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BANKING STABILITY, REPUTATIONAL RENTS, AND THE STOCK MARKET: SHOULD BANK REGULATORS CARE ABOUT STOCK PRICES?

by

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ABSTRACT

In this paper I begin with a model that generates quantity credit rationing by banks in the spot credit market when the stock market is not doing well, i.e., asset prices are low. Then I provide a theoretical rationale for a bank loan commitment as partial insurance against such future rationing. Incorporating uncertainty about both the creditworthiness of borrowers and the abilities of banks to screen borrowers, I show that the reputational concerns of banks can lead to an equilibrium in which loan commitments serve their role in increasing the supply of credit relative to the spot credit market, but produce the inefficiency of excessive credit supply when the stock market is doing well. Despite this, welfare is higher with loan commitments than with spot credit.

I use this result to then examine whether the level of the stock market – and more generally asset prices – should matter to bank regulators. My analysis suggests that it should, but not for the usual reason that a bull stock market could trigger inflation. Rather, it is because reputation-concerned banks lend too much during bull markets, leading to a worsening of credit quality and a higher liability for the federal deposit insurer. More stringent stock market information disclosure rules tend to attenuate this distortion and thus deserve consideration by bank regulators. A regulatory policy implication of the analysis is that regulation should be "state-contingent" – regulatory auditing of bank asset portfolios should be more stringent during bull stock markets, or asset pricing bubbles.

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I. INTRODUCTION

Two issues have recently preoccupied policymakers in financial markets. The first is the role of banks in the business cycle. As banks expand and contract the availability of credit to firms, they affect corporate investments and economic activity. The central bank attempts to influence the supply of credit from banks to corporations by manipulating monetary policy variables such as the money supply, the discount rate and so on (the money channel). But as Stiglitz and Weiss (1981) have observed, the central bank's ability to influence bank lending can be frustrated by quantity credit rationing by banks, i.e., what happens in the credit channel.[1] Such credit rationing takes the form of an unwillingness by the bank to extend further credit, even though the borrower may be willing to pay a higher price than that posted by the bank.

It has been *suggested* that loan commitments—whereby banks sell promises to extend *future* credit at partially-predetermined terms—can help to reduce credit rationing (e.g. Duca and Vanhoose (1990), Morgan (1998), and Woodford (1996)). This intuitive argument, which has not been formalized, is in line with two stylized facts. One is that loan commitments are widely used; a recent Federal Reserve Survey (June 1999) shows that 73% of all commercial and industrial lending is done under commitment contracts and that outstanding (unused) loan commitments of U.S. corporations stood at $1 trillion as of March 31, 1999. The other is that the Federal Reserve's Senior Loan Officer Opinion Survey on Bank Lending (1998) shows that borrowers view the guarantee against credit rationing provided by a loan commitment to be the most important reason for buying a loan commitment.

[1] See also Thakor (1996).

The second issue in recent policy debates is whether the level of the stock market should matter to bank regulators. In the U.S., the question is whether the Federal Reserve should condition monetary policy on the level of stock prices, the potential justification being that a stock price bubble can lead to excessive consumer spending and thus inflation.[2] In a broader context, an issue currently being discussed within the Federal Reserve System is whether bank regulation should be "state contingent" and change with the state of the economy.

These seemingly-unrelated policy issues raise two important and related questions:

(1) Is there a formal theoretical justification for viewing a loan commitment as a guarantee against the kind of (informationally-induced) quantity credit rationing identified by Stiglitz and Weiss (1981)?[3]

(2) Within the context of such a model for loan commitment demand, should bank regulators care about the level of the stock market or more generally about the level of asset prices? That is, should regulation be contingent on the state of the economy?

My answer to each question is yes, but for reasons not explored before. I address these questions with a two-period credit market model of competitive banks. Each bank faces a pool of borrowers that look alike but actually differ in their credit risks. Screening, therefore, becomes important. Additionally, the ability of a bank to screen is *a priori* unknown, and becomes revealed through time by the actions of the bank and the performance of the loans it makes. The bank has reputational concerns due to the possibility of harvesting future reputational rents (see, for example, Holmstrom (1999)).[4] Each borrower learns at the start of

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[2] Ultimately, the Fed's actions are presumably motivated by the goal of minimizing the likelihood of economic instability.

[3] There is a variety of papers that have presented theories in which loan commitments ameliorate informational frictions of various sorts (e.g. Boot, Greenbaum and Thakor (1993), and Shockley (1995)), and others in which there is a link between a bank's deposit-gathering and commitment-lending functions (see Kashyap, Rajan and Stein (2001)). None of these papers formally examines the credit rationing issues, however.

