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Abstract: Despite operating under substantial regulatory constraints, we find that commercial banks manage their investments largely consistent with the predictions of portfolio choice models with capital market imperfections. Based on 1990-2002 data for small (assets less than $1 billion) U.S. commercial banks, net new lending to the business, real estate, and consumer sectors increased with expected sector profitability, tended to decrease with the illiquidity of existing (overhanging) loan stocks, and was responsive to correlations in cross-sector returns. Small banks are most appropriate for this study, because they make illiquid loans and manage risk via on-balance sheet (non-hedged) diversification strategies.

JEL codes: G11, G21
Key words: commercial banks, loans, portfolio choice, risk overhang

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Introduction

Commercial banks play a central role in the supply of credit. About one-third of all household debt is obtained from commercial banks, and about two-fifths of all small businesses obtain some form of credit from a commercial bank.[1] Recent theory suggests that, when external finance is costly, value-maximizing banks make asset allocation and capital budgeting decisions in a risk-averse manner: they base new lending decisions not only on expected loan returns, but also on their available capital and on the covariance of these returns with their existing loan portfolio. Such behavior increases a bank's expected profit by reducing the probability that the bank finds itself with too little internal capital to fund a valuable loan in the future. This theorized behavior also affects borrowers, particularly small business borrowers who rely primarily on commercial bank lending for financing: in the long run, their bank is more likely to be around to finance them, but in the short run, they may face credit rationing during periods of high effective bank risk aversion.

In this paper, we investigate whether small commercial banks' lend in a manner consistent with this risk management and capital budgeting paradigm. As just noted, commercial banks provide vital access to capital and credit for small businesses and consumers, and this is especially true of small, locally focused commercial banks—even though these so-called "community banks" represent a relatively small share of total credit supply, they are a critical source of funding for informationally opaque small businesses and as such are important for economic growth.[2] We focus on the effect of 'risk overhang,' the risk represented by illiquid, outstanding loan stocks on net new lending. Because banks act as delegated monitors, they have private information about their loans that can lead to lemons problems if they attempt to sell the loans.[3] The degree of information asymmetry and liquidity varies across types of banks, types of loans, and types of borrowers. For example, as there is typically more publicly-available information on large firms and large firms are more likely to have publicly-traded shares and debt, the bulk of business loan sales involve loans to large businesses rather than small businesses. Risk overhang is likely to be a greater concern for small banks, since their business borrowers are typically small, privately-held firms and their consumer loan portfolios

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[1] Based, respectively, on data from the Federal Reserve Survey of Consumer Finances reported in DeYoung, Hunter, and Udell (2004) and the Federal Reserve Survey of Small Business Finances reported in Bitler, Robb, and Wolken (2001).

[2] As described in Petersen and Rajan (1994), Berger, Saunders, Scalise, and Udell (1997), Berger et al. (2005), and elsewhere, small banks engage in more relationship lending that small businesses utilize. More recently, however, Petersen and Rajan (2002) and Berger, Rosen, and Udell (2001) find that over time larger banks are providing more small business loans. Berger, Hasan, and Klapper (2004) document a positive empirical link between a large, healthy small banking sector and macroeconomic growth across 49 developed and developing nations.

[3] Seminal papers on delegated monitoring include Diamond (1984), Ramakrishnan and Thakor (1984), Boyd and Prescott (1986), and Williamson (1986).

are often too small to permit cost effective securitization. Small banks have little or no access to public funding markets, increasing their costs of external financing and thus increasing their need to manage asset risk effectively. These banks are also less likely to use credit derivatives such as credit swaps, so they must manage the risk of their loan portfolios through on-balance sheet loan concentrations. Thus, we test for the effects of risk overhang at small U.S. commercial banks with assets less than $1 billion—banks for which loan portfolio effects can be more accurately measured and are more relevant as a measure of bank risk-management activity. We note that our definition of 'small bank' includes well over 90 percent of all commercial banks in the U.S.

Using the capital budgeting model of Froot and Stein (1998), we begin by deriving a model of bank loan supply that explicitly illustrates the effect of risk. Our model generates empirically tractable predictions about the effects of risk overhang, expected loan returns, and competing lending opportunities on banks' supply of new loans, given their current portfolio composition and capital. We test these loan supply predictions for small commercial banks located in urban and rural markets between 1990 and 2002, measuring new loan supply as the net quarterly change in the portfolio shares of three different types of loans—real estate loans, business loans (which includes agricultural production loans for banks in rural markets), and consumer loans. We use two-stage least squares to control for the simultaneity of net lending decisions across these different sectors.

Overall, we find that small banks make capital allocation decisions that are consistent with risk-averse value-maximizing behavior. For example, controlling for expected returns, we find that banks make fewer net new loans when the riskiness of current lending opportunities is positively correlated with the riskiness of their existing stocks of loans. This risk overhang effect is larger when the existing loan stocks are less liquid and when the risk correlation is greater. These effects are particularly clear when we examine the impact of outstanding loan stocks on net lending within the same sector—the negative impact of outstanding stocks of business loans on net business lending is significantly greater than the same-sector overhang effect in the typically more liquid and less risky real estate (mostly home mortgages) or consumer loan sectors. In general, these risk overhang effects are exacerbated by temporary reductions in the liquidity of outstanding loan stocks caused by downturns in local economic markets and/or individual loan sectors.

We find evidence that technological advance, government policy, and the nature of bank-borrower relationships may have significant influences on the size and existence of risk overhang at small banks. Our measured loan overhang effects tend to be weaker in the second half of the sample, consistent with increased loan liquidity due to improved financial processes and information technologies (e.g., credit scoring, asset securitization, deeper secondary markets for loans). The exacerbating effects of economic downturns on loan overhang are more moderate in the business loan sector, perhaps because small banks have incentives to preserve valuable relationships with their small business clientele across the business cycle. This moderation is especially strong for business lending at rural banks, likely because a portion of the realized credit risk of farm loans at these banks is absorbed by government loan guarantees during agricultural sector downturns. Evidence of local focus is especially strong in our data: even for multi-bank organizations where there may exist the potential for inter-bank diversification, our findings suggest that portfolio management occurs at the bank level.

Our estimates confirm that we are estimating a supply relationship. Net lending increases when expected return is greater, but the effect of expected return is reduced somewhat if the loans are expected to be less liquid or more risky due to current conditions. We also find some evidence that banks with lower capital behave in a more risk averse fashion, especially for the riskiest loan sector (business loans) and during the riskiest period of our sample; however, this relationship is less clear for other sectors.

Our findings also support loan-supply motivations for the pro-cyclic nature of bank lending.[4] During an economic expansion demand for lending is high and business profitability is good, resulting in more profitable loans, more bank capital, and an expanding credit environment in which banks lend more at lower rates as they compete for business. As the economy slows, some businesses will suffer lower income or even losses, leading to delinquent loan payments or outright default, reductions in bank capital, and a tighter credit environment as banks make fewer loans at higher rates.[5] Our findings indicate that risk overhang effects from outstanding loans work to decrease loan supply during a recession even more than would be implied by the reduction in bank capital alone. Outstanding loan stocks may become less liquid: banks face greater adverse selection problems when trying to sell or securitize a riskier loan portfolio, and these are compounded by the fact that borrowers in weaker financial positions are more likely to try to roll over existing loans rather than repay them. Because economic shocks are generally correlated across economic agents, capital contractions or expansions will affect a significant portion of banks simultaneously, resulting in market-wide contraction or expansion of loan supply.

[4] Although our explanation focuses on bank capital, loan illiquidity, and risk aversion, there are other models of loan-supply procyclicality. Rajan (1994) presents a models credit cycles based on agency problems within banks. Berger and Udell (2003) present a behavioral model. Ruckes (2004) models changes in bank credit standards as a function of cyclical changes in loan quality and adverse selection problems.

[5] This example is done in terms of business loans, but a similar story can be told for consumer and real estate lending.

The rest of the paper proceeds as follows. Section 2 provides a brief overview of the bank lending literature, first the theoretical then the empirical. Section 3 presents our theoretical model of loan supply with capital market imperfections, which links bank loan portfolio management to existing (i.e., overhanging) loan stocks, expected loan profitability, current lending opportunities, loan covariances, and effective risk aversion. Section 4 operationalizes the model for empirical estimation and lays out our main hypotheses to be tested. Section 5 presents our detailed bank-level data set and regression variables. Section 6 analyzes our empirical results. Section 7 summarizes our main findings and discusses implications for policy.

2. Related literature

Our work is most closely related to theoretical work examining how financial institutions should manage their portfolios when they face costs of external financing linked to capital market imperfections. These theories apply particularly to banks with enough equity so that moral hazard via risk shifting does not become an issue.[6] Froot, Scharfstein and Stein (1993) show that firms facing costly external finance, stochastic net worth, and attractive future investment opportunities behave in a risk averse manner. Froot and Stein (1998) extend this to a model of financial institutions in which institutions' new investments are influenced not only by capital structure, but also by their existing asset portfolios and their ability to hedge new and existing risk. Froot and Stein show that the amount the institution will want to invest in a new opportunity will depend upon its level of capital, the covariance of that investment's cash flows with the cash flows of the firm's stock of illiquid (or non-tradable) asset exposures, and the covariance of the non-tradable cash flows of any other new investments the firm is considering.

