)$$

and μ_i and ν_t are state and time fixed effects (dummy variables), respectively.³⁴

In this regression the inclusion of the x_{it} -term allows the amount of income insurance to vary with the value of x_{it} . The coefficient β_0 then measures the

³³ We could subtract the aggregate rather than the average with very little effect on the results and no change in the interpretation.

³⁴ Equation (1) is written in terms of deviations from state and time averages. Hence, including fixed effects will not change the estimated value of β_0 . The fixed effects have no impact in equation (2) because the variables are in the form of deviations from time- and state-specific means, but they have an impact when interaction terms are included below.

average amount of income insurance when x_{it} is zero.³⁵ We refer to such x_{it} -terms as interaction terms. The coefficient β_1 measures the increase in income insurance associated with a one-unit increase in x . The focus of much of our work is on the size of this coefficient. In particular, if this coefficient is significantly different from zero, it implies that the relevant x -variable has an impact on income insurance. In the following we discuss the detailed implementation for various interaction variables—depending on the specific variable, x_{it} will be unadjusted, adjusted for its overall mean, or adjusted for the mean state-by-state. We discuss these details next.

Our main interaction terms are dummy variables for various types of banking deregulation. Let D_{it} be a generic term that describes one of our three dummy variables for banking deregulation, as explained in Section V. These dummies all take the value of zero in state i in the years before deregulation, and the value of one after deregulation. In this case, β_0 measures the amount of income insurance before deregulation and $\beta_0 + \beta_1$ measures the the amount of income insurance after deregulation, where β_1 is the change in income insurance. For the continuous measure of interstate banking deregulation, D_{it}^{reci} , β_1 measures the increase in income insurance in a state that moves from prohibiting out-of-state entry to nationwide entry (that is, when D_{it}^{reci} goes from zero to one).

Several things changed in the financial markets over the period we examine. Of particular relevance is the integration of mortgage markets into a nationwide market and technological advances that allowed physical distances between banks and firms to increase. These developments potentially led to greater risk sharing between states. Because these developments partly took place at the same time banking regulations were relaxed, we need to examine whether banking integration is still an important explanatory factor when these other competing explanations are taken into account.

Petersen and Rajan (2002) verify that changes in lending technology allow banks to lend at larger distances. The lending technology used by banks is not directly observable and thus the authors use as an approximation the measure TECH , bank loans per employee, which is basically a proxy for banks' lending efficiency. We examine whether TECH helps predict the amount of income insurance that states obtain and, in particular, if our measures of banking deregulation help explain insurance when lending technology is included as an explanatory factor.

We estimate the relation

$$\beta_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 (\text{TECH}_{it} - \overline{\text{TECH}}_i), \quad (4)$$

where “ D ” refers to one (or several) of our measures of deregulation. Lending technology is likely to vary between, say, agricultural states and financial center states, which we control for by subtracting the state-level average. The results of this regression must be interpreted with care: Deregulation allows

³⁵ Such regressions were previously used to estimate risk sharing by Melitz and Zumer (1999) and Sørensen et al. (2007).

for banks to merge into larger organizations that are likely at an advantage in using data-based lending technology because such technologies are associated with economies of scale. Therefore, technological change may be a competing explanation for increased income insurance but it may also be the result of banking deregulation. Nonetheless, it is important to determine whether banking reform improved risk sharing even after lending technology is taken into account.

The nationwide integration of mortgage markets may well be another reason risk sharing increased during our sample period. We explore this issue to a limited extent. We define *MBS* to be the total outstanding amount of securitized mortgage assets issued by government-sponsored enterprises divided by GDP. We then estimate

$$\beta_{it} = \beta_0 + \beta_1 x_{it} + \beta_2(MBS_t - \overline{MBS}). \quad (5)$$

If β_2 is significant and positive this implies that the securitization of mortgage markets is associated with better income insurance. We do not attempt to identify state-varying impacts from the integration of mortgage markets. This question is highly interesting in its own right but a more detailed study of it would take us too far afield in this paper.³⁶

Risk sharing between states may increase over time due to a myriad of underlying economic causes besides those just discussed. We therefore examine the effect of including a quadratic trend in risk sharing in our estimation. In particular, for a relevant variable *x*, we specify the coefficient β_{it} as

$$\beta_{it} = \beta_0 + \beta_1 x_{it} + \beta_2(t - \bar{t}) + \beta_3(t - \bar{t})^2, \quad (6)$$

where the *x*-variable is adjusted for its overall mean or state-specific mean in the same way as in the regressions without a trend. We include a term that is quadratic in time because income insurance cannot grow linearly forever.³⁷

In order to test whether banking integration improved income insurance for small business owners, we split our sample of states into three subsamples according to the fraction of small businesses. We have argued that small businesses are most dependent on bank finance so it is essential for our

³⁶ As a technical matter, we deduct the mean value of *MBS* because this keeps the interpretation of β_0 unchanged. When *MBS* is not included in the regression, β_0 measures (approximately) the amount of risk sharing when *MBS* takes its average value. In a regression in which *MBS* is included and $\overline{MBS}$ is not subtracted from *MBS*, the interpretation of β_0 is the amount of risk sharing when *MBS* = 0. Typically, if $\hat{\beta}_0$ is the estimate of β_0 from the former regression and $\tilde{\beta}_0$ is the estimate from the latter regression, one would find $\tilde{\beta}_0 = \hat{\beta}_0 - \hat{\beta}_2 \overline{MBS}$ while the estimated value of β_0 would be approximately invariant when the average has been subtracted from *MBS* as in our implementation. The estimated value of β_2 is mathematically identical in the two regressions. Braumoeiler (2004) gives an elementary treatment of this issue with examples.

³⁷ We do not restrict the estimated value of β to be less than one, but a value larger than one implies that income drops when output increases and vice versa, which is unlikely to be a typical situation.

interpretation that banking deregulation has stronger effects in the group of states in which small businesses are most prevalent.³⁸

We perform regressions such as equation (1) on each of the three subsamples separately and examine whether the impact of banking reform as measured by the β -coefficient is larger in the subgroup with a high prevalence of small businesses. Note that in these regressions the definitions of $\tilde{y}$ and $\widetilde{PINC}$ are the same as in the earlier regressions, that is, we remove the average across all states. The interpretation, therefore, is that we measure the amount of risk sharing relative to the benchmark of full U.S.-wide risk sharing. (If we control only for the averages in each subgroup, we would measure the amount of risk sharing *within* the subgroup and not the amount of risk the group shares with all U.S. states.)