[4] Another relevant paper is Holmstrom and Ricarti Costa (1986). See Prendergast (1999) for a review. While these papers deal with the career concerns of agents, I model the reputational rents of the bank.

the first period whether it needs a loan to finance a project. The project itself becomes available at the start of the second period, and the payoff on the project is observed at the end of the second period. Some borrowers have a choice between a safe (socially preferred) project and risky (socially undesirable) project. At the beginning of the second period, there is also a macroeconomic state variable that is realized, and whose realization affects the average quality of borrower pool. It can be either "high" or "low." When it is "high," the average quality of the borrower pool is high, the riskless rate is low, and the level of the stock market is consequently high. In this state, borrowers who have a choice prefer the safe project. When the state variable is low, average quality of the borrower pool is low, the riskless rate is high, and the level of the stock market is consequently low. In this state, there is asset-substitution moral hazard in that borrowers who have a choice prefer the risky project.

Consider first the spot credit market. In this case, nothing happens in the first period, other than borrowers discovering whether they will need future credit. In the second period, the macroeconomic state variable is realized, each borrower approaches a bank for credit, and each bank screens the borrower (conducts credit analysis) to noiselessly determine its type and decide whether to make the loan.[5] The main result in this case is that no spot credit is extended when the state variable is low, because of asset-substitution moral hazard. The reason for the spot credit rationing is that the bank's cost of funding is so high that it induces some borrowers to prefer the risky project as in Stiglitz and Weiss (1981), and the bank can't break even on lending to anyone. In the high macroeconomic state, all borrowers on whom the credit analysis results are favorable receive credit. The reputational concerns of the bank do not affect the outcome.

In the case with loan commitments, each borrower that needs future credit approaches a bank to purchase a loan commitment that will enable it to borrow in the second period at a rate that is predetermined at the time the commitment is purchased. The bank's credit analysis is now performed in the first period, but it is noisy at this stage. If the analysis reveals the borrower is a good credit risk, the loan commitment is sold and a fee is collected; otherwise, the borrower is rejected. Then in the second period, the macroeconomic state variable is realized. Along with this realization, the bank noiselessly learns the borrower's "type." If it discovers that the borrower is creditworthy, it honors the loan commitment. But if it discovers that the borrower is *not* creditworthy, it can invoke the Material Adverse Change (MAC) clause that is ubiquitous in loan commitment contracts and refuse to honor its commitment to lend.[6] This clause enables the bank to refuse to honor a commitment if the borrower's creditworthiness is deemed by the bank to have deteriorated significantly between the time the commitment was sold and the time it is exercised.

The key to the analysis is that invoking the MAC clause is reputationally costly for the bank. Moreover, the reputational cost is *higher* when the macroeconomic state is high than when it is low. Consequently, the equilibrium entails the bank lending only to creditworthy borrowers when the macroeconomic state is low, but also lending to unworthy credit risks when the macroeconomic state variable is high. That is, in the high state, the bank chooses not to invoke the MAC clause even though it could have.

The most important implication of this result is that, when loan commitments are the predominant channel for the supply of bank credit, there will be an *oversupply* of bank credit during bull stock markets (high macroeconomic state). This will lead to a higher incidence of borrower defaults in subsequent periods. A regulatory policy implication is that a central bank, like the U.S. Federal Reserve, should be concerned about the level of the stock market, not

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[5] The role of banks as information processors has been formalized in many papers. See, for example, Allen (1990) and Dell'Ariccia, Friedman and Marquez (1999).

[6] See Boot, Greenbaum and Thakor (1993). Data on loan commitment contracts are provided in Shockley and Thakor (1997) and its capital structure implications are discussed in Shockley (1995).

because of its highly-debatable ramifications for inflation, but because of the way it could affect bank portfolio choices. The frequency of bank examinations and the intensity of regulatory auditing of the *ex ante* quality of bank asset portfolios should go up during bull stock markets, particularly for banks with relatively high loan commitment exposures. To the best of my knowledge, such a *state-contingent* link between regulatory supervision of a bank and the percentage of its lending done under loan commitments has never previously been proposed. Moreover, since the high macroeconomic state in this model is synonymous with high asset prices, this regulatory implication should be viewed as applying to asset pricing bubbles in general.

Moreover, because banks tend to take on more credit risk when the stock market is high, the contingent liability of the federal deposit insurer (FDIC) is also affected by the level of the stock market.[7] The analysis suggests that more stringent information disclosure rules in the stock market will diminish the bank's ability to influence perceptions of its credit analysis skills. The reason is that more will be known to market participants about the true credit risks of borrowers as these borrowers are forced to disclose more. As this reduces the extent of the bank's gaming behavior, the credit oversupply inefficiency may go down as well. This suggests that bank regulators may favor more stringent information disclosure requirements in financial markets.

The analysis produces many empirical predictions. First, the incidence of defaults by bank borrowers will be higher in periods following bull stock markets. Second, borrowers will experience positive stock price reactions when they purchase bank loan commitments and again when they exercise them. Third, borrowers receiving credit under previously-purchased loan

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[7] For an interesting alternative theory of why bank credit policies fluctuate, see Rajan (1994). He considers a model in which bank managers have career concerns and observe each other's earnings reports; these reports are affected by whether banks cut off credit to bad borrowers or continue to lend to them. This leads to herding behavior

commitments will experience higher stock price reactions during bear stock markets than during bull markets. Fourth, receiving spot credit during a bull market will precipitate a higher stock price reaction than receiving credit during such a market under a previously-purchased loan commitment. Fifth, a bank will experience a positive stock price reaction when it sells a loan commitment, and then again when it honors it.

