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WHY BANK CREDIT POLICIES FLUCTUATE:
A THEORY AND SOME EVIDENCE*

RAGHURAM G. RAJAN

In a rational profit-maximizing world, banks should maintain a credit policy of lending if and only if borrowers have positive net present value projects. Why then are changes in credit policy seemingly correlated with changes in the condition of those demanding credit? This paper argues that rational bank managers with short horizons will set credit policies that influence and are influenced by other banks and demand side conditions. This leads to a theory of low frequency business cycles driven by bank credit policies. Evidence from the banking crisis in New England in the early 1990s is consistent with the assumptions and predictions of the theory.

Why do bank credit policies fluctuate? Why are changes in credit policy seemingly correlated with changes in the condition of those demanding credit? In a rational profit-maximizing world, banks should maintain a credit policy of lending if and only if borrowers have positive net present value (NPV) projects. Therefore, a change in the level of bank credit should be a consequence only of a change in the credit quality of borrowers—the demand side. In the absence of central bank-induced changes in the money supply, bank credit policy—the supply side—should not exert an independent influence on the level of credit.

That the supply side does not affect the level of credit seems at variance with reports in the financial press1 and the opinions held by bankers.2 Also, economists have expressed a spectrum of opposing viewpoints. The most moderate argue that bank credit policy changes are correlated with changes in fundamental busi-

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1. “Credit Crunch appears to Linger on for Years, Some Say—Despite Bush’s move to spur loans, Many Banks Cling to Cautious Policies, Profitable Firm gets Rejected,” title of the lead article in the Wall Street Journal [October 1, 1991].

2. R. Abboud, Chairman of First City Bancorp. of Texas: “Reacting to our own [banks’] excesses and the junk bond mania, we are now turning the spigot off to companies that really should be supported . . . we put the cannons on the deck and we never lash them down. And then we say: ‘My God, all the cannons are on the port side.’ Then we roll them all to the starboard side. To curb instability we go to excesses and we create an instability on the other side. We’ve got to stop doing that’’ [Financial World, May 15, 1990].

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ness conditions. This view has a hoary tradition. John Stuart Mill writes in *The Principles of Political Economy* [1965 p. 650]:

Fluctuations in the rate of interest arise from variations either in the demand for loans or in the supply. The supply is liable to variation though less so than the demand. The willingness to lend is greater than usual at the commencement of a period of speculation, and much less than usual during the revulsion which follows. . . . During the revulsion, . . . interest rates always rise inordinately, because, while there is a most pressing need on the part of many persons to borrow, there is a general disinclination to lend. This disinclination, when at its extreme point, is called a panic. . . .

More extreme is Wojnilower [1980], who suggests that the growth of credit is essentially supply determined, interrupted only by regulatory rigidities, problems in major financial institutions or markets, or changes in the expectations of financial market participants. Still others take the polar view that in addition to not being neutral to changes in the condition of borrowers, bank credit policy may actually cause the changes. In his monumental study of crises under the National Banking System, Sprague [1910, p. 209] describes the panic of 1893 thus:

Contraction in loans was perhaps the most striking feature of this crisis. From their maximum amount of $2,161,000,000 on May 4, loans of national banks were reduced . . . on October 4 to $1,843,000,000, or more than 14.7%. . . . It cannot be questioned, however, that the banks in many parts of the country caused needless damage to their customers by a ruthless policy of loan contraction. . . . Nowhere is this more clearly evident than in Chicago . . . Each bank pursuing its own selfish policy, all were forced to contract loans, thus increasing the strain upon their own customers. . . .

At the very least, these descriptions suggest that banks exacerbate demand expansions by funding negative NPV projects and accentuate contractions by not funding positive NPV projects. Unfortunately, it is not easy to validate these observations empirically because it is extremely hard to separate demand side effects from supply side effects. Also, with the exception of Bernanke and Gertler [1987], economists thus far have had no rational explanation for why changes in credit policy and changes in demand side conditions should be correlated.

In this paper I present a simple model that offers a theoretical framework consistent with the informal observations above. Bank management, in my model, is rational but has short-term concerns. In addition to maximizing the bank’s earnings, it is concerned about the stock or labor market’s perception of its abilities, i.e., its reputation. I assume that the composition of bank loan portfolios as well as the specific performance of borrowers is not immediately
and easily observable by the market. Instead, the market can observe only the bank’s earnings. Consequently, bank management may attempt to shape the market’s perceptions by manipulating current earnings.

This is most easily done if the bank alters its credit policy. For example, a bank may attempt to convince the market of its credit evaluation abilities by concealing the extent of bad loans originated. It can do this by maintaining a liberal credit policy: extending the term of loans, lending new money so that insolvent borrowers can keep up the pretense of being current on their loans, and weakening covenants so as to avoid recognizing default. Isomorphically, the bank may attempt to convince the market of the profitability of its lending. Again, it can achieve this with a liberal credit policy that generates up-front fees at the expense of future credit quality. In general, a liberal credit policy boosts current earnings at the expense of future earnings. The bank is trapped into this second-best credit policy simply because the market expects it.

The market is more forgiving of a bank’s poor performance if it

3. In the United States, banks are not bound to disclose information about individual loans. Borrower disclosures about private lending arrangements are limited to publicly traded firms with loan agreements in excess of 10 percent of corporate assets, and filings need not include the name of the banks involved (SEC Rule 601.b(4) of disclosure regulation S-K). The information that regulators obtain by examining banks remains confidential and is not subject to the Freedom of Information Act [5 U. S. C. 552 subsection (b) (8)].

4. Commenting on the then Citicorp Chairman Walter Wriston’s public commitment to an earnings growth target of 15 percent, George Champion, the conservative head of Chase Manhattan, complained about the pressure to compete with other banks by lowering lending standards [Grant 1992, p. 331]. Similarly, commenting on the pressure on banks to earn profits “commensurate” with the levels of capital accumulated, Eugene Lockhart, vice president at First Manhattan Consulting said, “It would be natural to expect banks to increase loan volume” [New York Times, November 13, 1992].

5. A classic example is that of MNC Financial, a Philadelphia bank which got into trouble in the late 1980s. In a report in U. S. Banker, October 1990, a Moody’s analyst describes the bank as follows: “They grew the institution rapidly and they also grew real estate quite rapidly. Part of it is they were a very stockholder driven firm and an earnings-per-share-driven firm. They had some very good numbers and that is what the stock market likes. And certainly real estate lending is a nice fee earnings business and obviously a nice spread business. You realize when you pass up that business you lose that profitability and your stock price gets hurt.”

Anders [1992, p. 80] offers another striking example of the hunger for fees. “By the late 1980s, banker’s priorities . . . were being bent ever further from the actual merits of the loans, and more towards the big fees involved. Citibank Chairman John Reed later said that his own bank’s internal credit memos underwent a strange metamorphosis in the late 1980s. Traditionally, Citicorp memos had begun with detailed analyses of a company’s prospects, and concluded with details of banker’s fees. As the leveraged lending boom reached its peak, Reed observed, the fees began to appear at the beginning of the memos, with actual business analysis tucked in the back.”

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knows that the entire borrowing sector has been hit by a systematic (and unpredictable) adverse shock. When multiple banks lend to a sector, the market learns something about the systematic component of uncertainty from each bank’s earnings. This informational externality makes bank credit policies interdependent. A bank’s reputation is less sensitive to poor earnings when other banks admit to poor earnings. Because true earnings are less likely to be high when the borrowing sector is distressed, banks coordinate on an adverse shock to borrowers to tighten credit policy. This can explain the correlation between changes in credit policy and changes in demand side conditions discussed above.

The extension to a dynamic setting, where the condition of the borrowing sector is endogenously determined by bank credit policies, is straightforward. A theory of low frequency business cycles, driven by suppliers of credit, emerges from this simple framework. When there is only a small probability of an adverse shock to the borrowing sector, banks are forced to maintain excessively liberal credit policies. This in turn leads to overinvestment by the borrowing sector which increases the likelihood of an adverse shock to it. It is only after the condition of the borrowing sector deteriorates considerably that banks have an incentive to tighten the supply of credit. When they retrench, investment is suddenly curtailed, the excesses are drained out of the borrowing sector, and the cycle resumes.

I study the experience of New England banks with real estate loans in the early 1990s and obtain evidence in support of some of the assumptions and implications of the model. I find evidence that suggests bank loan loss/earnings announcements conveyed information to the market about the condition of the real estate sector. Also, New England banks seemingly underreported real estate loan losses during much of 1988 and 1989, as is evidenced by the smoothness in reserving despite the dramatic deterioration in the real estate sector. Finally, bank quarterly loan loss provisions/charge-offs in New England between 1986 and 1992 were significantly related to the quarterly provisions/charge-offs made by

6. In a recent study Slovin et al. [1992] provide evidence that banks are special in that individual bank announcements generate external information effects on other banks. They examine the stock price effects of announcements of equity offerings. They find no intra-industry valuation effects for industrial equity issues, suggesting release of only firm-specific information. In contrast, for commercial bank equity issues they find significant negative valuation effects of −0.6 percent on rival commercial banks. It is, however, possible that information about regulatory intent rather than information about a common component of uncertainty affecting bank assets drives this effect.
other New England banks, even after correcting for changes in publicly observable fundamentals.

The rest of the paper is as follows. In Section I the basic model is laid out, and it is solved in Section II. Section III examines the evidence, and Section IV concludes with policy implications. The related literature is discussed during the course of the exposition.

I. THE MODEL

A. The Structure

Consider an economy with banks, many potential borrowers, and a public market. At date 0 each bank evaluates its lending opportunities and then makes a single loan. After the loan is made, the state of the borrowing sector is realized at date 1. It can be normal (N) or adverse (A). In practice, a bank’s competence in evaluating credit and monitoring loans determines whether its lending is profitable. I term these competencies the bank’s ability. Specifically, a bank’s state-contingent ability $\theta_s$ is the probability with which a loan made by that bank is good (to be defined shortly) when the state is $s \in S = \{N, A\}$. Then $1 - \theta_s$ is the probability that the loan turns out bad.

There are two types of banks: high type banks, indexed by $H$, and low type banks indexed by $L$. Furthermore, I assume that the adverse state makes it very hard for any banker to make a good loan; i.e., the adverse state collapses the distribution of abilities. A natural and economical parameterization of the state-contingent abilities of different types is $\theta^H_N = 1 > \theta^L_N = \theta^L$ and $\theta^H_A = 0 = \theta^L_A$. The assumption that leads to this parameterization is stronger than necessary, and I discuss alternative assumptions and parameters later.

After observing the realization of the loan at date 1, the bank has to decide whether to terminate or continue the loan. The termination of a bad loan will lead to costly bankruptcy and possibly, the liquidation of the borrower’s assets at a fire sale. For simplicity, I assume that the bank’s date 1 earnings are reduced by

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7. The market could be the labor market for bank managers, the stock market, or even the long-term bank bond market.

8. I use the word bank interchangeably with bank management, although reputation attaches to management.
$1 if it terminates and charges off\(^9\) a bad loan at date 1 and that date 1 earnings increase by a negligible amount if the loan is good.

Instead of disclosing poor earnings, the bank can attempt to hide the bad loan from the market until date 2 by setting a liberal credit policy: rescheduling payments, weakening covenants to prevent default, and lending “new” money to help the borrower make payments. If the bank sets such a policy, the bad loan does not affect earnings with probability \(a\). But regardless of whether the bad loan impacts earnings or not, the liberal policy reduces the bank’s future expected earnings by \(c\). Alternatively, the bank can set a tight policy, terminating bad loans whenever they occur. The tight policy has no effect on future earnings.