Froot and O'Connell (1997) and Gron and Winton (2001) provide specific applications of this framework. Froot and O'Connell apply this model to price determination in the catastrophe reinsurance market. They show that such financing imperfections can lead to costly reinsurer capital and also to reinsurer market power, and estimate the corresponding supply and demand curves. Gron and Winton focus on how outstanding risk exposures affect the current supply of firms' risky products, such as insurance policies or loans. They refer to these outstanding, illiquid exposures as 'risk overhang' and show that changes in risk overhang, such as a change in the distribution of the

[6] It is well-known that banks with very low capital levels may engage in moral hazard via risk-shifting, possibly by overly aggressive lending, as in Marcus (1984). This is more likely if deposit insurance is priced at a flat rate. By contrast, if capital levels are not very low, banks may become more conservative in their lending when capital levels fall, as in Thakor (1996), Holmstrom and Tirole (1997), Besanko and Kanatas (1996) and Diamond and Rajan (2000).

cash flows or a change in the covariance of past exposures with current opportunities, may significantly reduce current supply. In extreme cases, increases in risk overhang may lead firms to reduce their total exposure to the underlying risk by canceling policies they have written, calling outstanding loans they have made, and so forth.

Much of the empirical literature on bank capital and lending stems from the debate over whether implementation of the 1988 Basle Accord's capital requirements caused a "credit crunch" in the U.S. In general, these studies relate overall or sectoral loan growth to capital measures and other controls.[7] While this literature yields no consensus on the relationship between capital and loan supply, Sharpe (1995) identifies two robust results across studies: bank profitability has a positive effect on loan growth, and loan losses have the opposite effect. Since profits (loan losses) tend to increase (decrease) bank capital, these findings are consistent with a positive association between bank capital and loan growth. In more recent work, Beatty and Gron (2001) find evidence suggesting that banks with higher capital growth relative to assets have greater increases in their loan portfolios, with the most significant effects coming from the most capital-constrained banks.[8]

The empirical research on loan supply most closely related to our work is Hancock and Wilcox (1993, 1994a, 1994b) and Berger and Udell (1994). These papers focus on how capital levels, changes in capital requirements, and shocks to capital affect the supply of loans. Similar to the literature cited above, no clear consensus about the relation between bank capital and loan supply arises from this literature, although it does appear that negative capital shocks such as increases in nonperforming loans reduce loan supply.

Our paper differs from the previous literature in several respects. First, previous studies focused on large banks, chiefly because regulatory capital constraints are more likely to be binding for large banks and because large banks produce the lion's share of the aggregate loan supply. In contrast, we focus on small banks and the role of risk overhang for the reasons outlined above: small banks are more likely to be affected by risk overhang because their loans tend to be illiquid; small banks are more likely to suffer from risk aversion induced by costs of external financing because they do not have access to public funding markets; and small banks are more likely to manage credit risk on-balance sheet because they are typically unable to use credit derivatives. Second, previous studies estimated reduced-form regression models, whereas we estimate a structural model that

[7] Examples of this literature include Bernanke and Lown (1991), Hall (1993), Berger and Udell (1994), Haubrich and Wachtel (1993), Hancock and Wilcox (1994), Brinkman and Horvitz (1995), and Peek and Rosengren (1995).

[8] More specifically, Gron and Beatty find that banks with higher increases in equity relative to assets have greater growth in risk weighted assets.

includes other loan supply decisions. This framework provides a more complete test of risk-management practices at lending institutions and the effects of risk overhang on loan supply. Third, most previous studies used annual data over a limited period of time, whereas we observe detailed changes in portfolio composition and loan supply at quarterly intervals over a 12-year period.

3. Loan Supply with Capital Market Imperfections: Theory

In this section we develop a portfolio model of bank loan supply. We begin with a representative bank which has lending opportunities in several sectors. Loans can be funded out of net internal capital, W, or external funds, F, where external funds are assumed to be more costly than internal funds. This additional cost reflects information asymmetries between the firm and outside investors (e.g., Myers and Majluf (1984), Stein (1998), and DeMarzo and Duffie (1999)), as well as other transaction costs in accessing public markets.[9] In addition to current period loans, the bank may be able to make profitable loans in future periods. As shown by Froot, Scharfstein and Stein (1993), profitable future investment opportunities combined with costly external funds and stochastic internal funds cause the firm's objective function to be increasing and generally concave in the stock of internal funds. Intuitively, more internal funds lessen the extent to which a bank must rely on costly external funds, but this benefit is generally decreasing because, at the margin, there are fewer profitable uses for these funds. Denoting the indirect form of the bank's objective function as P(W), we have $P_W > 0$ and $P_{WW} < 0$ where the subscript denotes the partial derivative.

The bank begins period t with W_{t-1} in net internal funds ('capital'), L_{t-1i} in outstanding loans to sector i, and net external (debt) finance of $F_{t-1}=\sum_i (L_{t-1i}) - W_{t-1}$. Without loss of generality, we assume that F_{t-1} is positive, as is the case for most banks; we also assume that all external finance takes the form of debt.[10] For the moment, assume that all of the bank's outstanding loans are illiquid and cannot be sold due to the bank's private information on loan quality. Since the bank must bear the risk of L_{t-1i} loans to sector i regardless of its subsequent decisions in period t, L_{t-1i} is the bank's risk overhang in sector i in period t.

During period t the bank can make new loans, $NL_{ti} \geq 0$, to each sector i, resulting in end of period outstanding debt of $F_t = \sum_i (L_{t-1i}+ NL_{t,i}) - W_{t-1}$. The gross per dollar cost of debt funding is

[9] Although the cost of federally insured retail deposits is less likely to be affected by such information concerns, insured deposits are not a perfect, costless substitute for uninsured deposits. Billett et al. (1998) find that large banks with rated public debt that is downgraded do increase their use of insured deposits after the downgrade, but this increase is more than offset by their decreased use of uninsured liabilities.

[10] We assume that external finance takes the form of debt for simplicity alone; it is well known that issuing equity also involves significant transaction and informational costs.

$1+r_t$, which includes any costs of accessing external markets rather than using internal capital.[11] During period t, the bank realizes the gross per dollar return of $\tilde{R}_{ti/t-1}$ on loans to sector i that were originated in period t-1. $\tilde{R}_{ti/t-1}$ equals $1+r_t+p_{t-1i}-\tilde{\eta}_{ti}$, where $p_{t-1,i}$ is the per dollar credit spread or markup charged on sector i loans that originated in period t-1, and $\tilde{\eta}_{ti}$ is the random per dollar loan losses on sector i loans in period t. Similarly, the bank realizes the gross per dollar return $\tilde{R}_{ti/t}$ = $1+r_t+p_{ti}-\tilde{\eta}_{ti}$ on the new loans to sector i originated in period t, where p_{ti} is the per dollar credit spread on these loans. For simplicity, we assume that all losses on loans to sector i in period t are perfectly correlated, regardless of when the loan was made. Current period loan losses are assumed to be normally distributed: $\tilde{\eta}_{ti} \sim N(\mu_{ti}, \sigma_{ti})$ where both μ_{ti} and σ_{ti} depend on the sector's economic outlook at the start of that period.[12] Both μ_{ti} and σ_{ti} are decreasing in the sector's economic outlook: when borrowing firms have better prospects, both ex ante credit risk and ex post realized loan losses are lower because the borrowing firms' chances of default are reduced. Given these assumptions, it follows that the bank's net capital at the end of period t is

$$\begin{aligned} \tilde{W}_t &= \sum_{i=1}^{n}[L_{t-1i}\tilde{R}_{ti/t-1} + NL_{ti}\tilde{R}_{ti/t}] - F_t(1+r_t) \\ &= W_0(1+r_t) + \sum_{i=1}^{n}[L_{t-1i}(p_{t-1i}-\tilde{\eta}_{ti}) + NL_{ti}(p_{ti}-\tilde{\eta}_{ti})] \end{aligned} \quad \textbf{(1)}$$

where we have made use of the definitions of $\tilde{R}_{ti/t-1}$, $\tilde{R}_{ti/t}$, and F_t.

The bank chooses new loan amounts, NL_{ti}, that maximize expected profit, $E[P(\tilde{W}_t)]$ given the financing constraints. This leads to the following first order condition for each sector i:

$$0 = E[P_W \frac{\partial \tilde{W}_t}{\partial NL_{ti}}] = E[P_W(p_{ti}-\tilde{\eta}_{ti})] = E[P_W](p_{ti}-\mu_{ti}) - Cov(P_W, \tilde{\eta}_{ti}) \quad \textbf{(2)}$$

where we have made use of (1) and the identity E(xy) = E(x)E(y) + Cov(x,y). Since loan losses, $\tilde{\eta}_{ti}$, and the level of internal funds, $\tilde{W}_t$, are both normally distributed, we can apply Stein's Lemma and the definition of covariance to derive the bank's supply of new loans to sector i, NL^S_{ti}:[13]

[11] Once more, we assume that F_t is positive. We could easily incorporate net negative debt as holdings of marketable securities yielding $1+r_t-c_t$, where c_t is the additional cost (i.e., transaction costs plus any costs of asymmetric information) of external finance over and above the return to investors holding marketable securities.

[12] In reality, loan losses are skewed to the right: they cannot be less than zero, there is a high probability that they won't be too large, and a low probability of very large losses (see Carey, 1998, and Winton, 2000). The assumption of normality allows us to give a simple, tractable analytic solution to the bank's portfolio choice problem.

[13] Stein's lemma implies that $Cov(P_W, \tilde{\eta}_{ti}) = E[P_{WW}]Cov(\tilde{W}_t, \tilde{\eta}_{ti})$. We also use $Cov(\tilde{W}_t, \tilde{\eta}_{ti}) = -\sum_j (L_{t-1j} + NL_{tj})\sigma_{ij}$.

$$NL_{ti}^{S} = -\sum_{j \neq i} NL_{tj}^{S} \frac{\sigma_{ij}}{\sigma_{ii}} - L_{t-1i} - \sum_{j \neq i} L_{t-1j} \frac{\sigma_{ij}}{\sigma_{ii}} + \frac{p_{ti} - \mu_{ti}}{G\sigma_{ii}}. \qquad \textbf{(3)}$$

In (3), $G = -\frac{E[P_{WW}]}{E[P_{W}]}$ measures the bank's effective risk aversion induced by the costs of external finance, and we have suppressed the time subscript on the covariance and variance terms.