The intended contribution of this paper is thus threefold. First, it provides a formal justification for loan commitments as insurance against informationally-induced quantity credit rationing in the spot credit market. Second, it provides a justification state-contingent bank regulation that calls for more stringent examinations of bank asset portfolios during asset pricing bubbles. Third, it produces many new empirical predictions.

The rest of the paper is organized as follows. Section II analyzes the spot credit market model. Section III analyzes the equilibrium with loan commitments. Section IV discusses the implications of the analysis. Section V concludes. All proofs are in the Appendix.

II. THE MODEL AND ANALYSIS WITH SPOT CREDIT

In this section I describe the model, focusing first on the spot credit market. The spot credit market equilibrium is examined next. This is followed by introduction of the loan commitment, including an analysis of the loan-commitment equilibrium.

A. The Players and Preferences

The key players are borrowers who need funds to invest in projects and banks. Everybody is risk neutral. While borrowers care only about their expected payoffs at the maturity date of their bank loans, banks are assumed to also have concerns about the present

wherein banks cluster together in overextending credit when the state of the economy is favorable. For a comparison of Rajan's (1994) model and mine, see Section II.

value of their rents beyond the loan maturity date and thus weigh the reputational consequences of their actions in a manner that will be made precise shortly.

B. Time Line and Market Structure

There are three points in time for the first "business cycle" for banks. At date t=0, each borrower discovers whether it has a project it needs funding for. Each project requires a $1 investment at t=0 and will yield a single payoff at t=2. At t=1, every borrower that needs funding approaches a bank in the spot market for a loan. I assume that each borrower has equity E, so that if it decides to use it, the loan amount it would need is 1-E. Banks are initially all observationally identical and perfectly competitive and compete to offer loans that just break even in an expected value sense, given the information set at that time. However, banks care about a sequence of business cycles beyond t=2. We shall deal with the present value of the bank's rents from this sequence.

C. Project Types and Payoffs

There are two types of projects: good (g) and bad (b). Good projects payoff $X > 1 with probability one at t=2. Bad projects pay off $X with probability $\delta \in (0, 1)$ and 0 with probability $1 - \delta$, where $\delta X < 1$. We assume that each project provides the borrower with a private, non-contractible control rent at t=2; this rent is R>0 for the good project and NR, with N>1, for the bad project.[8] From the lender's standpoint then, good projects are worth funding if the cost of financing is not too high, whereas bad projects are never worth funding.

[8] The assumption that the control rent is higher for the bad project is not essential for the analysis, but it expands the set of exogenous parameter values for which the borrower would prefer the bad project, thereby exacerbating asset-substitution moral hazard. Intuitively, I want to capture a situation in which we have a project that is really very bad from an NPV standpoint, but the borrower may still like it because it permits a lot of non-contractible rent expropriation, much more so than the good project.

D. Borrower Types

At t=0, there are three types of borrowers: good (G), bad (B), and those whose types are not yet determined (BG). The G borrower has a choice between a "g" and a "b" project, whereas the B borrower is locked into the b project. No one, including the borrower itself, knows which category the borrower falls in. Everybody has a common prior belief that a randomly-selected borrower has a probability p of being G, q of being B, and 1 – p – q of being BG at t=0. At t=1, it will be determined which category the BG borrowers will belong to: B or G. This determination will be driven by the realization of a state of nature θ that represents a "macroeconomic" state or state of the economy. We assume $\theta \in \{H, L\}$, where H represents a "high" state in which interest rates are low and the economy is "doing well," and L represents a "low" state in which interest rates are high and the economy is "doing poorly."

If θ=H at t=1, every BG borrower becomes a G borrower. If θ=L at t=1, every BG borrower becomes a B borrower.[9] If a borrower applies for a loan to a bank *and* the bank performs credit analysis, the bank and the borrower *privately* discover the borrower's true type (B or G) at t=1. This information is not available to anyone else.

This specification of the macro shock implies that a good realization (θ=H) involves both a low interest rate and better investment opportunities. This describes a situation in which low interest rates help to stimulate consumer demand and improve the profitability of projects for firms. For example, when interest rates fall, typically demand for cars, homes and major home appliances goes up, improving the profitability of projects for automobile manufactures, real estate companies, and makers of home appliances like Maytag and Whirlpool[10].