A liberal credit policy reduces expected earnings because the returns from eventual liquidation may decrease as arrears accumulate, new money is wasted, and the borrower’s assets lose value in financial distress. Further, concealment activities could divert management’s attention from more productive investment opportunities. Finally, softness toward one delinquent borrower reduces the bank’s bargaining power in future negotiations. In this risk-neutral world where the discount rate is zero, I capture the idea that a liberal credit policy is a negative NPV extension of credit\(^{10}\) with

**Assumption 1.** \(c > a\).

**B. Information Structure**

It is immaterial to the results whether a bank knows its own ability. But I assume that the market and other banks do not know the bank’s ability. Their common date 0 prior that the bank’s ability is high, also termed the bank’s reputation, is \(p\). Banks are in close contact with the borrowing sector and can observe its state at date 1. A bank chooses its credit policy \(a_s\) at date 1, after observing the state of the borrowing sector and seeing the loan outcome. Of course, \(a_s = 0\) if the loan outcome is good. For obvious reasons, the

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9. In the United States a loan is charged off when losses are realized. A bank adds to loan loss reserves when it recognizes the potential for losses. The former reduces loan loss reserves while the latter reduces earnings. My theoretical model does not distinguish between the two, and in the empirical section I examine both.

10. A liberal or loose credit policy emphasizes current bank earnings at the expense of future earnings. A situation isomorphic to the one I model is one where credit policy is taken to be the extent to which banks make new loans in order to generate up-front fees. The more liberal the credit policy, the greater the volume of up-front fees, the greater the current earnings, and the more likely that loans made are substandard. In either case, a liberal credit policy will adversely impact the bank’s future earnings.
market does not see bank credit policy, nor does it see the state of borrowing sector at date 1. It only sees the earnings declared by the bank. Consequently, it gauges the state from earnings and its conjectures about credit policy.\textsuperscript{11}

In summary, the timing is shown in the tabulation below.

<table>
<thead>
<tr>
<th>Date 0</th>
<th>Date 1</th>
<th>Date 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank makes a single loan to a firm.</td>
<td>State $s = A, N$ of the world realized. Probability of loan turning out good or bad depends on state and ability of originating bank.</td>
<td>Bank sees state. If loan good, bank does nothing. If loan bad, bank implements credit policy $a_s \in [0,a]$.</td>
</tr>
<tr>
<td></td>
<td>If loan good, bank’s earnings are positive. If loan bad, earnings are positive with probability $a_s$ and negative with probability $(1 - a_s)$.</td>
<td>Bank bears cost $c$ if it set $a_s = a$.</td>
</tr>
<tr>
<td></td>
<td>Market sees only bank earnings.</td>
<td></td>
</tr>
</tbody>
</table>

\textbf{C. Management Incentives}

Bank management’s objective function has two terms. The first is the expected discounted sum of bank earnings. The second is its reputation in the market. At time 1 and conditional on the loan being bad, bank management chooses $a_s$ to maximize

$$U_1 = (1 - \gamma)(- (1 - a_s) - c.1_{[a_s = a]}) + \gamma E_1 P_1,$$

where $\gamma$ is the weight bank management places on its expected date 1 reputation, $p_1$, and $1_{[a_s = a]}$ is the indicator function. A bank manager may be concerned about the market’s perception of her ability for a number of reasons. Management may worry about getting jobs in other firms. Alternatively, there may be some probability that the bank has to raise capital (to meet regulatory requirements) or roll over debt in the next few periods. In a repeated game it is easy to

\textsuperscript{11} All that is needed for the results to hold is that the market does not know the state of the borrowing sector perfectly and gets some information from bank earnings about it. I present evidence for this later.
show that maximizing reputation results in minimizing the cost of capital at date 1. In general, managerial compensation contracts are inadequate in lengthening horizons. For instance, the threat of takeovers where both explicit and implicit contracts are breached (see Shleifer and Summers [1988]) could lead to a collapse of managerial horizons. I now examine bank behavior in this simple setting.

II. EQUILIBRIUM BANK BEHAVIOR

It is instructive to examine the simplest cases first. Let $\gamma = 0$ so that the manager does not have short-term concerns. In that case, from the manager’s maximization problem and Assumption 1, $a_s = 0$, which is also the first-best credit policy. All the results in this paper are therefore a product of management’s short-term concerns. Now let $\gamma > 0$.

A. Equilibrium with only One Bank

Consider, at first, an economy with only one bank. Let the market’s prior of the adverse state occurring be $\pi$. Further, let the market conjecture that the bank’s date 1 credit policy is $a_N^c$ in the normal state and $a_A^c$ in the adverse state. The market observes the bank’s earnings and updates the bank’s reputation using Bayes rule. Because the market does not see the state, conditional on seeing a bad loan outcome the bank has identical incentives when setting credit policy in either state. This implies that $a_N^c = a_A^c$. If the updated reputation is $p^+(a_N^c, a_A^c, \pi)$ when the market sees positive earnings and $p^-(a_N^c, a_A^c, \pi)$ when the market sees negative earnings, it follows from the definition of types that

$$p^+ > p^-.$$

In equilibrium, the market’s conjectures must be correct. So the bank will set a liberal credit policy ($a_s = a$) if

$$c \leq a \left(1 + \frac{\gamma}{1 - \gamma} \right) \left[p^+(a,a,\pi) - p^-(a,a,\pi)\right],$$

and a tight credit policy ($a_s = 0$) if

$$c \geq a \left(1 + \frac{\gamma}{1 - \gamma} \right) \left[p^+(0,0,\pi) - p^-(0,0,\pi)\right].$$

It is easily shown that for a given market prior $\pi$,

**Proposition 1A.** There exist costs $c'$ and $c''$, where $a < c' < c''$ such that it is an equilibrium for the bank to set a liberal credit
WHY BANK CREDIT POLICIES FLUCTUATE

policy if and only if \( c \leq c' \) and to set a tight credit policy if and only if \( c \geq c'' \). No equilibrium exists if \( c' < c < c'' \).

Proof of Proposition 1a. See Appendix.

Note that there is at most a unique equilibrium. Furthermore, the bank’s credit policy is the same in both states. It is clear that for \( c < c' \) reputational concerns distort managerial credit policy away from the optimal tight policy. The higher the \( \gamma \), the greater the bank’s incentive to set a liberal policy and the higher are \( c' \) and \( c'' \). The incentive to set a liberal credit policy exists even though the market fully anticipates it and the expected change in the bank’s reputation is zero. This replicates the result in Holmstrom [1983], Narayanan [1985], and Stein [1989].

The bank’s incentive to liberalize credit policy depends directly on the sensitivity of date 1 reputation to earnings, \( p^+ - p^- \). Differentiating, I get

\[ \frac{\partial}{\partial \pi} (p^+ - p^-) < 0. \]

I assumed in subsection I.A that ability differences between the high type bank and the low type bank are relatively higher in the normal state than in the adverse state. This assumption, similar to the single crossing conditions in signaling models, is responsible for Lemma 1. When the market’s prior of the adverse state having occurred is low, the bank’s earnings are very informative about ability. Reputation is very sensitive to earnings performance. Conversely, when the prior is high, earnings performance is attributed to the state (or credit policy) rather than to any difference in ability. Reputation is not sensitive to performance. It immediately follows that the bank’s incentives to liberalize credit policy vary negatively with the market’s prior, \( \pi \).

When only one bank lends to the borrowing sector, the market’s prior, \( \pi \), which it uses to evaluate bank earnings is not state dependent. Consequently, bank credit policy is not state dependent. This is because the market has nothing to compare the bank’s earnings with. It cannot distinguish between poor performance stemming from the adverse state and poor performance arising from idiosyncratic ability. I now consider equilibria when two banks lend. The main difference now is that the market has two sources of information—each bank’s earnings. Clearly, the
unobservable date 1 state is a common component of earnings uncertainty for both banks. A bank’s earnings helps the market update its prior on the state. The market then uses the posterior to evaluate the other bank. Evaluation is now state dependent. The informational spillover from bank earnings causes a strategic interaction between bank policies which has very interesting effects. I now examine this.

B. Equilibrium with Two Banks

Consider now two banks who lend to the same sector. The first bank (indexed by 1) observes the state and its own loan outcome. It then decides its credit policy, after which its earnings are publicly revealed. For notational simplicity, I set $\gamma = 1/2$ so that it drops out of the incentive compatibility conditions. For expositional reasons, I first assume the second bank (indexed by 2) hears the first bank’s earnings announcement before deciding credit policy. As I discuss later, the results continue to hold when banks announce earnings simultaneously. I start my analysis by considering the second bank’s problem.

The market updates the second bank’s reputation in two steps. It first updates its prior $\pi$ on the state, using the first bank’s earnings. If the bank’s earnings are positive and its state-contingent actions are conjectured to be $a_{1c}^N$ and $a_{A}^{lc}$, then

\begin{equation}
\pi^{1+}(a_{1c}^N,a_{A}^{lc}) = \text{prob}\ [\text{adverse state} \mid \text{1st bank’s earnings} > 0, a_{1c}^N, a_{A}^{lc}] = \frac{a_{A}^{lc} \pi}{a_{A}^{lc} \pi + [(p^1 + (1 - p^1)\theta_L) + (1 - p^1)(1 - \theta_L)a_{1c}^N](1 - \pi)}.
\end{equation}

If the first bank’s earnings are negative,

\begin{equation}
\pi^{1-}(a_{1c}^N,a_{A}^{lc}) = \text{prob}\ [\text{adverse state} \mid \text{1st bank’s earnings} < 0, a_{1c}^N, a_{A}^{lc}] = \frac{(1 - a_{A}^{lc}) \pi}{(1 - a_{A}^{lc}) \pi + (1 - a_{1c}^N)(1 - p^1)(1 - \theta_L)(1 - \pi)}.
\end{equation}

The market uses the posterior $\pi^1$ and the second bank’s earnings to update the latter’s reputation. By Lemma 1 this affects the second bank’s incentives. Note that independent of the actual state, the market’s posterior about the state completely determines the second bank’s incentives and hence its credit policy. Thus, the second bank’s equilibrium credit policy can only be contingent on
the first bank’s earnings and not on the state. The incentive compatibility conditions are then obtained by substituting the appropriate \(a_{2-}\) and \(\pi_{1-}\), or \(a_{2+}\) and \(\pi_{1+}\), for \(a_s\) and \(\pi\) in (3) and (4), where \(a_{2-(+)}\) is the second bank’s credit policy on seeing the first bank declare negative (positive) earnings. In the Appendix I show that in any equilibrium, \(\pi_{1-} > \pi_{1+}\).

