Consumption Risk Sharing over the Business Cycle: the Role of Small Firms' Access to Credit Markets

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Abstract

Consumption risk sharing among U.S. federal states increases in booms and decreases in recessions. We find that small firms' access to credit markets plays an important role in explaining this stylized fact: business cycle fluctuations in aggregate risk sharing are more pronounced in states in which small firms account for a large share income or employment. In addition, better access of small firms to credit markets in the wake of state-level banking deregulation during the 1980s seems to have loosened the dependence of aggregate risk sharing on the business cycle. Not only do our result support that better access to credit markets may have made it easier for the owners of small firms to smooth income in the face of adverse cash-flows shocks to their business. They suggest a major additional benefit from banking deregulation: access to bank credit has become more reliable and is more easily available when households and firms need it most urgently - in economic downturns.

JEL Code: E32, E44, F3

Keywords: interstate risk sharing, regional business cycle, proprietary income, small businesses, state banking deregulation.

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1 Introduction

Consumption risk sharing among U.S. federal states increases in booms and decreases in recessions. We find that small firms' access to credit markets plays an important role in explaining this stylized fact: business cycle fluctuations in aggregate risk sharing are more pronounced in states in which small firms account for a large share of income or employment. Better access of small firms to credit markets in the wake of state-level banking deregulation during the 1980s has, however, dampened the dependence of aggregate risk sharing on the business cycle.

Our analysis places itself at the intersection of two important recent strands of the literature. The first strand emphasizes that the degree to which certain household groups and small firms have access to financial markets varies dramatically over the business cycle. In particular, a considerable body of theoretical and empirical work on the financial accelerator[1] has argued that tightening collateral constraints in credit markets may act as a potentially powerful amplification mechanism for aggregate shocks. Gertler and Gilchrist (1994) were among the first to illustrate empirically that small firms with their strong dependence on bank finance are particularly exposed to such shocks.

We provide a comprehensive taxonomy of business cycle variation in interstate risk sharing. First, we show that the extent to which interstate risk sharing varies with the aggregate output cycle is quantitatively important: over our sample period, which ranges from 1963-98, on average almost 80 percent of state-specific shocks to output are shared across state-borders. However, this average masks considerable variation over time: at the trough

[1] We will not attempt to survey this work here. Leading examples include Bernanke (1983), Bernanke and Gertler (1989) and Kiyotaki and Moore (1997)) among others.

of the typical NBER recession during that period, the fraction of risk shared was almost 20 percentage points below this level. This dependence of aggregate risk sharing on the business cycle is robust to controls for other factors such as stock market and in particular housing price fluctuations which, as recently argued by Lustig and van Nieuwerburgh (2005, 2008), may also affect the ability of households to share risk across regional borders.

Secondly, we identify the sources of the procyclical variation in interstate risk sharing. Specifically, we ask through which channels risk is shared and how the contribution of these channels varies over time. Building on Asdrubali, Sørensen and Yosha (1996) we distinguish between three channels of risk sharing: income smoothing (through interstate flows of capital and labor income), fiscal transfers and consumption smoothing through personal savings and dissavings. As the main source of the procyclicality in aggregate consumption risk sharing we identify strong procyclical fluctuations in the extent to which a region's households can smooth consumption through savings and dissavings. Importantly, this very characteristic pattern of risk sharing over the business cycle is more pronounced in federal states where small businesses are particularly prevalent as employers or where the income of small business owners accounts for a large share of state personal income.

To show that it is truly small business access to credit that is key in explaining the time-variation in aggregate risk sharing, we connect to a second strand of the literature. Starting with Jayaratne and Strahan (1996), a series of studies has exploited the experience of U.S. state-level banking deregulation during the 1970s and 1980s as a natural laboratory in which to study the effect of liberalizations on growth, the comovement of regional business cycles (Morgan, Rime and Strahan (2004)) and, more recently, risk sharing (Demyanyk, Ostergaard and Sørensen (2007), Acharya, Imbs and

Sturgess (2006)). We build on these papers in arguing that this wave of deregulation has had a significant impact on small firm access to credit: small firms typically cannot issue stocks or bonds and therefore heavily rely on bank finance. The key aspect we emphasize here is that this makes them vulnerable to changes in local credit market conditions which tend to worsen in downturns and to improve in booms. At the same time, the business and private finance of small business owners are closely intertwined so that fluctuations in the access to business credit are also likely to affect the ability to smooth personal consumption over time. State-level banking deregulation transformed a highly fragmented, localized banking system into a system with larger banks that can pool funds across local and state boundaries. We conjecture that this makes the availability of credit less dependent on the phase of the business cycle and that small firms would be prime beneficiaries of such a development.

Our results provide strong support for this hypothesis. We document that intrastate banking deregulation has dramatically lowered the variability of risk sharing over the cycle: before deregulation, each additional percentage point of GDP growth increased aggregate risk sharing by around 3-4 percentage points. This variability in the extent to which state-level idiosyncratic risks can be shared across the nation has almost vanished as a result of the abolition of intrastate bank branching and merger restrictions. Small firms seem to have played an important role in transmitting the effects of this deregulation to the real economy: the procyclical pattern in risk sharing is reduced most strongly in those states where small businesses account for a large share of income or employment.

This paper is possibly most closely related to Demyanyk, Ostergaard and Sørensen (2007) who show that interstate income smoothing increased by around 15 percentage points *on average* following banking deregulation. We extend the results by Demyanyk et al. (2007) by showing that the increase in income smoothing is part of a larger shift in the patterns of interstate consumption risk sharing: banking deregulation seems to have lowered the contribution from consumption smoothing out of income (through savings and dissavings) while allowing better smoothing of income in the face of state-specific output shocks. While interesting in its own right, this shift implies that the net effect of banking deregulation on the longer-term average level of *consumption* risk sharing has overall been rather small. However – and that is the gist of our results – banking deregulation has made consumption risk sharing a lot steadier over the cycle. In particular, this means that consumption risk is almost 20 percentage points higher than it used to be before deregulation *in the average recession.*

The welfare costs of aggregate business cycles critically depend on the extent of heterogeneity among economic agents. Therefore, the reduction in the variability of interstate risk sharing that we document here is a potentially important source of the aggregate benefits from banking deregulation. Since small firms are especially exposed to aggregate shocks (Gertler and Gilchrist (1994)), it is important they can keep borrowing in recessions. The abolition of state bank branching regulations seems to have achieved exactly this: especially in states with lots of small firms, access to credit has become much less dependent on the state of the aggregate economy.

The remainder of the paper is structured as follows: in the next section, we introduce our empirical framework and use it to document the procyclical nature of aggregate risk sharing. We then present our data and the details of the empirical implementation in section three. In section four we discuss our results. Section five concludes.

2 Consumption risk sharing over the business cycle

We measure consumption risk sharing through panel regressions of the form

$$\Delta \log \frac{C_t^k}{C_t^*} = \beta_U \left[\Delta \log \frac{GSP_t^k}{GSP_t^*} \right] + \varepsilon_t^k \tag{1}$$

where C_t^k is per capita consumption in federal state k in period t, GSP_t^k is gross state product per head and the asterisk denotes the national per capita average of the respective variable. In such a regression, we can think of the estimate of β_U as the amount of uninsured idiosyncratic output risk.

Regressions such as (1) by now have some tradition in the both the microeconometric as well as in the macro literature. Mace (1991), Cochrane (1991) and Townsend (1994) were the first to suggest regressions similar to (1) on household level data as a test of the null of complete markets. Here, we follow the macroeconomic literature on risk sharing (Asdrubali et al. (1996), Crucini (1999)) and assume that each federal state is represented by a stand-in consumer. In a world with complete markets, growth in marginal utility should be equated across regions, so that in all states of nature:

$$\frac{u'(C_{t+1}^k(s))}{u'(C_t^k(s))} = \lambda(s) \tag{2}$$

where s indexes the state of nature and $\lambda(s)$ is the growth in the shadow-price of consumption. A key implication of (2) is that if risk is efficiently allocated, marginal utility growth should be independent of country-specific variables. To the extent that we can associate changes in marginal utility with consumption growth, consumption growth should therefore be independent of a region's business cycle risks - regressions of the form (1) should yield a coefficient of zero. More recently, Asdrubali, Sørensen and Yosha (1996) have argued that the estimate of β_U may be more generally informative: even if the null of complete financial markets is rejected, β_U still is a measure of market incompleteness. In panel regressions, β_U is regularly between 0 and unity, so that $1 - \beta_U$ can straightforwardly be interpreted as the share of the average region's idiosyncratic risk that gets laid off in financial markets, whereas β_U is the portion of non-diversified idiosyncratic risk faced by the average region.

Estimates of β_U based on regional data typically fall into the range between $0.2 - 0.3$, a quarter to a third of a region's idiosyncratic output risk remains uninsured. Based on our U.S. state-level data set here, we obtain an estimate of 0.22. Such estimates are typically based on panel regressions such as (1) and they do not allow for the possibility that the amount of risk sharing that a group of regions achieves may actually be varying over the business cycle.

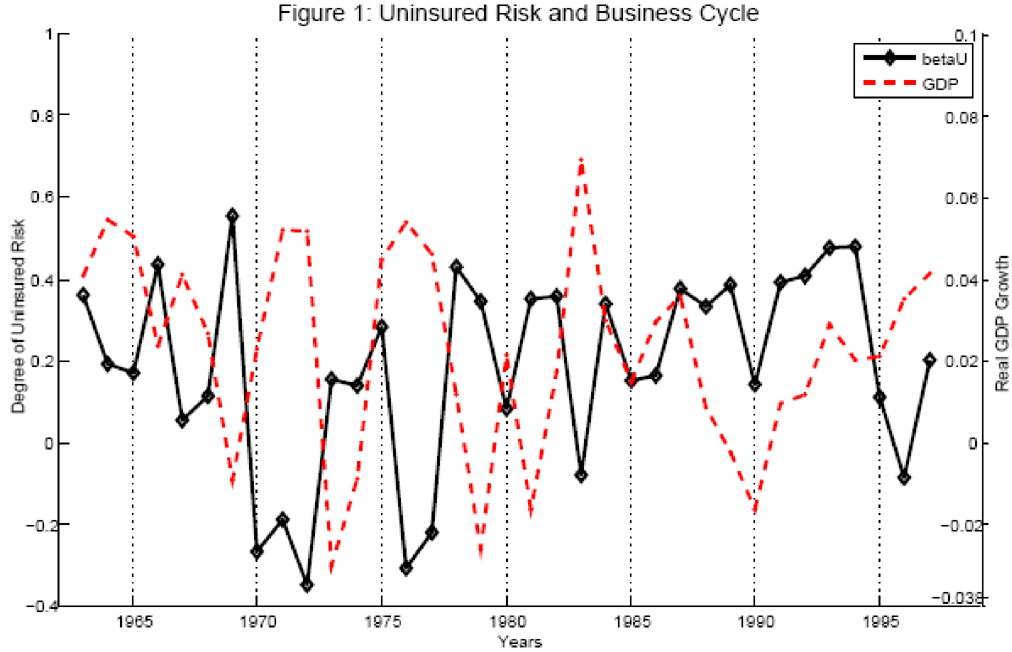
In this paper we argue that aggregate risk sharing varies over the business cycle because certain groups of households may find it harder to obtain consumption insurance in financial markets during recessions than during booms. In particular, many small firms heavily rely on access to bank loans, i.e. to credit markets, to smooth fluctuations in business cash flow. It is well documented that credit market frictions tend to hit small firms harder than bigger firms that can issue their own bonds or may even be able to raise equity in stock markets. Gertler and Gilchrist (1994) show that the credit channel of monetary policy has a much stronger impact on small firms than on bigger firms. Fluctuations in cash flow and in the availability of credit over the business cycle may therefore affect the degree of consumption risk sharing that the proprietors of small businesses and possibly also their employees can achieve. In this way, credit market restrictions may translate into fluctuations in aggregate risk sharing across regions.