[9] This is simply a modeling device to introduce a correlation between the average quality of the borrower pool and the state of the economy.
[10] Alternative specifications of the macro shock are clearly possible in which there is a finer partitioning of the state space. With this finer partition, low interest rates may be accompanied sometimes by good investment opportunities (high asset prices) and sometimes by poor investment opportunities (low to medium asset prices). What I want to

E. Bank Types

At t=0, there is uncertainty about the bank's type. Nobody, including the bank, knows its type. The prior probability is $\alpha \in (0,1)$ that the bank is "talented" (T) and it is $1 - \alpha$ that it is "not talented" (N). This type uncertainty is relevant only if the bank is screening borrowers at t=0, because in that case the identification of the borrower's type is based on a noisy credit-analysis signal ϕ, and the precision of the T bank's signal is higher than that of the N bank's signal. This will play a role in the case with the loan commitments because the bank has to decide who to sell commitments to at t=0, but not with spot credit where all decisions are made at t=1 when the bank's credit analysis reveals the borrower's type noiselessly, regardless of the bank's type. The idea is that over time, *all* banks that conduct credit analysis are able to learn what they need to about their borrowers, but the more talented banks are able to gather more precise information *earlier* in the process. We will describe the signals the T and N banks receive when we examine loan commitments.

F. Who Knows What and When

At t=0 the borrower finds out whether it needs credit but is unaware of its type. Nothing else happens at this time in the spot credit market. At t=1, the state of the economy, θ, is realized, and everybody discovers whether it is H or L. Now each borrower that needs credit approaches a bank in the spot credit market. The bank approached by the borrower performs credit analysis and consequently the borrower and the bank become privately informed about the borrower's type, but all that is common knowledge is that it is more likely that the borrower is G if θ=H than if θ=L. It is not known whether the bank manager is T or N, but there are common

describe is a situation in which there is simultaneously a plentiful supply of credit (low rates) and high asset prices (a bull stock market). So, consideration of a finer partitioning of the state space would produce additional notational clutter without affecting the conclusions.

priors over the bank's type. If credit is extended at t=1, the payoff on the borrower's project is realized at t=2 and the bank is paid if possible.

The bank's cost of funds is the riskless rate. The single-period rate covering the first period is zero at t=0, and it is random at t=1. If θ=H at t=1, this rate is $C_H - 1>0$, whereas if θ=L at t=1, this rate is $C_L - 1 > C_H - 1$. Thus, the relevant interest factors (one plus the interest rate) in the second period are C_H and C_L. We assume $X > C_L$. We assume that the single-period interest factor for all periods beyond t=2 is the interest factor realized at t=1. Moreover, the borrower's equity is small enough that $C_H[1-E]>1$.

G. The Stock Market

Investors in the stock market do not have access to any of the private information possessed by banks and borrowers. Thus, at t=1 after the state θ is realized, the price of a firm borrowing in the spot market is given by:

$$P_1^S = E\left(\tilde{x} \mid \Omega_1\right)$$

where $E(\bullet \mid \bullet)$ is the conditional expected present value operator at t=1, $\tilde{x}$ is the net expected payoff (net of its repayment obligation under the loan) to the borrowing firm at t=2, and Ω_1 is the market's information set about the borrower at t=1. Clearly, $\Omega_1 = \{\hat{\theta}, |, d\}$, where $\hat{\theta}$ is the realization of θ, $|$ is the bank's credit *policy* in equilibrium (i.e., the market's beliefs about *how* the bank will make its credit-granting decision) and d is the bank's decision of whether to give the borrower a loan or not at t=1, i.e., $d \in \{A, R\}$, where "A" means accept the borrower and grant credit and "R" means reject the borrower. It is easy to see that

$$E(\tilde{x} \mid \{H, |, d\}) = P_1^S(H,d) > E(\tilde{x} \mid \{L, |, d\}) = P_1^S(L,d).$$

That is, holding the bank's credit policy and credit decision fixed, the borrower's stock price is higher in the H state than in the L state. The reason is that if we hold $|$ and d fixed, then the distribution of $\tilde{x}$ is the same for θ=H as for θ=L. Thus, the only difference between the two states is the interest factor, which is higher in the L state, i.e., $C_L > C_H$. This makes the present value at t=1 smaller in the L state than in the H state. Similarly,

$$E(\tilde{x} \mid \{\hat{\theta}, |, A\}) = P_1^s(\hat{\theta}, A) \geq E(\tilde{x} \mid \{\hat{\theta}, |, R\}) = P_1^s(\hat{\theta}, R)$$

which simply says that, holding $\hat{\theta}$ and $|$ constant, the borrower's stock price can't be worse if it receives a loan than if it does not.