The first bank sets its credit policy keeping in mind that the market will evaluate it after updating \(\pi\) with information from the second bank’s (yet uncertain) earnings. It does, however, know that the probability the second bank’s earnings are positive depends on the state. Consequently, the expected sensitivity of the first bank’s reputation to earnings is state dependent, and its credit policy becomes state dependent. The first bank’s incentive compatibility conditions are straightforward and derived in the Appendix. An equilibrium is a set of incentive-compatible credit policies \(((a_A,a^1_A),(a_{2+},a_{2-}))\) such that the market’s conjectures are true. If bank costs of concealment are equal so that \(c_1 = c_2 = c\) (a similar proposition holds when they are different), then it follows almost trivially that

**Proposition 1B.** For every market prior \(\pi\), there exist costs \(c^{*U}\), \(c^*\), \(c**\), and \(c**U\), where \(a < c^{*U} \leq c^* < c** \leq c^{**U}\) such that \(((a_A,a^1_A),(a_{2+},a_{2-}))\) is an equilibrium if and only if \(c \leq c^*\), and is the unique equilibrium if \(c \leq c^{*U}\). Also, \(((0,0),(0,0))\) is an equilibrium if and only if \(c \geq c**\) and is the unique equilibrium if \(c \geq c^{**U}\). If \(c^{*U} < c < c^{**U}\), there may be no equilibrium, one equilibrium, or multiple equilibria.

*Proof of Proposition 1b.* See Appendix.

To reiterate the intuition so far, bank credit policies are linked because bank earnings provide the market information about the common component of uncertainty (the state). I now examine the implications.

**C. The Effects of Demand Side Conditions on Credit Policy**

When a single bank lends, credit policy does not depend on the state of the borrowing sector (the demand side). But when two banks lend to the same sector, the first bank’s equilibrium credit policy can be state contingent. Because the first bank’s earnings influence the second bank’s credit policy, the latter’s expected credit policy will also be different across states, even though it may not directly be state contingent. It turns out that there is a clear relationship between equilibrium credit policies in different states:
Proposition 2.

(i) The first bank’s credit policy is (weakly) more liberal in the normal state than in the adverse state so that \( a^1_N \geq a^1_A \).

(ii) The second bank’s credit policy is (weakly) more liberal when the first bank declares positive earnings than when the first bank declares negative earnings, so that \( a^{2+} \geq a^{2-} \).

(iii) The second bank’s expected credit policy, conditional on getting a bad loan outcome is (weakly) more liberal in the normal state.

Proof of Proposition 2. See Appendix.

The intuition is simple. From Lemma 1 and because \( \pi^{1-} > \pi^{1+} \), the second bank has a greater incentive to adopt a liberal credit policy when the first bank announces positive earnings than when it announces negative earnings so that \( a^{2+} \geq a^{2-} \). Thus, the second bank is more likely to announce negative earnings in the adverse state than in the normal state. The first bank’s reputation is expected to be less sensitive to earnings in the adverse state, giving it a smaller incentive to attempt to hide its bad loans. Thus, \( a^1_N \geq a^1_A \). Finally, the first bank is more likely to get a bad loan outcome in the adverse state. This combined with (i) ensures that it is more likely to show negative earnings in the adverse state. (iii) then follows directly from (ii). Note that the weak inequalities arise simply because the action spaces are discrete.

The point of Proposition 2 is that banks tighten credit policy when the state of the borrowing sector deteriorates, even though the deterioration is not observable to the public. The change in state—the demand shock—provides a signal on which banks credibly coordinate in tightening credit policy. Thus demand shocks have supply side effects. From an outside observer’s perspective though, the supply side effect may seem to predate, or even cause, the demand side effect.

This proposition has important practical implications. There is a debate (for example, see Bernanke and Lown [1991]) whenever banks as a group tighten credit as to whether the contraction is driven by a deterioration in the quality of borrowers (demand side) or whether it is a whimsical change in bank credit policy (supply side). Proposition 2 suggests that a contraction in credit policy will accompany an adverse shock to borrowers, compounding the effect of the shock. When the shock dissipates, banks liberalize their
credit standards. Bank credit policies thus accentuate demand side fluctuations, and it will be hard to empirically distinguish the two. The popular press may be right when it argues that banks become overly conservative in bad times, but this is only relative to the excessively liberal policies that prevailed earlier. Economists may be right when they say that the contraction in credit is related to the condition of borrowers (the demand side), but there is also an independent change in bank credit policy, for the reasons we have discussed.

A corollary to Proposition 2 is that an adverse shock to one borrowing sector will affect bank credit policy in another. When the market knows the bank has made loans to a sector hit by a shock (it knows about the shock from the earnings performance of other specialized banks), the sensitivity of the bank’s reputation to its earnings will be reduced. But by assumption, the quality and composition of the bank’s assets are not observed by the market. If the bank lends to multiple sectors, the market cannot trace back poor earnings performance to any specific sectoral loan. The bank then faces the same incentives when determining credit policy toward a loan, independent of the sector the loan has been made to. Thus, a demand shock in one sector will cause banks to contract credit to all sectors.\(^\text{12}\)

Bank credit policies thus have an expansionary bias and diverge from first best even in a rational expectations world, simply because bank management has short-term concerns. Ex ante no bank expects to gain, but ex post all banks are forced to participate. Is the case then for regulatory intervention clear? As I argue below, the “right” intervention is not always obvious. Unless regulators have the right model in mind, even narrow interventions can have widespread or perverse effects.

A possible intervention to reduce the expansionary bias toward providing credit is that the regulatory authorities curtail the ability of banks to continue loans: for instance, by reducing the availabil-

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12. Consider the following excerpt from the *New York Times*, October 12, 1989: “Led by large New York banks that have already announced plans to take heavy losses on their loans to less-developed countries, other banks are likely to report poor earnings for the third quarter, analysts say. ‘The losses at a few big banks will set the tone for the quarter,’ said James J. McDermott Jr., executive vice president at Keefe, Bruyette & Woods, a New York-based securities firm that specializes in banking companies. ‘Under the cover of increasing their reserves for loans to less-developed countries, banks will see an opportunity to clean up a lot of other problems. For regional and small banks, analysts said, poor results are more likely to be overlooked by investors when the results for the entire industry are bad. Therefore, these banks may recognize other loan losses at this time’.”
ity of loanable funds or imposing credit controls. Clearly, this could reduce efficiency because a bank’s ability to continue good loans is reduced. Moreover, it is not clear that the bank’s incentive to continue (or initiate) bad loans is reduced. More targeted intervention is thus called for.

The first best can be achieved if the regulators increase the cost of continuing bad loans above $c^{**}$ (see Proposition 1). For instance, regulators could monitor bank portfolios carefully and force banks to dispose of bad loans or face high penalties. However, if the monitoring process is fraught with error (as is likely) or it is too costly to monitor all banks, intervention may take place at only a few banks. If so, regulatory intervention can have the perverse effect of making the credit policies of banks who escape regulatory oversight more liberal. Consider the following example.

**Example 1.** Let $\theta_L = 0.5$, $\alpha = 0.2$, $\pi = 0.2$, and $p^1 = p^2 = 0.6$.

Let the cost of a liberal credit policy, $c^1$, be 0.230 for bank 1 and $c^2$ be 0.323 for bank 2. The unique credit policy equilibrium is $((a,a), (0,0))$. If regulators want to intervene selectively, they would naturally focus on bank 1, which has a very liberal credit policy. Assume that they warn the bank that future examinations will be more frequent and more exhaustive. This threat raises $c^1$, say to 0.7, and forces bank 1 to tighten its credit policy to $(0,0)$. Unfortunately, the consequent informational spillovers force the unregulated bank 2 to adopt a more expansionary policy of $(a,0)$. The intuition is revealing. Before intervention, the market still has some residual uncertainty about the state after observing positive earnings from the first bank. It is possible that positive earnings could be a result of the liberal credit policy followed by the bank in the adverse state, but after intervention the market knows the first bank is forced to maintain a tight credit policy. If it nevertheless declares positive earnings, it must imply that the state is normal for sure. This then removes the protection of residual uncertainty from the second bank, making its reputation much more sensitive to earnings. Thus, the second bank liberalizes credit policy in response to the intervention.

Selective intervention can also cause the unregulated bank to tighten credit policy if, for instance, the market’s posterior of the adverse state is higher after intervention. Again the intuition is that even though the market fully anticipates the consequences of the intervention, the information with which the market evaluates the unregulated bank changes. These spillovers change the latter’s
WHY BANK CREDIT POLICIES FLUCTUATE

413

credit policy. If such spillovers are unanticipated by regulators, the change in credit policy may seem perverse or excessive compared with the direct intervention.13

D. Welfare Implications: Herd behavior versus Niche Behavior

Is the second bank better off lending alone to a different sector (with its own independent shocks), or is it better off lending to the same sector as the first bank? In other words, is it better for the market to have more, or less, information to evaluate the bank? In a rational expectations equilibrium the market anticipates the bank’s actions perfectly. Ex ante the realization of the state and loan outcome, the expected change in the bank’s reputation is zero. Consequently, the bank only takes into account the expected excess cost of its future credit policy when it evaluates the above two situations at date 0.

Because the first bank’s earnings are informative, \( \pi^1 < \pi \geq \pi^1 + \). Denoting the second bank’s (constant) credit policy if it lends alone as \( a_s \), from Lemma 1 it is clear that

\[
a_{-2} \leq a_s \leq a_{+2}.
\]

It is easily shown that

PROPOSITION 3. For every market prior \( \pi \), there exists \( \bar{a} > 0 \) and \( c_a,c_b,c_c,c_d,c' \) such that if \( a \leq \bar{a} \), the second bank is strictly better off lending together with the first bank when its cost \( c^2 \in (c_a,c_b) \) and strictly worse off when \( c^2 \in (c_c,c_d) \), where \( c_a < c_b \leq c' < c'' \leq c_c < c_d \).

Proof of Proposition 3. See Appendix.

When the bank lends alone, equilibrium credit policies are constant, either at \( (a,a) \) or \( (0,0) \). But an equilibrium policy of \( (a,0) \) is possible when the bank lends along with the other bank because the market has additional information. This variable policy is strictly better than \( (a,a) \) and strictly worse than \( (0,0) \). The

13. Looking back at the Credit Restraint Program in 1980, the Vice Chairman of the Federal Reserve Board puzzles over why it did not work as planned: “When the Board enacted its program, we did not anticipate, and we had no reason to anticipate the impact it would have. Given the limited coverage of the program, it would have been expected to have had a moderate effect . . . there was a remarkable shift in attitudes that led to a sudden contraction of credit flows. This contraction involved even those sectors that were explicitly exempted from controls . . . when we removed the controls . . . we were surprised again by how quickly the economy snapped back” (quoted in Schreft [1990, p. 46]).
proposition results simply from comparing equilibria in the single and multibank situations.14

Proposition 3 has interesting parallels with the problem of relative performance evaluation in the agency literature. If two agents are placed in competition, their performance gives the principal two sources of information. From these signals she can extract the common systematic shock (which is beyond an agent’s control) and reward only their idiosyncratic effort or ability. For example, in Banerjee and Besley [1990] students learn about their abilities, partly from their own performance and partly from the performance of their peers taking the same test. The performance of the peer group helps filter out the common uncertainties in the test. Similarly, in my model the market can filter out the common component of state uncertainty if multiple banks lend to the same sector.

In general, if the common component of uncertainty is filtered out, rewards become more sensitive to the agent’s performance. In turn, this will increase the expected amount of influence activities (see Milgrom and Roberts [1990]) the agent undertakes to affect performance measurement. Since credit policy in my model is essentially an influence activity, it is interesting to understand why it does not always become more liberal when uncertainty is filtered out. The reason is that, unlike previous work, ability differences in my model are dependent on the common component of uncertainty (the state). Even though the bank is largely stripped of excuses in the normal state (which increases influence activities), in the adverse state it is not expected to perform well even if it is the high type (which reduces its influence activities). Whether the additional information about the state from relative performance evaluation increases or reduces influence costs depends on the importance of each effect. This is why welfare could go either way.