The bank's supply of new loans is determined by several factors—the bank's existing exposures to risks, the correlations between the new loans and existing exposures, the bank's other new loan opportunities in sectors $j \neq i$, and the attractiveness of the new loans normalized by the bank's risk tolerance. The first term on the right hand side of equation (3) accounts for the risk impact of alternative lending opportunities on lending to sector i, and equals the net effect of new lending opportunities in other sectors j and the covariance-variance ratios σ_{ij}/σ_{ii} (which we measure as the covariance of loan losses in sectors i and j to the variance of loan losses in sector i). The second term is the existing portfolio exposure in sector i, that is, the overhang of outstanding loans in sector i at time t. The third term is the combined effect of the risk overhang in each of the other sectors j and their covariance-variance ratios. The last term represents the attractiveness of sector i loans to the bank: the return–risk (or Sharpe) ratio $(p_{ti}-\mu_{ti})/\sigma_{ti}$ multiplied by the bank's tolerance for risk G^{-1} (the inverse of the bank's risk aversion G).

It is straightforward to verify that equation (3) has the features of a supply curve. The supply of new loans to sector i is increasing in the current credit spread (or 'markup') p_{ti} and decreasing in expected loan losses (or costs) μ_{it}. Assuming that p_{ti} exceeds μ_{ti}, new loan supply is also decreasing in the bank's effective risk aversion G. Further, the supply of new loans to sector i is decreasing in the overhang of outstanding loans in that sector, L_{t-1i}. Finally, if the covariance between sector i and sector j is positive, then the supply of new loans in sector i is decreasing in both the overhang of outstanding loans in sector j and the supply of new loans in sector j; by contrast, if the covariance is negative, then the supply of new loans in sector i is increasing in loans to sector j.

4. Loan Supply with Capital Market Imperfections: Issues for Empirical Specification

Equation (3) forms the basis for our empirical analysis. Before we proceed to the data and estimation, however, we must incorporate two features of the data that run counter to our assumptions above. The first is that banks hold liquid as well as illiquid loan stocks. The second is that we do not directly observe new loan supply, only the change in loan stock. We then present our estimation equation and predicted outcomes for the regression parameters.

4a. Banks hold liquid and illiquid loan stocks

During a given accounting period, some loans will mature and be repaid. The remaining loan stocks exhibit varying degrees of liquidity. As shown by Froot and Stein (1998), under optimal portfolio allocation with imperfect capital markets, it is optimal for banks to shed all loans that can be sold at fair value. However, the market prices for loan sales may be below the banks' expected values due to information asymmetries or transaction costs of selling loans, resulting in illiquid loans which are held rather than sold.

To include the effects of illiquid loan stocks, let $\delta_{t-1i} \in (0,1)$ be the illiquid portion of the outstanding loans at the *beginning* of period t (*end* of period t-1). The remaining loans are assumed to be liquid and will either run off naturally or else can be sold off at no cost to make room for new loans. Since only illiquid loan stocks will affect new lending, we can rewrite equation (3) as follows

$$NL_{ti}^{S} = -\sum_{j\neq i} NL_{tj}^{S}\frac{\sigma_{ij}}{\sigma_{ii}} - \delta_{t-1i}L_{t-1i} - \sum_{j\neq i} \delta_{t-1j}L_{t-1j}\frac{\sigma_{ij}}{\sigma_{ii}} + \frac{p_{ti}-\mu_{ti}}{G\sigma_{ii}}. \quad \textbf{(3')}$$

While equation (3') is predicted by theory, the available data do not allow us to observe the portion of loan stocks that are illiquid. We use total outstanding loans in period t-1, L_{t-1i}, in our estimation equations instead of $\delta_{t-1i}L_{t-1i.}$ Thus, the coefficient on outstanding loan stocks in our estimations is not predicted to be exactly -1 as in equation (3'); instead, the coefficient will capture the average effect of loan stock liquidity as well as the fact that losses on outstanding loan stocks may not be perfectly correlated with losses on new loans.[14]

The degree to which outstanding loans are liquid or illiquid is not fixed but can change with exogenous conditions. A downturn in a sector will reduce the liquidity of outstanding loans for two reasons. First, borrowers in that sector are in worse shape, so they are more likely to try to roll over their maturing loans. Second, because these loans are riskier, the bank faces greater adverse selection problems when trying to sell or securitize the loans. While we cannot account for all liquidity changes over time, our estimations do allow for a differential effect of loan stocks during sector downturns.

In addition to the loan risk and liquidity effects described above, sector downturns may also have a capital effect. A sector downturn may increase expected future losses on outstanding loans, reducing a bank's expected capital and making it effectively more risk averse. This capital effect

[14] Following the model we would expect the estimated coefficient on outstanding loans from sector i to be the average share of illiquid loans for the bank over the period. However, in addition to the fact there are other considerations which affect loan supply, we will make several adjustments to our estimation equation (such as estimating shares and not levels to avoid size effects) which change this prediction.

predicts that a downturn in one sector will decrease net lending changes in other sectors, especially more liquid sectors, because banks can more easily shed risk in those sectors. To separately capture the impact of such a correlation, we interact bank portfolio downturns with the risk aversion term.

4b. New loans are unobservable

A second concern is that new loan supply, NL^S, is not directly observable in the data. Instead, we use the net period-to-period change in the stock of loans, which we refer to as the net lending change, NLC. Note that the stock of outstanding sector i loans L_{ti} at the *end* of period t is the sum of three items: the illiquid portion of the period t-1 loan stock, any retained liquid portion of the period t-1 loan stock, and the new period t loans. Letting $\tau_{ti} \in (0,1)$ represent the fraction of outstanding *liquid* sector i loans from period t-1 that the bank retains at the end of period t, it follows that L_{ti} equals $(\delta_{ti} + \tau_{ti}(1-\delta_{ti}))L_{t-1i} + NL^S_{ti}$. We have

$$\begin{aligned} NLC_{ti} &= L_{ti} - L_{t-1i} \\ &= NL^S_{ti} + [\delta_{ti} + \tau_{ti}(1-\delta_{ti})]L_{t-1i} - L_{t-1i} \\ &= NL^S_{ti} - [(1-\tau_{ti})(1-\delta_{ti})]L_{t-1i} \end{aligned}$$

Net lending change is then the actual supply of new loans less the portion of liquid loan stocks that are sold. Banks will sell or hedge some liquid loans if they can do so at fair prices, and will hold some liquid loans either due to market imperfections or for strategic purposes. Regardless, banks will tend to draw down or sell off the liquid portion of their outstanding loans more when their capital falls (due to increased risk aversion) or if the portfolio risk associated with their liquid loans increases (i.e., higher correlations with other loans). If the share of liquid loans, $(1–\delta_i)L_{t-1i}$, is small relative to the flow of new loans, or if the bank retains a large portion of its liquid loans—and both of these conditions are more characteristic of small banks than of large banks—then NLC will be highly correlated with new loan supply NL^S.

4c. Specification

Equation (4) presents our basic estimation equation, which takes into account both the unobservability of illiquid loans and new loan supply as well as the effects of sectoral downturns on existing loan liquidity and new loan supplies. We also separate the risk tolerance measure G^{-1} from the Sharpe ratio $(p_{ti}-\mu_{ti})/\sigma_{ti}$ in order to better distinguish their effects.[15] For ease of exposition, we express equation (4) separately for each of the three loan sectors in the data—real estate, business, and consumer. These adjustments result in the following set of estimation equations:

[15] We have also done the estimation with the combined term and there are no significant differences in the qualitative outcomes.

$$NLC_{t1} = -\sum_{i=2,3}\phi_{i1}NLC_{ti} - (\beta_1 + \gamma_1 D_{t1})L_{t-1\,1} - \sum_{i=2,3}\left((\rho_{i1} + \lambda_{i1}D_{ti})L_{t-1i}\right) + (\chi_1 + \omega_1 DP_t)\frac{p_{t1} - \mu_{t1}}{\sigma_{11}} + (\xi_1 + \varsigma_1 DP_t)G_t^{-1} \quad \textbf{(4.1)}$$

$$NLC_{t2} = -\sum_{i=1,3}\phi_{i2}NLC_{ti} - (\beta_2 + \gamma_2 D_{t2})L_{t-1\,2} - \sum_{i=1,3}\left((\rho_{i2} + \lambda_{i2}D_{ti})L_{t-1i}\right) + (\chi_2 + \omega_2 DP_t)\frac{p_{t2} - \mu_{t2}}{\sigma_{22}} + (\xi_2 + \varsigma_2 DP_t)G_t^{-1} \quad \textbf{(4.2)}$$

$$NLC_{t3} = -\sum_{i=1,2}\phi_{i3}NLC_{ti} - (\beta_3 + \gamma_3 D_{t3})L_{t-1\,3} - \sum_{i=1,2}\left((\rho_{i3} + \lambda_{i3}D_{ti})L_{t-1i}\right) + (\chi_3 + \omega_3 DP_t)\frac{p_{t3} - \mu_{t3}}{\sigma_{33}} + (\xi_3 + \varsigma_3 DP_t)G_t^{-1} \quad \textbf{(4.3)}$$

where i ranges from 1 to 3 indexing the three loan loan sectors mentioned above. D_{ti} is an indicator variable that equals one if there is a downturn in sector i during period t. DP_t summarizes the effect of downturns on the bank's portfolio; it is a loan-share weighted average of the D_{ti} indicator variables for period t. G_t is the bank-specific risk aversion factor at the beginning of period t as described above; its inverse G_t^{-1} is the bank's risk tolerance. $(p_{ti}-\mu_{ti})/\sigma_{ii}$ is the expected return-risk ratio (Sharpe ratio) for sector i loans. The coefficients ϕ, β, γ, ρ, λ, χ, ω, ξ, and ζ are parameters to be estimated. The coefficients on the net lending change and loan stock variables (ϕ, β, γ, ρ, and λ) absorb the effects of the correlation and variance terms, σ_{ij}/σ_{ii}, present in (3) but absent here. The coefficients on loan stocks also absorb the unobservable liquidity effects discussed above.