H. Objective Function of Bank

A key to the model is that each bank cares not only about the payoff on the loan it makes at t=1, but also about the present value of its payoffs beyond t=2. That is, the bank may care about the perceived value of its credit-analysis ability at t=2. The reason for this is that new borrowers at t=2 may be concerned abut whether it is an N or a T bank they are dealing with because the bank's type affects the borrower's welfare (this will be verified later; see Proposition 6 in Section III). We assume that there is an unlimited number of *de novo* banks at t=2 that borrowers could approach for credit in business cycles beyond the one we focus on. Each *de novo* bank has a reputation of α, i.e., Pr(T) = α. However, a bank that has made loans prior to t=2 may develop a reputation that differs from α. If the bank's reputation exceeds α, we assume it can earn a rent on its lending at t=2 and beyond that is proportional to the difference between its reputation and α.[11] If the bank's reputation is less than α, it cannot acquire any more business at t=2. Thus, the bank's objective function is to maximize

$$V = ay + b(C_i)\max\{[P_2(T \mid \Omega) - \alpha], 0\} \qquad (1)$$

[11] This is similar to the setup about reputational rents in Boot, Greenbaum and Thakor (1993).

where a > 0 is an exogenous constant, $b(C_i) > 0\ \forall C_i$, y is the bank's net payoff at t=2 from lending (or not lending) to the borrower at t=1, and $\Pr(T \mid \Omega)$ is the posterior probability that the bank is T, conditional on the market's information set, Ω, at t=2.[12] Note that $b(C_i)$ is a function of the interest factor C_i to reflect the fact that the present value of the bank's rents beyond t=2, assessed at t=2, will depend on the prevailing interest rate. That is, $b(C_H) > b(C_L)$.

I. The Myopic Credit Market Equilibrium

By a "myopic" equilibrium, I mean one in which the bank cares only about its first-business-cycle payoff at t=2, and not its reputation-dependent payoff beyond t=2. For this analysis, I want to focus on parameter values such that banks are willing to lend to only G borrowers when θ=H, and are unwilling to extend credit to any borrowers when θ=L. The reason for focusing on this case is that it provides the basis for the loan commitment to create value as a guarantee against the (quantity) rationing of credit that would occur in the spot market (in state L). Let r_L^G be the loan interest factor (one plus the interest rate) the bank would charge a G borrower when θ=L, if the bank believed the borrower would choose project g. Similarly, let r_L^B be the loan interest factor the bank would charge a B borrower or a G borrower it believes will choose project b when θ=L. It is obvious that each of these rates must be the rate at which the (competitive) bank just breaks even. The reason is that there are only two types of credit risks—g and b. If the credit risk is b, the bank should simply deny credit, so its willingness to extend credit must mean that the credit risk is g, in which case any attempt to charge a higher rate should invite a (Bertrand) competitor to undercut the bank's price.

Now, it is apparent that $r_H^G = C_H$, and that the rate the bank would like to charge to break even when θ=L is C_L (with a repayment obligation of $C_L[1-E]$ if the borrower puts up E in

[12] Clealry, $y \in \Omega$.

equity) if the borrower is G and can be assumed to choose the g project, and it is C_L/δ (with a repayment obligation of $C_L[1\text{-}E]/\delta$) if this borrower chooses the b project. However, since $C_L[1\text{-}E]/\delta > X$, there is no rate at which the bank can break even on a loan to a borrower investing in a b project. We assume that the following parametric restriction holds:

$$X - C_H + R > \delta[X - C_H] + NR$$

i.e., the G borrower prefers the g project to the b project when the repayment obligation is C_H, and even if there is no equity participation. We further assume that

$$X - C_L[1\text{-}E] + R < \delta[X - C_L[1\text{-}E]] + NR$$

i.e., the G borrower prefers the b project to the g project even with equity participation of E if the loan is priced at C_L (the source of the asset-substitution moral hazard). This means that banks will not extend credit to any borrowers when θ=L. Combining the above inequalities gives us a single parametric restriction (PR)

$$[X - C_H][1 - \delta] > R[N - 1] > [X - C_L[1\text{-}E]]\,[1 - \delta] \qquad \text{(PR-1)}$$

Let r* be the critical loan interest factor (one plus the interest rate) such that the borrower is indifferent between the good and bad projects:

$$X - r^* + R = \delta[X - r^*] + NR.$$

That is, $r^* = X - \dfrac{R[N-1]}{1-\delta}$. (2)

It is clear from (PR-1) that $r^* \in (C_H, C_L)$. Note that if the borrower puts up E in equity, the critical loan interest factor becomes $\hat{r}^* = r^*[1\text{-}E]^{-1} > r^*$.

Figure 1 shows the equilibrium that is stated in Proposition 1.

Figure 1 goes here

Proposition 1: *The myopic equilibrium in the spot credit market at t=1 entails the following. If the state of the economy is θ=H, all borrowers that need funds approach banks. Each receives a \$1-E loan with a repayment obligation of* r_H^G *[1-E], where* r_H^G *=* C_H*, if the bank's credit analysis reveals the borrower is type G and is denied credit if it reveals the borrower is type B. If the state of the economy is θ=L, no borrowers approach banks because they know they will be denied credit regardless of the bank's credit analysis signal. After the bank's credit-granting decision becomes known, the firm's stock prices are:*

$$P_1^S(H,A) > P_1^S(L) = P_1^S(H,R) = 0 .$$

The intuition behind Proposition 1 is straightforward. When θ=L, the riskless rate is so high that even a G borrower's repayment obligation with a g project is too high to induce it to invest in the g project and give up the non-contractible private control rent, NR, available with the b project. This asset-substitution moral hazard induces the bank to ration credit, as in Stiglitz and Weiss (1981), when θ=L. In the θ=H state, the riskless rate is low enough that the bank can price its loan to both break even and coax the G borrower to choose b. So, credit is extended to G borrowers. From this, it is clear that the firm will enjoy its highest stock price when θ=H and it receives credit. In all other states, it cannot invest in the project and hence is worthless.