A. Econometric Issues

We implement the relation described by equations (2) and (3) by estimating the relation

$$\tilde{y}_{it} - \widetilde{PINC}_{it} = \mu_i + v_t + \beta_0 \tilde{y}_{it} + \beta_1 x_{it} \tilde{y}_{it} + \gamma x_{it} + \epsilon_{it} \quad (7)$$

using GLS. We interpret $\beta_0 + \beta_1 x_{it}$ as the time-varying risk-sharing coefficient β_{it} . The “linear term” γx indicates whether the variable x had an impact on the average growth difference between income and output—while this is not of interest in the present study, we include the term as it is normal in regressions allowing for interaction effects in order to be certain that the estimated coefficient on the interaction term is not affected by erroneously leaving out a significant linear term.

Our estimations utilize a two-step GLS estimator. The first step is a panel OLS estimation. From the residuals we estimate the variance of the error terms in the regression assuming that it varies by state—the estimates typically confirm this assumption with small states having higher residual variance than large states. In the second step the variables for each state are weighted by the estimated standard error for the state. It is feasible that the error terms may be correlated over time within each state and correlated with state-specific output growth (the regressor). Bertrand, Duflo, and Mullinaithan (2004) demonstrate that such “clustering” of standard errors can lead to severely biased standard errors in the presence of serial correlation. Our data do not display severe autocorrelation but we find that it is prudent to display estimated standard errors that are robust to “clustering-type” heteroskedasticity.³⁹

³⁸ As a robustness check we alternatively measure the importance of small businesses by the number of small *firms* in 1988 (the earliest available year). The results using this measure are very similar to those reported and are omitted for brevity.

³⁹ Our implementation is similar to the robust clustering procedure built into the STATA econometrics package.

B. Proprietors' Income

Proprietors are typically dependent on banks to the same degree as small business owners. Accordingly, we would also like to examine if banking reform led to disproportionately higher income insurance for proprietors. We do not directly observe the production output from proprietors and hence we cannot directly estimate the amount of income insurance obtained by proprietors. However, we can examine if proprietors' income has become less sensitive to output growth following banking reform. We estimate the amount of proprietors' income smoothing from the regression

$$\widetilde{\text{PROPINC}}_{it} = \mu_i + \nu_t + \beta_0 \tilde{y}_{it} + \beta_1 \text{D}_{it} \tilde{y}_{it} + \gamma \text{D}_{it} + \epsilon_{it}, \quad (8)$$

where PROPINC_{it} measures aggregate proprietors' period t income in state i and D is one (or several) of our measures of deregulation. Here, a positive value of β_0 implies that proprietors' income co-moves with output and a value larger than 100% implies that a given percentage shock to state-level output is associated with a more than 100% change in proprietors' income in the same direction. A negative value of β_1 indicates that an increase in D typically is associated with less sensitivity of the proprietors' income to output shocks. We consider the negative of the estimated value of β_1 as a proxy for the measured effect on small business owners' income insurance. For completeness, we also examine whether wage income and dividend, interest, and rental income have become less sensitive to output growth following deregulation.

VII. Results and Discussion

A. Descriptive Figures and Tables

Figure 1 displays the average value of D^{reci} across states for each year in our sample and, similarly, the value of D^{reci} over time for three randomly selected states. For Idaho, the variable looks much like a binary variable while for Michigan and New York, the variable gradually increases from zero to one during the period from the early 1980s to the mid-1990s.

Figure 2 displays the growth rates of GSP and personal income for the average U.S. state and the state-specific (state minus average) growth rates of GSP and personal income for Idaho, Michigan, and New York. Panel A suggests that the volatility of state-level GSP declined after deregulation, consistent with Morgan, Rime, and Strahan (2004). Panels B to D show that large fluctuations in state-specific GSP are typically associated with large fluctuations in personal income, but the latter are damped relative to those of GSP, reflecting interstate income insurance. We mark the dates of the three discrete banking deregulations by vertical lines and we display the correlation of state-specific income with state-specific GSP before and after deregulation. For the states shown in the figure, the correlation of personal income with GSP declined after each type of deregulation.

Figure 3 depicts similar graphs with proprietors' income instead of personal income. The volatility of proprietors' income has declined considerably since the

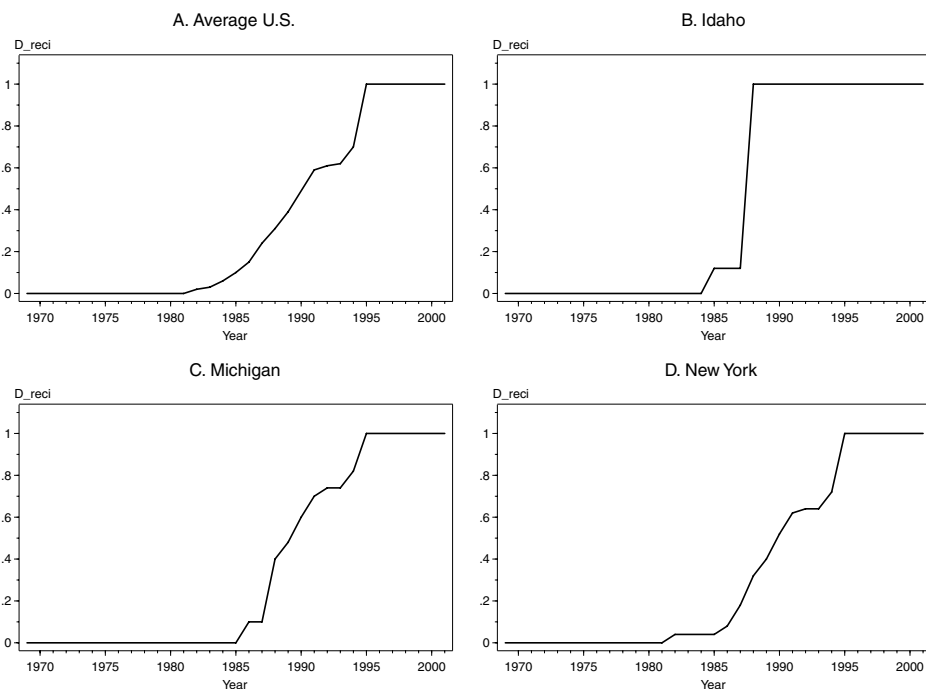


Figure 1. Reciprocal interstate banking deregulation. The figure shows the interstate deregulation measure D_{reci} defined as the fraction of (outside) states in the sample from which entry is de facto allowed, taking into account whether the reciprocity constraint for each individual outside state is binding or not. The variable takes values between zero and one, where a value of one means that banks from any other state are permitted to enter, and a value of zero means that banks from no other state may enter. Sample: 1970–2001. The states of Delaware and South Dakota are excluded.

early 1980s, when proprietors' income displayed extremely high sensitivity to GSP shocks. During that period, fluctuations in GSP were strongly amplified in proprietors' income (Panel A). For the three selected states, we observe a strong decline in the amplitude of state-specific proprietors' income in the period after banking reform. While changes in GSP are not equivalent to endowment shocks for proprietors, this pattern is nevertheless consistent with better income insurance for proprietors following banking deregulation.