We estimate equation (4) separately for each of the three loan sectors, controlling for fixed bank effects, quarterly effects, and using two stage least squares (2SLS) to account for the endogeneity or simultaneity of the net lending change variables, NLC_{it}. Our approach differs from prior research on the determinants of loan supply (net lending) changes by focusing on the impact of past and current portfolio decisions (existing loan stocks in the same sector, existing loan stocks in other sectors, and new lending in other sectors) and by distinguishing loan stock effects in normal times ($D_{ti}=0\ \forall$ i) from loan stock effects during sector downturns ($D_{ti}\neq 0$ for at least one i) when we expect these stocks to be less liquid.

4d. Predicted signs for estimated coefficients

Based on the discussion above, we can make the following predictions about the estimated coefficients of equation (4):

- ***Same-sector loan overhang:*** Within a given sector, net lending change will be negatively related to overhang (β_i<0). This negative overhang effect will be stronger for sectors that are less liquid; for example, if sector i loans are less liquid than sector j loans, then $\beta_i<\beta_j<0$.

- ***Same-sector downturns:*** Within a given sector, downturns will increase loan illiquidity and bank risk aversion, and as a result banks will desire to shed loans in that sector ($\gamma_i<0$).
- ***Cross-sector loan overhang:*** If the portfolio model is the primary determinant of net lending changes, then the impact of cross-sector loan overhang on net lending change (ρ_{ji}) will be increasingly negative (or less positive) as the covariance between loan losses in sectors i and j increases. Holding covariance constant (and not equal to zero), the magnitude of ρ_{ji} will be larger the more illiquid is loan stock j.
- ***Cross-sector downturns.*** All else equal, a downturn in sector j will both increase loan illiquidity in that sector *and* make the bank more risk averse due to expected reductions in capital. The illiquidity effect increases loan overhang in sector j and amplifies the effect of the loan stock on the net lending change (i.e., λ_{ji} should have the same sign as ρ_{ji}). The risk aversion effect will cause the bank to shed loans in all sectors, including sector i ($\lambda_{ji}<0$ regardless of the sign of ρ_{ji}), and will be larger if the loans in sector i are more liquid. The net effect will depend upon whether these two effects reinforce or offset one another and, in the latter case, which factor dominates.
- ***Cross-sector net lending change:*** If our model holds strictly, the estimated effect of net lending change in sector j on net lending change in sector i (ϕ_{ji}) should be the same sign as the estimated effect of sector j loan stocks on net lending change in sector i (ρ_{ji}). The coefficients will be exactly the same ($\phi_{ji}=\rho_{ji}$) only if the loan stocks and net lending change have the same degree of liquidity and if loan losses for each have the same correlation with loan losses for the net lending change in sector i.
- ***Risk-adjusted profits and risk tolerance:*** Within a given sector, net lending change will increase with the return-risk ratio ($\chi_i>0$) and with the bank's risk tolerance ($\xi_i>0$). Both of these effects will be dampened by increased portfolio exposure to downturns, which reduce capital and make the bank more risk averse ($\omega_i,\zeta_i<0$).

5. Data and Variables

We estimate equation (4) for three categories of loans: real estate loans, business loans, and non-credit-card consumer loans, using quarterly data on small commercial banks from the Federal

Reserve's Report of Condition and Income (Call Report) for the period 1987:4 to 2002:4.[16] The data exclude banks with less than $25 million in assets in current dollars (the Call Reports require very little detail for banks below this size) and exclude banks with more than $1 billion in assets in real, 2000 dollars. This $1 billion threshold is a typical cut-off for defining community banks (DeYoung, Hunter, and Udell 2004), and it retains over 90% of all U.S. commercial banks during our sample period. Although the Call Report data offer somewhat greater detail on the loan portfolios of larger banks, small banks are attractive for our purposes because their loans tend to be less liquid than those of larger banks.

The limited lending capacity of small banks precludes them from making loans (or from participating in loans) to large publicly traded firms; instead, small banks specialize in business loans to small, privately-held businesses. These loans typically rely on relationships between a small bank's loan officers and its business borrowers that allow the bank to observe soft (i.e., not quantifiable) information about the borrower that can be used to evaluate the borrower's creditworthiness (Stein 2002). Because the supporting information for these 'relationship loans' cannot be credibly conveyed to outside investors, these loans should be less liquid than loans based upon quantifiable information; Berger et al. (2005) find evidence consistent with this prediction.

Similar considerations apply to consumer lending, where asset securitization has driven a wedge between small banks and large banks. Origination and securitization of consumer loans (e.g., credit card or automobile loans) impose a number of fixed costs on the lender, including legal and credit rating agency fees, overhead for performing statistical analysis, costs of establishing a reputation in the asset-backed securities market, and the ability to provide 'credit enhancements' (e.g., retain a portion of the loans' credit risk) to the buyers of the asset-backed securities. The result is that consumer loans are relatively liquid when made by large banks that operate at the scale needed to efficiently participate in securitized consumer lending, but are relatively illiquid when made by small banks that cannot. The relative illiquidity of business loans and consumer loans at small banks suggests that, all else equal, risk overhang will be a bigger concern for small banks than for large banks.

Although commercial real estate lending by small banks suffers from the same illiquidity as does their business lending, their residential real estate lending is relatively liquid. Most home

[16] We exclude credit card loans because nearly all small banks exited this line of business during our sample period, due to new production processes (i.e., credit scoring and loan securitization) that exhibit huge scale economies. The Call Reports also include data on a number of other loans (e.g., loans to government entities, loans to other financial institutions), but these loans comprise a negligible portion of the loan portfolios of small banks.

mortgage securitizations are done through government-sponsored enterprises (GSEs) which take on the fixed costs just mentioned, and typically do not involve explicit credit enhancement by the originating bank. Thus, to the extent a small bank's real estate lending is residential in nature, risk overhang may be a lesser issue in this sector.

Small banks have several other attractive features for our study. Small banks operate within a smaller geographic area than large banks and hence are less well diversified; this makes small banks more sensitive to fluctuations in local business conditions that can shift their optimal loan portfolio composition away from their current (perhaps illiquid) loan portfolio composition. Also, because small banks lack the scale and expertise to produce many nontraditional, off-balance-sheet banking products (e.g., insurance and securities underwriting, securities brokerage, loan securitization), their strategic focus remains on traditional portfolio lending. This not only makes small banks a relatively homogeneous population for statistical analysis, but also means that lending portfolio concerns such as loan overhang should loom larger for small banks than for large banks. Furthermore, during our period of investigation, small banks are less likely to be involved in mergers that significantly alter their business strategies. And finally, as most small banks lack the expertise to hedge credit and other risks with off-balance sheet derivative securities, balance-sheet-based measures may be a more accurate measure of a small bank's capacity for bearing risk than they would be for a larger bank.

Table 1 presents the definitions of the variables we use to specify and estimate equation (4). Real estate loans, L_{RE}, include commercial development loans and mortgages on farmland, single family homes, and multi-family dwellings. Business loans, L_{BUS}, include all commercial and industrial loans; for banks located in rural markets L_{BUS} also includes agricultural production loans. Consumer loans, L_{CON}, include all revolving, installment, or single payment loans to individuals (e.g., auto loans, students loans, personal lines of credit). Our dependent variable NLC_{it}, the net lending change in sector i lending in quarter t, is measured as the end of quarter t loan stock minus the beginning of quarter t (end of quarter t-1) loan stock, plus net loan charge-offs (loans charged off minus loans recovered) during the quarter. In order to reduce the effect of size-induced differences between banks, we normalize all net lending change variables and all loan stock variables by dividing them by beginning-of-quarter assets.

We construct the Sharpe ratio as the expected profit for loan type i at each bank for each period t, divided by the profit variance of loan type i over the sample period. Expected profit is the expected percent return (the bank's interest and fee income from loan sector i during period t divided by its stock of accruing loans at the end of period t) multiplied by the expected performance of loans in sector i (the historical percentage of accruing loans in sector i) minus the average deposit rate paid by the bank (the interest paid on deposits during period t divided by the average deposits in the current and prior period).[17] The profit variance of loan type i is measured as the variance of the quarterly change in expected profit in sector i for the whole sample period, calculated separately for urban and rural banks in each state.[18]

Bank specific risk tolerance, G^{-1}, is measured as total equity capital divided by total assets. Intuitively, banks with lower financial leverage (higher equity capital) will in general be more risk tolerant in their lending decisions because they are better able to absorb loan losses (and the attendant reductions in equity capital), and are also better able to sustain increased illiquidity in any one loan sector without making compensating adjustments in the other portions of their loan portfolio.[19] Our indicator variable for a sectoral downturn in loans is NPpoor, which equals one in quarters for which the average ratio of nonperforming loans to assets across all banks in a geographic market (MSA for urban banks, nonMSA counties within the state for rural banks) is in the highest quartile of the sample distribution for that market during our sample period. We measure the combined effect of sectoral downturns on a bank's portfolio with the variable NPport, which is a loan-weighted sum of the sectoral indicator variables $NPpoor_i$. (The NPport risk measure may be a more conditional measure of risk than the whole-sample estimate of profit variance in the Sharpe ratio, and thus may be more relevant for explaining net lending change in the short-run.)