This result should be interpreted as characterizing a situation in which a correlation between a macroeconomic state variable (which implies a high funding cost for banks) and individual borrowers' credit risks leads banks to ration credit. Although for simplicity I have chosen to consider the case in which *all* borrowers are rationed in a particular state, in a more general version of this model a subset of borrowers would be rationed.

Because the borrower does have \$ E in equity, using it to partly finance the project increases the critical loan interest rate above which asset-substitution moral hazard is triggered.

However, the parametric assumptions are such that this equity is not enough to deter moral hazard. The consequence of this is described in the result below.

Lemma 1*: The borrower's welfare is unaffected by whether it uses its equity to reduce the loan amount to \$1-E or borrows \$1.*

The intuition is that the borrower is risk neutral, loans are competitively priced, and the opportunity cost of equity for the borrower is the same as the opportunity cost of funds for the bank. The only way equity can make a difference in this setting is if alters the borrower's project choice and makes the bank willing to lend in a state in which it would not lend without the equity. Since that does not happen here, the borrower's welfare is unaffected by E. Given this, I will assume, for notational parsimony, that the borrower avoids equity participation and borrows \$1 in the spot market. Equity will have a bigger role to play with loan commitments.

So far I have considered what would happen if banks were only maximizing their payoff between t=1 and t=2. I now consider the behavior of banks that maximize (1).

J. The Spot Credit Market Equilibrium with Reputational Concerns

In this case the bank is also concerned about its reputation at t=2 and the present value of its future business at that time. Consider first θ=H. Since *both* the T and N banks observe the *same* information about a borrower's type, they should both make the same credit granting decision. Hence, the borrower's repayment outcome at t=2 reveals nothing about the bank's type. In equilibrium, the borrower does not default and hence nothing is revealed about the bank anyway. If the bank makes an out-of-equilibrium choice and loans to a B borrower, it loses money on the first-period loan in an expected value sense. If the borrower repays the loan, the market does not discover an out-of-equilibrium move was made and there is no reputational gain (i.e., the belief about the bank's type remains the same as the prices). There is also no reputational gain if the borrower defaults and the market does realize that an out-of-equilibrium move was made. The reason is that the bank did not know its own type when it made the move, so no information is revealed by the default. A similar argument shows that there is no reputational gain in lending to any borrower when θ=L. Hence, the myopic equilibrium is obtained even when the bank cares about reputational rents.

Proposition 2: *When the state of the economy is* θ*=H, the reputation-conscious bank continues to implement the myopic spot credit policy in the reputational Nash equilibrium, extending credit to G borrowers and denying credit to B borrowers when* θ*=H, and denying credit to all borrowers when* θ*=L. This equilibrium is also sequential (Kreps and Wilson (1982)) and is universally divine (Banks and Sobel (1987)) with the posterior belief that any bank that lends to a borrower when* θ*=L or lends to a borrower when* θ*=H but then faces borrower default at t=2 is type N with probability one. After the bank's credit-granting decision is known, the firm's stock prices are:*

$$P_1^s(H,A) > P_1^s(L) = P_1^s(H,R) = 0\,.$$

The reason why the reputation-conscious bank does not deviate from the myopic policy is that there is no tension between the two parts of the bank's objective function, ay and b max{[Pr(T|Ω) – α], 0}. The inefficiency of this equilibrium is that too little credit is extended when θ=L since even the good (G) borrowers are unable to obtain loans. We will see in the next section that this can open the door to a loan commitment as a way to increase credit availability. As before, the borrower's highest stock price is when θ=H and it receives credit.

This result provides an interesting contrast to Rajan's (1994) result that banks provides *too much* spot credit when the state of the economy is favorable and just the right amount of spot credit when the state of the economy is unfavorable. In the model here, there is just the right amount of spot credit provided when the state of the economy is favorable and too little credit when the state of the economy is unfavorable.

A second important difference between Rajan's (1994) spot credit result and the one here is that the economic state is *unobservable* to everyone but banks in Rajan (1994). Thus, his model predicts credit herding by banks but *not* any correlation between credit extension and *observable* state variables like the stock market. By contrast, since θ is an observable state in my model and stock prices are higher when $\theta=H$ than when $\theta=L$, the model predicts that there will be just the right amount of spot credit extended during a "bull" stock market and too little extended during a "bear" stock market.