We present first evidence to this effect in figure 1: the figure plots a sequence of cross-sectional estimates of the coefficient β_U. To obtain this sequence, we run the regression (1) as a cross-sectional regression for each year in our sample period that ranges from 1964 to 1998:

$$\Delta\widetilde{c}_t^k = \beta_U(t)\Delta\widetilde{gsp}_t^k + \tau_t + \varepsilon_t^k \tag{3}$$

where $t = 1964...1998$, τ_t is the constant of the time t cross-sectional regression and ε_t^k the disturbance term. Here, and in the remainder of the paper, we use lower-case letters with a tilde to denote logarithmic deviations from the US-wide mean, so that $\Delta\widetilde{c}_t^k = \Delta \log \left[C_t^k / C_t^*\right]$ and $\Delta\widetilde{gsp}_t^k = \Delta \log \left[GSP_t^k / GSP_t^*\right]$. The solid line in figure (1) represents the sequence $\{\beta_U(t)\}$, the dashed line is aggregate U.S. real GDP growth. The sequence of risk sharing coefficients has a mean of roughly 0.2 but it fluctuates dramatically over the cycle: $\beta_U(t)$ displays a strong negative correlation (-0.48) with aggregate GDP growth – the share of non-diversified state-level idiosyncratic risk increases in recessions and decreases in booms.

Figure 1: Uninsured Risk and Business Cycle



Notes: This figure reports uninsured risk component β_U vs. GDP growth rates. β_U-sequence is estimated as cross-sectional regression (3) for each year over 1963-1998.

As we show in the remainder of the paper, this cyclical pattern in $\beta_U(t)$ is more pronounced in states were small businesses are important. Closer inspection of figure (1) also reveals that the negative correlation between $\beta_U(t)$ and GDP growth breaks towards the end of the sample period, after 1985. We will argue that this decline in the comovement of $\beta_U(t)$ with the business cycle is the result of banking deregulation at the state level during the 1970s and 80s. Deregulation seems to have made small business access to credit a lot steadier, thus virtually removing the correlation between aggregate risk sharing and the business cycle.

2.1 Patterns of risk sharing

The coefficient β_U in (3) tells us how much of the idiosyncratic risk faced by the average federal state remains uninsured at time t. In order to obtain a better understanding of the nature of the frictions that drive time variation in $\beta_U(t)$, we also want to know *how* risk sharing is achieved. Building on Asdrubali, Sørensen and Yosha (1996), we therefore explicitly consider three channels of interstate risk sharing.

We refer to the first channel as income smoothing: to what extent do net interstate capital and labour income flows help insure income against fluctuations in output? To capture net interstate capital and labour income flows, we look at the wedge between output (gross state product, GSP) and state level income (SI). Since the original paper by Asdrubali et al. (1996) the literature has generally associated this channel with net factor (mainly: capital) income flows from other states and conveniently refers to it as the capital market channel. While this interpretation is highly intuitive, for our purposes here it is important to note that state income does not reflect all income flows to a state. State income excludes income flows to legal entities (such as incorporated firms) in as far as this income is not eventually disbursed to private households. In this respect SI differs from the income concept underlying gross national product (GNP) that is used in national income accounting. Since GNP data is not available at the state level, it is therefore not possible to disentangle risk sharing through net interstate factor income flows from the intrastate income smoothing achieved through the balance sheets of legal entities. Small firms - that are our focus here - are often registered as limited liability companies or in other quasi-incorporated forms (such as S-corporations), and we discuss below in which respect this distinction might matter for some of our findings.[2]

The second channel we consider are net fiscal transfers– either through

[2] Specifically, the extent to which small (incorporated) firms have access to credit markets could affect the way in which they disburse dividends to their owners and may therefore also affect the choice of income smoothing vs. other channels of risk sharing. See in particular our discussion surrounding footnote 10 below.

the progressivity of the tax system or through the social security system both of which may allow residents of a federal state to further smooth disposable relative to state income. For brevity, and in line with the extant literature, we call this channel the fiscal channel.

Finally, there may be further consumption smoothing through credit markets at the individual (household) level, after (disposable) income for the current period is known. This effectively amounts to households smoothing their consumption through savings and dissavings. We therefore refer to this third channel as consumption smoothing.

To gauge the contribution of each of these channels to aggregate risk sharing, we run the following panel regressions:

$$\begin{aligned} \Delta\widetilde{gsp}_t^k - \Delta\widetilde{si}_t^k &= \alpha_K + \beta_I \Delta\widetilde{gsp}_t^k + \delta_I^k + \varepsilon_{K,t}^k \\ \Delta\widetilde{si}_t^k - \Delta\widetilde{dsi}_t^k &= \alpha_F + \beta_F \Delta\widetilde{gsp}_t^k + \delta_F^k + \varepsilon_{F,t}^k \\ \Delta\widetilde{dsi}_t^k - \Delta\widetilde{c}_t^k &= \alpha_C + \beta_C \Delta\widetilde{gsp}_t^k + \delta_C^k + \varepsilon_{C,t}^k \\ \Delta\widetilde{c}_t^k &= \alpha_U + \beta_U \Delta\widetilde{gsp}_t^k + \delta_U^k + \varepsilon_{U,t}^k \end{aligned} \tag{4}$$

where si and dsi denote the logarithms of state level income and disposable income respectively. Since all states face aggregate US-wide shocks that cannot be insured by definition, we focus on the idiosyncratic, state-specific component of all variables that we again denote with a tilde so that $\Delta\widetilde{y}_t^k = \Delta y_t^k - \Delta y_t^{US}$ (for $\Delta\widetilde{y}_t^k = \Delta\widetilde{gsp}_t^k$, $\Delta\widetilde{si}_t^k$, $\Delta\widetilde{dsi}_t^k$, $\Delta\widetilde{c}_t^k$). With this specification we control for common time-specific effects. The coefficients δ_X^k capture state-specific fixed effects.

The theoretical values of the coefficients in the above set of regressions are

$$\beta_I = cov(\Delta \widetilde{gsp}_t^k - \Delta \widetilde{si}_t^k, \Delta \widetilde{gsp}_t^k)/var(\Delta \widetilde{gsp}_t^k)$$

$$\beta_F = cov(\Delta \widetilde{si}_t^k - \Delta \widetilde{dsi}_t^k, \Delta \widetilde{gsp}_t^k)/var(\Delta \widetilde{gsp}_t^k)$$

$$\beta_C = cov(\Delta \widetilde{dsi}_t^k - \Delta \widetilde{c}_t^k, \Delta \widetilde{gsp}_t^k)/var(\Delta \widetilde{gsp}_t^k)$$

$$\beta_U = cov(\Delta \widetilde{c}_t^k, \Delta \widetilde{gsp}_t^k)/var(\Delta \widetilde{gsp}_t^k).$$

so that

$$\beta_I + \beta_F + \beta_C = 1 - \beta_U$$

by construction. Hence, the set of regressions (4) provides us with a complete decomposition of the cross-sectional variance of state-specific output growth. In this way we obtain not only a picture of how much risk is shared $(1-\beta_U)$, but we also get a breakdown into the contribution of the different channels to aggregate risk sharing (the coefficients β_I, β_F and β_C). We call the vector $\boldsymbol{\beta}= [\beta_I, \beta_F, \beta_C, \beta_U]$ the pattern of risk sharing. So far, the regression setup we have presented here assumes that β is time-invariant. In our empirical implementation, we allow for the possibility that $\boldsymbol{\beta}$ varies over time and also between federal states. The next section presents our data set and discusses how we capture such variation in the patterns of risk sharing.

3 Empirical implementation

3.1 Data

We use a panel of variables for the 50 U.S. states and for Washington D.C. for the period 1963-1998. All data is annual. To measure regional risk sharing on each level we employ an updated version of the data set used by Asdrubali et al. (1996). These data consist of annual gross state product and personal income data from the Bureau of Economic Analysis (BEA). Disposable state income is constructed as state income plus federal transfers, minus total federal taxes raised in the state. State consumption consists of state/local government and private consumption. Since private consumption data at the state level is not available, state private consumption is estimated as the state retail sales data rescaled by the ratio of total (US-wide) private consumption to total US retail sales. Real gross domestic product is the sum of gross state products over all states. All these variables are in per capita terms and deflated by the price index for personal consumption expenditure. Growth rates of real per capita variables are calculated as first differences of natural logarithms of per capita deflated level values. Further details on all data and their preparation are provided in the appendix.

We consider two measures of the importance of small businesses in a federal state. Our first and principal measure is the share of proprietors' income in state personal income. This measure of proprietors' income or proprietary income is readily obtained from the regional economic account tables available from the Bureau of Economic Analysis (BEA). The second measure is the share of small business employment in total state employment. This measure defines establishments as 'small' if they have less than 100 employees. However, these data are recorded only for the period after 1977. They are available from the Geospatial and Statistical Data Center at the University of Virginia library.

Recession and expansion dates are from NBER Business Cycle Data Base.

3.2 Capturing time- and state variation in interstate risk sharing

To explore business cycle fluctuations in the pattern of risk sharing as well as its variation across federal states, we parametrize β as a function of aggregate variables. In addition, we control for (potentially time-varying) state-specific characteristics. Again, collecting $\boldsymbol{\beta}^k(t) = [\beta_I^k(t), \beta_F^k(t), \beta_C^k(t), \beta_U^k(t)]$, we parametrize

$$\beta_X^k(t) = \beta_{X0} + \mathbf{z}_t^{k\prime}\boldsymbol{\beta}_{X1} \tag{5}$$

for $X = I, F, C, U$. Here, β_{X0} measures the average amount of risk insured via income, fiscal, and consumption smoothing and uninsured risk respectively when $\mathbf{z}_t^k$ equals zero. $\boldsymbol{\beta}_{X1}$ gives the marginal effect on risk sharing through channel X that is induced by shifts in $\mathbf{z}_t^k$. We partition $\mathbf{z}_t^k$ into aggregate, time-varying ($\mathbf{x}_t'$) and time-invariant state-specific ($\mathbf{u}'^k$) characteristics. In addition, we allow for characteristics that can vary across both state and time ($\mathbf{y}_t'^k$), so that $\mathbf{z}_t^{k\prime} = \left[\mathbf{x}_t', \mathbf{u}'^k, \mathbf{y}_t'^k\right]$.