Table III displays the average values, standard deviations, and correlations for our deregulation variables. The mean value of the dummy variables has a simple interpretation as the fraction of the sample for which the particular form of deregulation has been in place. For example, on average states had removed restrictions on intrastate branching by mergers and acquisitions for 60% of the years in our sample.

The correlation matrix shows that all our integration measures are positively correlated. In particular, the pair of intrastate deregulation variables and the pair of interstate deregulation variables are highly correlated: 0.83 and 0.79,

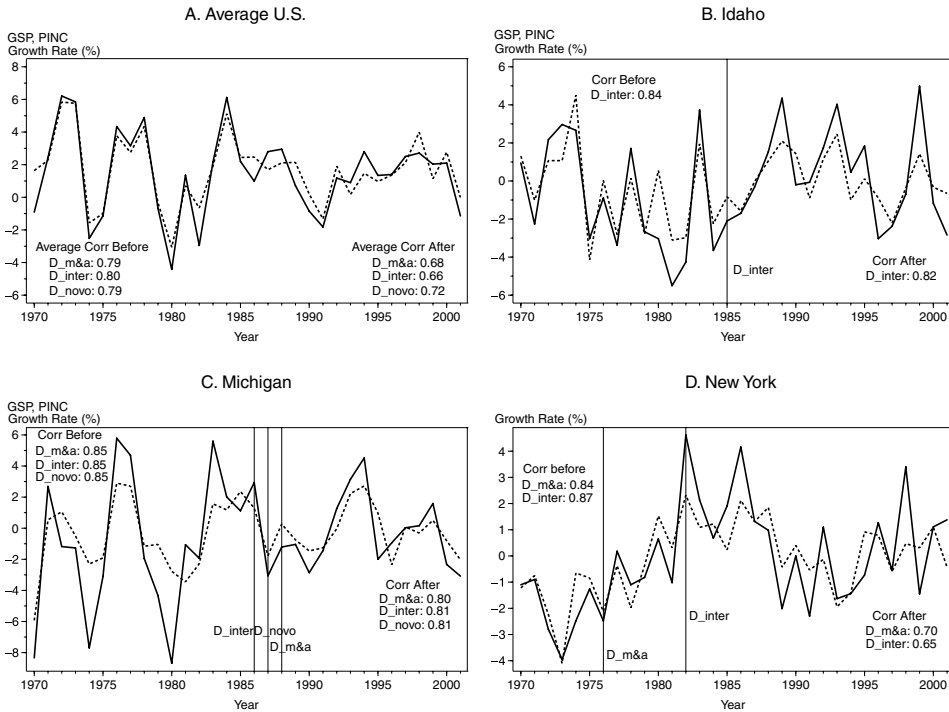


Figure 2. Average and state-specific growth rates of GSP and personal income. The figure displays growth rates of Gross State Product (GSP) (solid line) and State Personal Income (PINC) (dotted line) for the average of U.S. states (Panel A), and state-specific (state minus average) growth rates for three arbitrary states (Panels B–D). Vertical lines correspond to the dates of deregulation, where $D_{m\&a}$ denotes the year in which statewide branching by mergers and acquisition was permitted, D_{inter} denotes the year in which interstate banking was permitted, and D_{novo} denotes the year in which statewide de novo branching was permitted. In Panels B to D, the left side of each panel gives the correlation coefficients between GSP and PROPINC for the years prior to deregulation and the right side gives the correlation coefficients for the years following deregulation. In Panel A, the corresponding correlations are computed as the averages across U.S. states. Sample: 1970–2001. The states of Delaware and South Dakota are excluded.

respectively. This makes it difficult to estimate the separate impact of the variables in a regression that includes both intrastate (or both interstate) deregulation measures. The correlations between each of the intrastate dummies with each of the interstate deregulation variables are above 0.5 but no higher than 0.64. Our data set is fairly large, hence a correlation of this magnitude may potentially, but not necessarily, be too high for us to separate the impact of intrastate deregulation from the impact of interstate deregulation. The measure of lending technology is quite highly correlated with the interstate deregulation dummies, with correlations of around 0.5, but less correlated with the measures of intrastate deregulation.