Finally, the source of credit rationing in my model is asset-substitution moral hazard, a feature that is absent in Rajan (1994).[13]

III: THE MODEL AND ANALYSIS WITH A LOAN COMMITMENT

A loan commitment is defined as a contract that gives the borrower the option to borrow in the future at (partially) predetermined terms. The option belongs to the borrower, so the bank cannot refuse to lend even if by doing so it stands to incur an expected loss. The borrower, by contrast, can walk away if it locates cheaper credit in the spot market. The only exception to the bank's obligation to lend is if it discovers that the borrower's financial condition has deteriorated sufficiently significantly from the time it sold the loan commitment to the time it must decide to extend the loan. In this case, the bank can invoke the Material Adverse Change (MAC) clause in the loan commitment contract and refuse to honor its commitment. As Boot, Greenbaum and Thakor (1993) have show, invoking the MAC clause has two effects. On the one hand, it

[13] Other differences are as follows. My focus is on the difference between loan commitments and spot credit, whereas Rajan focuses exclusively on the extension of previously-granted spot credit. Moreover, Rajan's is a model of career concerns, whereas I examine reputational rents. Thus, I do not need to worry about how compensation contracts may be used to deter the manager from pursuing career goals in conflict with the shareholders' interests.

preserves some of the financial capital the bank would have lost by lending to a borrower that was not creditworthy. On the other hand, it depreciates some of the bank's reputational capital built up over time by honoring its commitments.[14]

A. Sequence of Events and Who Knows What and When

At t=0, the borrower finds out whether it has a project, but not what kind of project. If it has a project, it approaches a bank to purchase a loan commitment that gives it the option to borrow \$1 at t=1 at a predetermined interest rate. It pays a fee, F, at t=0 for this commitment, by using its equity E. For simplicity, I assume that F is approximately equal to E, so that once F is paid, the borrower has virtually no equity left, and must borrow \$1 under the commitment. At t=0, nobody is aware of the bank's type, but there is a commonly-shared prior belief $\alpha \in (0, 1)$ that the bank is T. Moreover, nobody is aware of the borrower's type either, but there is a commonly-shared prior belief that the probability is p that the borrower is G, 1 – p – q that it is BG, and q that it is B. However, the bank conducts credit analysis prior to deciding whether to sell the borrower a loan commitment. This generates a signal ϕ about the borrower's type at t=0 that is *privately* observed only by the bank. The probability distribution of ϕ is as follows:

Pr(ϕ = i | borrower's true type j, bank manager's type k)

$$= \begin{cases} 1 & \text{if } i = j, \quad j \in \{G, B\}, \quad k = T \\ 0 & \text{if } i \neq j, \quad j \in \{G, B\}, \quad k = T \\ \beta \in (0,1) & \text{if } i = G, \quad j = BG, \quad k \in \{N, T\} \\ \beta & \text{if } i = G, \quad j \in \{B, G\}, \quad k = N \\ 1-\beta & \text{if } i = B, \quad j = BG, \quad k \in \{N, T\} \\ 1-\beta & \text{if } i = B, \quad j \in \{B, G\}, \quad k = N \end{cases} \tag{15}$$

[14] Loan commitments may be thought of as "relationship lending" whereas spot lending may be thought of as "transaction lending" (see Boot and Thakor (2000) and Dinc (2000)). See also Sharpe (1990) and Rajan (1992) for models that illuminate the relationship nature of bank lending. There is an older literature on bank-customer relationships and how they affect lending decisions. See Kane and Malkiel (1965).

Thus, the T-type bank receives a perfect signal about the borrower's type and the N-type bank receives a completely uninformative signal as long as the borrower's type is either B or G. If the borrower's type is BG, both the T and N bank are equally ineffective in screening, since each receives an uninformative signal ϕ = G with probability β. Thus, the effect of the bank's talent diminishes as the proportion of BG types, $1 - p - q$, increases.

I will confine my attention to parameter values such that the bank, in the first-best case, will sell the loan commitment to a borrower on whom ϕ = G is observed and decline selling it if ϕ = B is observed.

Now consider a borrower that purchased a loan commitment at t=0 that commits the bank to lend \$1 at t=1 at an interest factor $\bar{r}$ that is determined at t=-0. Thus, the loan commitment sold at t=0 is a contract $\{F, \bar{r}\}$.[15] At t=1, the state θ is first realized. This realization becomes common knowledge. If θ=H, all the BG borrowers become G borrowers, and if θ=L, all the BG borrowers become B borrowers. Next, each borrower and the bank it purchased the loan commitment from noiselessly learn the borrower's type. After this, the bank decides whether to honor its loan commitment and lend to the borrower at t=1. Note that, as in the spot credit case, the information about the borrower's type that is generated at t=1 is *privately* observed by the bank and the borrower; the market remains uninformed about the borrower's type at t=1.