By plugging (5) into the panel sharing regressions (4) above and multiplying out, we then obtain a set of interaction terms with $\Delta\widetilde{gsp}_t^k$. The coefficients on these interaction terms then correspond to the respective coefficients in the vector $\boldsymbol{\beta}_{X1}$ and allow us to calculate $\beta_X^k(t)$ given the aggregate and state specific characteristics at time t. We generally estimate panel OLS regressions of the form

$$x_t = \beta_{X0}\Delta\widetilde{gsp}_t^k + \mathbf{z}_t^{k\prime}\boldsymbol{\beta}_{X1}\Delta\widetilde{gsp}_t^k + \mathbf{y}_t^{k\prime}\boldsymbol{\beta}_Y + \alpha_X + \delta_X^k + \tau_t^X + \varepsilon_{X,t}^k \tag{6}$$

with $x_t = \Delta\widetilde{gsp}_t^k - \Delta\widetilde{si}_t^k$, $\Delta\widetilde{si}_t^k - \Delta\widetilde{dsi}_t^k$, $\Delta\widetilde{dsi}_t^k - \Delta\widetilde{c}_t^k$, $\Delta\widetilde{c}_t^k$ and for $X = I, F, C, U$ respectively. Besides the usual time-invariant state-specific (δ_X^k)

effects, this specification also includes state-invariant time-fixed (τ_t^X) effects, even though $\Delta\widetilde{gsp}_t^k$ and x_t are already measured as deviations from the cross-sectional (i.e. national) mean. This keeps our regressions parsimonious while avoiding spuriously significant partial effects: the panel time-specific effects capture the first-order impact of time-variation in aggregate variables. Equally, as long as the regional characteristics are time-invariant, their first-order effects will be fully captured by the state fixed-effects. The only uninteracted elements of $\mathbf{z}_t^k$ we therefore need to control for in this specification are the time- *and* state specific variables $\mathbf{y}_t'^k$.[3]

4 Results

4.1 Cyclical patterns of Interstate consumption risk sharing

Our first set of results is presented in table 1. Here we run the decomposition (4) above by parametrizing

$$\beta_X(t) = \beta_{0X} + \beta_{1X}\Delta gdp_t \qquad (7)$$

where Δgdp_t is aggregate GDP growth. Confirming the intuition provided in figure (1), we find that consumption risk sharing increases in booms and decreases in recessions (i.e. $\beta_U(t)$ is countercyclical). Interestingly, the income and consumption smoothing channels have opposite cyclical dependence on GDP; whereas income smoothing decreases in booms and increases in recessions, the opposite is true for both fiscal transfers and in particularly consumption smoothing. Consumption smoothing decreases in recessions, whereas it improves in booms. This latter effect dominates the positive ef-

[3] In particular, the state-level banking deregulation dummy we use below will be of this latter form.

fect of recessions on income smoothing (and is further reinforced through the fiscal channel) so that the total extent of risk sharing, as measured by $1 - \beta_U(t)$, is strongly procyclical.

These results are robust to alternative measures of the business cycle. In panel B, we capture the business cycle using the official NBER recession and expansion dates. We also distinguish between recessions and booms to check for the possibility of asymmetries in the dependence of risk sharing on the cycle. There is no sign of such asymmetries: the coefficients on the expansion and recession indicators are virtually of the same order of magnitude and all correctly signed throughout and – with the sole but only marginal exception of the expansion indicator in the regression for β_U – also highly significant.[4]

Turning to the pattern of risk sharing, we see that the main source of procyclicality in risk sharing is consumption smoothing – our estimate of $\beta_C(t)$ is strongly procyclical and highly significant.

This procyclicality in consumption smoothing is partly offset by income smoothing ($\beta_I(t)$) which decreases in booms and rises in recessions. A similar pattern has also been observed by Agronin (2003) who also pointed at the possibility that an explanation for this feature might be purely mechanical: the share of small business owners' income (proprietary income) in U.S. output is strongly procyclical. Since income from small businesses is not generally disbursed across state boundaries, say through profit or dividend payments (since the owner of a typical small business is likely to reside in the state), the share of income that flows across state borders to provide income smoothing decreases in booms.[5]

[4]Though the point estimates indicate that the reduction of aggregate risk sharing in recessions is stronger than its rise in booms, we cannot reject the hypothesis $\beta_{1U} + \beta_{2U} = 0$. Hence, we cannot reject that there are no asymmetries between expansions and recessions.

[5]This interpretation is supported by the fact that we find a negative link between

However, $\beta_C(t)$ is much more strongly procyclical than $\beta_I(t)$ is anticyclical. The impact on the procyclicality in aggregate risk sharing $(1 - \beta_U(t))$ is further reinforced through the fiscal channel , even though this effect is rather small. Hence, fluctuations in access to consumption smoothing possibilities *given disposable income* are the main driver of the variation in interstate consumption risk sharing over the business cycle.

4.2 Importance of small businesses

We show next that the cyclical pattern of risk sharing that we established in table 1 is much more pronounced in those states where small firms are important.

As discussed in the data description, we employ two measures of small firm importance (that we denote by μ throughout) in a state: our first measure is the share of proprietary income in state personal income ($\mu_1 = Shapi$). This measure has the advantage that it specifically focuses on the importance of those households that actually own small businesses for the regional economy.

As an additional measure, we also consider the share of total employment in small businesses of less than 100 employees ($\mu_2 = SBE$). It encompasses a somewhat different concept of small business importance in that it focuses on the role of small businesses as employers and therefore for the local economy at large. One drawback of this measure is that state-level time-series for small business employment are available only from 1977, thus covering only what is essentially the second half of our sample period.

For both the employment (SBE) and income ($Shapi$) based measure we split our sample of states into three equally sized groups according to

income smoothing and the aggregate share of proprietors' income in GNP once, in analogy to (7) we parametrize β_I as a function of this variable.

whether the importance of small businesses in a given state is high, middle or low.[6] We conduct this sample split based on sample averages for the proprietors' income measure, whereas we use the earliest available observation (1977) for the employment-based measure of small-business importance. [7]

We then rerun the regression specification (7) for the unsmoothed component , $\beta_U(t)$, on each of these groups. The results are in panel A of table 2: as is apparent, the coefficient on the interaction term between aggregate GDP, Δgdp_t, and the growth of gross state product, $\Delta \widetilde{gsp_{k,t}}$, is highly significant and negative for those states where small businesses are important. For the other two groups of states, aggregate risk sharing does not seem to covary strongly with the business cycle. As is apparent, the results are qualitatively the same, irrespective of whether we use the income- or the employment-based measure of small business importance.[8]

[6]These groups, to which we refer as high-, middle- and low-μ groups, are detailed in table A1 in the appendix.

[7]We checked that it is indeed the cross-sectional dispersion (and not time variation) in μ^k that drives the results. First, we also ran most of our specifications with the time-averages of $\mu_1 = Shapi$ taken over the first or the second half of the sample only. Secondly, we parametrized many of the regressions below in a way that allows μ_1 to vary across both time and state. All results reported in the paper were robust to these changes. For the employment-based measure, we focus on the earliest available observation for two reasons. First, because our argument below is going to be that the dependence of aggregate risk sharing on the business cycle (and the role of small business importance for the strength of this dependence) is going to be weaker after the deregulation wave of the mid 1980s. Secondly, the recession of the early 1980s has had a major impact on the ranking of some big states in terms of small business importance. Still, most of our results based on SBE would be the same if we used averages instead of the earliest observation.

[8]The coefficient β_{U0} may decline as we move from the low to the high μ-group but this does *not* necessarily mean that the high μ group shares more risk on average. The reason for this variation in β_{0U} between the groups is mainly mechanical: We could equivalently estimate the specification $\beta_u(t) = \overline{\beta}^i_{0U} + \beta^i_{1U}(\Delta gdp_t - \overline{\Delta gdp})$ where $\overline{\Delta gdp}$ is the sample mean of aggregate GDP growth and i stands for the low, middle and high-μ groups respectively. Then $\overline{\beta}^i_{0U} = \beta^i_{0U} - \beta^i_{1U}\overline{\Delta gdp}$ is the average amount of risk shared by group i. It is apparent that the group with the higher business cycle sensitivity (lower β^i_{1U}) of risk sharing will necessarily have a lower β^i_{0U} if the average amount of risk shared, $\overline{\beta}^i_{0U}$, does *not* vary across groups. We do not report the specification with demeaned Δgdp mainly because this would in turn make the interpretation of the coefficients on interactions involving Δgdp as we will consider them in the remainder of the paper considerably less intuitive. We explore in the next specification if there are systematic differences in the

We then explore to what extent the entire pattern of risk sharing is sensitive to the aggregate business cycle. We do so by parametrizing $\beta_X(t)$ as a function of the share of proprietary income in state personal income:

$$\beta_X(t) = \beta_{X0} + \beta_{X1}\Delta gdp_t + \beta_{X2}\Delta gdp_t\left(\mu_1^k - \mu_1\right) + \beta_{X3}\left(\mu_1^k - \mu_1\right)$$

where μ_1^k is the sample average of the share of proprietary income for state k and μ_1 the cross-sectional mean of μ_1^k. Panel B of table 2 presents the results for this specification. Again it is clearly apparent that the cyclical dependence of interstate risk sharing overall ($\beta_U(t)$) is more pronounced where small firms account for a large share of state income. Inspecting the patterns of risk sharing, we see that this feature can primarily be explained by the fact that the consumption smoothing channel, $\beta_C(t)$, is particularly procyclical in states where μ_1 is high.

These findings suggests that small firms play an important role in explaining *why* aggregate risk sharing fluctuates over the business cycle. It is, however, conceivable, that the time variation in these firms' access to finance is not mainly the result of them being rather small, but rather the outcome of these firms being concentrated in particular sectors of the economy.

We address this issue in table 3, where we repeat our regressions for $\beta_U(t)$, but now we also include a number of controls. Specifically, we capture industrial structure through a sectoral specialization index of the form

$$IS_k = \sum_{s=1}^{S}\left\{\frac{GSP_k^s}{GSP_k} - \frac{1}{K-1}\sum_{j=1, j\neq k}^{K}\frac{GSP_j^s}{GSP_j}\right\}^2$$

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extent to which the three groups share risk on average.

where GSP_k^s/GSP_k is the share of value added in sector s in the total value added of state k. In our regressions, we use the estimates of IS_k provided in table (1) of Kalemli-Ozcan, Sørensen and Yosha (2001) for both the one and the two digit industry classification levels. In our specification for $\beta_U(t)$ we then also include both IS and its interaction with Δgdp. In several of the regressions reported in table 3 we also include a linear trend in the specification for $\beta_U(t)$ to control for the effect of other, gradual developments that could have affected interstate risk sharing over the sample period.

In addition, we estimate some of the specifications in table 3 by GLS to account for potential heteroskedasticity in the data. We first estimate the respective equation for the entire panel by OLS. Then we use the residuals to estimate the residual variance for each state. In a second step, we correct for heteroskedasticity by weighting observations with the inverse of this state-specific variance. This never affects our results and here and elsewhere in the paper we mainly report the results for panel OLS which gives slightly higher weight to smaller states.

The results in table 3 clearly show that industrial structure matters both for the degree of interregional risk sharing as well as for its cyclical dependence. More specialized regions tend to be better insured, a stylized fact first established by Kalemli-Ozcan, Sørensen and Yosha (2001, 2003). It also appears to be the case that more specialized regions tend to be exposed more to cyclical variation in risk sharing, even though this result appears less pronounced in the generalized least squares regressions. Controlling for industrial structure does, however, not affect our findings that small businesses are paramount in explaining why aggregate risk sharing fluctuates over the cycle. We therefore conclude that it is not mainly industrial structure but the incidence of small firms itself that can account for the patterns we have documented in this subsection.