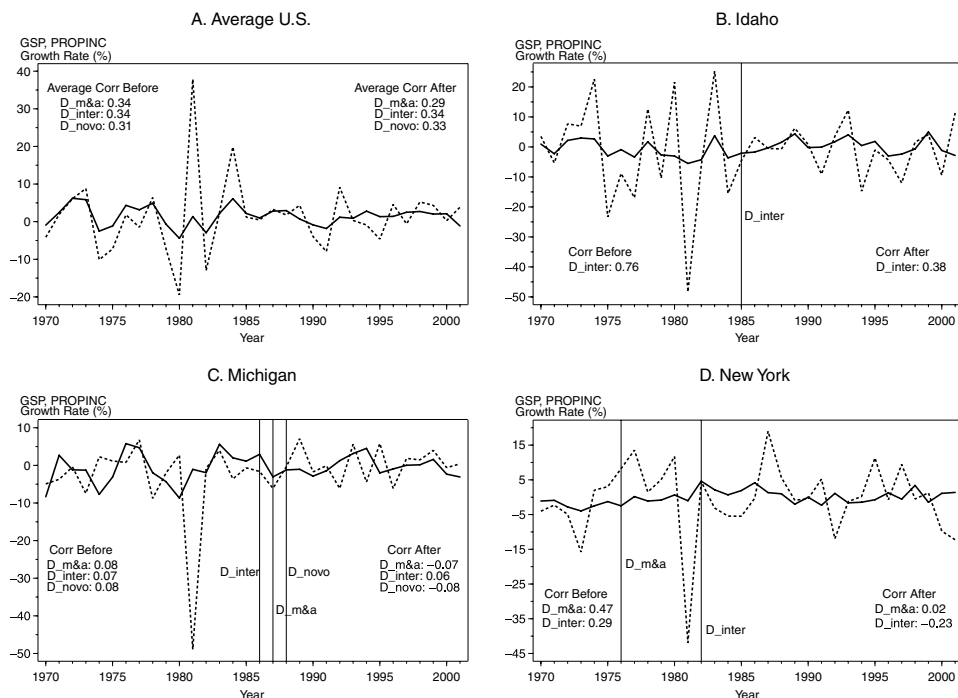


Figure 3. Average and state-specific growth rates of GSP and proprietors' income. The figure depicts growth rates of Gross State Product (GSP) (solid line) and State Proprietors' Income (PROPINC) (dotted line) for the average across U.S. states (Panel A), and state-specific (state minus average) growth rates for three arbitrary states (Panels B–D). Vertical lines correspond to the dates of deregulation, where $D_{m\&a}$ denotes the year in which statewide branching by mergers and acquisition was permitted, D_{inter} denotes the year in which interstate banking was permitted, and D_{novo} denotes the year in which statewide de novo branching was permitted. In Panels B to D, the left side of each panel states the correlation coefficients between GSP and PROPINC for the years prior to deregulation and the right side states the correlation coefficients for the years following deregulation. In Panel A, the corresponding correlations are computed as the averages across U.S. states. Sample: 1970–2001. The states of Delaware and South Dakota are excluded.

B. Bank Reform and Income Insurance

Did interstate income insurance increase following banking reform? In Table IV, we examine whether risk sharing improved following deregulation. In the top part of the table, we display results for each deregulation measure separately, for all measures together, and for combinations of measures in order to establish which of the variables best capture the effect of deregulation. At the bottom part of Table IV, we display the coefficients on the deregulation variables in non-interacted form. The coefficient estimates of the non-interacted terms indicate whether output in deregulated states tends to grow faster than income. This question is not of interest for the purpose of our study but the variables are included as control variables—we suppress the non-interacted coefficients in the following tables (but continue to include them in the regressions).

Table III
Measures of Banking Deregulation: Descriptive Statistics

See Table II for variable definitions. The correlation of TECH with the other variables is calculated as TECH minus the mean for each state corresponding to the way it is interacted with output growth in the regression tables. Sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded.

Panel A: Means and Standard Deviations				
	Mean	Std. Dev.	Sample	
$D^{m\&a}$	0.60	0.49	1970–2001	
D^{novo}	0.47	0.50	1970–2001	
D^{inter}	0.48	0.50	1970–2001	
D^{reci}	0.35	0.44	1970–2001	
TECH	6.92	0.13	1970–2001	

Panel B: Correlations					
	$D^{m\&a}$	D^{novo}	D^{inter}	D^{reci}	TECH
$D^{m\&a}$	1.00	0.76	0.64	0.59	0.31
D^{novo}	–	1.00	0.51	0.51	0.26
D^{inter}	–	–	1.00	0.83	0.52
D^{reci}	–	–	–	1.00	0.52
TECH	–	–	–	–	1.00

The first four columns of Table IV show that each banking deregulation variable strongly and significantly predicts higher income insurance. In particular, income insurance was, on average, 45% before deregulation of restrictions on branching by mergers and acquisitions; see the coefficient on GSP in column (1). This estimate is large in economic terms and strongly significant.⁴⁰ After deregulation, the amount of income insurance increased to 55.3% (45.0% + 10.3%). The estimated impact (10.3%) of banking deregulation is large in economic terms and the estimate is statistically significant at the usual 5% level. The results in columns (2) and (3) are of similar magnitude, while the estimated impact of interstate deregulation, as measured by D^{reci} , is even larger with an increase in risk sharing of almost 18%.

In column (5), we include all four measures of deregulation. The estimated impact of D^{reci} is nearly unchanged, but the estimated impact of D^{novo} and interstate deregulation D^{inter} are now both negative. Clearly, the deregulation variables are so highly correlated that we cannot sort out the relative effect of each variable. Next, in column (6), we ask a less ambitious question: Which of the two intrastate deregulation variables has more explanatory

⁴⁰ The estimate is very close to the 39% value for “capital market risk sharing” found by Asdrubali, Sørensen, and Yosha (1996), who define capital market risk sharing similarly to our measure of income insurance except that they remove all federal transfers to persons from personal income but add all revenue of state governments not collected from individuals in the state. Nonetheless, their estimate has a very similar interpretation to ours.

Table IV
Banking Deregulation and Income Insurance

The results are from the following GLS regression: $\widetilde{\text{GSP}}_{it} - \widetilde{\text{PINC}}_{it} = \alpha_i + \nu_t + \beta_0 \widetilde{\text{GSP}}_{it} + \beta_1 \text{D}_{it} + \beta_2 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it} + \epsilon_{it}$. D_{it} is a variable for banking deregulation, measured in terms of four different variables: $\text{D}^{\text{m\&a}}$, D^{novo} , D^{inter} , and D^{reci} . α_i and ν_t are not reported. See Table II for variable definitions. The sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded. GLS clustering-robust standard deviations are in parentheses. Coefficients and standard deviations are multiplied by 100. The number of observations is 1,536.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GSP	45.0 (2.7)	46.1 (2.4)	46.8 (2.1)	46.4 (2.0)	44.8 (2.7)	44.9 (2.7)	46.6 (2.1)	44.8 (2.7)	44.7 (2.4)
Intrastate Deregulation									
GSP · $\text{D}^{\text{m\&a}}$	10.3 (3.0)	—	—	—	4.5 (5.1)	8.5 (4.1)	—	3.5 (3.7)	—
GSP · D^{novo}	—	9.5 (3.1)	—	—	−0.3 (4.0)	2.2 (4.2)	—	—	5.2 (3.5)
Interstate Deregulation									
GSP · D^{inter}	—	—	11.8 (2.3)	—	−4.9 (5.2)	—	−3.1 (4.4)	—	9.5 (2.4)
GSP · D^{reci}	—	—	—	17.6 (3.3)	20.2 (6.0)	—	20.9 (6.3)	15.4 (3.8)	—
Linear Terms									
$\text{D}^{\text{m\&a}}$	−0.2 (0.1)	—	—	—	−0.2 (0.1)	−0.2 (0.1)	—	−0.2 (0.1)	—
D^{novo}	—	−0.0 (0.1)	—	—	0.1 (0.1)	0.1 (0.1)	—	—	−0.0 (0.1)
D^{inter}	—	—	−0.1 (0.1)	—	0.1 (0.1)	—	0.0 (0.1)	—	−0.1 (0.1)
D^{reci}	—	—	—	0.1 (0.2)	0.1 (0.2)	—	0.1 (0.2)	0.1 (0.2)	—
R^2	0.62	0.62	0.61	0.62	0.63	0.62	0.62	0.63	0.62