If banks manage their different types of loans as a portfolio of loans, then the net lending changes in sectors $j \neq i$ on the right-hand-side of equation (4) will be endogenous to the dependent variable, the net lending change in sector i. We use several measures of endogenous sector j supply effects as instruments to identify the equation.[20] These include the expected profit term $p_{tj} - \mu_{tj}$ for the relevant endogenous variable, as well as a number of predictors of local economic conditions identified in Daly, Krainer and Lopez (2003) and Crone (2003): Crone's regional index, the change

[17] Historical nonaccruing loans are calculated as the four-quarter lagging average of nonperforming loans to beginning of period loan stock when available. When the four-quarter average is not available but a three-quarter average is, the three-quarter average is used.

[18] We estimate the profit variance at the state level rather than at the bank level in order to ensure exogeneity. Using the variance of nonperforming loans instead of profit variance has no qualitative effect on the results.

[19] In our model, banks are only risk averse due to the costs of external finance, so banks with more equity to assets have greater ability to take on additional risky loans in the future. Thus, higher equity to assets indicates greater risk tolerance. By contrast, in models of managerial agency banks with more risk-averse managers will have higher equity to asset ratios, all else equal, since these managers hold more capital so as to reduce the bank's risk of failure. In this alternative model, higher equity to assets would indicate higher (managerial) risk aversion.

[20] Any variable that is correlated with the right-hand-side endogenous variables but not correlated with the errors in the banks' loan supply decisions will be useful for identifying the equation. We use standard two-stage least squares (2SLS) techniques, first regressing loan changes on measures of local economic conditions along with excluded variables from the other equations, and then using these results to create fitted values for use in the second stage regressions, which correspond to equation (4).

in this index, and state-level measures of personal income growth, employment growth, unemployment growth, the unemployment rate, and the growth in housing prices.[21]

Since our goal is to examine banks' portfolio decisions and the manner in which banks trade off new loans given outstanding loan stocks, we only consider banks that engage in substantial amounts of all three types of lending—real estate, business and consumer—and specialize in none of them.[22] We define these 'nonspecialist' lenders as banks that have at least 5 percent of assets invested in real estate loans and at least 3 percent of assets invested in business loans and in consumer loans. We also omit banks with over 65 percent of assets invested in real estate loans or over 50 percent of assets invested in either business loans or consumer loans.[23] We selected these thresholds primarily to exclude banks doing little or no lending in a given category, since these banks would not be considering the trade-offs between all three loan categories. Indeed, the minimum thresholds are binding far more often than the maximums: about 92% of the observations that do not meet these standards fall below the minimum thresholds. In all, about 25% of the observations fail to meet either the minimum or maximum thresholds.

We make several additional data adjustments to avoid the effects of data errors, merging banks, or banks with an abrupt change in strategy. The data from small banks can be very noisy. Thus, we delete bank-quarter observations where the ratio of nonperforming loans to beginning of period loans, the ratio of net lending change to beginning of period assets, the quarterly change in assets, or the quarterly change in equity capital are over the 99th percentile or below the 1st percentile of the sample distributions. We also omit bank-quarter observations when banks have negative equity, bank-quarter observations in which the assets of another bank are acquired, and all

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[21] The Federal Reserve Bank of Philadelphia's Consistent Economic Indexes for the 50 states are available at: http://www.phil.frb.org/econ/stateindexes/index.html. Personal income growth data come from the Bureau of Economic Analysis, employment and unemployment data are from the Bureau of Labor Statistics, and the housing price data are from the Office of Federal Housing Enterprise Oversight. All series have been adjusted for quarterly effects by using residuals from a regression on quarterly indicator variables.

[22] When we estimate equation (4) for all banks—including those that specialize in one category of lending as well as those that manage a more diversified portfolio—the estimated effects of the endogenous net lending changes $NLC_{t,i\neq i}$ and loan stocks $L_{t-1,j}$ are much less consistent. This is not surprising since it is quite likely that a bank that specializes in just one type of loans—say, business loans—practices most of its on-balance sheet portfolio risk management across loans *within* the business loan category (which the data do not allow us to observe) rather than across all three observable loan categories. The fact that the data preclude us from testing for on-balance sheet portfolio risk management within loan categories does not invalidate our tests for this behavior across loan categories.

[23] We used higher upper and lower thresholds for real estate loans because they comprise a larger percentage of assets for the average small bank in the U.S. (about 25% at year-end 1989 and 35% at year-end 1999) than consumer loans (about 11% and 8%) or business loans (about 11% and 10%). A higher proportion of rural banks fall below the minimum real estate and business loans thresholds, while a higher proportion of urban banks fall below the minimum consumer loans threshold. Varying the thresholds somewhat does not significantly change our results.

observations from banks that never lend more than 15% of their assets.[24] Given these constraints, our dataset begins with 322,236 bank-quarter observations.

We estimate the model separately for banks located in urban markets (banks located in MSAs) and banks located in rural markets (outside of MSAs) for several reasons. First, rural banks typically face less competition and often have considerable local market power. With greater rents at stake, their ability and willingness to absorb risk and overhang may differ markedly from those of urban banks. Second, a large percentage of business loans at rural banks are made to agricultural businesses, mostly to small farms. For rural banks, we include agricultural production loans (which banks report in a separate category in the Call Reports) in our business loans. Small farm financing is often a mixture of operating loans to the business, real estate loans for the farm home, and consumer loans to purchase vehicles and other services used primarily in farm production. Thus, the precise nature of, and correlations between, the three loan sectors are likely to be different for rural banks as compared with urban. Previous research shows that rural banks hold relatively low levels of total loans, relatively high levels of marketable securities, and relatively high levels of equity compared to similarly sized urban banks (DeYoung, Hunter, and Udell, 2004), consistent with a less sophisticated approach to risk management.

Table 2 presents summary statistics for the data and variables used in our regression analysis. The top panel reports statistics for rural banks, the bottom for urban banks. The number of observations falls to 189,650 bank-quarters (69,013 for urban banks; 120,323 for rural banks) due to lags required to calculate variables and missing data. (For example, our expected profit calculations require at least three consecutive prior quarters of profit data.) On average, rural banks are significantly smaller than urban banks in terms of total assets and hold proportionally fewer assets in real estate loans, more assets in business (including agricultural production) loans, and similar amounts of assets in consumer loans.

6. Estimation Results

Table 3 presents our equation (4) regression results describing quarterly net lending changes in real estate (panel A), business (panel B) and consumer (panel C) loans. We performed separate estimations for rural banks and urban banks, and with and without the indicator dummy

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[24] While it might be desirable to keep banks with negative equity, negative equity poses potential problems for using bank equity capital to measure bank risk tolerance. Since banks with negative equity account for very few observations, excluding these is unlikely to affect the estimation in a significant way.

variables for sectoral downturns (NPpoor) and portfolio downturns (NPport) described above. All of the regressions include bank-specific fixed effects and seasonal (quarterly) controls.

The results in table 3 are substantially consistent with our predictions, and strongly suggest that small commercial banks make net lending change decisions in a manner that is consistent with optimal risk management and capital budgeting. The estimated coefficients on the same-sector overhang variables ($L_{i,t-1}$) are all negative and statistically significant, as expected. Moreover, these coefficients tend to be larger in magnitude for more illiquid types of loans. For rural banks, the estimated same-sector overhang effect for real estate lending (-.007 or -.009) is smaller in magnitude than the same-sector effect for consumer lending (-.033 or -.030), which in turn is smaller in magnitude than the same-sector effect for business lending (-.102 or -.104). The ordering is less strict for urban banks, where the same-sector real estate and consumer loan effects are relatively small but quite similar in magnitude (-.026 versus -.026 or -.024, respectively), while the same-sector business lending effect is relatively larger in magnitude (-.084 or -.082). In all cases this risk overhang effect is strongest for business loans—not surprising given that the small banks tend to make business loans to small, privately owned firms, and the informational opacity of these borrowers makes their loans substantially less liquid on average than the other types of loans. The magnitudes are non-trivial—for example, a 10 percent increase in business loan "overhang" at the average urban bank is associated with an approximate 8/10ths percent reduction in business loan share during the following quarter.[25]

The estimated effects of a same-sector downturn ($L_{i,t-1}$*$NPpoor_{i,t}$) tend to have the expected negative sign: in general, we expect loan stocks to become more illiquid during a sector downturn, which would reinforce the negative same-sector loan overhang coefficients just discussed. This is always the case for the urban banks. For rural banks the results are mixed: a significant negative coefficient (suggesting increased illiquidity) for consumer loans, a non-significant coefficient for real estate loans, and a significant positive coefficient (suggesting *reduced* illiquidity) for business loans. The positive sign likely reflects institutional factors. As farmers' creditworthiness deteriorates in a rural downturn, many become eligible for subsidized government loan programs that provide the bank with loan loss guarantees. The presence of these government loan programs—which in effect reduces the riskiness and the illiquidity of these loans—coupled with farmers' increased demand for credit during downturns, act to dampen rather than exacerbate the same-sector loan overhang effect.

[25]Multiplying the same-sector loan overhang coefficient (-.084) by a ten percent change in mean business loans/assets (.0113) and dividing by mean business loans/assets yields the result. While this effect only partially offsets the current period overhang in business loans, additional reductions would continue in following quarters, ceteris paribus.

Since our real estate loan variable contains farm mortgages, these same institutional factors may be causing the non-significant coefficient on the same-sector real estate downturn for rural banks. This interpretation is supported by the fact that we do not observe these anomalies in the urban bank regressions.

The magnitudes of the same-sector downturn effects are consistent with known differences in the nature of the bank-borrower relationship across loan categories. The estimated coefficient on $L_{i,t-1}$*$NPpoor_{i,t}$ for business loans is the least negative (or most positive) of the three same-sector downturn effects for both urban banks (-.005 versus -.008 and -.011), respectively, for real estate and consumer lending) and rural banks (.006 versus -.001 and -.008). Thus, even though business loans tend to be more risky and less liquid than the other loan types, small banks' sensitivity to risk overhang remains relatively unaffected by business sector downturns. This suggests that small banks measure the value of their relationships with business clients across the business cycle, and are willing to accept temporary increases in risk and illiquidity in order to maintain the business relationship throughout the downturn. Indeed, credit access during downturns is a crucial component of a banking relationship for small business firms. Moreover, because small banks' business loans are very illiquid to begin with, a downturn may not increase this much further.