4.3 The role of banking deregulation

Our maintained hypothesis is that small firms' access to credit markets, particularly to bank loans, is a key determinant of the extent to which interstate risk sharing fluctuates over the aggregate business cycle. A major development that could have affected the availability of credit to small firms in our sample period is the gradual deregulation of the U.S. banking market during the 1970s and 1980s. Until that time, the U.S. had a highly fragmented, localized banking system. State regulation generally prohibited the operation of out-of-state banks and also strongly limited bank branching within a state, to the point that in some states banks where allowed to operate only a single branch.[9] From the point of view of economic theory, one would expect that the gradual lifting of this regulation would lead to considerable welfare gains through the formation of bigger banks and a better inter- and intrastate pooling of credit risk. Indeed, Jayaratne and Strahan (1996) show that federal states that deregulated their banking markets earlier did eventually grow faster. They ascribe much of this growth gain to better access of small firms' to credit. Morgan et al. (2004) find that deregulation has lowered the volatility of U.S. state business cycles. In a recent important contribution, Demyanyk et al. (2007) demonstrate that income risk sharing increased due to state-level banking deregulation and they also show that this increase was more pronounced in states where there are lots of small businesses. While our paper is related to Demyanyk et al.'s, our analysis differs in scope in that we focus on the role of proprietary businesses and

[9] See Kroszner and Strahan (1999) for a succinct overview of the historical origins of this regulation and for a detailed account of of the political and economic determinants of deregulation.

state-level banking deregulation for business cycle *variability* in risk sharing rather than on the effect of deregulation on the *average* level of risk sharing. Specifically, we investigate to what extent banking deregulation has *steadied* interstate risk sharing by improving small firms' access to finance.

The literature has distinguished between two dimension of state-level deregulation: intrastate deregulation removed branching and merger restrictions for banks and bank holding companies that were domiciled in a state. Interstate deregulation allowed access to the local market by out-of state banks and bank holding companies (often on a reciprocal basis) thus making the interstate pooling of bank funds possible.

As we show in the next subsection, it was *intra*state deregulation that has affected the cyclical pattern of risk sharing whereas interstate deregulation had virtually no effect in this respect. Unless otherwise mentioned, our focus in this paper is therefore on intrastate deregulation.

To exploit both the cross-sectional and intertemporal dimensions of deregulation we use a dummy variable SDD_t^k which becomes one from the year in which deregulation took place in state k. Following the practice of Jayaratne and Strahan (1996), Kroszner and Strahan (1999) and Demyanyk et al. (2007), we define the date of intrastate deregulation as the year in which state-wide branching through mergers and acquisitions was fully permitted. Deregulation dates are from Kroszner and Strahan (1999) for the years 1978-2001 and Amel (1993) for the years prior to 1978.

In table 4, we explore if intrastate banking deregulation has had an impact on the pattern of risk sharing and the degree to which it varies over the business cycle. In panel A, we first introduce the dummy SDD_t^k to allow for a state-specific impact on the long*er* term *average* level of risk sharing. Doing so leaves our conclusions with respect to the cyclical fluctuation in the pattern of risk sharing unaffected; the point estimates on the Δgdp-term for all channels as well as for the unsmoothed component remain virtually unchanged and highly significant.

Quite in line with Demyanyk et al. (2007), we find a sizeable positive level effect of banking deregulation on the average level of income smoothing: deregulation leads to between 15 and 20 percentage points more risk sharing through the income channel. Interestingly, however, we also find that deregulation lowers the average amount of consumption smoothing by roughly the same, so that the net effect of banking deregulation on $\beta_U(t)$ appears insignificant. This would seem to suggest that banking deregulation has had a pronounced effect on the *patterns* of income and consumption smoothing but less so on the total extent to which consumption risk is shared across state boundaries.

It is beyond the scope of this paper to explore this shift in the pattern of risk sharing in detail.[10] But while this impact on the patterns of risk sharing clearly seems very marked, deregulation seems to have had a rather small effect on the average level of consumption risk sharing. Our argument here is that banking deregulation has still had an economically very important effect on consumption risk sharing by weakening its variability over the business cycle.

Table 4, panel B shows the impact of banking deregulation on the *cyclical* pattern of risk sharing. Here, we report on a specification which allows the sensitivity of $\beta_X^k(t)$ to GDP growth to change after banking deregulation:

[10] One possible explanation could be provided by the creation of the S-corporation in the early 1980s. The S-corporation, though being a legal entity, is tax exempt. Only profits disbursed to shareholders are taxed as personal income (statistically they are then registered as proprietary income). In a progressive tax system, this could create a tax incentive to smooth the disbursement of profits, provided the firm can buffer fluctuations in cash flow through access to credit markets. Clearly, we would expect the latter to have become easier in the wake of deregulation.

$$\beta_X^k(t) = \beta_{X0} + \beta_{X1}\Delta gdp_t + \beta_{X2}\Delta gdp_t SDD_t^k + \beta_{X3} SDD_t^k \qquad (8)$$

For both the income and the consumption smoothing, the coefficients β_1 and β_2 have opposite sign and are highly significant. In both cases, we accept the hypothesis $\beta_1 + \beta_2 = 0$ at very high significance levels. This also carries over to $\beta_U(t)$. Here, again, we cannot reject $\beta_{U1} + \beta_{U2} = 0$. These findings suggest that banking deregulation has eliminated almost all of the business-cycle dependence of aggregate risk sharing. In any case deregulation seems to have contributed substantially to weakening this dependence.

As our previous results suggest, this business cycle dependence used to be particularly pronounced in states where small businesses are particularly prevalent. Hence, if banking deregulation has almost eliminated the dependence of risk sharing on the state of the business cycle, then it would seem that its effect should have been strongest in states with lots of small businesses. We explore this possibility next.

Table 5 presents regressions in which β_U is again parametrized as a function of GDP growth:

$$\beta_U(t) = \beta_{0U} + \beta_1 \Delta gdp_t$$

As in table 2, the regressions reported in panel A of table 5 are performed on subsamples formed according to the importance of small businesses. Again, we refer to these groups as high-, middle-, and low-μ groups respectively. In addition, we split the sample into an early period (1963-1983) and a later period (1986-1998). The early period is characterized by gradual deregulation. While in 1963 only relatively few states (roundabout 25%) had deregulated, roughly 45% had done so by 1983. The second period starts with the wave of deregulations of the mid-late 1980s.[11]

If banking deregulation has had an impact on the cyclical variability to which risk can be shared over the cycle mainly through its effect on small businesses we would expect that the business cycle sensitivity of risk sharing would have decreased mainly in the 'high-μ' states. This is exactly what we see: in the early part of the sample, the high-μ group is strongly exposed to fluctuations in GDP whereas the low- and middle-μ groups are not. But in the later sub-sample, risk sharing does not longer depend on GDP, even for the high-μ group. Again, this pattern holds for both the income and the employment-based measures of small business importance.

In principle it is conceivable that this pattern could be driven by other developments that coincided with the deregulation of bank branching restrictions. Not so: to show that it is indeed the impact of banking deregulation that drives these results, we run the same regressions as in panel A for the first subperiod, i.e. 1963-83, but now we sort states into four categories: above/below median small business importance (high/low μ) and whether the state had deregulated by 1983 or not (late/early deregulation). Results are in panel B of table 5. As is clearly apparent, risk sharing by small business intensive states was significantly exposed to fluctuations in GDP (as indicated by β_{1U}) only in those states that were late deregulators . For all other groups, in particular for the high μ/ early deregulation group, there is no significant link of β_U with aggregate GDP. Again, this is true for both measures of small business importance.

[11] Between 1985 and 1988, 16 states abolished intrastate M&A and branching restrictions. We exclude the years 1984 and 1985 from the sample so as to make sure that most states had actually liberalized for most of the second sample period.

4.4 Intra- vs. interstate banking deregulation

The measure of deregulation we use in our analysis is the date of intrastate deregulation of banking services in a given state. Here, we examine whether this focus is justified: we compare to what extent intra- or interstate deregulation respectively have contributed to the shifting patterns of interstate risk sharing and, in particular, to what extent the two forms of deregulation have changed the variability of risk sharing over the cycle.

Table 6 displays results for each deregulation measure separately and for both measures together including both long-term (average level) and business-cycle effects on risk sharing. It is apparent that whilst interstate deregulation has mainly affected the average level of income and consumption smoothing, only *intrastate* deregulation has had a significant impact on the variability of risk sharing over the cycle. Again, this is true for all individual channels as it is for aggregate risk sharing, $1 - \beta_U(t)$. We think that these results have a highly intuitive interpretation: We would expect that longer-term improvements in interstate risk sharing for the average household can only be brought about by better access to credit from out-of-state. Allowing the formation of banks that operate and provide credit across state borders was exactly a key feature of *interstate* deregulation. *Intrastate* deregulation, on the other hand, has permitted banks to branch into other counties within the same state which is likely to have led to a cross-county, state-wide diversification of banks' credit risks. Such better pooling of credit risks may in turn have allowed to extend lines of credit to certain household groups and in particular to small firms whose cash flows and collateral value are highly correlated with local (county-specific) economic conditions. In particular, such a development may have improved small firms' ability to smooth consumption and income, in particular in aggregate cyclical downturns, when collateral values are low. Our results in this respect clearly tie in with the findings of Jayaratne and Strahan (1996), Morgan et al. (2004) and Demyanyk et al. (2007) who also ascribe the importance of deregulation for small businesses rather to the intrastate than to the interstate dimension.

4.5 Extensions and robustness

4.5.1 Risk sharing, asset prices and collateral constraints

As both an extension and robustness check we examine to what extent our results concerning the fluctuation of risk sharing with aggregate GDP could actually be driven by fluctuations in asset prices. Asset prices are highly correlated with the business cycle and the relation between $\beta_U(t)$ and aggregate GDP growth could just reflect what is actually a direct effect of asset prices on risk sharing. There are at least two channels through which asset prices could account for time-variation in the extent to which risk can be shared across state borders. First, asset prices fluctuations affect the value of collateral and may therefore have an impact on credit market access. Secondly, asset price fluctuations, in particular of stock prices, could affect risk sharing over the cycle because they directly change the degree of interregional portfolio diversification: household holdings of the national stock market (e.g. through retirement savings plans) represent a claim to output in other federal states so that stock ownership brings interregional diversification.[12] When stock prices rise, the value of this diversified component of wealth increases relative to that of interregionally non-diversifiable components, such

[12] This is certainly true if a household holds a diversified claim on the entire national stock market portfolio. But it is also possible if the household holds shares only of a limited number of companies. Provided these companies have operations outside the state of residence of the household, their stock is likely to represent claims to profits from many different federal states, thus providing interstate diversification to the household.

as labour income, housing or proprietary wealth. Therefore, interstate risk sharing could fluctuate with stock market valuations.

To assess to what extent our results interact with time variation in collateral values, we turn to the recent study by Lustig and van Nieuwerburgh (2006) who have argued that the availability of housing collateral constrains interstate risk sharing in the United States. Possibly, the availability of housing collateral could also help explain why risk sharing fluctuates with aggregate GDP. In addition, given that small businesses face high non-insurable risk and may therefore face particularly severe credit constraints, the availability of housing collateral may be especially important for small business owners for whom personal and business finance are closely intertwined. To explore this nexus, we parametrize $\beta_U^k(t)$ as a function not only of Δgdp_t but also Lustig's and van Nieuwerburgh's indicator of housing collateral scarcity, the so-called my-residual[13], and of various other controls, including interactions between Δgdp and μ, my and μ, as well as of a linear trend.