power? We ask a similar question for the pair of interstate deregulation measures in column (7). Considering intrastate branching deregulation first, we find that branching by mergers and acquisitions appears more important than de novo branching. Of the interstate deregulation measures, D^{reci} is the more important. In columns (8) and (9), we run regressions with combinations of intrastate and interstate deregulation measures. We first combine the measures from each deregulation group, $\text{D}^{\text{m\&a}}$ and D^{reci} , which are associated with significance in the previous columns. We find that the interstate measure has very high statistical significance while the intrastate measure is not significant, although the estimated coefficient is positive and of reasonable size. When we use the combination of D^{novo} and D^{inter} instead, we obtain similar results, as D^{inter} is highly significant and the impact of D^{novo} is positive although not statistically significant at conventional levels. In the following, we run regressions of the type shown in columns (8) and (9) in order to examine

whether intrastate or interstate deregulation had a larger impact on income insurance.

Overall, the results of Table IV clearly indicate that income insurance improved markedly after deregulation and, while intrastate and interstate deregulation both appear to matter, it seems that the strongest effects come from interstate deregulation. Below we examine whether the inclusion of other potential determinants of risk sharing may explain these results, but first we ask whether banking deregulation had a relatively larger impact in states with many small businesses as theory would suggest.

C. Banking Reform and Small Businesses

In Table V we estimate the relation between income insurance and banking reform separately for the third of the states with the highest fraction of employees in small businesses, the third with the lowest fraction, and the middle third. We expect to find a higher effect of deregulation in states with a high number of small businesses. This result obtains in the results of Table V. We display t -statistics for the null hypothesis that the group of states with many

Table V
Banking Deregulation and Income Insurance in States with High, Middle, and Low Prevalence of Small Businesses (I)

The results are from the following GLS regression: $\widetilde{\text{GSP}}_{it} - \widetilde{\text{PINC}}_{it} = \alpha_i + v_t + \beta_0 \widetilde{\text{GSP}}_{it} + \beta_1 \text{D}_{it} + \beta_2 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it} + \epsilon_{it}$. D_{it} is a variable for banking deregulation, measured in terms of four different variables: $\text{D}^{\text{m\&a}}$, D^{novo} , D^{inter} , and D^{reci} . β_1 , α_i , and v_t are not reported. See Table II for variable definitions. We split states into three equal-sized groups according to this measure ("High," "Low," and "Middle") and say that small businesses are relatively more prevalent in a state if it belongs to the High group. We estimate the coefficients for the pooled Middle and Low groups and perform a simple t -test for the equality of these coefficients and the corresponding coefficients of the High group. The sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded. GLS clustering-robust standard deviations are in parentheses. Coefficients and standard deviations are multiplied by 100. The number of observations in each group is 512.

	High				Middle			Low					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	t -test
GSP	38.1 (5.6)	37.5 (6.1)	44.5 (4.3)	43.6 (4.5)	47.5 (4.0)	48.6 (3.2)	47.6 (3.2)	47.6 (3.0)	51.9 (3.9)	51.1 (2.9)	48.4 (3.2)	48.0 (3.2)	
Intrastate Deregulation													
GSP · $\text{D}^{\text{m\&a}}$	21.1 (6.5)	—	—	—	3.8 (3.8)	—	—	—	2.6 (4.6)	—	—	—	2.5
GSP · D^{novo}	—	23.3 (7.7)	—	—	—	1.8 (3.6)	—	—	—	4.6 (3.6)	—	—	2.5
Interstate Deregulation													
GSP · D^{inter}	—	—	19.2 (4.8)	—	—	—	4.5 (3.3)	—	—	—	13.3 (4.5)	—	2.1
GSP · D^{reci}	—	—	—	23.8 (5.2)	—	—	—	6.9 (5.4)	—	—	—	20.3 (5.6)	1.7
R^2	0.64	0.65	0.62	0.62	0.64	0.63	0.64	0.64	0.62	0.61	0.61	0.62	

small businesses is similar to the remaining states. We reject this hypothesis at the 10% level of significance for D^{reci} and at the 5% level or lower for the other deregulation variables.

One may notice the large coefficient estimate for D^{reci} in the group of states with fewer small businesses and, to a lesser extent, for D^{inter} . Both measures predict a somewhat higher effect of deregulation in states with many small businesses, but the coefficient estimates for the “low” group suggest that interstate deregulation is associated with improvements in income insurance that do not work predominantly through small businesses. In contrast, the effects of intrastate deregulations are mainly relevant for small businesses. These results are consistent with our hypothesis that a banking system comprising small banks shielded from competition are prone to inefficiencies stemming from lack of diversification, lack of scale economies, and little integration into national credit and capital markets. Our results suggest that these inefficiencies are detrimental for bank-dependent small firms and the welfare of small business owners. The results are also consistent with the finding of Jayaratne and Strahan (1996) that improvements in bank efficiency are behind the sizeable growth effects of intrastate deregulation that they estimate.

The difference between the estimated effects of the intrastate and interstate variables indicates that the main issue for small businesses is whether banks branch and merge, and less whether banks become part of cross-border organizations. We conjecture that the interstate deregulation measures are picking up fewer of the effects from consolidation and more of the effect from improved risk sharing between banks—effects that are likely to benefit not only small business owners.

Also notice that the estimated *level* of income insurance before deregulation (row “GSP”) is lower in states with a high prevalence of small businesses. This is consistent with our hypothesis that it is relatively harder for small business owners to smooth their income due to the intertwining of their personal income with the finances of their business.

Table VI shows the results from multivariate regressions including both intrastate and interstate deregulation variables as regressors. The results are very similar to those in Table V. Deregulation of branching by mergers and acquisitions had a strong effect on risk sharing in states with many small businesses but no significant effect in other states, while interstate deregulation as measured by D^{reci} had an equally strong effect in states with many and few small businesses. The results are robust to which particular pair of intra- and interstate deregulation dummies we use, except the estimated impact of D^{inter} is smaller than the estimated impact of D^{reci} .