Proposition 3 has practical implications for a bank’s portfolio choice. Consider a situation where two banks have to decide the fraction of their lending to allocate to a particular sector. Their decision is affected by their anticipation of the costs of distorted credit policies. If the banks have low costs to providing liberal credit (i.e., c is low), the proposition suggests that the portfolio

14. An interesting corollary to Proposition 3 is that a bank will want to commit ex ante to disclosing ahead of (or after) its competitor, even when this has no effect on the competitor’s credit policy. This is simply because trading places redistributes incentives between states, enabling the bank to adopt a better (ex ante) credit policy. Of course, the relative timing of earnings disclosures can only increase in importance if it also affects the competitor’s credit policy.
fractions chosen are strategic complements; that is, it costs a bank less to lend to a sector if it knows another bank is also lending to it. Thus, there could be ex ante herding in lending to certain sectors even if those sectors are intrinsically less profitable than others. Conversely, if banks have high costs of liberal credit, their portfolio decisions are strategic substitutes; that is, banks want to lend to relatively uncrowded but perhaps less profitable niches.\footnote{For example, the cost of liberal credit policies is directly proportional to the extent of regulatory oversight. The model would suggest that herd behavior should be more prevalent when regulatory oversight is lax, while niche behavior should be apparent when regulatory oversight is tough.}

E. Simultaneity, Multiple Equilibria, and Endogenous Credit Cycles

While I have examined the case of sequential credit policy decisions first, it is equally straightforward to have banks choose credit policy simultaneously. Propositions 1, 2, and 3 continue to hold, with the obvious change that the second bank’s credit policy is now a function of the state rather than the first bank’s earnings (proofs are available from the author). Interestingly, both banks are now uncertain about each other’s earnings when choosing credit policy. This introduces an element of strategic complementarity in bank credit policies. If one bank believes the other bank will liberalize credit policy, it has an incentive to do so itself. This could result in multiple equilibria. Also, it is interesting to extend the model to multiple periods because the shock to borrowers (the change of state) can be endogenized. Putting the extensions together, I show that bank credit policies can create low frequency business cycles.

To keep the model tractable, I make some simplifying assumptions. First, managers live only for two periods. Second, managers hired at date $t$ run the bank for only one period during which they make one loan, after which they retire to start a career in politics (or another industry). At date $t + 1$ the next generation of managers takes over. As the new management has not had the opportunity to take decisions, it starts with the same reputation $p$ as did old management. Finally, I assume that at date $t + 2$ when the market sees the bank’s earnings, it also learns about the actual credit policies followed by the date $t$ managers. Date $t$ managers die at this date, so they cannot be rewarded or punished for their past policies. Thus, the effect of liberal date $t$ credit policies on future
earnings, $c$, is filtered out by the market before it evaluates date $t + 1$ managers, and has no effect on future managerial decisions.\textsuperscript{16}

The probability of the adverse shock, $\pi_t$, is representative of the condition of the borrowing sector, i.e., the condition of the real economy. It is natural to think that $\pi_t$ is a function of past credit policies. The greater the number of unprofitable projects that are continued with liberal credit policies (as opposed to being closed down), the lower the economic profits in the sector, the more perverse the actions of the borrowers, and the greater the chances that even ex ante creditworthy borrowers will be driven to ruin. Another interpretation is that the more projects that are financed today in order to generate current fees, the more likely it is that there will be a future glut of production in the market. A representation of the dynamics of $\pi_t$ consistent with this intuition is

\begin{equation}
\pi_{t+1} = \pi_t + f(a_{St}^{1}, a_{St}^{2}, \pi_t),
\end{equation}

where $f(\cdot; \pi_t) > 0$ if either $a_{St}^{1}$ or $a_{St}^{2} > 0$ and $f(\cdot; \pi_t) < 0$ if both are zero. Also, $f(\cdot; 1) \leq 0$, and $f(\cdot; 0) \geq 0$. In words, the probability of the adverse state increases if at least one of the banks maintains a liberal policy, and decreases if both banks maintain tight policies.\textsuperscript{17}

The market’s prior of the adverse state occurring, $\pi_t$, is the variable that links periods together. To understand the dynamics, it is instructive to examine how equilibrium credit policies depend on $\pi_t$. I assume that both banks have the same cost of liberal credit $c$ each period. This combined with the fact that bank managements start with the same initial reputation each period enables me to focus on symmetric equilibria.

**Proposition 4.**

(i) If $(a,a)$ is an equilibrium for some $\pi_t = \pi'$, it is an equilibrium for all $\pi_t < \pi'$. Consequently, $(a,a)$ is an

\textsuperscript{16} These assumptions help me finesse the issue of reputation and signaling effects that are worthy of an entirely new paper. Also, I ignore tipping effects; a liberal credit policy today can increase the bank’s cost of maintaining a liberal credit policy in the future, either because it increases the volume of loans that have to be concealed each period or because the bank has less cash to continue making poor loans. Thus, the liberal credit policy equilibrium can “tip” over into the tight credit policy equilibrium automatically. But the simplifying assumptions I make are not implausible. New management has an incentive to reveal old management’s mistakes so as not to be held responsible for them in the future.

\textsuperscript{17} Implicit in my analysis is that a bank ignores the effect of its own credit policies on the future probability of the adverse state. This is a good approximation if many banks lend to the same sector, as would be true in a more detailed model.
equilibrium for some $\pi_t \in [0,1]$ only if

$$p^+(a,a,0) - p^-(a,a,0) > \frac{c - a}{a}. \tag{10}$$

If (10) holds, $(a,0)$ is not an equilibrium as $\pi_t \to 0$.

(ii) If $(0,0)$ is an equilibrium for some $\pi_t = \pi'$, it is an equilibrium for all $\pi_t > \pi'$. Also, $(0,0)$ is an equilibrium for some $\pi_t \in [0,1]$ only if

$$\bar{\theta}_L(p^+(0,0,1) - p^-(0,0,1)) + (1 - \bar{\theta}_L)(p^+(0,0,1) - p^-(0,0,1))< \frac{c - a}{a}, \tag{11}$$

where $\bar{\theta}_L = p + (1 - p)\theta_L$. If (11) holds, $(a,0)$ is not an equilibrium as $\pi_t \to 1$.

(iii) If $(a,0)$ is an equilibrium for some $\pi_t = \pi'$, and also for $\pi_t = \pi''$ where $\pi'' > \pi'$, it is an equilibrium for all $\pi_t \in [\pi', \pi'']$.

(iv) Only $(a,0)$ and $(a,a)$ can be equilibria simultaneously.

Proof of Proposition 4. See Appendix.

The proposition describes how equilibrium credit policies change with $\pi_t$, for a given specification of the other parameters. The intuition for the proposition is simply that credit policies are monotonic in the probability of the adverse state. Consider an example of how the proposition suggests equilibria should line up.

Example 2. Let $c = 0.23$, $\theta_L = 0.5$, $a = 0.2$, and $p = 0.7$. It is easily checked that only (10) holds.

The unique symmetric equilibrium is $(a,a)$ if $0 \leq \pi < 0.15$; this is the liberal credit region. The two possible symmetric equilibria are $(a,a)$ and $(a,0)$ if $0.15 \leq \pi < 0.39$; this is the multiple equilibria region. The unique symmetric equilibrium is $(a,0)$ if $0.39 \leq \pi < 1.0$; this is the tight credit in adversity region.

Before tracing out the condition of the borrowing sector over time, I have to specify how I select an equilibrium when multiple equilibria obtain. A plausible selection rule is persistence; that is, if multiple equilibria are possible this period, the one that obtains is the one that prevailed in the last period. By (i), (iii), and (iv) above, this rule is well defined provided that $\pi_t - \pi_{t-1}$ is not too large. More important, this rule ensures that the endogenous business cycles are not a result of movements between sunspot equilibria.\textsuperscript{18}

\textsuperscript{18} Also, it is consistent with the assumption in previous work on endogenous cycles, as for example in Murphy, Shleifer, and Vishny [1989].
I simulate the condition of the borrowing sector, $\pi_t$, over 80 periods for the data in example 2 (see Figure I). It is easy to understand why the path is cyclic. If business conditions are good ($\pi_t$ is low), equilibrium credit policies will be very liberal. Even if an adverse shock hits, credit policy will continue to be liberal. Furthermore, adverse shocks will be infrequent because $\pi_t$ is low. But by (9), $\pi_t$ will increase because of the liberal credit policies. When $\pi_t$ enters the multiple equilibria region from below, by the assumption of persistence, banks will maintain liberal policies, $(a_0, a)$. The adverse shocks will become more frequent, but this will have no effect on credit policies.

But when $\pi_t$ becomes higher still, the unique equilibrium is for banks to coordinate on any adverse shock to tighten credit. Because $\pi_t$ is high, adverse shocks are frequent, and credit policy on average is tight so that $\pi_t$ falls. Over time, the system could enter the multiple equilibria region again from above. By the assumption of persistence, the tight credit in adversity equilibrium will prevail, with adverse shocks less frequent, until $\pi_t$ enters the region with the unique liberal credit equilibrium. The cycle then repeats.

19. For the updating rule, I assume that

$$\pi_{t+1} = \pi_t + 0.5(a_{S_1} + a_{S_2}) - 0.2a$$

if $0 \leq \pi_t + 0.5(a_{S_1} + a_{S_2}) - 0.2a \leq 1$

$$= 1(0)$$

if $\pi_t + 0.5(a_{S_1} + a_{S_2}) - 0.2a > 1(<0)$. 
Clearly, there is nothing deterministic about the periodicity of the business cycle. When the equilibrium credit policy is state contingent, the frequency of adverse shocks determines how much \( \pi_t \) falls. Economic conditions could oscillate rapidly simply because adverse shocks are not frequent enough to drive \( \pi_t \) down to the liberal credit region. But averaging across 1000 runs, there are 1.9 cycles in the 80-period horizon (where the frequency of the business cycle is defined as the number of times the credit policy equilibrium changes from liberal to tight and back to liberal, or equivalently, half the number of times \( \pi_t \) traverses the multiple equilibria region).

Regulatory intervention can have the effect of tipping the system from one equilibrium to another in the multiple equilibria region. For example, if regulators move the banking system from the liberal credit equilibrium to the state-contingent credit equilibrium, \( \pi_t \) does not need to increase to a high level before it starts falling. Of course, it is also possible for regulators to ease too much in response to the political pressures generated by adverse shocks thus precipitating the liberal credit equilibrium and preventing \( \pi_t \) from falling. In sum, intervention can move the system toward the first best, but it requires regulators to have a very good understanding of the “true” model.20

F. Alternative Assumptions and Related Models

Is this model of sufficient generality? Consider the “reduced form” of the assumptions that generate the results in this paper. First, bank managers should believe that future rewards (or punishment) depend on their relative performance vis-à-vis other bank managers in the industry. Second, the reward structure should be such that good performance is more valued when other bank managers are performing well than when they are performing badly. The first reduced-form assumption is standard and stems directly from managerial concerns about reputation and the common component of uncertainty.