Table 7 reveals that the business cycle dependence of risk sharing remains highly significant in all these specifications. As found by Lustig and van Nieuwerburgh (2006), housing collateral scarcity clearly matters for risk sharing, but it cannot explain away the dependence of interstate risk sharing on aggregate GDP growth. Interestingly, the effect of collateral scarcity on risk sharing is amplified in states with a high share of proprietary income, the interaction between μ and my has a large positive coefficient and is also significant in two specifications. Note also that once we consider the interaction of proprietorship with housing collateral scarcity, the aggregate housing collateral factor alone switches sign and generally ceases to have a signifi-

[13] Housing collateral scarcity, my_t, is the residual of a cointegrating relationship between housing wealth and income, rescaled to the interval between zero and one, with unity indicating highest scarcity (lowest availability of collateral). Further details are given in the data appendix.

cant impact on aggregate risk sharing. This result again suggests that small firms' access to credit seems to be crucial in understanding why risk sharing fluctuates over the business cycle. But the fact that the cyclical dependence of risk sharing holds up even once we control for a measure of collateral scarcity also underscores our point that housing collateral constraints are likely to be only one aspect of the story we focus on here.

Table 8 explores the impact of stock market valuations on interregional diversification. To this end, we include a measure of asset price cycles as an additional interaction term in our regressions. We use Lettau's and Ludvigson's (2001) *cay* -residual, an econometric proxy of the consumption-wealth ratio that, as Lettau and Ludvigson have shown, is a very good indicator of the cyclical component in U.S. stock markets. As is apparent from columns II-IV of table 8, *cay* indeed helps explain fluctuations in aggregate risk sharing: risk sharing significantly increases when asset prices are high (*cay* is low) and decreases, when asset prices are low (*cay* is high). We think this is an interesting result in its own right, though we do not aim to explore it further in this paper. Again, the inclusion of *cay* does not change our results with respect to the variation of risk sharing as a function of aggregate GDP, though. Another interesting feature that is noteworthy from Table 8 is that the interaction of ΔGDP with a deregulation trend variable, $CumD_t$ – the cumulative fraction of states that had deregulated at a given date – is generally positive and significant, once again suggesting that the dependence of aggregate risk sharing on the GDP-cycle has decreased as deregulation has progressed. Interestingly enough, this very same trend does not seem to have changed the role of asset prices for fluctuations in risk sharing – the interaction between $CumD_t$ and cay_t is insignificant.

4.5.2 Monte Carlo evidence

In this final subsection, we illustrate the robustness of our main results further by way of a Monte Carlo simulation: first, interstate risk sharing fluctuates more with the aggregate business cycle in states where small businesses account for a large share of economic activity. Secondly, intrastate bank branching deregulation has considerably weakened this business cycle dependence of risk sharing, presumably through its impact on small business access to finance. We ask whether the specific incidence of small businesses in a state and the specific date at which intrastate deregulation took place have a direct bearing on our results or whether these results could have been obtained by chance e.g. because they are driven by other developments that more or less coincided with the unfolding of deregulation across time and states.[14]

We follow Aghion et al. (2008) and randomly assign 'placebo' measures of small business importance (μ^k) and deregulation dates (SDD_t^k) to each state by sampling 1000 draws from the empirical distribution of these variables. For both small business importance and deregulation dates, we then run two different exercises: in the first exercise, we run our specification on the placebo variable alone, asking in what percentage of cases it is more significant than the true variable. In the second exercise, we include both the placebo and the actual variable and we investigate in how many of our simulations the placebo and the actual variable respectively are individually significant.

Panel A illustrates that the strength of the cyclical variation in $\beta_U(t)$ depends on small business prevalence. As is apparent, the interaction between the placebo measure of μ_1 (the share of proprietary income in state

[14] We thank Fabrizio Zilibotti for suggesting this exercise

personal income) and aggregate GDP growth is more significant than in the real data in less than 3 percent of all cases. Conversely, if both the placebo and the actual measure are included, the interaction between GDP and the real measure is always significant, whereas it is only significant in around 10 percent of all cases for the placebo.

Panel B gives the corresponding results for intrastate deregulation: the interaction between the placebo deregulation date and aggregate GDP growth is more significant than between GDP and the real deregulation date in just 10 percent of cases. If the interactions of GDP with both the true and the placebo deregulation date are included, the coefficient on the true interaction is significant in 84 percent of all simulations, but only in 12 percent for the placebos. Note also that SDD when not interacted with GDP, is almost never significant and only 12 percent of the placebo draws in the placebo-only specification would yield a t-statistics that is higher than the (insignificant) t-statistics on the true deregulation date. This once again highlights the relative importance of deregulation for the variability of interstate risk sharing: whereas, as we have seen above, deregulation seems to have had a major effect on the patterns of risk sharing (more income smoothing, as shown by Demyanyk et al. (2007) but also less consumption smoothing), its impact on the average level of aggregate consumption risk sharing appears insignificant. In as far as consumption risk sharing is concerned, the main impact of deregulation seems to have been to make risk sharing less variable over the business cycle.

The simulations in Panel C further illustrate that it is truly the interaction between small business importance and intrastate bank deregulation that is responsible for the reduced variability of risk sharing. Here, we sample from the joint distribution of μ and SDD.[15] We then repeat the exercise from table 5, panel B: based on their placebo assignments, we sort all states into four groups: high/low μ and early/late deregulation. The estimation period is again 1963-83. For the high-μ/late deregulation group we report the percentage of cases in which the respective coefficients are significant and correctly signed. As is apparent the coefficients is almost never significant when based on the placebo: in only 0.3% and 0.2% of all cases for the income and employment based measures respectively. This underscores that business cycle fluctuations in a state's ability to share risk with other states are clearly not random but explained by the interaction of the two particular characteristics we focus on: the prevalence of small businesses and whether a state had deregulated its banking market or not.

5 Conclusions

In this paper we establish that interstate risk sharing in the United States varies over the business cycle, with risk sharing increasing in booms and decreasing during downturns. This variation in aggregate risk sharing is quantitatively important. Over our sample period, the average state would share almost 80 percent of its business cycle risk with other states. But every percentage point increase in US-wide GDP growth increases interstate risk sharing by almost four percentage points and in the trough of the average recession in our sample period, risk sharing was 17% percentage points below its mean.

There is also a distinct pattern in *how* risk is shared over the business

[15] As shown in Kroszner and Strahan (1999), deregulation did not occur randomly. Rather, states whith lots of small businesses tended to deregulate earlier. To account for this correlation, we do not draw μ and SDD independently but from their joint distribution.

cycle. Interestingly, we find that income smoothing through capital income flows is hugely countercyclical, whereas consumption smoothing through savings and dissavings at the household level is strongly procyclical. It is the latter effect that dominates, so that aggregate risk sharing is also strongly procyclical.

We argue that these patterns of risk sharing are determined by time-variation in the ability of small firms to obtain credit. First, we demonstrate that the business cycle dependence of risk sharing is much more pronounced in states where small firms are particularly prevalent. Secondly, we show that the liberalization of state-level bank branching and holding legislation in the U.S. has hugely affected this pattern: banking deregulation virtually removed the dependence of aggregate risk sharing on the business cycle and this reduction in cyclical dependence occurred primarily in states where small businesses account for a large share of income or employment.

At a theoretical level, banking deregulation may affect risk sharing in two ways: better interstate pooling of credit risk may lead to more risk sharing on average. Secondly, if firms and households face collateral and borrowing constraints, the extent to which consumption risk sharing is possible may be sensitive to the phase of the business cycle. Our results suggest that this second effect is particularly important: banking deregulation seems to have improved credit market access for small firms most when it is also most needed – in cyclical downturns.

6 Data appendix

Gross State Product (*GSP*). Gross State Product is defined as the "value added" of the industries of a state. Data for gross state product are available from the BEA. GSP (as all our data) is divided by state-by-state population.

State Income (*SI*). State income is defined as the sum of earnings (wages and proprietors' income), distributed profits (including interest and rent) of residents of the state and state and federal non-personal taxes (including corporate taxes and indirect business taxes). We construct it following Asdrubali et al. (1996) as the sum of state personal income, federal nonpersonal taxes and contributions, state and local nopersonal taxes, interest on state and local funds less direct transfers (federal and state). State personal income is available from the BEA and is defined as income that is received by, or on behalf of, persons who live in the state. It is calculated as the sum of wage and salary disbursements, supplements to wages and salaries, proprietors' income with inventory valuation adjustment and private capital consumption adjustment (CCAdj), rental income of persons with CCAdj, personal dividend income, personal interest income, and personal current transfer receipts, less contributions for government social insurance.

Disposable State Income (*DSI*). Disposable income is defined as state income plus federal transfers to individuals and federal grants to state governments minus federal non-personal taxes and contributions and federal personal taxes. Federal grants are provided by the United States Statistical Abstract, federal personal taxes and transfers are available by state from the BEA.

State Consumption (*C*). State consumption is defined as the sum of private consumption and consumption by the state government. Private consumption at the state level is not available. We follow Asdrubali et al. (1996) and the extant literature and construct private consumption as retail sales re-scaled by the ratio of aggregate US private consumption to aggregate US retail sales.

Share of Proprietary Income (*Shapi*). We calculate the share of proprietary income as the ratio of state proprietary income to state personal income. The both data for personal and proprietary income are from the BEA. Proprietary income is defined by the BEA as current-production income of sole proprietorships, partnerships, and tax-exempt cooperatives. It excludes dividends, monetary interest received by nonfinancial business, and rental income received by persons not primarily engaged in the real estate business. A sole proprietorship is an unincorporated business owned by a person; a partnership is an unincorporated business association of two or more partners; a tax-exempt cooperative is a non-profit business organization that is collectively owned by its customer-members[16].

Small Business Employment (SBE^k). Small businesses are establishments with a number of employees less than 100. We measure small business employment as number of people employed in small business establishments relative to total employment in a state in 1977, the earliest date available. The data is available from Geospatial and Statistical Data Center, University of Virginia library.

Gross Domestic Product (GDP_t). Gross domestic product is constructed as sum of gross states products (not per capita) over all states for every time period t divided by total US population.

NBER Indicators. The data are from NBER Business Cycle Dates (http://www.nber.org/cycles.html). $NBERpeak_t$ dummy equals one, when business cycle reaches peak, otherwise it is zero. $NBERtrough_t$ dummy equals one, when business cycle reaches it's trough, otherwise it is zero.

Deregulation ($SDD_{k,t}$). We use data on banking deregulation from Demyanyk et al. (2007), Table 1. A deregulation dummy becomes one from the year where intrastate deregulation took place. We measure the effect of intrastate branching deregulation using dummy variable $SDD_{k,t}$, that switches on (from 0 to 1) the year state k permitted statewide branching by merges and acquisitions and stays on thereafter. We generally use intrastate deregulation dummy. The interstate deregulation indicator switches on the year state k permits entry by out-of-state banks and stays on thereafter. Deregulation dates are from Kroszner and Strahan (1999) for the years 1978-2001 and Amel (1993) for the years prior to 1978. Since the actual date of deregulation is unknown for states that deregulated before 1960, the date is listed as 1960.