D. The Impact of Banking Reform versus the Impact of Lending Technology and Integration of Mortgage Markets

The increase in income insurance that occurred after deregulation is not necessarily caused only by banking reform. In this subsection, we examine whether

Table VI
Banking Deregulation and Income Insurance in States with High, Middle, and Low Prevalence of Small Businesses (II)

The results are from the following GLS regression: $\widetilde{\text{GSP}}_{it} - \widetilde{\text{PINC}}_{it} = \alpha_i + v_t + \beta_0 \widetilde{\text{GSP}}_{it} + \beta_1 \text{D}_{it}^k + \beta_2 \text{D}_{it}^m + \beta_3 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^k + \beta_4 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^m + \epsilon_{it}$. D_{it}^k is a measure of intrastate deregulation: Either $\text{D}_{it}^{\text{m\&a}}$ or $\text{D}_{it}^{\text{novo}}$. D_{it}^m is a measure of interstate deregulation: Either $\text{D}_{it}^{\text{inter}}$ or $\text{D}_{it}^{\text{reci}}$. $\beta_1, \beta_2, \alpha_i$, and v_t are not reported. See Table II for variable definitions. We split states into three equal-sized groups according to this measure ("High," "Low," and "Middle") and say that small businesses are relatively more prevalent in a state if it belongs to the High group. We estimate the coefficients for the pooled Middle and Low groups and perform a simple t -test for the equality of these coefficients and the corresponding coefficients of the High group. The sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded. GLS clustering-robust standard deviations are in parentheses. Coefficients and standard deviations are multiplied by 100. The number of observations in each group is 512.

	High		Middle		Low		t -test
	(1)	(2)	(3)	(4)	(5)	(6)	
GSP	37.9 (5.6)	37.0 (5.9)	47.5 (4.0)	47.8 (3.3)	51.2 (3.8)	48.8 (3.3)	
Intrastate Deregulation							
GSP · $\text{D}_{it}^{\text{m\&a}}$	13.8 (8.0)	— —	1.1 (4.1)	— —	−7.4 (6.1)	— —	1.9
GSP · $\text{D}_{it}^{\text{novo}}$	— —	18.9 (8.5)	— —	−0.8 (3.8)	— —	−2.2 (5.5)	2.3
Interstate Deregulation							
GSP · $\text{D}_{it}^{\text{inter}}$	— —	10.1 (4.7)	— —	5.0 (3.4)	— —	15.1 (5.7)	0.2
GSP · $\text{D}_{it}^{\text{reci}}$	15.2 (6.0)	— —	6.2 (5.9)	— —	25.8 (7.0)	— —	0.1
R^2	0.64	0.65	0.64	0.64	0.62	0.61	

banking deregulation is still a significant predictor of income insurance when we simultaneously allow for either a measure of lending technology or a measure of national mortgage market integration.

Banking deregulation was occurring at about the same time improvements in technology were making it possible to lend at greater distances. In Table VII, we therefore add a measure of the efficiency of lending technology, TECH, to the regressions that estimate the effect of deregulation for the full sample of states. The first column of Table VII shows that lending technology is a significant predictor of income insurance. However, when we include either pair of bank deregulation measures, deregulation remains significant while lending technology becomes insignificant. The point estimate for lending technology is even negative, which is likely a reflection of too high a correlation with the banking deregulation variables.

Alternatively, when we include a measure of mortgage market integration, MBS, which does not vary by state, the coefficient is clearly significant; refer to column (4). The estimated impact of mortgage market integration is not robust

Table VII
Banking Deregulation and Income Insurance: Robustness to Other Market Developments

The results are from the following GLS regression: $\widetilde{\text{GSP}}_{it} - \widetilde{\text{PINC}}_{it} = \alpha_i + \nu_t + \beta_0 \widetilde{\text{GSP}}_{it} + \beta_1 \text{D}_{it}^k + \beta_2 \text{D}_{it}^m + \beta_3 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^k + \beta_4 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^m + \beta_5 \text{X}_{it} + \beta_6 \widetilde{\text{GSP}}_{it} \cdot \text{X}_{it} + \epsilon_{it}$. X_{it} is TECH_{it} in the first three columns and MBS_{it} in columns four to six. D_{it}^k is a measure of intrastate deregulation: Either $\text{D}^{\text{m\&a}}$ or D^{novo} . D_{it}^m is a measure of interstate deregulation: Either D^{inter} or D^{reci} . $\beta_1, \beta_2, \alpha_i$, and ν_t are not reported. See Table II for variable definitions. The sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded. GLS clustering-robust standard deviations in parentheses. Coefficients and standard deviations are multiplied by 100. The number of observations is 1,536.

	(1)	(2)	(3)	(4)	(5)	(6)
GSP	50.9 (1.9)	43.8 (2.9)	44.2 (2.7)	53.0 (2.0)	44.7 (4.7)	48.8 (3.9)
Intrastate Deregulation						
GSP · $\text{D}^{\text{m\&a}}$	—	3.4 (3.7)	—	—	3.6 (4.2)	—
GSP · D^{novo}	—	—	5.5 (3.6)	—	—	4.2 (4.0)
Interstate Deregulation						
GSP · D^{inter}	—	—	10.4 (3.1)	—	—	2.3 (4.8)
GSP · D^{reci}	—	18.4 (4.9)	—	—	15.0 (8.3)	—
Alternative Measures						
GSP · TECH	29.3 (12.1)	−18.4 (18.6)	−7.9 (18.7)	—	—	—
GSP · MBS	—	—	—	0.5 (0.1)	0.0 (0.3)	0.3 (0.2)
R^2	0.59	0.63	0.63	0.61	0.63	0.62

to the inclusion of the banking deregulation variables. In column (5), where the $\text{D}^{\text{m\&a}}$ and D^{reci} variables are included, the measure of mortgage market integration is insignificant while the point estimate for D^{reci} is very close to that found in Table IV, although the estimate now is only borderline significant at the 5% level due to a higher standard deviation. Using the D^{novo} and D^{inter} measures, MBS becomes larger and nearly significant, while the banking deregulation variables become smaller and statistically insignificant.

Our results suggest that it is difficult to separate the effect of banking deregulation from other trending variables. During our sample period, states’ status changed from regulated to deregulated, with no state moving in the opposite direction. Therefore, our bank integration measures are correlated with a trend. We examine how robust the results are to the inclusion of a quadratic trend.