I obtain the second reduced-form assumption in the paper by assuming that the distribution of abilities collapses in the adverse state. This then leads to Lemma 1 that the sensitivity of reputation

20. Why are cycles so pronounced in insurance markets (see Winter [1991]) but less so in commercial lending? One potential reason is that regulatory supervision of commercial lending is much tighter. In fact, one of the most important reasons for setting up the Federal Reserve System in the United States in 1913 was to deal with the periodic booms and busts caused by bank lending.
to performance increases as the market’s prior of the normal state increases because the high type is more likely to be able to distinguish itself in the normal state. The assumption about state-contingent abilities in the paper is, however, much stronger than needed (though assuming that the state-contingent ability of one kind of bank dominates the ability of the other kind in a first-order stochastic sense makes labeling the dominant bank as the high type uncontroversial). All I need is that the management or the market should value ability in the normal state much more than ability in the adverse state. In other words, the mapping from the state-contingent abilities of different banks to the valuation implicit in the type specifications should be such that high types have greater ability than low types in the normal state, while in the adverse state the difference in abilities can be smaller or even reversed. This mapping is easily rationalized. For instance, managers may care about their reputation because it helps them get higher quality jobs in other banks. If the number of job openings is positively correlated with the banking industry’s prospects (the probability of the normal state), then managers want to be known as the type who performs relatively well in the normal state.21

Also there are more direct ways of obtaining the second reduced-form assumption than through the mapping of state-contingent abilities into types. For instance, let there be a wealthy corporate raider in the economy. Because the raider has a limited capacity to analyze bank stocks, she would like to focus, if possible, on stocks where she knows management is poor. A bank’s poor performance when other banks perform well will attract the raider’s attention with a consequent loss in managerial perks. Poor performance is less damaging when others perform badly because the raider spreads her attentions and there is only a small probability of being the one targeted for takeover.22

21. Alternatively, the expectation of the occurrence of the normal state in the long run may be much higher than the expectation of the occurrence of the adverse state. If managers become entrenched once they are hired, shareholders have an incentive to hire types who do relatively better in the normal state, because this will maximize long-run profits.

22. The following is yet another justification for the reduced-form assumption. Assume that banks have capacity constraints (in the short run) on the amount of deposits they can take in. Bank earnings performance informs depositors about the safety of the bank. When other banks are expected to do well, good performance is crucial. Otherwise, uninsured depositors will desert in droves and spread their deposits over other, safer banks, thus precipitating a run. Good performance is less important when other banks are doing badly, simply because the gain in deposits to the capacity-constrained bank is small.

Banking institutions may want to acquire reputations as lenders of last resort. Therefore, it is possible to argue that if institutional reputation (rather than the
Given these assumptions, the model argues that bank credit policies will have an expansionary bias. It suggests that small events touch off large changes in bank lending and that suppliers of credit could generate business cycles. Given the informational spillovers from a bank’s performance, the paper argues that regulatory intervention can have unforeseen consequences unless regulators have an appreciation of the true model.

Other models can generate some of these predictions. For instance, Banerjee [1992] and Welch [1992] present models of cascades where the initial actions of the first few agents can lead all other agents to ignore their own private information and follow suit. There are some important differences between the cascade model and mine. First, the cascade model assumes that banks are relatively uninformed about the true state of the borrowing sector and rely on other banks for this information. My model, on the other hand, assumes that banks have sufficiently well-diversified portfolios in a sector so that they can learn the true state by observing the performance of their loan portfolios, and it is the public markets that are relatively uninformed. I provide evidence suggesting that the public market does learn about the state from bank loan loss announcements. A second difference is that the cascade model predicts far less persistence than does mine. Once banks learn that they have mistakenly overinvested in a sector with the herd, they should cut their losses and exit equally quickly. My model argues that they will be trapped, and will exit only when it is publicly apparent that the sector is a disaster. Third, the cascade model predicts that bank credit will be, in turn, excessively expansionary and excessively contractionary (and this does not necessarily have to vary with demand conditions). My model predicts that it varies from being excessively expansionary in normal times to being just right in adverse ones, so that credit crunches seem contractionary only with respect to prior credit policies but they are not contractionary with respect to true reputations of individual bank managers) is at stake, banks may have a greater incentive to show they are good when everyone else is doing badly than when everyone else is doing well. If so, our second reduced-form assumption is reversed. Accordingly, banks are no longer responsible for adversely affecting borrower health through excessively liberal credit policies during expansions. But when borrowers are adversely affected for exogenous reasons, banks prolong the shock by continuing unviable projects with liberal credit. Thus, the behavior of banks in an individualistic economy like the United States may be different from that in a more institution-based one like Japan.
demand conditions. In summary, the cascade model is based on information assumptions that are plausible in explaining herd-like behavior in the initial entry into lending to a particular sector, but are less plausible in explaining why banks may paper over losses, declare loan losses together, and contract credit policy in bad times.

An alternative explanation of the correlation between demand shocks and the supply of credit is the “capital constraint” theory proposed by Bernanke and Gertler [1987]. According to their theory, an adverse shock to bank capital constrains bank borrowing from the market and consequently bank lending. Thus, credit policy will vary from being just right in normal times to being excessively contractionary after demand shocks. The contractionary bias this model predicts is exactly the opposite of what my model predicts.

While there is no reason to believe that the theories are mutually exclusive, the cascade and capital constraint models can be distinguished from the one I present because the theories predict different reactions of credit policy (relative to the optimal) to changes in demand side conditions. For instance, a finding of negative excess returns for new bank real estate loans made when the real estate sector is generally known to be healthy and insignificant excess returns when it has suffered an adverse shock is consistent with my model. In contrast, the capital constraint model predicts positive excess returns to bank lending when the sector has suffered an adverse shock and insignificant returns otherwise. The cascade model does not predict a specific relationship between excess returns and demand side conditions unless, of course, credit policy causes the demand side conditions. In the latter situation, excess returns should be negative when the sector is doing well and positive when it is doing badly. Examining all this is beyond the scope of this paper, though others have made a beginning in this regard (see Mei and Saunders [1993]). Instead, I study the experience of New England banks with real estate loans.

23. The potential ex ante herd behavior demonstrated in my model is different from the ex post herding that characterizes work by Scharfstein and Stein [1990]. In their paper high ability managers tend to get the same signal about the quality of investments. Managers who are concerned about reputation have an incentive to ignore their private information and mimic the investment decisions made by other managers. Herd behavior is always inefficient because managers do not use all available information. In my model, by contrast, herd behavior can sometimes improve efficiency (relative to going it alone) because the market can then distinguish poor performance from sectoral shocks, which reduces distortions in credit policy.
in the early 1990s and obtain formal evidence in support of some of the assumptions and implications of the model.

III. EMPIRICAL ANALYSIS

A. Evidence of Information Externalities

The model assumes that information about the performance of a bank’s loan portfolio conveys information about the true state of the economy, and consequently about the likely performance of other bank portfolios. Earlier studies provide peripheral evidence to support this assumption. Aharony and Swary [1983] assess market reactions to signals of the impending failure of U. S. National Bank of San Diego (USNB), Hamilton National Bank, and Franklin National Bank. They find that the failures of USNB and Hamilton, which were primarily a result of idiosyncratic problems like fraud and internal irregularities, did not have any effect on other banks. However, Franklin’s failure, which was a result of heavy foreign exchange losses, affected other bank stock prices negatively. Aharony and Swary argue that this was because the Franklin failure conveyed information about a common component of uncertainty affecting bank earnings. Similarly, Peavy and Hempel [1988] find that the failure of Penn Square strongly affected the stock prices of banks operating in the same region as Penn Square.

But does failure convey information about common components of uncertainty surrounding the assets of similar banks, or does it convey information about the increased costs of financing from henceforth jittery and unsophisticated depositors? To answer this question, I examine the effects of the following announcement on December 15, 1989, which was reported in the Los Angeles Times (among others) as follows: “Bank of New England Corp., hurting from the region’s sagging real estate market, announced today it will sharply boost its reserves to cover bad loans and expects to report a ‘substantial’ loss for the year. . . . Bank of New England, which said it will boost its loan loss reserves to more than $1 billion, already had made provisions for bad loans totaling $207.3 million in the nine months ended Sept. 30.”

According to the model, banks charge off loans or add to reserves only when such actions are anticipated by the market and convey little new information. This biases studies of increased voluntary loan loss provisions toward finding no information
effects. The Bank of New England, however, made this announce-
ment after regulators scrutinized its books. Because the extent of
provisioning was largely determined by regulators, this event is
truly exogenous. Moreover, this was the first large addition to
reserves against real estate loans by a major New England bank in
that period. This event is ideal for testing hypotheses about
information effects.

I calculate the abnormal return for different portfolios of bank
stocks over a three-day window surrounding the announcement.
The $t$-statistic based on the portfolio approach corrects for cross-
sectional correlations in residuals. The results are reported in
Table I. The portfolio of 90 banks (not including the Bank of New
England) had a significant negative cumulative abnormal return
(CAR) of $-2.4$ percent ($t$-statistic $= -3.34$). The loss in market
capitalization for these banks totaled $2.3$ billion. Banks with
headquarters in one state in New England suffered a disproporti-
one loss. The cumulative abnormal return was $-8$ percent
($t = -8.33$). The abnormal returns were smaller for the money
center banks (CAR $= -2.2$ percent, $t = -1.67$), and smallest for
banks in other regions (CAR $= -1.5$ percent, $t = 2.1$). These
results suggest that the more likely a bank was to make loans in the
New England region, the more negative was the announcement
effect.

But do these stock price reactions have anything to do with
information about real estate? The Bank of New England had real
estate loans in 23 states. If, indeed, the announcement conveyed
information about the state of the real estate sector, the stock
prices of firms connected with real estate should be affected. To
check this, I collected a sample of publicly traded developers and
real estate investment companies. The cumulative abnormal re-
turn for the entire sample is a significant $-1.5$ percent. Moody’s
contains data on the holdings of these companies, from which I
identified eleven firms with at least one property in New England.

24. See Madura and Zarruk [1992] for a detailed examination of the difference
in information effects between loan loss announcements related to LDC loans and
loan loss announcements related to real estate. This subsection is partly based on a
data set similar to theirs.

25. Bank of Boston made a large addition to reserves the previous quarter but
announced that a substantial part of the addition was to cover potential losses on a
single highly leveraged transaction.

26. I include all the New England based banks that I could find on the CRSP
tapes. The regional banks are a random subset of 50 of the regional banks listed on
CRSP. The money center banks are those in Elliott, Hanna, and Shaw [1991] except
for First Interstate Bancorp which I treat as a regional bank.
TABLE I
MARKET REACTIONS TO BANK OF NEW ENGLAND’S ANNOUNCEMENT

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<th>Banks</th>
<th>Real estate firms</th>
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<td></td>
<td>abnormal returns</td>
<td>in portfolio</td>
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<td>All</td>
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<tr>
<td>New Englanda</td>
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<tr>
<td>Other</td>
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<td>a) Other real estate firms</td>
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<td>b) Money center banks</td>
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<td>c) Regional banksb</td>
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</tbody>
</table>

Notes. The daily abnormal return is \( r_p - \alpha_p - \beta_p r_M \), where \( r_p \) is the return on the value weighted portfolio, \( r_M \) is the return on the value-weighted NYSE/AMEX portfolio, and \( \alpha_p \) and \( \beta_p \) are the coefficient estimates from the market model regression estimated between 270 and 20 days before the event. The cumulative abnormal returns are the summation of abnormal returns over days \(-1\) to \(+1\), where day 0 is December 15, 1989.

* \( t \)-statistics are computed using Patell’s variance of the forecast error.

* a. These are regional banks with headquarters in New England (but not including the Bank of New England) and real estate firms with at least part of their portfolio (as obtained from Moody’s) in New England.