Industrial Structure ($IS_k^{1d,2d}$). We measure industrial structure using the sectoral specialization index constructed by Kalemli-Ozcan, Sørensen and Yosha (2001) for both the one and the two digit industry classification levels as $IS_k = \sum_{s=1}^{S} \left\{ \frac{GSP_k^s}{GSP_k} - \frac{1}{K-1} \sum_{j=1, j\neq k}^{K} \frac{GSP_j^s}{GSP_j} \right\}^2$, where GSP_k^s/GSP_k is the share of value added in sector s in the total value added of state k.

Housing Collateral Ratio (my_t). We follow Lustig and van Nieuwerburgh (2005, 2006) and estimate the housing collateral ratio my_t as the deviation from the cointegrating relationship $my_t = \log(h_t) + \widehat{\varpi} \log(y_t) + \widehat{\upsilon} t + \widehat{\chi}$, where h_t is housing wealth measured by real estate wealth, y_t is labor income plus transfers, t is time trend, and $\widehat{\chi}$ is a constant. Then we remove a constant and a trend, so that the resulting time series my_t are mean zero and stationary, according to an ADF test. The housing collateral ratio is

[16] The national estimates of the income of non-farm proprietorships are based on tabulations of Internal Revenue Service (IRS) tax returns. According to tax law IRS does not distinguish between general partnerships, limited partnerships and limited liability companies and, hence, owners of partnerships and LLCs report their business income or losses on their individual tax returns. That is why proprietary income does include income from LLCs .

rescaled so that it lies between 0 and 1 and measures collateral scarcity: $my_t = \frac{my^{\max} - my_t}{my^{\max} - my^{\min}}$, where $my^{\max}$ and $my^{\min}$ are the maximum and minimum observation in the respective samples.

Consumption-Wealth Ratio (cay_t). As a measure of asset price cycles we use *cay*, the residual of a cointegrating relationship between aggregate consumption, asset wealth and labor income. Details are in Lettau and Ludvigson (2001). The data are freely available at Martin Lettau's home page (http://faculty.haas.berkeley.edu/lettau/). We take annual averages to convert quarterly into annual data.

Population (pop_t^k). The data for state population are from the BEA.

Consumption Price Index (cpi_t). We use the PCE to deflate all nominal variables.

7 References

[1] Acharya, Viral V.; Imbs, Jean and Jason Sturgess,(2006). "Finance and Efficiency: Do Bank Branching Regulations Matter?", working paper.

[2] Aghion, Philippe , Burgess, Robin, Redding, Stephen and Fabrizio Zilibotti, (2007). "The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India", *American Economic Review*, forthcoming..

[3] Agronin, Eugene (2003). "Risk Sharing across the United States, Proprietary Income and the Business Cycle", manuscript, Harvard University.

[4] Amel, Dean (1993). "State laws affecting the geographic expansion of commercial banks", manuscript, Board of Governors of the Federal Reserve System.

[5] Asdrubali, Pierfederico; Sørensen, Bent E. and Yosha, Oved (1996). "Channels of Interstate Risk Sharing: United States 1963-1990", *The Quarterly Journal of Economics* 111 (4), pp. 1081-1110.

[6] Bernanke, Ben (1983). "Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression", *American Economic Review*, vol. 73, pp. 257-76.

[7] Bernanke, Ben and Mark Gertler (1989). "Agency Costs, Net Worth and Business Fluctuations", *American Economic Review*, vol. 79, pp. 14-31.

[6] Cochrane, John H. (1991). "A Simple Test of Consumption Insurance", *Journal of Political Economy*, vol. 99 (5), pp. 957-976.

[7] Crucini, Mario C. (1999). "On international and national dimensions of risk sharing", *The Review of Economics and Statistics*, 81(1): 73-84.

[8] Demyanyk, Yuliya; Ostergaard, Charlotte and Sørensen, Bent (2007). "U.S. Banking Deregulation, Small Businesses, and Interstate Insurance of Personal Income", *Journal of Finance*, vol. LXII, No. 6, pp.2763-2801.

[9] Gertler, Mark and Gilchrist, Simon (1994). "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms", *The Quarterly Journal of Economics*, vol. 109(2), pp. 309-40.

[10] Jayaratne, Jith and Strahan, Philip E. (1996). "The Finance-Growth Nexus: Evidence from Bank Branch Deregulation", *The Quarterly Journal of Economics*, vol.111 (3), pp. 639-70.

[11] Kalemli-Ozcan, Sebnem, Bent Sørensen and Oved Yosha,(2001). "Economic Integration, Industrial Specialization, and the Asymmetry of Macroeconomic Fluctuations", *Journal of International Economics*, 55.

[12] Kalemli-Ozcan, Sebnem, Bent Sørensen and Oved Yosha,(2003)."'Risk Sharing and Industrial Specialization: Regional and International Evidence", *American Economic Review*, 93.

[13] Kiyotaki, Nobuhiro and Moore, John (1997). "Credit Cycles", *Journal of Political Economy*, vol. 105(2), pp. 211-48.

[14] Kroszner, Randall S. and Philip E. Strahan, (Nov., 1999). "What Drives Deregulation? Economics and Politics of the Relaxation of Bank Branching Restrictions", *The Quarterly Journal of Economics*, vol. 114, No. 4, pp. 1437-1467.

[15] Lettau, Martin and Ludvigson, Sydney (2001). "Consumption, Aggregate Wealth and Expected Stock Returns", *Journal of Finance,* LVI (3), pp.815-849.

[16] Lustig Hanno N. and Van Nieuwerburgh Stijn G. (2005). "Housing Collateral, Consumption Insurance, and Risk Premia: An Empirical Perspective", *Journal of Finance*, vol. 60(3), pp. 1167-1219.

[17] Lustig Hanno N. and Van Nieuwerburgh Stijn G. (2008). "How Much Does Household Collateral Constrain Regional Risk Sharing?", working paper dated July 6, 2008. Available at *http://ssrn.com/abstract=1156104*

[18] Mace, Barbara J. (1991). "Full Insurance in the Presence of Aggregate Uncertainty", *Journal of Political Economy*, vol. 99 (5), pp.928-956.

[19] Morgan, Donald P.; Rime, Bertrand and Strahan Philip E. (2004). "Bank Integration and State Business Cycles", *The Quarterly Journal of Economics*, vol.119 (4), pp. 1555-85.

[20] Townsend, Robert M. (1994). "Risk and insurance in village India", *Econometrica* 62, pp. 539-591.

Table 1: Risk Sharing and the Business Cycle.

Table reports the results of the panel OLS regressions (4). $\beta.(t)$ are defined as specified in the panel heading. The dot $\cdot$ stands for I, F, C, U. Constants are not reported. The data are annual from 1963 to 1998. T-statistics are in parentheses. Significance at the 10% (5%) level is indicated by * (**).

	(I)	(F)	(C)	(U)
Panel A: $\beta.(t) = \beta_{0\cdot} + \beta_{1\cdot}\Delta gdp_t$				
$\beta_{0\cdot}$	0.5802**	0.0310**	0.1732**	0.2156**
	(46.7801)	(3.0251)	(5.6453)	(7.6592)
$\beta_{1\cdot}$	-3.3473**	1.0826**	6.4711**	-4.2063**
	(-8.2816)	(3.2455)	(6.4735)	(-4.5853)
Panel B: $\beta.(t) = \beta_{0\cdot} + \beta_{1\cdot}NBERpeak_t + \beta_{2\cdot}NBERtrough_t$				
$\beta_{0\cdot}$	0.5354**	0.0775**	0.2404**	0.1467**
	(38.9674)	(6.9792)	(7.1569)	(4.7666)
$\beta_{1\cdot}$	-0.0598**	-0.1030**	0.2760**	-0.1133*
	(-2.2522)	(-4.8053)	(4.2553)	(-1.9075)
$\beta_{2\cdot}$	0.0530*	-0.0282	-0.1911**	0.1663**
	(1.9308)	(-1.2724)	(-2.8490)	(2.7076)

Table 2: Risk Sharing and Small Businesses

Panel A reports the results of the panel OLS regression $\Delta\widetilde{c}_{k,t} = \alpha^U + \beta_U(t)\Delta\widetilde{gsp}_{k,t} + \tau_t^U + \delta_U^k + \epsilon_{k,t}^U$. $\beta_U(t)$ is defined as $\beta_U = \beta_{0U} + \beta_{1U}\Delta gdp_t$. The states are split according to the measure of small business importance ("low", "middle", "high") μ^k.

Panel B reports the results of the panel OLS regressions (4) where $\beta_\cdot^k(t)$ is specified as defined in the panel heading. μ^k denotes time-series means of the share of proprietary income for every state k and $\overline{\mu^k}$ is the cross-sectional mean of μ^k.

Constants are not reported. The dot $\cdot$ stands for I, F, C, U. The data are annual from 1963 to 1998. T-statistics are in parentheses. Significance at the 10% (5%) level is indicated by * (**).

Panel A

	low μ^k	middle μ^k	high μ^k
$\mu^k = Shapi$ $(Share\ of\ proprietary\ income)$			
β_{0U}	0.4142**	0.2014**	0.3043**
	(5.5631)	(6.0781)	(4.3639)
β_{1U}	-2.4910	-1.1571	-8.3408**
	(-1.0301)	(-0.9328)	(-4.4062)
$\mu^k = SBE$ $(Small\ Business\ Employment\ in\ 1977)$			
β_{0U}	0.3877**	0.2138**	0.1425**
	(4.7905)	(3.4517)	(3.6182)
β_{1U}	-2.7020	-0.5194	-4.2800**
	(-1.1028)	(-0.2438)	(-3.3053)

Panel B

$$\beta_\cdot^k(t) = \beta_{0\cdot} + \beta_{1\cdot}\Delta gdp_t + \beta_{2\cdot}\Delta gdp_t(\mu^k - \overline{\mu}) + \beta_{3\cdot}(\mu^k - \overline{\mu})$$

	$(I\ )$	(F)	$(C\ )$	$(U\ )$
$\beta_{0\cdot}$	0.6005**	0.0293**	0.1443**	0.2259**
	(51.8880)	(2.8459)	(4.7916)	(8.0215)
$\beta_{1\cdot}$	-1.4684**	0.9918**	3.0979**	-2.6212**
	(-3.6463)	(2.7706)	(2.9551)	(-2.6745)
$\beta_{2\cdot}$	-4.1307	-8.1140	94.5434**	-82.2987**
	(-0.4131)	(0.9130)	(3.6325)	(-3.3822)
$\beta_{3\cdot}$	-4.5131**	0.6519*	3.5562**	0.3050
	(-11.7357)	(1.9072)	(3.5525)	(0.3259)

Table 3: Risk Sharing, Proprietary Income and Industrial Structure

Table reports the results of the panel GLS/OLS regressions $\widetilde{\Delta c}_{k,t} = \alpha^U + \beta^k_U(t)\Delta\widetilde{gsp}_{k,t} + \tau^U_t + \delta^k_U + \epsilon^U_{k,t}$. β_U is defined as $\beta^k_U(t) = \beta_{U0} + \beta'_{U1}\mathbf{z}^k_t$, where $\mathbf{z}^k_t$ contains the aggregate and state characteristics listed in the first column. $IS^{1d,2d}_k$ are 1- or 2-digit specialization indices. μ^k_1 denotes time-series means of the share of proprietary income for every state k. Constants are not reported. The data are annual from 1963 to 1998. T-statistics are in parentheses. Significance at the10% (5%) level is indicated by * (**).