Including the trend in Table VIII, we see from columns (1) to (4) that the estimated coefficients of the intrastate deregulation variables remain positive but become insignificant, while D^{inter} turns negative and D^{reci} retains its order

Table VIII

Banking Deregulation and Income Insurance: Robustness to a Trend

The results are from the following GLS regression: $\widetilde{\text{GSP}}_{it} - \widetilde{\text{PINC}}_{it} = \alpha_i + \beta_0 \widetilde{\text{GSP}}_{it} + \beta_1 \text{D}_{it}^k + \beta_2 \text{D}_{it}^m + \beta_3 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^k + \beta_4 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^m + \beta_5 t + \beta_6 t^2 + \epsilon_{it}$. D_{it}^k is a measure of intrastate deregulation; Either $\text{D}_{it}^{\text{m\&a}}$ or $\text{D}_{it}^{\text{nov}}$. D_{it}^m is a measure of interstate deregulation; Either $\text{D}_{it}^{\text{inter}}$ or $\text{D}_{it}^{\text{reci}}$. β_1 , β_2 , and α_i are not reported. See Table II for variable definitions. The sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded. GLS clustering-robust standard deviations are in parentheses. Coefficients and standard deviations are multiplied by 100. The number of observations is 1,536.

	(1)	(2)	(3)	(4)	(5)	(6)
GSP	48.9 (3.1)	47.9 (2.6)	52.6 (2.6)	44.9 (3.1)	44.2 (4.0)	49.8 (3.3)
Intrastate Deregulation						
GSP · $\text{D}_{it}^{\text{m\&a}}$	3.3 (4.7)	—	—	—	1.1 (4.1)	—
GSP · $\text{D}_{it}^{\text{nov}}$	—	5.6 (4.6)	—	—	—	6.3 (4.4)
Interstate Deregulation						
GSP · $\text{D}_{it}^{\text{inter}}$	—	—	−3.4 (4.3)	—	—	−4.9 (3.9)
GSP · $\text{D}_{it}^{\text{reci}}$	—	—	—	16.9 (8.2)	16.7 (7.8)	—
Quadratic Trend						
GSP · TREND	0.9 (0.2)	0.9 (0.2)	1.2 (0.3)	0.3 (0.4)	0.3 (0.4)	1.1 (0.3)
GSP · TREND ²	−0.1 (0.0)	−0.1 (0.0)	−0.1 (0.0)	−0.1 (0.0)	−0.1 (0.0)	−0.1 (0.0)
R^2	0.64	0.65	0.63	0.65	0.65	0.64

of magnitude and remains significant. Including both intrastate and interstate deregulation variables does not change the results much.

The trend in risk sharing is a function of underlying changes in the economy and deregulation itself is likely to be a partial explanation for this trend. The results so far, however, leave doubt about the importance of banking deregulation given the other potential explanations. If intrastate banking deregulation is important we should see a stronger impact where small businesses are more prevalent, even in the presence of a trend. We turn to that question next.

Table IX shows that intrastate branching deregulation had a strong positive effect in states with many small businesses. The result is robust to trending and the effect of branching deregulation is significantly larger than in other states. The estimated impact of deregulation is negative in the two other groups of states, even significantly so for states with few small businesses in the case of $\text{D}_{it}^{\text{m\&a}}$. The negative coefficient estimate is due to the correlation with the trend. The important finding is that the intrastate deregulation variables have disproportionately larger impacts in states with many small businesses, and this result is clearly statistically significant with a t -value of 2.6 for each of the

Table IX
Banking Deregulation and Income Insurance in States with High, Middle, and Low Prevalence of Small Businesses: Robustness to a Trend

The results are from the following GLS regression: $\widetilde{\text{GSP}}_{it} - \widetilde{\text{PINC}}_{it} = \alpha_i + \beta_0 \widetilde{\text{GSP}}_{it} + \beta_1 \text{D}_{it}^k + \beta_2 \text{D}_{it}^m + \beta_3 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^k + \beta_4 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^m + \beta_5 t + \beta_6 t^2 + \epsilon_{it}$. D_{it}^k is a measure of intrastate deregulation: Either $\text{D}^{\text{m\&a}}$ or D^{nov} . D_{it}^m is a measure of interstate deregulation: Either D^{inter} or D^{reci} . β_1, β_2 , and α_i are not reported. See Table II for variable definitions. The sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded. GLS clustering-robust standard deviations are in parentheses. Coefficients and standard deviations are multiplied by 100. The number of observations is 1,536.

	High		Middle		Low		
	(1)	(2)	(3)	(4)	(5)	(6)	<i>t</i> -test
GSP	34.0 (6.7)	36.9 (6.9)	52.2 (4.7)	53.5 (3.6)	50.0 (8.7)	62.4 (4.5)	
Intrastate Deregulation							
GSP · $\text{D}^{\text{m\&a}}$	16.0 (8.6)	– (–)	–3.8 (4.0)	– (–)	–11.6 (4.7)	– (–)	2.6
GSP · D^{nov}	– (–)	21.4 (8.7)	– (–)	–0.8 (3.7)	– (–)	–3.2 (4.5)	2.6
Interstate Deregulation							
GSP · D^{inter}	– (–)	3.8 (6.8)	– (–)	–9.2 (5.0)	– (–)	–13.4 (8.9)	1.9
GSP · D^{reci}	16.3 (9.2)	– (–)	–3.0 (10.4)	– (–)	33.8 (18.6)	– (–)	0.8
Quadratic Trend							
GSP · TREND	0.0 (0.6)	0.5 (0.6)	1.0 (0.6)	1.2 (0.4)	0.2 (0.9)	1.9 (0.6)	
GSP · TREND ²	–0.2 (0.0)	–0.2 (0.0)	–0.1 (0.0)	–0.0 (0.0)	–0.1 (0.1)	–0.1 (0.0)	
<i>R</i> ²	0.69	0.70	0.65	0.65	0.63	0.63	

intrastate deregulation variables. As found in Table V, the interstate branching variables do not have significantly different impacts in states with many or few small businesses. The point estimates for the interstate variables seem noisy in this table, but the overall message is that the impact of intrastate deregulation on income insurance in states with many small businesses is robust to the inclusion of a trend.