* b. These are regional banks with headquarters outside New England.
The CAR for this subsample is $-2.1\%$ ($t = -1.49$), while it is $-1.4\%$ ($t = -2.37$) for the remaining firms.

The adverse effect on real estate firms could be the result of an anticipated contraction in the supply of bank credit to such firms (either for the reasons laid out in the model or because of closer regulatory scrutiny of bank real estate loans). But this does not explain the greater adverse effect on real estate firms with property in New England. These firms are well diversified across states (which together with their lower leverage could explain the lower CAR relative to New England banks) and are likely to have access to sources of credit outside New England. It is, perhaps, more plausible to attribute the greater negative effect on firms owning property in New England to information on the state of the real estate sector in New England conveyed by the announcement.

Finally, I obtain additional evidence in favor of information effects when I examine the determinants of the change in each bank’s value on the announcement. The dependent variable in the regressions reported in Table II is the change in the market value of the bank’s equity on the announcement, normalized by the bank’s assets. Column (i) shows that New England banks lost a significant 0.4 percent more of their assets than banks outside New England. More interesting, the extent of the loss is related to the size of the bank’s real estate lending. An increase in real estate lending from the minimum to the mean increases the loss suffered by a significant 0.34 percent of assets. These figures must be judged keeping in mind that the average loss suffered by the banks is only 0.32 percent of assets.

Consider now the specification in column (ii). Note first that it is not that a bank is in New England that accounts for the adverse effects. New England banks without real estate holdings do not suffer any greater loss than do banks outside New England. But the loss in equity value per unit of real estate holdings is over 3.3 times greater for New England banks than for other banks. This suggests that the announcement conveyed information about the value of real estate loans in general, and in particular about those made by New England banks. Again, it is possible to argue that the greater loss for banks with New England real estate loans is because the market anticipated regulators would unduly constrain these banks. Presumably, the ability of regulators to interfere

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27. Bank Compustat has data on only 38 of the 90 banks in my sample. I lose a majority of the regional and New England banks in this regression.
why bank credit policies fluctuate

### TABLE II

**Explaining the Market Reaction of Bank Stocks**

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Coefficient (standard error)</th>
<th>(i)</th>
<th>(ii)</th>
<th>(iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator if New England bank</td>
<td>0.0041***</td>
<td>0.0017</td>
<td>0.0015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0013)</td>
<td>(0.0029)</td>
<td>(0.003)</td>
<td></td>
</tr>
<tr>
<td>Indicator if money center bank</td>
<td>0.0004</td>
<td>0.00008</td>
<td>0.0003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0012)</td>
<td>(0.0012)</td>
<td>(0.0012)</td>
<td></td>
</tr>
<tr>
<td>Real estate loans as a fraction of total bank assets</td>
<td>-0.0164***</td>
<td>-0.01*</td>
<td>-0.012**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0048)</td>
<td>(0.0053)</td>
<td>(0.0056)</td>
<td></td>
</tr>
<tr>
<td>Indicator if New England fraction real estate loans</td>
<td>-0.023**</td>
<td>-0.023**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.107)</td>
<td>(0.107)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market value of equity two days before announcement as a fraction of assets</td>
<td>-0.031**</td>
<td>-0.041**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.019)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Book value of equity + preferred + debentures as a fraction of assets</td>
<td>0.044</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.047)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.41</td>
<td>0.49</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 10 percent level.
**Significant at the 5 percent level.
***Significant at the 1 percent level.

Notes. The dependent variable is the loss in equity value for a bank surrounding the December 15 announcement divided by the bank’s total book asset value in previous quarter. The estimated regression is Loss in equity = $\alpha + \beta \text{(explanatory variables Bank)} + \epsilon_{\text{Bank}}$.

The balance sheet data in this regression are obtained from Bank Compustat. The Bank of New England is not included in this regression. The book value of assets used to normalize the variables is that reported in the third quarter of 1989. The regressions include a constant whose coefficient is not reported.

Would be higher for banks with lower capitalization. But the coefficient on the market equity to assets ratio before the announcement is significantly negative, suggesting that better capitalized banks suffered a greater loss. An increase in market equity ratio from the minimum to the mean increases the loss by 0.27 percent of assets. It could be argued that regulators focus on book capital rather than market capital. In Column (iii), I include book capital to the specification in column (ii). While the coefficient is positive, it is not statistically different from zero, and does not add to the explanatory power of the regression.

Finally, these regressions offer (weak) evidence that distinguishes my theory from the capital constraint theory proposed by Bernanke and Gertler [1987]. A peripheral implication of their
theory is that demand shocks should impact banks with low market capital to a greater extent than banks with high market capital, which is inconsistent with the results in the regression. On the other hand, an explanation consistent with my model is that banks with high market capital are ones who have thus far managed to conceal their troubles and are most affected by the announcement. There are other possible explanations of this phenomenon, the theories are not mutually exclusive, and I cannot draw strong conclusions because I lose so many observations in the regression. The results, however, are intriguing enough to warrant investigation in future research.

B. Evidence on Bunching of Provisions/Charge-offs

The model predicts that banks will alter credit policies in order to show higher earnings. At the margin, this should be reflected in nontransparent accounting decisions like the provision for bad debts and loan charge-offs. Moyer [1990] and Beatty, Chamberlain, and Magliolo [1992] find evidence that the decision by a bank to provision is discretionary and partially motivated by capital adequacy considerations. In addition, my model predicts that provisions/charge-offs by other banks in the same lines of business should affect a bank’s provisions/charge-offs.

There is a sizable literature on the bunching of loan loss provisions against LDC debt (for example, see Elliott, Hanna, and Shaw [1991]). Following Citicorp’s decision to boost loan loss reserves on May 19, 1987, at least 45 major U.S. banks announced substantial increases in their loan loss reserve levels by July 1987. That there were no changes in fundamentals warranting this provisioning is supported by the initial reported reactions of officers at other banks.28

Returning to my case study of New England banks, I plot the Bank of Boston’s provisions against loan losses (normalized by book assets) between the first quarter of 1986 and the second

28. Responding to Citicorp’s announcement, a Bank America spokesman stated that its reserves “are appropriate for the asset mix in our overall portfolio. We are aware of no developments that would produce a need for adjustments to this reserve” [Wall Street Journal, May 20, 1987]. But in that very quarter, Bank America added $1.1 billion to its loan loss reserves. There were further rounds of reserving. The regional banks followed the Bank of Boston in another round of provisioning against LDC debt in the fourth quarter of 1987, while the money center banks followed Chase Manhattan in the third quarter of 1989.
quarter of 1992 in Figure II. The provisions averaged $50 million until the sudden spike in the second quarter of 1987 following Citicorp’s announcement. Bank of Boston started a second round of provisioning and charge-offs against LDC debt (imitated mainly by the regional banks) in the last quarter of 1987, and this accounts for the second spike. But between the first quarter of 1988 and the second quarter of 1989, Bank of Boston’s loan loss provisions are remarkably smooth, in fact, *exactly the same in dollar terms each quarter*. This occurred even though we now know (from Dun and Bradstreet’s Business Failure Record) that business failures in finance, insurance, and real estate sectors increased by 55 percent in New England in 1988, and by a further 37 percent in 1989. The smoothness in provisions is perhaps explained by excessive prior reserving, though this seems unlikely because Bank of Boston’s reserve against bad debts declines from $732 million to $642 million over the same period. It would, therefore, appear that the bank may have been papering over the deterioration in its loan portfolio.29 At any rate, following a visit from regulators in the

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29. The top officers at Shawmut National Corp. and the Bank of New England were later charged in shareholder lawsuits with artificially inflating bank earnings during 1989 and concealing evidence that their loan portfolios had seriously deteriorated.
third quarter of 1989, the bank boosted its provisions tenfold to $370 million.\textsuperscript{30} The figure also shows that reserving by the other New England banks followed a similar pattern.

Even after correcting for observable fundamental changes in the condition of the borrowing sector, is a bank's provisioning/charge-off decision influenced by the decisions of other banks? The model suggests that provisioning by other banks is a proxy for the nonpublic information about the state of the borrowing sector. To the extent that I do not include all the market's information about the state of the economy in the specification, I shall be overestimating the influence of other banks on a bank's decision. To the extent that I include information that was not public at the time, I shall be underestimating the influence. This caveat, and the caveat that we do not know how much of the reserving in 1990–1992 is voluntary, must be kept in mind while evaluating the results below.

Following work by Moyer [1990] and Beatty, Chamberlain, and Magliolo [1992], I estimate a simultaneous-equation model of the decision to provision and charge off. A bank's provisions (charge-offs) are hypothesized to be a function of its charge-offs (provisions), fundamental economic conditions, the bank's characteristics, and the provisions (charge-offs) made by other banks. I analyze data obtained from Bank Compustat on the quarterly provisioning and charge-offs by seven New England banks over the period 1986–1991.\textsuperscript{31}

A proxy for the true state of the real estate sector is the bank's real estate holdings (other than bank premises), which represents

\textsuperscript{30} Unlike Bank of New England's announcement, this may not have sent a clear signal to the market about the quality of its real estate portfolio because the bank simultaneously announced problems with a loan to a highly leveraged company. According to the Chairman, Ira Stepanian, "... several factors contributed to the decision to increase the reserve ...," including "... an expected increased level of nonaccrual loans, continued weakness in the real estate industry, further signs of softness in general economic conditions, and a large individual credit on our portfolio of highly leveraged transactions, which has been placed on discretionary nonperforming status." Perhaps more revealing about the reason for Bank of Boston's decision is the Chairman's announcement later in his speech that "... following a review by the Office of the Comptroller of the Currency (OCC) of Bank of Boston's internal controls, real estate operations and risk review, the corporation expected to enter into an agreement with the Comptroller under which the board of directors will review various studies and steps to strengthen operations in those areas ..." [PR Newswire, October 2, 1989].

\textsuperscript{31} These are all the New England banks on the 1992 Bank Compustat database and includes Bank of Boston, Shawmut Bank, Fleet/Norstar, Multibank Financial, Northeast Bancorp, State Street Bank, and Baybanks.
WHY BANK CREDIT POLICIES FLUCTUATE

the real estate the bank has accumulated through foreclosures.\footnote{The problem with using this measure or the value of nonperforming real estate loans (which other authors have used) as a measure of true economic conditions is that it may understate the decline in the real estate sector for the reasons specified in the model. Banks will lend (at least for a while) to keep the loans performing. It would, however, be extremely costly for a bank to keep alive a firm close to foreclosure. Therefore, the level of nonpremise real estate may be a better measure of the true state of the real estate sector than the level of nonperforming loans.} In a world without short-term behavior, provisions should be influenced by the change in the holdings since the last quarter and expected future changes (normalized by the current value of the bank’s assets). Charge-offs should be influenced only by the change in the holdings since the last quarter and not by future changes.

The greater the value of real estate loans as a fraction of total assets, the more likely a bank is to face losses and to have to provision or charge off. Hence, the ratio of real estate loans to total assets in the previous fiscal year is included as an explanatory variable. The level of loan loss reserves indicates the future charge-offs a bank expects. Furthermore, a bank with adequate reserves is less likely to provision. So I include the loan loss reserves to assets ratio (lagged one quarter). Moyer [1990] argues that banks with low regulatory capital to assets have a tax incentive to add to reserves, so I include the regulatory capital to asset ratio (lagged one quarter).