$\mathbf{z}^k_t$	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
β_{0U}	0.40**	0.41**	0.51**	0.54**	0.41**	0.44**	0.44**	0.55**
	(3.75)	(3.43)	(4.31)	(4.54)	(3.82)	(3.87)	(3.86)	(4.54)
Δgdp_t	3.73	3.92	2.60	0.10	2.63	2.36	2.09	-0.05
	(1.38)	(1.44)	(0.86)	(0.03)	(0.83)	(0.76)	(0.67)	(-0.02)
$\Delta gdp_t{\cdot}\mu_k$	-77.71**	-76.12**	-76.12**	-67.95**	-74.36**	-76.67**	-70.71**	-63.35**
	(-3.27)	(-3.19)	(-2.58)	(-2.28)	(-3.06)	(-2.59)	(-2.34)	(-2.10)
IS^{1d}_k	-0.02**				-0.02**	-0.03**	-0.03**	
	(-4.24)				(-4.22)	(-2.91)	(-2.92)	
IS^{2d}_k		-0.01**	-0.01**	-0.02**				-0.02**
		(-2.88)	(-3.52)	(-3.80)				(-3.81)
$\Delta gdp_t{\cdot}IS^{1d}_k$					0.12	0.18	0.12	
					(0.69)	(0.49)	(0.33)	
$\Delta gdp_t{\cdot}IS^{2d}_k$				0.25				0.22
				(1.56)				(1.39)
μ_k	-0.28	-0.58	-0.67	-0.80	-0.31	-0.16	-0.24	-0.88
	(-0.30)	(-0.60)	(-0.58)	(-0.70)	(-0.33)	(-0.14)	(-0.21)	(-0.76)
Trend	no	no	no	no	no	no	yes	yes
Method	OLS	OLS	GLS	GLS	OLS	GLS	GLS	GLS

Table 4: Risk Sharing, Banking Deregulation and the Business Cycle

Table reports the results of the panel OLS regressions

$$\Delta\widetilde{gsp}_{k,t} - \Delta\widetilde{inc}_{k,t} = \alpha^I + \beta_I^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^I SDD_t^k + \tau_t^I + \delta_I^k + \epsilon_{k,t}^I,$$
$$\Delta\widetilde{inc}_{k,t} - \Delta\widetilde{dinc}_{k,t} = \alpha^F + \beta_F^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^F SDD_t^k + \tau_t^F + \delta_F^k + \epsilon_{k,t}^F,$$
$$\Delta\widetilde{dinc}_{k,t} - \Delta\widetilde{c}_{k,t} = \alpha^C + \beta_C^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^C SDD_t^k + \tau_t^C + \delta_C^k + \epsilon_{k,t}^C,$$
$$\Delta\widetilde{c}_{k,t} = \alpha^U + \beta_U^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^U SDD_t^k + \tau_t^U + \delta_U^k + \epsilon_{k,t}^U.$$

SDD_t^k is intrastate deregulation dummy, it becomes 1 from the year of the k's state intrastate deregulation. The $\beta_{\cdot}^k(t)$ are specified as defined in the panel heading. The dot $\cdot$ stands for I, F, C, U. Constants and $\beta_d^{\cdot}$ are not reported. The data are annual from 1963 to 1998. T-statistics in parentheses. Significance at the 10% (5%) level is indicated by * (**).

	(I)	(F)	(C)	(U)
Panel A: $\beta_{\cdot}^k(t) = \beta_{0\cdot} + \beta_{1\cdot}SDD_t^k + \beta_{2\cdot}\Delta gdp_t$				
$\beta_{0\cdot}$	0.4607**	0.0756**	0.2600**	0.2037**
	(25.3404)	(4.9552)	(5.6681)	(4.8316)
$\beta_{1\cdot}$	0.1952**	-0.0727**	-0.1403**	0.0177
	(8.8712)	(-3.9316)	(-2.5261)	(0.3463)
$\beta_{2\cdot}$	-3.0152**	0.9573**	6.2243**	-4.1664**
	(-7.5839)	(2.8673)	(6.2057)	(-4.5189)
Panel B: $\beta_{\cdot}^k(t) = \beta_{0\cdot} + \beta_{1\cdot}\Delta gdp_t + \beta_{2\cdot}\Delta gdp_t SDD_t^k + \beta_{3\cdot}SDD_t^k$				
$\beta_{0\cdot}$	0.4900**	0.0859**	0.1777**	0.2464**
	(25.1826)	(5.2384)	(3.6241)	(5.4452)
$\beta_{1\cdot}$	-4.7046**	0.3647**	10.9683**	-6.6284**
	(-8.2371)	(0.7576)	(7.6208)	(-4.9902)
$\beta_{2\cdot}$	3.2507**	1.1401	-9.1280**	4.7372**
	(4.1030)	(1.7071)	(-4.5721)	(2.5711)
$\beta_{3\cdot}$	0.1471	-0.0896	-0.0050	-0.0525
	(5.9165)	(-4.2736)	(-0.0798)	(-0.9085)

Table 5: Risk Sharing, Banking Deregulation and Small Businesses

Panel A reports the results of the panel OLS regression $\Delta\widetilde{c}_{k,t} = \alpha^U + \beta^k_U(t)\Delta\widetilde{gsp}_{k,t} + \tau^U_t + \delta^k_U + \epsilon^U_{k,t}$ with $\beta^k_U(t) = \beta_{0U} + \beta_{1U}\Delta gdp_t$ for two periods: pre-1983 and post-1986. The states are split according to the measure of small business importance ("low", "middle", "high") μ^k.
Panel B reports the results of the panel OLS regression $\Delta\widetilde{c}_{k,t} = \alpha^U + \beta^k_U(t)\Delta\widetilde{gsp}_{k,t} + \tau^U_t + \delta^k_U + \epsilon^U_{k,t}$ with $\beta^k_U(t)$ as in panel A for the period 1963-83. The states are split into four categories: above/below median small business importance and whether the state had deregulated by 1983 or not (early/late deregulation). Constants are not reported. T-statistics are in parentheses. Significance at the10% (5%) level is indicated by * (**).

Panel A

$\mu^k = Shapi$ (*Share of proprietary income*)

	pre-1983			post-1986		
	low μ^k	middle μ^k	high μ^k	low μ^k	middle μ^k	high μ^k
β_{0U}	0.3207**	0.1625**	0.2911**	0.4758**	0.1380	0.0354
	(3.8767)	(3.4969)	(3.5468)	(2.2676)	(1.2396)	(0.2721)
β_{1U}	0.0721	-1.3016	-8.5831**	2.5051	0.7495	3.6489
	(0.0283)	(-0.8708)	(-4.1885)	(0.4792)	(0.2781)	(1.0929)

$\mu^k = SBE$ (*Small Business Employment*)

	pre-1983			post-1986		
	low μ^k	middle μ^k	high μ^k	low μ^k	middle μ^k	high μ^k
β_{0U}	0.3238**	0.1746**	0.1205**	0.4325*	0.2499	0.0463
	(3.2162)	(2.2433)	(2.5458)	(2.5537)	(2.1901)	(0.4970)
β_{1U}	-2.1775	-0.7414	-3.9476**	4.1740	2.1845	-2.4978
	(-0.7501)	(-0.3123)	(-2.9282)	(0.5704)	(0.3958)	(-0.5703)

Panel B (1963-83)

$\mu^k = Shapi$ (*Share of proprietary income*)

	early deregulation		late deregulation	
	low μ^k	high μ^k	low μ^k	high μ^k
β_{0U}	0.0984**	0.0726	0.4323**	0.1529**
	(2.0064)	(0.3643)	(5.5960)	(2.5827)
β_{1U}	-0.1418	0.6289	-1.6523	-6.4791**
	(-0.0888)	(0.1338)	(-0.6670)	(-3.9689)
Nr. obs	300	120	220	380

$\mu^k = SBE$ (*Small Business Employment*)

	early deregulation		late deregulation	
	low μ^k	high μ^k	low μ^k	high μ^k
β_{0U}	0.1290	0.1168**	0.3440**	0.1527**
	(0.9179)	(2.0812)	(4.0015)	(2.3766)
β_{1U}	3.0884	-2.2348	-4.5344*	-6.9490**
	(0.7840)	(-1.3417)	(-1.7376)	(-3.9273)
Nr. obs	260	180	240	340

Table 6: Risk Sharing, Intra- and Interstate Banking Deregulation

Table reports the results of the panel OLS regressions

$$\Delta\widetilde{gsp}_{k,t} - \Delta\widetilde{inc}_{k,t} = \alpha^I + \beta_I^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^I SDD_t^k + \tau_t^I + \delta_I^k + \epsilon_{k,t}^I,$$
$$\Delta\widetilde{inc}_{k,t} - \Delta\widetilde{dinc}_{k,t} = \alpha^F + \beta_F^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^F SDD_t^k + \tau_t^F + \delta_F^k + \epsilon_{k,t}^F,$$
$$\Delta\widetilde{dinc}_{k,t} - \Delta\widetilde{c}_{k,t} = \alpha^C + \beta_C^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^C SDD_t^k + \tau_t^C + \delta_C^k + \epsilon_{k,t}^C,$$
$$\Delta\widetilde{c}_{k,t} = \alpha^U + \beta_U^k(t)\Delta\widetilde{gsp}_{k,t} + \beta_d^U SDD_t^k + \tau_t^U + \delta_U^k + \epsilon_{k,t}^U.$$

$SDD_{k,t}^{Intra}$ and $SDD_{k,t}^{Inter}$ denote intra- and interstate deregulation respectively. The $\beta_\cdot^k(t)$ are specified as defined in the panel heading where the dot $\cdot$ stands for I, F, C, U. Constants and $\beta_d^\cdot$ are not reported. The data are annual from 1963 to 1998. T-statistics are in parentheses. Significance at the 10% (5%) level is indicated by *(**).