As expected, the estimated coefficients on the Sharpe ratio are positive and all are statistically significant. This is a supply effect: banks increase their net lending when the risk-adjusted expected returns from lending increase. This supply effect is stronger during economic downturns, as indicated by the positive coefficients on the $Sharpe_{i,t}$*$NPport_{i,t}$ variable. During economic downturns, net lending becomes more responsive to increases in expected profitability, perhaps because higher expected profitability increases capital. This effect tends to be small, however—the only exception being the relatively large estimated coefficient (.004) for business lending at urban banks, again suggesting an important countercyclical role for small commercial banks.

The results for the risk tolerance variable (G^{-1}) are less straightforward than we had expected, but nonetheless consistent with optimal portfolio risk management. As expected, the risk tolerance coefficients are positive for business lending—but these coefficients are unexpectedly negative and significant for real estate lending, and are generally non-significant for consumer lending. Thus, holding constant existing loan mix and net lending changes in other sectors, increased risk tolerance at both urban and rural banks is manifested by movements out of relatively liquid loans (real estate, mostly home mortgages) and into relatively risky, illiquid loans (business). Economic downturns have little impact on these findings, as indicated by the estimated coefficients on G^{-1}*NPport which are statistically non-significant in five of six cases. We explore this finding further in our subsample estimates below.

Although we have no *a priori* expectation about the coefficient signs on the cross-sector loan stock ($L_{j\neq i,t-1}$) or net lending change ($NLC_{j\neq i,t-1}$) variables, we do expect these coefficients to have the same sign for a given loan type. We obtain this result more often than not: of the 24 pairs of cross-sector coefficients in the Table 3 regressions, 13 pairs have the same statistically significant sign while only six pairs have statistically significant opposite signs. Moreover, the large majority of the individual cross-sector coefficient estimates (34 out of 48) are positive and significant; based on our theoretical model (see equation (3) above) this implies that bank lenders act as if loan shocks covary negatively among pairs of loan types included in our data. The most systematic of these relationships is for business and real estate lending: in Panel A (real estate NLC) all eight of the cross-sector coefficients for business loans are positive and significant, while in Panel B (business NLC) all eight of the cross-sector coefficients for real estate loans are also positive and significant. The results also imply, although less systematically, that bank lenders expect business loans and consumer loans to covary negatively: the cross-sector coefficients linking these two types of lending (the cross-sector coefficients on consumer loans in Panel A and real estate loans in Panel C) are positive and significant in 10 out of 16 cases, and negative and significant just twice. The weakest evidence of cross-sector effects is for real estate lending and consumer lending (consumer loans in Panel A and real estate loans in Panel C), for which the cross-sector coefficients are positive and significant in just eight cases but negative and significant in five cases. These results are economically reasonable, as they suggest that shocks to household loans (consumer loans and real estate loans, which at small banks are predominantly home mortgages) tend to move together, while shocks to business sector loans and household sector loans do not.

As a robustness test we checked to see whether the loan covariances implied by our Table 3 estimates of bank loan portfolio behavior are consistent with the actual loan covariances in the raw data. Using the raw data on expected profits for real estate, business, and consumer loans (i.e., the numerators in our Sharpe ratios), we calculated variance-covariance matrices at the bank-level, and then aggregated up to produce an average variance-covariance matrices for both urban and rural banks. Although all of the average expected profit covariances are positive, their relative magnitudes are consistent with our regression estimates.[26] For example, the smallest positive covariances are between real estate loans and business loans, consistent with the diversification opportunities implied by our cross-sector parameter estimates for this pair of loans. In contrast, the largest covariances are between consumer loans and real estate loans, consistent with the weak cross-sector results in our regressions for this pair of loan types. Our calculations are also consistent with the relative ordering of our estimated same-sector risk overhang results: the raw data variance for expected profits is largest for business loans and smallest for real estate loans.[27]

6a. Subsample estimations

Over the twelve years of our estimation period, improvements in financial technology and information flows (e.g., automated loan underwriting, loan securitization) have deepened the secondary market for loans—for small banks this has been especially relevant for home mortgage loans, which have become increasingly liquid investments. To examine the impact of these developments on loan overhang and portfolio risk management, we re-estimated equation (4) separately for an early sub-period (1990 through mid 1996) and a late sub-period (mid 1996 to 2002). The results are displayed in Table 4. Overall, the estimated model parameters for the two sub-periods are very similar in signs and significance to the full-sample estimates in Table 3, with the following notable exception: the results suggest that loan overhang effects have grown weaker over time, perhaps in response to increases in the liquidity of consumer and real estate loans.

In both the real estate and consumer NLC regressions (Panels A and C) the estimated risk tolerance coefficients change from largely positive or positive and non-significant in the early period to largely negative and significant in the later period. In contrast—and consistent with the full-sample results—the risk tolerance coefficients are always positive in the business NLC regressions (Panel B). Thus, the early period results are consistent with our original expectations that increased risk tolerance (i.e., extra equity capital) is associated with increased net lending across the board, while in the later period our results suggest that banks respond to increased risk tolerance by shifting their net lending out of relatively less risky (and increasingly liquid) real estate and consumer loans and into relatively more risky business loans. The estimates also suggest more straightforward patterns of risk management and portfolio diversification in the early sub-period that are consistent with generally

[26] For urban banks the average covariances of expected profits are 0.00009 (real estate-business), 0.00011 (business-consumer), and 0.00014 (consumer-real estate). For rural banks these same covariances are 0.00013, 0.00013, and 0.00017, respectively.

[27] For urban banks the average variances of expected profits are 0.00071 for business loans, 0.00022 for consumer loans, and 0.00016 for real estate loans. For rural banks these same variances are 0.00041, 0.00022, and 0.00018, respectively.

less liquid loan stocks: the same-sector loan overhang coefficients tend to be larger (i.e., more negative) and the estimated cross-sector coefficients are always positive in the early period.

We also investigated whether banks in multi-bank holding companies (MBHCs) managed their loan portfolios differently than independent banks. Multi-bank organizations may manage their loan portfolios at the holding company level rather than at the bank level, possibly facilitated by internal capital markets—if so, we would expect to find generally weaker evidence of loan overhang and risk sensitivity in our regressions for banks affiliated with these organizations. To examine this possibility, we re-estimated equation (4) for a sub-sample of quarterly observations of banks that were MBHC members either in every quarter of the data or in every post-1989 quarter. The results are displayed in Table 5 and offer little evidence that loan portfolios in these banks are managed at the organization level.

For example, compared the full-sample results in Table 3 (first and third columns), 11 of the 18 same-sector and cross-sector loan overhang coefficients are statistically significant *and larger*. Similarly, 5 of the 6 coefficients on both the Sharpe variable and the risk tolerance variable are statistically significant and larger than in Table 3. These results imply that loan portfolios are managed at the local bank level, not at the organization level, which is consistent with the relationship-based nature of many of the loans made by community banks. Given this local focus, the results also imply that affiliate bank managers face especially strong incentives to manage portfolio risk, perhaps because the monitoring and performance management environment in these organizations is stronger than in independent banks, many of which are family-owned and managed (DeYoung, Spong, and Sullivan 1999). If there are functioning internal capital markets within these multi-bank organizations, their impact on investment decisions appears to be minimal.

7. Conclusion and Discussion

In this paper we use a portfolio model of bank lending to examine how existing loan stocks, net lending decisions, financial leverage, exogenous shocks to loan quality and capital, and loan sector profitability affect the net lending decisions of small commercial banks for a 13-year period, 1989:Q4-2002:Q4. We document that small banks lend in a manner that is generally consistent with optimal risk management and capital budgeting under costly external finance. For these banks' shareholders, this suggests that banks are managing their capital and asset portfolios in a manner that reduces the chances that the bank will find itself with too little capital to fund attractive projects in the future. Our evidence suggests that this management is performed at the (separately capitalized) bank level; we find little evidence consistent with internal capital markets.

Our results also have implications for the dynamics of bank lending. All else equal, our results indicate that banks allocate capital toward loan sectors with the highest risk adjusted returns, where it will be most productive. But during sector downturns, we find that banks systematically reduce credit supply not only to borrowers in that sector, but also to borrowers in other sectors. In addition, the supply-increasing effect of an increase in expected profitability is smaller during sector downturns, perhaps because downturns increase the credit risk of both outstanding loan stocks and new loans alike.

At a theoretical level, our model and results suggest that pro-cyclic lending arises out of changes in bank lending capacity based on bank capital, loan illiquidity and effective risk aversion. In this respect, it is closest to the model of Holmstrom and Tirole (1997), who focus on the effect of bank capital on bank lending. Nevertheless, we go beyond their model by predicting and demonstrating the impact of loan illiquidity and loan overhang. These results are generally consistent with the models of Froot and Stein (1998) and Gron and Winton (2001).

Our findings also have policy implications for the supply of bank credit to households and small businesses and macroeconomic activity. We show that shocks to bank capital and loan portfolios reduce lending; since shocks to small banks' asset portfolios generally come from shocks to local economic activity, this implies that bank lending will be pro-cyclical. If bank lending becomes more profitable (a positive shock), banks will increase their lending capacity and risk tolerance as their equity increases, and this will be further enhanced by the relatively liquid nature of well-performing loans. As local economic activity continues to expand, at some point banks will compete for more business by providing loans to more risky borrowers or by providing loans to borrowers at lower interest rates. When local economic activity in a particular sector begins to slow, banks' loan portfolios in that sector will begin to deteriorate. Defaults will directly reduce bank capital and lending capacity and, as our results highlight, bank lending will be further reduced by the effects of loan overhang as outstanding loans in the depressed sector become more risky and less liquid.