It is impossible to know exactly what a bank knows about the likely provisions/charge-offs of other banks who have not yet declared their quarterly results. I assume that a bank has rational expectations about what the other banks will do in the current quarter. To deal with the problem of endogeneity, I include the average provisions (charge-offs) to assets ratio taken by the other banks in the current quarter, instrumented by the average provisions (charge-offs) to assets ratio taken by the other banks in the previous quarter. If there is serial correlation in provisioning (charge-offs)—as suggested by the model—this should be a good instrument. Summary statistics for the variables are reported in Table IIIa, and the results of a two-stage least squares estimation using the pooled data in Table IIIb.

Consider the first column in Table IIIb where the dependent variable is the bank’s quarterly provisions. This is statistically unrelated to charge-offs, but it is related to the change in real
TABLE IIIa
SUMMARY STATISTICS FOR THE VARIABLES IN TABLE IIIb

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan loss provisions to total assets</td>
<td>0.0026</td>
<td>0.0035</td>
<td>0.0001</td>
<td>0.020</td>
</tr>
<tr>
<td>Charge-offs to total assets</td>
<td>-0.0017</td>
<td>0.0026</td>
<td>-0.0081</td>
<td>0.022</td>
</tr>
<tr>
<td>Increase in real estate holdings over total assets in current quarter</td>
<td>0.0022</td>
<td>0.007</td>
<td>-0.023</td>
<td>0.042</td>
</tr>
<tr>
<td>Increase in real estate holdings over total assets in next quarter</td>
<td>0.0023</td>
<td>0.007</td>
<td>-0.024</td>
<td>0.041</td>
</tr>
<tr>
<td>Real estate loans in previous quarter over total assets</td>
<td>0.233</td>
<td>0.111</td>
<td>0.0085</td>
<td>0.411</td>
</tr>
<tr>
<td>Loan loss reserves in previous quarter over total assets</td>
<td>0.0137</td>
<td>0.01</td>
<td>0.004</td>
<td>0.045</td>
</tr>
<tr>
<td>Book value of equity + preferred + debentures as a fraction of assets</td>
<td>0.062</td>
<td>0.0095</td>
<td>0.0325</td>
<td>0.083</td>
</tr>
<tr>
<td>Average provisions-to-assets ratio for other banks instrumented by previous quarter's provisions-to-assets ratio</td>
<td>0.0027</td>
<td>0.0013</td>
<td>0.0015</td>
<td>0.007</td>
</tr>
<tr>
<td>Average charge-offs-to-assets ratio for other banks instrumented by previous quarter's charge-offs-to-assets ratio</td>
<td>0.0017</td>
<td>0.0013</td>
<td>-0.0014</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Estate holdings. A one-standard-deviation increase in the change in holdings over the past quarter increases provisions by about 10 percent of its standard deviation. A similar effect obtains for the change in holdings over the next quarter. A one-standard-deviation increase in the ratio of real estate loans to total assets increases provisioning by 25 percent of its standard deviation. The effect of loan loss reserves is statistically small though it has the expected sign. The higher the loan loss reserves, the less the need to set aside new provisions. Banks with lower book capital are more likely to provision, consistent with Moyer's argument that provisioning may be a tax favored way of adding to regulatory capital. The dummy for the quarters in which banks set aside provisions against their third world loans is positive but not significant. Of greatest interest is the coefficient estimate for average provisions by other banks in the quarter, which is economically and statistically significant (at the 5 percent level). A one-standard-deviation increase in the average provisioning by other banks increases a bank's provisioning by 43 percent of its standard deviation.
### TABLE IIIb
THE DECISION TO CHARGE-OFF/PROVISION

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Dependent variable: loan loss provisions to total assets</th>
<th>Dependent variable: loan charge-offs to total assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan loss provisions to total assets</td>
<td>0.232**</td>
<td></td>
</tr>
<tr>
<td>Charge-offs to total assets</td>
<td>-0.319</td>
<td></td>
</tr>
<tr>
<td>Increase in real estate holdings over total assets in current quarter</td>
<td>0.052</td>
<td>0.025*</td>
</tr>
<tr>
<td>Increase in real estate holdings over total assets in next quarter</td>
<td>0.048*</td>
<td></td>
</tr>
<tr>
<td>Real estate loans in previous quarter over total assets</td>
<td>0.0076*</td>
<td>0.0028**</td>
</tr>
<tr>
<td>Loan loss reserves in previous quarter over total assets</td>
<td>-0.02</td>
<td>0.0707***</td>
</tr>
<tr>
<td>Book value of equity + preferred + debentures as a fraction of assets</td>
<td>-0.046*</td>
<td>-0.00024</td>
</tr>
<tr>
<td>Dummy if summer 1987 or winter 1987</td>
<td>0.0005</td>
<td>-0.00007</td>
</tr>
<tr>
<td>Average provisions to assets ratio for other banks instrumented by previous quarter’s provisions to assets ratio</td>
<td>0.702**</td>
<td></td>
</tr>
<tr>
<td>Average charge-offs-to-assets ratio for other banks instrumented by previous quarter’s charge-offs-to-assets ratio</td>
<td></td>
<td>0.345***</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.454</td>
<td>0.716</td>
</tr>
<tr>
<td>Number of observations</td>
<td>173</td>
<td>173</td>
</tr>
</tbody>
</table>

*Significant at the 10 percent level.
**Significant at the 5 percent level.
***Significant at the 1 percent level.

Notes. The dependent variables are the quarterly charge-off-to-asset ratio and the provisions-to-asset ratio for each bank between 1986 and summer 1992. The data are pooled, and coefficients estimated using two-stage least squares. The balance sheet data are obtained from Bank Compustat. The book assets used to normalize variables are from the previous quarter. Both estimated equations include a constant whose coefficient is not reported.

The estimates from the regression with charge-offs as the dependent variable are reported in the second column. Charge-offs are significantly positively related to current provisions suggesting that the two decisions are, indeed, related. Charge-offs are also related to the change in the real estate sector since the last quarter as measured by the change in real estate holdings. Finally, charge-offs are significantly positively related to the average charge-
offs by other banks in the quarter (at the 1 percent level). A one-standard-deviation increase in average charge-offs by other banks increases a bank’s charge-offs by 20 percent of its standard deviation.\textsuperscript{33}

To summarize, I find that the Bank of New England’s announcement about loan losses affected the market’s valuation of similar banks and real estate firms. The evidence suggests that these valuation effects stem from information contained in the bank’s announcement about the condition of the real estate sector rather than from information about possible regulatory intervention. I also find that bank quarterly loan loss provisions/charge-offs in New England between 1986 and 1992 are significantly related to the quarterly provisions/charge-offs made by other New England banks. This finding is, of course, subject to the caveats that I mentioned earlier.

IV. DISCUSSION AND SCOPE FOR FUTURE RESEARCH

Why is this a model of financial intermediaries and not just of any industrial firm? I believe that banks and insurance companies have much more leeway in borrowing from the future to massage current earnings. They can do this simply by reducing the quality of the loans they make or the insurance policies they write, and the recipients have no incentive to complain. By contrast, industrial firms can reduce the quality of their output but will immediately face customer outrage.\textsuperscript{34} However, I do not rule out applying this model to industrial firms. For instance, it offers a rationale for why automobile firms in the United States were reluctant to cut dividends in the early nineties, despite their being in a desperate financial situation, and for why they all cut dividends as soon as General Motors took the plunge.

The model provides an alternative view of agency costs at banks which contrasts with the more common view that the deposit insurance put option causes moral hazard and is the

\textsuperscript{33} As a check, I include the ex post annual failure rate for all businesses in New England (as reported in the Dun and Bradstreet Business Failure Record). The change in explanatory power of the regressions is insignificant, suggesting that I have captured the fundamentals (assuming, of course, that the failure rate is a good proxy for fundamentals even though the model suggests it is partly endogenous).

\textsuperscript{34} If this problem is of different magnitudes in industrial and banking firms, we should see differences in how they set management compensation schemes to deal with it. Banking firms should have relatively fewer pay for performance/stock based compensation schemes than industrial firms. Houston and James [1993] provide evidence consistent with this.
WHY BANK CREDIT POLICIES FLUCTUATE

primary reason for regulating bank investment decisions. Unlike the latter, the agency problem I refer to is important even if management is not an owner and even if the bank is well capitalized. While the model provides a rationale for regulation, it also cautions against the excesses of ill-informed regulation. Moreover, regulators could themselves suffer from a similar agency problem (see Boot and Greenbaum [1993]).

Another problem the paper highlights is that of optimal information disclosure. The model shows that requiring more information to be disclosed is not necessarily welfare improving, because it gives banks the incentive to manipulate real activities in order to present a better picture. It is theoretically possible that a decision to allow banks to fudge their accounting and to maintain secret reserves can improve the quality of their lending decisions. This is yet another example of counterintuitive comparative statics in a second-best world, and merits further empirical investigation.

An interesting area for future research is that of the effects that would arise if banks tried to exploit this kind of agency problem against their competitors. For instance, a highly reputable bank might intentionally maintain a facade of normality in adverse times, making it much harder for its less reputable competitors to dump their bad loans. This kind of predatory behavior (or “destructive competition”) could exacerbate the inefficiencies in the model and deserves to be studied.

APPENDIX

Proof of Proposition 1a. Note that the only action being taken is ex post the realization of the state. Therefore, to prove that a strategy is an equilibrium, we have only to show that it is incentive compatible. Also, regardless of whether a bank is a high type or a low type, it faces the same incentive compatibility conditions on seeing a bad loan. Therefore, equilibrium policy is not type dependent, and we do not really care whether the bank knows its own type or not. Let

\( c' = a(1 + \gamma/(1 - \gamma)[p^+(a,a,\pi) - p^-(a,a,\pi)]) \).

From the incentive compatibility condition (3), a liberal credit policy of \( a \) is an equilibrium if and only if \( c \leq c' \). Similarly, a tight credit policy of \( 0 \) is an equilibrium if and only if \( c \geq c'' \), where

\( c'' = a(1 + \gamma/(1 - \gamma)[p^+(0,0,\pi) - p^-(0,0,\pi)]) \).
If the market believes the bank’s policy in the normal state is $a_N$ and $a_A$ in the adverse state, then the bank’s reputation on disclosing positive earnings is

$$p^+(a_N,a_A,\pi) = \frac{\text{prob}(\text{ability} = \text{High} | \text{earnings} > 0,a_N,a_A,\pi)}{[(1 - \pi) + a_A\pi]p + [(1 - \pi)(\theta^L + (1 - \theta^L)a_N) + a_A\pi](1 - p)}.$$  

(4.3)

Conditional on the market observing negative earnings, the bank’s reputation is

$$p^-(a_N,a_A,\pi) = \frac{\text{prob}(\text{ability} = \text{High} | \text{earnings} < 0,a_N,a_A,\pi)}{[\pi(1 - a_A)]p + [\pi(1 - a_A) + (1 - \pi)(1 - \theta^L)(1 - a_N)](1 - p)}.$$  

(4.4)

From simple algebra,

$$p^+(0,0,\pi) > p^+(a,a,\pi),$$  

and

$$p^-(0,0,\pi) = p(a,a,\pi).$$  

This implies that $c'' > c'$. Also, because $p^+ > p^-$, $c' > a$.