	(I)	(F)	(C)	(U)	(I)	(F)	(C)	(U)
	$SDD_{k,t}$= $SDD_{k,t}^{Intra}$, Intrastate Deregulation				$SDD_{k,t}$= $SDD_{k,t}^{Inter}$, Interstate Deregulation			
	$\beta_\cdot^k(t)= \beta_{0\cdot}+\beta_{1\cdot}\Delta gdp_t+\beta_{2\cdot}\Delta gdp_t \cdot SDD_{k,t}+\beta_{3\cdot}SDD_{k,t}$							
$\beta_{0\cdot}$	0.49**	0.09**	0.18**	0.25**	0.51**	0.03**	0.28**	0.19**
	(25.18)	(5.24)	(3.62)	(5.45)	(36.58)	(2.40)	(7.86)	(5.83)
$\beta_{1\cdot}$	-4.71**	0.37	10.97**	-6.63**	-3.55**	1.11**	6.63**	-4.18**
	(-8.24)	(0.76)	(7.62)	(-4.99)	(-8.55)	(3.12)	(6.30)	(-4.29)
$\beta_{2\cdot}$	3.25**	1.14*	-9.13**	4.74**	0.12	-0.27	1.01	-0.85
	(4.10)	(1.71)	(-4.57)	(2.57)	(0.09)	(-0.26)	(0.32)	(-0.29)
$\beta_{3\cdot}$	0.15**	-0.09**	-0.01	-0.05	0.26**	0.01	-0.37**	0.10
	(5.92)	(-4.27)	(-0.08)	(-0.91)	(8.43)	(0.45)	(-4.77)	(1.39)

$$\beta_\cdot^k(t)= \beta_{0\cdot}+\beta_{1\cdot}\Delta gdp_t+\beta_{2\cdot}\Delta gdp_t \cdot SDD_{k,t}^{Inter}+\beta_{3\cdot}\Delta gdp_t \cdot SDD_{k,t}^{Intra}+\beta_{4\cdot}SDD_{k,t}^{Inter}+\beta_{5\cdot}SDD_{k,t}^{Intra}$$

	(I)	(F)	(C)	(U)
$\beta_{0\cdot}$	0.48**	0.08**	0.19**	0.24**
	(25.23)	(5.13)	(3.85)	(5.39)
$\beta_{1\cdot}$	-4.72**	0.36	10.97**	-6.61**
	(-8.38)	(0.76)	(7.67)	(-4.98)
$\beta_{2\cdot}$	-1.57	-0.69	5.71*	-3.46
	(-1.20)	(-0.61)	(1.72)	(-1.12)
$\beta_{3\cdot}$	3.05**	1.12	-9.37**	5.20**
	(3.68)	(1.58)	(-4.46)	(2.66)
$\beta_{4\cdot}$	0.22**	0.07**	-0.43**	0.14*
	(6.69)	(2.36)	(-5.11)	(1.81)
$\beta_{5\cdot}$	0.06**	-0.11**	0.15**	-0.10
	(2.25)	(-4.94)	(2.19)	(-1.52)

Table 7: Robustness check: Risk Sharing, Proprietary Income and Housing Collateral

Table reports the results of the panel GLS/OLS regressions $\Delta\widetilde{c}_{k,t} = \alpha^U + \beta^k_U(t)\Delta\widetilde{gsp}_{k,t} + \tau^U_t + \delta^k_U + \epsilon^U_{k,t}$. $\beta^k_U(t)$ is defined as $\beta^k_U(t) = \beta_{U0} + \beta_{U1}\mathbf{z}^k_t$, where $\mathbf{z}^k_t$ contains the aggregate and state characteristics listed in the first column. The collateral measure my_t is real estate wealth, that is defined in detail in the data appendix. μ^k denotes time-series means of the share of proprietary income for every state k. Constants are not reported. The data are annual from 1963 to 1998. T-statistics are in parentheses. Significance at the 10% (5%) level is indicated by * (**).

$\mathbf{z}^k_t$	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VII)	(VIII)	(IX)
β_{0U}	0.41**	0.41**	0.39**	0.69**	0.70**	0.46**	0.43**	0.42**	0.45**	0.46**
	(4.31)	(4.10)	(3.83)	(3.96)	(3.66)	(2.31)	(2.18)	(1.98)	(2.13)	(2.14)
Δgdp_t	-3.42**	-4.15**	-3.89**	-3.27**	-3.80**	4.20	3.57	2.55	-2.82	-2.50
	(-3.46)	(-4.35)	(-4.07)	(-3.31)	(-3.99)	(1.47)**	(1.24)	(0.83)	(-0.75)	(0.66)
$\Delta gdp_t{\cdot}\mu^k$						-71.41	-64.63**	-66.95**	-71.48**	-66.58**
						(-2.83)	(-2.52)	(-2.19)	(-2.36)	(-2.16)
$\Delta gdp_t{\cdot}my_t$									9.21**	8.17
									(2.67)	(2.28)
$\mu^k{\cdot}my_t$				6.60**	6.67*	4.78	4.71	4.19	3.19	3.56
				(2.34)	(1.90)	(1.64)	(1.62)	(1.22)	(0.92)	(1.02)
μ^k	-1.93**	-2.07**	-1.98**	-4.89**	-5.17**	-2.30	-2.28	-2.18	-1.41	-1.69
	(-2.91)	(-2.54)	(-2.41)	(3.21)	(-2.73)	(-1.25)	(-1.24)	(-1.00)	(-0.65)	(-0.77)
my_t	0.01	0.21**	0.23**	-0.61**	-0.41	-0.48	-0.43	-0.18	-0.24	-0.25
	(0.07)	(2.08)	(2.31)	(-1.99)	(-1.19)	(-1.52)	(-1.36)	(-0.53)	(-0.70)	(-0.71)
Trend	no	no	yes	yes	yes	no	yes	yes	no	yes
Method	OLS	GLS	GLS	OLS	GLS	OLS	OLS	GLS	GLS	GLS

Table 8: Robustness check: Risk Sharing and Asset Prices.

Table reports the results of the panel GLS/OLS regressions $\Delta\widetilde{c}_{k,t} = \alpha^U + \beta_U(t)\Delta\widetilde{gsp}_{k,t} + \tau_t^U + \delta_U^k + \epsilon_{k,t}^U$. $\beta_U(t)$ is defined as $\beta_U(t) = \beta_{U0} + \beta_{U1}\mathbf{z}_t$, where $\mathbf{z}_t$ contains the aggregate characteristics listed in the first column. cay_t is demeaned consumption-wealth ratio. cay_t is deviation from cointegrating relationship between consumption, asset wealth and labor income. $CumD_t$ is defined as the fraction of states in the sample, that have deregulated. Constants are not reported. The data are annual from 1963 to 1998. T-statistics are in parentheses. Significance at the10% (5%) level is indicated by * (**).

$\mathbf{z}_t$	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
$\beta_0.$	0.33**	0.27**	0.32**	0.32**	0.30**	0.19**	0.29**	0.19**
	(11.43)	(10.93)	(11.22)	(10.86)	(9.97)	(6.51)	(9.68)	(6.34)
Δgdp_t	-3.81**		-3.86**	-3.84**	-4.59**	-4.55**	-4.67**	-4.61**
	(-5.15)		(-4.08)	(–4.04)	(-4.70)	(-4.68)	(-4.77)	(-4.71)
cay_t		14.32**	12.07**	12.86**	13.42**	8.98**	11.48**	8.20**
		(5.94)	(4.99)	(2.29)	(5.49)	(3.68)	(3.91)	(2.90)
$\Delta gdp_t \cdot cay_t$				-20.86				
				(-0.16)				
$\Delta gdp_t \cdot CumD_t$					8.78**	10.24**	10.32**	11.06**
					(3.11)	(3.43)	(3.33)	(3.31)
$cay_t \cdot CumD_t$							7.05	3.55
							(1.17)	(0.54)
Method	GLS	GLS	GLS	GLS	GLS	OLS	GLS	OLS

Table 9: Robustness check: Monte Carlo Simulations

Table reports results from the Monte Carlo simulations for the share of proprietary income μ_k (Panel A), intrastate banking deregulation $SDD_{k,t}$ (Panel B), and both the share of proprietary income μ_k and intrastate banking deregulation $SDD_{k,t}$ (Panel C). We take 1000 random draws from the empirical distribution of these variables for each specification. In panels A and B the first row presents the percentage of cases where estimated coefficients in the regressions with 'placebo' variable are more significant than true ones. The second row reports the percentage of cases where estimated coefficients are individually significant. Superscript $\cdot^P$ denotes a 'placebo' variable and its associated coefficient. Panel C reports the percentage of cases for which the coefficient on $\Delta gdp \times \Delta \widetilde{gsp}_t^k$ is significant and correctly signed for the high μ/late deregulation group. See notes to Table 5 for details on how these groups are formed.

Panel A: Simulated μ_k

$$\beta_U^k(t) = \beta_0 + \beta_1 \Delta gdp_t + \beta_2^P \Delta gdp_t \mu_k^P + \beta_3^P \mu_k^P$$

Percentage of simulated t-stats larger than t-stats from real data

$\widehat{\beta}_1$	100%	$\widehat{\beta_2^P}$	3%	$\widehat{\beta_3^P}$	50%

$$\beta_U^k(t) = \beta_0 + \beta_1 \Delta gdp_t + \beta_2 \Delta gdp_t \mu_k + \beta_2^P \Delta gdp_t \mu_k^P + \beta_3 \mu_k + \beta_3^P \mu_k^P$$

Percentage of significant t-stats

$\widehat{\beta}_2$	100%	$\widehat{\beta_2^P}$	10%	$\widehat{\beta}_3$	0%	$\widehat{\beta_3^P}$	28%

Panel B: Simulated $SDD_{k,t}$

$$\beta_U^k(t) = \beta_0 + \beta_1 \Delta gdp_t + \beta_2^P \Delta gdp_t SDD_{k,t}^P + \beta_3^P SDD_{k,t}^P$$

Percentage of simulated t-stats larger than t-stats from real data

$\widehat{\beta}_1$	14%	$\widehat{\beta_2^P}$	10%	$\widehat{\beta_3^P}$	12%

$$\beta_U^k(t) = \beta_0 + \beta_1 \Delta gdp_t + \beta_2 \Delta gdp_t SDD_{k,t} + \beta_2^P \Delta gdp_t SDD_{k,t}^P + \beta_3 SDD_{k,t} + \beta_3^P SDD_{k,t}^P$$

Percentage of significant t-stats

$\widehat{\beta}_2$	85%	$\widehat{\beta_2^P}$	12%	$\widehat{\beta}_3$	0.5%	$\widehat{\beta_3^P}$	23%

Panel C: Simulated μ_k and $SDD_{k,t}$

$$\beta_U^k(t) = \beta_0 + \beta_1 \Delta gdp_t \;\; for\ states\ with\ high\ \mu_k\ and\ late\ deregulation$$

Percentage of cases for which coefficient on Δgdp_t negatively signed and more significant

$\mu^k = Share\ of\ proprietary\ income$		$\mu^k = Small\ Business\ Employment$	
$\widehat{\beta}_1$	0.3%	$\widehat{\beta}_1$	0.2%

Table A1: Importance of small businesses across U.S. states

	Low		Middle		High	
	$Shapi_k$	SBE_k	$Shapi_k$	SBE_k	$Shapi_k$	SBE_k
1	Maryland	S. Carolina	New York	Rhode Island	California	Iowa
2	Rhode Island	Connecticut	Alabama	Alabama	Colorado	Colorado
3	Virginia	Pennsylvania	Pennsylvania	West Virginia	Oregon	Arizona
4	Michigan	Illinois	Georgia	Georgia	Kentucky	Washington
5	New Jersey	Ohio	Utah	Minnesota	Vermont	Oklahoma
6	West Virginia	Michigan	Illinois	Virginia	Mississippi	Kansas
7	Ohio	Indiana	Wisconsin	Kentucky	Texas	Nebraska
8	Massachusetts	N. Carolina	Alaska	Mississippi	Wyoming	Alaska
9	Connecticut	Delaware	New Mexico	Maryland	Oklahoma	Oregon
10	S. Carolina	Massachusetts	North Carolina	New Hampshire	Kansas	Hawaii
11	Hawaii	Nevada	Louisiana	Texas	Arkansas	Florida
12	Delaware	New York	Missouri	Maine	Montana	Idaho
13	Nevada	D.of Columbia	D. of Columbia	California	Idaho	New Mexico
14	Florida	Tennessee	Maine	Arkansas	Nebraska	Wyoming
15	Indiana	New Jersey	Washington	Louisiana	Iowa	Montana
16	Arizona	Wisconsin	Tennessee	Utah	North Dakota	South Dakota
17	New Hampshire	Missouri	Minnesota	Vermont	South Dakota	North Dakota

Note: The states are ranked in ascending order according to the prevalence of small businesses measured by the sample average share of proprietary income ($Shapi$) and 1977 small business employment (SBE).

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