This effect will be moderated if the bank holds a significant portion of its loans in sectors whose shocks are less positively correlated with the sector experiencing the downturn. In our data, banks were able to achieve such diversification by lending both in the business sector and in the consumer and/or real estate sectors. As such, our model suggests that there may be welfare gains from improved bank diversification. We also find that the effects of economic downturns are more moderate in the small business loan sector, perhaps because banks have greater incentives to preserve the value of these lender-borrower relationships across the business cycle.

Nevertheless, a caveat is in order. Our paper has focused on the behavior of small and relatively diversified banks; large banks or more specialized banks may behave differently. For example, large banks may be able to use alternative risk management techniques to reduce overhang effects. Similarly, specialized banks' loan performance may be better than that of diversified banks due to the expertise derived from greater lending focus, which might lead to improved risk-bearing ability in downturns. Alternatively, their lack of diversification may make them behave in a more procyclical way, exacerbating the effects we have found. These issues remain to be tested.

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Table 1: Variable Definitions

Variable	Variable Name	Description
Net lending change	NLC_{it}	The change in sector i loan stock during period t (from the end of period t-1 through the end of period t), plus loan charge-offs and less loan recoveries during the period, normalized by bank assets at the beginning of the period.
Outstanding loan stock	L_{it-1}	The loan stock in sector i at the end of period t-1, normalized by bank assets.
Risk tolerance	G_t^{-1}	Bank equity capital divided by bank assets at end of period t-1.
Sharpe ratio	$Sharpe_{it}$	Expected profit for loans in sector i in period t divided by the variance of 'shocks' to loan sector i divided by 100.
Expected profit	$p_{it} - \mu_{it}$	Interest revenue divided by loans in force (loan stock minus non-accruing loans) in sector i during period t-1, multiplied by the historical percentage of accruing loans in sector i (four quarter lagging average), minus the bank's opportunity cost of funds (interest payments on deposits during the period divided by the average level of deposits during the period).
Variance of shocks	σ_{ii}	The variance of the expected profit in sector i over the full sample period, calculated at the market level, where markets are defined as MSAs for urban banks and as the in-state, non-MSA county average for rural banks.
Nonperforming loan ratio	NPL_{it}	Nonperforming loans in sector i in period t divided by sector i loan stock at the end of the prior period.
Sectoral downturn	$NPpoor_{it}$	An indicator variable equal to one if the nonperforming loans ratio for sector i, aggregated to the state-quarter-rural level, is in the highest quartile for the full data period in period t.
Sectoral downturn effect on bank portfolio	$NPport_t$	A loan-share weighted average of the $NPpoor_{it}$ indicator variables in period t. The shares are the beginning of period loans to total assets for the three types of loans.

Notes: In the definitions above, "end of period t-1" is identical to "beginning of period t." Unless otherwise noted, all data are from the Call Reports. Employment growth numbers are from Bureau of Labor Statistics, Employment (Payroll) Survey. All variables except $NPpoor_{it}$ and σ_{ii} are bank-specific; we have omitted the bank subscript for simplicity.

Table 2: Sample Statistics

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
RURAL BANKS						
number of quarters	120,323	30.05	30	14.73	5	56
Assets	120,323	93533.77	66158	85943.76	25002	1033720
NLC_{RE}	120,323	0.007	0.005	0.017	-0.226	0.287
NLC_{BUSAG}	120,323	0.003	0.002	0.019	-0.260	0.222
NLC_{CON}	120,323	0.001	0.001	0.008	-0.185	0.353
RE loans/ assets	120,323	0.306	0.300	0.123	0.033	0.745
BUSAG loans/assets	120,323	0.165	0.144	0.095	0.005	0.731
CON loans/ assets	120,323	0.094	0.081	0.053	0.0004	0.478
$Sharpe_{RE}$	120,323	4.787	5.002	2.494	-9.276	19.525
$Sharpe_{BUSAG}$	120,323	0.892	0.672	0.719	-0.121	8.136
$Sharpe_{CON}$	120,323	1.490	1.423	1.065	-2.530	11.524
G_t^{-1}	120,323	0.099	0.093	0.027	0.005	0.317
Expected RE profit	120,323	.012	.012	.005	-.017	.038
Expected BUSAG profit	120,323	.031	.029	.019	-.007	.207
Expected CON profit	120,323	.015	.015	.010	-.017	.102
URBAN BANKS						
dataq	69,013	28.64	28	14.58	5	56
Assets	69,013	162354.4	103362	160919.6	25044	1044676
NLC_{RE}	69,013	0.009	0.007	0.021	-0.386	0.364
NLC_{BUS}	69,013	0.002	0.002	0.015	-0.389	0.333
NLC_{CON}	69,013	0.001	0.0005	0.010	-0.193	0.231
RE loans/ assets	69,013	0.350	0.349	0.121	0.038	0.716
BUS loans/assets	69,013	0.113	0.097	0.066	0.007	0.546
CON loans/ assets	69,013	0.099	0.080	0.066	0.005	0.532
$Sharpe_{RE}$	69,013	3.698	3.599	2.383	-7.065	21.065
$Sharpe_{BUS}$	69,013	0.318	0.233	0.296	-0.106	5.580
$Sharpe_{CON}$	69,013	1.332	1.175	0.986	-1.958	13.014
G_t^{-1}	69,013	0.090	0.001	0.024	0.002	0.350
Expected RE profit	69,013	.012	.013	.006	-.017	.036
Expected BUSAG profit	69,013	.034	.024	.029	-.007	.335
Expected CON profit	69,013	.017	.015	.012	-.017	.105

Notes: All variables are from the Call Reports, and defined in Table 1. RE is real estate, BUSAG is business and agricultural (reported for rural only), BUS is business (reported for urban only), and CON is consumer. The loan-to-assets ratios and the G_t^{-1} variables are measured at the beginning of the period.

Table 3: Instrumental Variables Regression with Bank Fixed Effects and Seasonal Controls*

Panel A: Dependent Variable Net Change in Real Estate Lending

	RURAL		URBAN	
$NLC_{BUS,t}$	0.269*** (0.016)	0.275*** (0.016)	1.212*** (0.069)	1.174*** (0.07)
$NLC_{CON,t}$	0.194*** (0.041)	0.130*** (0.043)	0.001 (0.068)	-0.053 (0.07)
$L_{RE,t-1}$ (*same-sector*)	-0.007*** (0.001)	-0.009*** (0.001)	-0.026*** (0.002)	-0.026*** (0.002)
$L_{RE,t-1}$*$NPpoor_{RE,t}$		-0.001 (0.002)		-0.008*** (0.003)
$L_{BUS,t-1}$ (*cross-sector*)	0.051*** (0.002)	0.052*** (0.002)	0.167*** (0.007)	0.162*** (0.007)
$L_{BUS,t-1}$*$NPpoor_{BUS,t}$		-0.003 (0.002)		0.002 (0.004)
$L_{CON,t-1}$ (*cross-sector*)	0.021*** (0.003)	0.020*** (0.003)	-0.006 (0.005)	-0.008* (0.005)
$L_{CON,t-1}$*$NPpoor_{CON,t}$		-0.002 (0.002)		-0.006 (0.004)
$Sharpe_{RE,t}$	0.002*** (0.000)	0.002*** (0.000)	0.003*** (0.0001)	0.003*** (0.0001)
$Sharpe_{RE,t}$* $NPport_t$		0.000** (0.0001)		0.001*** (0.0003)
G_t^{-1}	-0.003 (0.004)	-0.006 (0.004)	-0.040*** (0.01)	-0.042*** (0.01)
G_t^{-1}* $NPport_t$		0.001 (0.016)		0.024 (0.032)
constant	-0.010*** (0.001)	-0.009*** (0.001)	-0.012*** (0.002)	-0.011*** (0.002)

Panel B: Dependent Variable Net Change in Business Lending

	RURAL		URBAN	
$NLC_{RE,t}$	0.245*** (0.02)	0.266*** (0.02)	0.159*** (0.016)	0.144*** (0.016)
$NLC_{CON,t}$	-0.061 (0.046)	-0.027 (0.048)	0.114*** (0.036)	0.065* (0.037)
$L_{RE,t-1}$ (*cross-sector*)	0.011*** (0.001)	0.012*** (0.001)	0.015*** (0.001)	0.013*** (0.001)
$L_{RE,t-1}$*$NPpoor_{RE,t}$		0.000 (0.002)		-0.003** (0.002)
$L_{BUS,t-1}$ (*same-sector*)	-0.102*** (0.002)	-0.104*** (0.002)	-0.084*** (0.002)	-0.082*** (0.002)
$L_{BUS,t-1}$*$NPpoor_{BUS,t}$		0.006*** (0.002)		-0.005** (0.002)
$L_{CON,t-1}$ (*cross-sector*)	0.009*** (0.003)	0.009*** (0.003)	0.012*** (0.002)	0.010*** (0.002)
$L_{CON,t-1}$*$NPpoor_{CON,t}$		0.007*** (0.002)		0.002 (0.002)
$Sharpe_{BUS,t}$	0.007*** (0.0002)	0.007*** (0.0002)	0.007*** (0.0004)	0.007*** (0.0004)
$Sharpe_{BUS,t}$* $NPport_t$		0.000 (0.001)		0.004*** (0.001)
G_t^{-1}	0.019*** (0.005)	0.021*** (0.005)	0.028*** (0.005)	0.025*** (0.005)
G_t^{-1}* $NPport_t$		-0.014 (0.018)		0.000 (0.017)
Constant	0.002** (0.001)	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)