QED

Proof that $\pi^+ < \pi^-$. From the definitions of $\pi^+$ and $\pi^-$, it is easily shown that the inequality holds iff $\pi > 0$ and

$$\theta^L a_A^1 + (1 - p)(1 - \theta^L) a_A^1 < p + (1 - p)\theta^L + (1 - p)(1 - \theta^L)a_N^1.$$  

(4.7)

For this not to hold, a minimum condition is

$$a_A^1 > a_N^1.$$  

(4.8)

So the only equilibrium in which $\pi^+ \geq \pi^-$ is one where bank 1’s equilibrium actions are $a_A^1 = a$ and $a_N^1 = 0$. I shall show by contradiction that such an equilibrium cannot exist. Assume it does exist.

Case 1. Bank 2’s equilibrium actions are $a^2_+ = a^2_- = a^2 \in [0,a]$. From the first bank’s incentive compatibility condition, it will
set \( a_N^1 = 0 \) if

\[
(A.9) \quad c > a(1 + (p^2 + (1 - p^2)\theta^L + (1 - p^2)(1 - \theta^L)a^2) \times [p^{1+}(0,a,\pi^2+) - p^{1-}(0,a,\pi^2+)] + (1 - p^2)(1 - \theta^L)(1 - a^2)[p^{1+}(0,a,\pi^2-) - p^{1-}(0,a,\pi^2-)]).
\]

It will set \( a_A^1 = a \) if

\[
(A.10) \quad c < a(1 - a^2[p^{1+}(0,a,\pi^2+) - p^{1-}(0,a,\pi^2+)] + (1 - a^2)[p^{1+}(0,a,\pi^2-) - p^{1-}(0,a,\pi^2-)]).
\]

Noting that \( \pi^2^- > \pi^2^+ \) and using Lemma 1, the right-hand side of (A.10) is less than the right-hand side of (A.9), so that the two inequalities cannot simultaneously hold. Thus, \(((0,a),(a^2, a^2))\) cannot be an equilibrium.

Case 2. Bank 2’s equilibrium actions are \( a^2^+ \neq a^2^- \). The first bank will set \( a_N^1 = 0 \) if

\[
(A.11) \quad (c - a)/a > (p^2 + (1 - p^2)\theta^L + (1 - p^2)(1 - \theta^L)a^2^+) \times p^{1+}(0,a,\pi^2+(a^2^+)) + ((1 - p^2)(1 - \theta^L)(1 - a^2^+))p^{1+}(0,a,\pi^2-(a^2^+)) - (p^2 + (1 - p^2)\theta^L + (1 - p^2)(1 - \theta^L)a^2^-)p^{1-}(0,a,\pi^2+(a^2^-)) - ((1 - p^2)(1 - \theta^L)(1 - a^2^-))p^{1-}(0,a,\pi^2-(a^2^-)).
\]

It will set \( a_A^1 = a \) if

\[
(A.12) \quad (c - a)/a < a^2^+p^{1+}(0,a,\pi^2+(a^2^+)) + (1 - a^2^+)p^{1+}(0,a,\pi^2-(a^2^+)) - a^2^-p^{1-}(0,a,\pi^2+(a^2^-)) - (1 - a^2^-)p^{1-}(0,a,\pi^2-(a^2^-)).
\]

It follows from the definition that

\[
(A.13) \quad \pi^2+(a^2^+) < \pi^2-(a^2^+),
\]

and

\[
(A.14) \quad \pi^2+(a^2^-) < \pi^2-(a^2^-).
\]

If \( a^2^+ = a \) and \( a^2^- = 0 \), then

\[
(A.15) \quad p^{1-}(a_N^1,a_A^1,\pi^2+(a^2^-)) = 0.
\]

Substituting (A.15) in (A.11) and (A.12), using (A.13) and (A.14), and knowing that \( dp^+ / d\pi < 0 \) and \( dp^- / d\pi > 0 \), it is easily shown that the incentive compatibility constraints for the first bank cannot be simultaneously satisfied. A similar exercise shows that
they are not satisfied when \(a^2+ = 0\) and \(a^2- = a\). Thus, \(a^1_A = a\) and \(a^1_N = 0\) cannot be an equilibrium, and \(\pi^{1+} < \pi^{1-}\).

QED

**Proof of Proposition 1b.** The proof is by construction. Define

\[
\begin{align*}
\text{(A.16)} \quad c_1 &= a(1 + [p^2+(a,a,\pi^{1+}(a,a)) - p^2-(a,a,\pi^{1+}(a,a))] ) \\
\text{(A.17)} \quad c_2 &= a(1 + [p^2+(a,a,\pi^{1-}(a,a)) - p^2-(a,a,\pi^{1-}(a,a))] ) \\
\text{(A.18)} \quad c_3 &= a(1 + [p^2+(a,a,\pi^{1-}(a,0)) - p^2-(a,a,\pi^{1-}(a,0))] ),
\end{align*}
\]

where \(\pi^{1+}\) and \(\pi^{1-}\) are defined in the text. Now, \(((a,a),(a,a))\) is an equilibrium only if the second bank’s incentive compatibility constraints are satisfied—only if \(c < \min [c_1, c_2] = c^{2*}\). Now define

\[
\begin{align*}
\text{(A.19)} \quad c_4 &= a(1 + [p^2+(0,0,\pi^{1+}(0,0)) - p^2-(0,0,\pi^{1+}(0,0))] ) , \\
\text{(A.20)} \quad c_5 &= a(1 + [p^2+(0,0,\pi^{1-}(0,0)) - p^2-(0,0,\pi^{1-}(0,0))] ) , \\
\text{(A.21)} \quad c_6 &= a(1 + [p^2+(0,0,\pi^{1-}(a,0)) - p^2-(0,0,\pi^{1-}(a,0))] ) .
\end{align*}
\]

\(((0,0),(0,0))\) is an equilibrium only if \(c \geq \max [c_4, c_5] = c^{2**}\). But \(\pi^{1-}(0,0) = \pi^{1-}(a,a)\). From (A.5) and (A.6) it follows that \(c_5 > c_2\). Thus, the equilibrium regions do not intersect. Furthermore, the cost \(c_3\) is such that if \(c < c_3\), even when the market has the highest prior about the adverse state, \(\pi^{1-}(a,0)\), the second bank does not want to set a tight policy. Thus, \((a,a)\) is the unique possible equilibrium strategy for bank 2 if

\[
\begin{align*}
&c \leq c^{2*U} = \min [c^{2*}, c_3] .
\end{align*}
\]

Similarly, \((0,0)\) is the unique possible equilibrium strategy if

\[
\begin{align*}
&c \geq c^{2**U} = \max [c^{2**}, c_6] .
\end{align*}
\]

If these hold, a necessary condition for these candidates to be equilibria is that the first bank’s incentive compatibility constraint be satisfied. For equilibrium \(((a,a),(a,a))\) to hold, following the same steps, we can derive \(c^{1*}\) such that the first bank’s incentive compatibility condition is satisfied only if \(c \leq c^{1*}\). Now define \(c^* = \min [c^{1*}, c^{2*}], c^{*U} = \min [c^{1*U}, c^{2*U}]\). Similarly, \(c^{**} = \max [c^{1**}, c^{2**}]\) and \(c^{**U} = \max [c^{1**U}, c^{2**U}]\). Thus, (i) holds by construction.

QED

**Proof of Proposition 2.** We have already proved that \(\pi^{1+} < \pi^{1-}\). By Lemma 1, \(a^{2+} \geq a^{2-}\). Furthermore, we have shown that
WHY BANK CREDIT POLICIES FLUCTUATE

(0,a) is never an equilibrium strategy for bank 1. Therefore, \( a_{1}^{1} \geq a_{1}^{-1} \). As discussed in the text, (iii) immediately follows.

QED

Proof of Proposition 3. When the second bank lends alone, we know that it will set a liberal credit policy in both states if \( c^{2} < c' \), where

\[
(A.22) \quad c' = a(1 + [p^{2+}(a,a,\pi) - p^{2-}(a,a,\pi)]).
\]

Now assume that \( c^{2} \leq c' \). When two banks lend, the second bank will set its credit policy to be \((a,0)\) if

\[
(A.23) \quad c^{2} \leq a(1 + [p^{2+}(a,a,\pi^{1+}) - p^{2-}(a,a,\pi^{1+})]).
\]

and

\[
(A.24) \quad c^{2} \geq a(1 + [p^{2+}(0,0,\pi^{1-}) - p^{2-}(0,0,\pi^{1-})]).
\]

Regardless of the first bank’s equilibrium credit policy, because its earnings are informative,

\[
(A.25) \quad \pi^{1+} < \pi < \pi^{1-}.
\]

From Lemma 1 and (A.22), (A.23) is always satisfied when \( c^{2} \leq c' \). But for (A.24) to be satisfied for some \( c^{2} \leq c' \), it must be that

\[
(A.26) \quad p^{2+}(a,a,\pi) - p^{2-}(a,a,\pi) > p^{2+}(0,0,\pi^{1-}) - p^{2-}(0,0,\pi^{1-}).
\]

The left-hand side of (A.26) decreases with \( a \). Using Lemma 1 and (A.25), (A.26) is always satisfied at \( a = 0 \). By continuity, it must be satisfied for all \( a \leq \bar{a} \), where \( \bar{a} \) is a real number greater than zero. Therefore, there is a range \((c_{a},c_{b})\), where \( c_{a} < c_{b} \leq c' \) such that \((a,0)\) is the equilibrium response for the second bank if its cost lies in the range. The proposition holds because the ex ante expected cost to the second bank of a credit policy of \((a,0)\) is strictly better than the ex ante expected cost of a policy \((a,a)\)—which it would maintain if it lent alone. Note that this conclusion is reached independent of the first bank’s equilibrium policies. Similarly, it can be shown that the second bank can be made strictly worse off. Knowing that \( c' < c'' \), the rest of the proposition follows.

QED

Proof of Proposition 4.

(i) By the simultaneous move version of Proposition 2, a necessary and sufficient condition for \((a,a)\) to be an
equilibrium is

\[(A.27)\quad a[p^+(a,a,\pi^+(a,a)) - p^-(a,a,\pi^+(a,a))] + (1 - a)[p^+(a,a,\pi^-(a,a)) - p^-(a,a,\pi^-(a,a))] \geq (c - a)/a.\]

As both \(\pi^+\) and \(\pi^-\) increase in \(\pi_t\), by Lemma 1 the left-hand side of (A.27) decreases in \(\pi_t\). Hence (i) is true, and (10) is sufficient for an equilibrium to exist.

The necessary and sufficient conditions for \((a,0)\) to be an equilibrium as \(\pi \to 0\) are

\[(A.28)\quad (\bar{\theta}_L + (1 - \bar{\theta}_L)a)[p^+(a,0,\pi^+(a,0)) - p^-(a,0,\pi^+(a,0))] + (1 - \bar{\theta}_L)(1 - a)[p^+(a,0,\pi^-(a,0)) - p^-(a,0,\pi^-(a,0))] \geq (c - a)/a\]

and

\[(A.29)\quad [p^+(a,0,\pi^-(a,0)) - p^-(a,0,\pi^-(a,0))] \leq (c - a)/a.\]

It is easily checked that (A.29) does not hold if (10) does.

(ii) Similar to (i).

(iii) This follows directly from the monotonicity of conditions (A.28) and (A.29) in \(\pi_t\).

(iv) This follows directly by comparing the necessary and sufficient conditions for \((a,0)\) and \((0,0)\), or \((a,a)\) and \((0,0)\), to be equilibria simultaneously.

REFERENCES