In untabulated robustness tests we examine whether the results hold if the small and more volatile oil states, Alaska and Wyoming, are dropped from the sample.⁴¹ The estimated coefficients become more sensitive to the inclusion of a trend when Alaska and Wyoming are omitted. This obtains because the two states are influential observations and the trend is highly correlated with the interstate deregulation variables in particular. When we drop these two

⁴¹ The full set of results may be found in Demyanyk, Ostergaard, and Sørensen (2006).

states, the results are similar to those that obtain with these states, except that all banking deregulation variables become insignificant when a quadratic trend is included. However, our main result, that intrastate banking deregulation had a disproportionately large and positive effect on risk sharing in states with many small businesses, holds whether a trend is included or not. In fact, the null hypothesis that states with many small businesses obtain no more risk sharing than other states is rejected with even higher levels of significance when Alaska and Wyoming are excluded. Also, the sensitivity of proprietors' income to output shocks is robust to the exclusion of Alaska and Wyoming.

Furthermore, we run regressions using OLS estimation. In contrast to the GLS estimates, the OLS estimates are unweighted and therefore give larger weight to smaller states. The OLS estimates are more noisy than the GLS estimates but our conclusions hold using this simple estimator. Overall, the OLS results are very similar to the GLS results, and the estimated stronger impact of deregulation in states with more small businesses is even more significant when OLS is used.

E. Banking Deregulation and the Sensitivity of Proprietors' Income and Other Income Categories to GSP Fluctuations

A different way of examining whether risk sharing increased after banking reform is to consider if proprietors' income became less correlated with state-specific output shocks following banking reform. In Table X, we show the results of regressions of proprietors' income on output shocks allowing for fixed effects and interactions with deregulations variables. We interpret the results as reflecting risk sharing although state-level output is not a direct endowment shock for proprietors; nonetheless, a lower co-movement of proprietors' income with output following banking deregulation is likely to at least partly reflect increased income insurance. The coefficient on GSP in column (1) of Table X shows that before banking reform a 1% drop in state-specific output would be associated with a 2.88% drop in proprietors' income on average, that is, state-specific proprietors' income is more volatile than output. The predicted impact after "full" banking deregulation (where both $D^{m\&a}$ and D^{reci} are equal to unity) is that a one-percentage point fall in state-specific output is associated with only a 0.2% drop in proprietors' income ($288.4\% - 204.0\% - 65.8\%$ of 1%). The estimates have large standard errors but both $D^{m\&a}$ and D^{reci} are significant at the conventional 5% level. The results are similar using the alternative set of banking deregulation variables in column (2). The high level of significance of the measures of banking deregulation is unaffected by the inclusion of a quadratic trend. In columns (5) and (6), we examine whether wage growth became less correlated with output shocks following deregulation. The point estimates imply that intrastate banking deregulation *increased* the correlation of wages with output shocks while interstate deregulation lowered the correlation by a similar amount, implying a zero overall effect. We do not investigate this somewhat puzzling result further because the impact on wage smoothing

Table X
Banking Deregulation and Sensitivity of Personal Income
Components to Output

The results are from the following GLS regressions: $\widetilde{\text{INC}}_{it} = \alpha_i + \beta_0 \widetilde{\text{GSP}}_{it} + \beta_1 \text{D}_{it}^k + \beta_2 \text{D}_{it}^m + \beta_3 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^k + \beta_4 \widetilde{\text{GSP}}_{it} \cdot \text{D}_{it}^m + \beta_5 t + \beta_6 t^2 + \epsilon_{it}$. In columns (1)–(4), INC_{it} is proprietors' income, in columns (5) and (6)—wages, and in columns (7) and (8)—income from dividends, interest, and rent. D_{it}^k is a measure of intrastate deregulation: Either $\text{D}^{\text{m\&a}}$ or D^{novo} . D_{it}^m is a measure of interstate deregulation: Either D^{inter} or D^{reci} . β_1, β_2 , and α_i are not reported. See Table II for variable definitions. The sample is 1970–2001. District of Columbia and the states of Delaware and South Dakota are excluded. GLS clustering-robust standard deviations are in parentheses. Coefficients and standard deviations are multiplied by 100. The number of observations is 1,536.

	Proprietors' Income				Wages		Int., Div. & Rent	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GSP	288.4 (40.5)	263.7 (37.1)	342.8 (48.2)	294.9 (42.8)	51.6 (3.8)	54.7 (3.8)	21.7 (3.0)	20.6 (2.8)
Intrastate Deregulation								
GSP · $\text{D}^{\text{m\&a}}$	−204.0 (64.0)	— —	−195.8 (57.2)	— —	19.1 (4.3)	— —	−7.8 (8.0)	— —
GSP · D^{novo}	— —	−175.4 (62.2)	— —	−139.5 (60.0)	— —	8.6 (4.1)	— —	−7.7 (7.1)
Interstate Deregulation								
GSP · D^{inter}	— —	−63.2 (31.9)	— —	−133.4 (41.0)	— —	−11.6 (4.1)	— —	3.6 (5.9)
GSP · D^{reci}	−65.8 (31.7)	— —	−172.6 (30.0)	— —	−26.9 (5.1)	— —	3.0 (7.0)	— —
Quadratic Trend								
GSP · TREND	— —	— —	6.2 (2.1)	3.7 (2.4)	— —	— —	— —	— —
GSP · TREND ²	— —	— —	−0.3 (0.2)	−0.4 (0.2)	— —	— —	— —	— —
R ²	0.05	0.04	0.05	0.05	0.49	0.47	0.07	0.08

is not our focus here. There is no significant impact of banking deregulation on the sensitivity of interest, dividend, and rental income to output shocks; see columns (7) and (8). This result is intuitive because, to a large extent, such income is diversified across the United States.

VIII. Conclusion

This paper provides evidence that U.S. banking deregulation and the consequent changes in bank market structure had significant real effects on the economy through the role banks play as the main source of funds for small businesses. Our analysis further casts light on the risk-sharing function of banks and the integration of bank markets.

We demonstrate that interstate risk sharing at the income level (income insurance) increased significantly in states that deregulated restrictions on

banks' ability to operate branching networks or holding companies within or between states. We hypothesize that this effect works in large part through small businesses because of the intertwining of the personal finances of bank-dependent small business owners with the finances of their firms. We find two sets of results consistent with this hypothesis. First, we show that the positive effect of deregulation on income insurance is significantly stronger in states in which small businesses are more important, as measured in terms of share of employment. Second, we show that proprietors' income is considerably less sensitive to output shocks following banking deregulation. We conjecture that the changes in the U.S. banking industry that have led to an improvement in income insurance are due to improved efficiency in lending to small businesses after deregulation and to improved efficiency of interbank capital allocation.

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