Panel C: Dependent Variable Net Change in Consumer Lending

	RURAL		URBAN	
$NLC_{RE,t}$	0.075*** (0.008)	0.070*** (0.007)	0.104*** (0.025)	0.056** (0.024)
$NLC_{BUS,t}$	-0.012 (0.008)	-0.031*** (0.008)	0.003 (0.011)	-0.020* (0.011)
$L_{RE,t-1}$ (*cross-sector*)	-0.005*** (0.0004)	-0.006*** (0.0005)	-0.005*** (0.001)	-0.006*** (0.001)
$L_{RE,t-1}$*$NPpoor_{RE,t}$		0.000 (0.001)		-0.006*** (0.001)
$L_{BUS,t-1}$ (*cross-sector*)	0.013*** (0.001)	0.012*** (0.001)	0.009*** (0.003)	0.007*** (0.003)
$L_{BUS,t-1}$*$NPpoor_{BUS,t}$		0.002** (0.001)		-0.003** (0.001)
$L_{CON,t-1}$ (*same-sector*)	-0.033*** (0.001)	-0.030*** (0.001)	-0.026*** (0.001)	-0.024*** (0.001)
$L_{CON,t-1}$*$NPpoor_{CON,t}$		-0.008*** (0.001)		-0.011*** (0.001)
$Sharpe_{CON,t}$	0.002*** (0.000)	0.002*** (0.000)	0.003*** (0.0001)	0.003*** (0.0001)
$Sharpe_{CON,t}$* $NPport_t$		-0.0004*** (0.0002)		0.001** (0.0003)
G_t^{-1}	0.001 (0.002)	0.000 (0.002)	0.002 (0.003)	-0.004 (0.004)
G_t^{-1}* $NPport_t$		-0.001 (0.007)		0.028*** (0.011)
Constant	0.001** (0.0003)	0.001*** (0.0003)	0.000 (0.001)	0.001*** (0.001)

*All regressions include a constant, fixed effects for bank entity, and controls for quarterly effects. ***signifies statistical significance at the .01 level, ** at the .05 level and * at the .10 level. The number of observations in the rural regression is 120,323; the number of observations in urban regressions is 69,013. The within R^2s vary from negative to .034. This is not surprising as the 2SLS or instrumental variables (IV) regression will not try to maximize the R^2s as OLS does. Recall that an OLS regression will maximize R^2 without taking into account the endogeneity of the included NLC, and will result in many negative estimated coefficients on NLC. In contrast, we estimate the model accounting for the endogeneity and resulting in many positive estimated coefficients on the included NLC. For 2SLS and IV the R^2 is calculated with fitted values calculated using the *estimated* coefficient and the *original* data. We know that the values that maximize the R^2 calculated this way would be the OLS coefficients, but we clearly do not want those, we want the estimated coefficients accounting for the endogeneity. Hence it is not surprising that the calculated R^2s may be negative.

Table 4: Estimation for Early and Late time periods*

Panel A: Dependent Variable Net Change in Real Estate Lending

Variable:	Early	Late	Early	Late
	RURAL		**URBAN**	
$NLC_{BUS,t}$	0.215*** (0.02)	0.268*** (0.023)	0.664*** (0.066)	1.557*** (0.147)
$NLC_{CON,t}$	0.187*** (0.047)	0.163*** (0.066)	0.091 (0.061)	-0.171 (0.135)
$L_{RE,t-1}$ (*same-sector*)	-0.048*** (0.002)	-0.041*** (0.002)	-0.076*** (0.003)	-0.043*** (0.004)
$L_{BUS,t-1}$ (*cross-sector*)	0.070*** (0.005)	0.062*** (0.005)	0.181*** (0.012)	0.230*** (0.019)
$L_{CON,t-1}$ (*cross-sector*)	0.027*** (0.005)	0.034*** (0.006)	0.008 (0.007)	-0.032*** (0.01)
$Sharpe_{RE,t}$	0.002*** (0.0001)	0.002*** (0.0001)	0.004*** (0.0001)	0.003*** (0.0002)
G_t^{-1}	0.018*** (0.008)	-0.024*** (0.008)	0.007 (0.015)	-0.066*** (0.019)

Panel B: Dependent Variable Net Change in Business Lending

Variable:	Early	Late	Early	Late
	RURAL		**URBAN**	
$NLC_{RE,t}$	0.237*** (0.029)	0.228*** (0.026)	0.057*** (0.023)	0.118*** (0.022)
$NLC_{CON,t}$	0.315*** (0.055)	-0.022*** (0.074)	0.171*** (0.039)	0.090 (0.059)
$L_{RE,t-1}$ (*cross-sector*)	0.007** (0.003)	0.014*** (0.003)	0.009*** (0.003)	0.009*** (0.002)
$L_{BUS,t-1}$ (*same-sector*)	-0.175*** (0.003)	-0.164*** (0.003)	-0.152*** (0.004)	-0.113*** (0.004)
$L_{CON,t-1}$ (*cross-sector*)	0.052*** (0.006)	0.019*** (0.007)	0.028*** (0.004)	0.010** (0.004)
$Sharpe_{BUS,t}$	0.013*** (0.0003)	0.006*** (0.0002)	0.012*** (0.0006)	0.006*** (0.0005)
G_t^{-1}	0.050*** (0.01)	0.043*** (0.008)	0.037*** (0.01)	0.024*** (0.009)

Panel C: Dependent Variable Net Change in Consumer Lending

	Early	Late	Early	Late
	RURAL		**URBAN**	
$NLC_{RE,t}$	0.054*** (0.01)	0.109*** (0.01)	0.093*** (0.029)	0.276*** (0.044)
$NLC_{BUS,t}$	0.004 (0.013)	-0.016* (0.01)	0.062*** (0.017)	-0.006 (0.014)
$L_{RE,t-1}$ (*cross-sector*)	0.002** (0.001)	-0.009*** (0.001)	0.005*** (0.002)	-0.007*** (0.001)
$L_{BUS,t-1}$ (*cross-sector*)	0.020*** (0.002)	0.026*** (0.002)	0.021*** (0.006)	0.031*** (0.006)
$L_{CON,t-1}$ (*same-sector*)	-0.062*** (0.002)	-0.062*** (0.002)	-0.051*** (0.002)	-0.033*** (0.002)
$Sharpe_{CON,t}$	0.002*** (0.0001)	0.001*** (0.0001)	0.004*** (0.0001)	0.002*** (0.0001)
G_t^{-1}	0.014*** (0.004)	-0.005* (0.003)	0.004 (0.007)	-0.007 (0.006)

*Standard errors are in parentheses below the coefficient estimates with * signifying different from zero at the 10% level, ** different from zero at the 5% level and *** as different from zero at the 1% level. The **early** period covers 1990, quarter 1 through 1996, quarter 2. The **later** period covers 1996, quarter 2 through 2002, quarter 4. All regressions include a constant, fixed effects for bank entity, and controls for quarter effects. The number of observations in the early rural regressions are 59,165 and in the later rural regressions 61,158; for urban regressions the number of observations is 36,843 for the early period and 32,170 for the later period. The within R^2s vary from negative to .06.

Table 5: Banks in Multibank Holding Companies Only

Panel A: Dependent Variable Net Change in Real Estate Lending

	RURAL	URBAN
$NLC_{BUS,t}$	0.5023*** (0.057)	0.9313*** (0.11)
$NLC_{CON,t}$	0.0457 (0.082)	0.3106*** (0.1)
$L_{RE,t-1}$ (*same-sector*)	-0.0364*** (0.003)	-0.0414*** (0.005)
$L_{BUS,t-1}$ (*cross-sector*)	0.1011*** (0.01)	0.2010*** (0.017)
$L_{CON,t-1}$ (*cross-sector*)	-0.0023 (0.008)	-0.0022 (0.008)
$Sharpe_{RE,t}$	0.0019 (0.0001)	0.0033*** (0.0002)
G_t^{-1}	-0.0250*** (0.016)	-0.0634*** (0.023)
constant	.003 (.002)	-.001*** (.004)

Panel B: Dependent Variable Net Change in Business Lending

	RURAL	URBAN
$NLC_{RE,t}$	0.2037*** (0.043)	0.1253*** (0.033)
$NLC_{CON,t}$	0.0170 (0.071)	-0.0494 (0.059)
$L_{RE,t-1}$ (*cross-sector*)	0.0098*** (0.003)	0.0126*** (0.003)
$L_{BUS,t-1}$ (*same-sector*)	-0.1288*** (0.005)	-0.1267*** (0.006)
$L_{CON,t-1}$ (*cross-sector*)	0.0181*** (0.007)	0.0124*** (0.005)
$Sharpe_{BUS,t}$	0.0080*** (0.0004)	0.0091*** (0.0008)
G_t^{-1}	0.0224* (0.013)	0.0017 (0.013)
constant	.004* (.002)	.007*** (.002)

Panel C: Dependent Variable Net Change in Consumer Lending

	RURAL	URBAN
$NLC_{RE,t}$	0.0993*** (0.025)	-0.1675*** (0.05)
$NLC_{BUS,t}$	0.0098 (0.022)	0.0850*** (0.026)
$L_{RE,t-1}$ (*cross-sector*)	-0.0029* (0.002)	0.0030 (0.002)
$L_{BUS,t-1}$ (*cross-sector*)	0.0171*** (0.004)	-0.0227*** (0.008)
$L_{CON,t-1}$ (*same-sector*)	-0.0504*** (0.003)	-0.0215*** (0.003)
$Sharpe_{CON,t}$	0.0031*** (0.0001)	0.0042*** (0.0002)
G_t^{-1}	-0.0168** (0.007)	0.0203** (0.01)
constant	.0002 (.001)	-.003* (.002)

*Standard errors are in parentheses below the coefficient estimates with * signifying different from zero at the 10% level, ** different from zero at the 5% level and *** as different from zero at the 1% level. All regressions include a constant, fixed effects for bank entity, and controls for quarter effects. The number of observations in the rural regressions is 19,618, the number in the urban regressions is 14,650. The within R^2s vary from negative to .03.

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