The bank can invoke the MAC clause and refuse to honor its commitment if it discovers that the borrower is B.[16] We assume that a borrower who is denied credit under a loan commitment can sue the bank for contractual non-performance. If the borrower is B, it would lose in such legal action. But if the borrower is G, it is sure to win. The only role played by this

[15] The fee F should be viewed as the price of the put option sold by the bank to the borrower when it issues a commitment.
[16] The MAC clause is intended for situations in which the bank receives new information after it sells the commitment. This is clearly true here for the BG borrowers whose types are determined at t=1. It is also true for

assumption about the legal system is to ensure that the bank won't refuse to honor its commitment to a G borrower, but it *may* choose to do so when the borrower's type is B.

Figure 2 shows the sequence of events in the loan commitment case. Unlike *Figure 1*, this merely describes the payoffs assuming the borrower is able to invest in the project at t=1. Thus, it ignores the possibility that a B borrower would not be able to borrow at t=1. Throughout I assume that all of the bank's decisions (sell or not sell the loan commitment, the commitment fee, the borrowing rate under the commitment, and whether to lend or refuse to lend under the commitment) are publicly observable. Only the realizations of ϕ at t=0 and the borrower's type at t=1 are privately observed by the bank.

Figure 2 goes here

It should be clear that any borrower denied credit under a loan commitment at t=1 by a bank invoking the MAC clause will not be able to obtain credit from another bank. The reason is that the loan commitment seller's credit denial indicates it is a B borrower. Even if this were not the case, the borrower would have to approach another bank and be screened by it. This screening would reveal the borrower to be B and credit would be denied. However, a G borrower that decides not to borrow under a previously-purchased commitment can always access the spot credit market and have itself screened by another bank in order to obtain spot credit.

B. The Stock Market

A borrower that succeeded in purchasing a loan commitment at t=0 will experience the following stock price at t=1:

the B and G borrowers since, even though their types were determined at t=0, the bank acquires *new* information about them *after* selling the commitment at t=0.

$$P_1^{\ell} = E(\tilde{x} \mid \Omega_1).$$

Here $\Omega_1 = \{\hat{\theta}, |, d\}$,, where $\hat{\theta}$ is the realization of θ, $|_{\ell}$ is the bank's credit-granting policy at t=1 under a commitment sold at t=0, and $d \in \{A,R\}$ represents the bank's decision to give the firm a loan (A) at t=1 or reject the firm by invoking the MAC clause (R). Once again

$$E(\tilde{x} \mid \{H, |_{\ell}, d\}) > E(\tilde{x} \mid \{L, |_{\ell}, d\}) \text{ and}$$

$$E(\tilde{x} \mid \{\hat{\theta}, |_{\ell}, A\}) \geq E(\tilde{x} \mid \{\hat{\theta}, |_{\ell}, R\}).$$

C. The Loan Commitment Equilibrium

Once again, the myopic equilibrium is the outcome when the bank maximizes its payoff between t=0 and t=2 and ignores payoffs beyond t=2. To analyze this outcome, let us work backwards from t=1. It is clear that at this time, since the bank has discovered each borrower's type, it will honor the loan commitment and lend to the G borrowers, and invoke the MAC clause for the B borrowers, regardless of the realization of θ.

What will happen at t=0? If there was a sufficiently large cost to not honoring a commitment, the bank would sell commitments to borrowers on which it observes ϕ=G and deny credit to the ϕ=B borrowers. But we have assumed no such direct cost. There may be reputational costs associated with not honoring a commitment at t=1, but these costs would concern the bank only if it cared about its payoffs beyond t=2. So the bank will sell commitments to all applicants at t=0, offering each the same $\{F, \bar{r}\}$ contract, and then rejecting the B borrowers at t=1. This leads to the next proposition.

Proposition 3: *In the unique myopic loan commitment equilibrium, the bank sells loan commitments to all applicants at t=0, regardless of* ϕ*. The only commitment contract sold in equilibrium is of the form* $\{F_G, \bar{r}\}$ *where* $\bar{r} = r^*$*, and* F_G *is set so that the expected profit on the loan commitment is zero if the bank has observed* ϕ*=G and positive if it has observed* ϕ*=B. At* *t=1, the bank learns each borrower's type and honors its commitment if the borrower is G, invoking the MAC clause if the borrower is B. The G borrower takes down the commitment if* θ*=L and borrows in the spot credit market rather than under the commitment if* θ*=H.*

The intuition is as follows. The bank can set the commitment borrowing rate anywhere in the interval [0, r*] and still ensure that the G borrower will choose the g project at t=1. At t=0, even though the bank's credit analysis signal ϕ distinguishes between borrowers, the bank has no incentive to deny a commitment to a borrower with ϕ=B because at t=1 it will learn the borrower's type with certainty and thus can invoke the MAC clause on the B borrowers then. In principle, the bank would like to offer two contracts, $\{F_G^*, \bar{r}\}$ to the borrowers on which ϕ=G is observed, and $\{F_B^*, \bar{r}\}$ to the borrowers on which ϕ=B is observed. However, since F_G^* and F_B^* are simply the present values of the interest rate subsidies to be received by the respective borrowers in the future, it is clear that $F_G^* > F_B^*$ because the ϕ=G borrower is more likely to receive credit at t=1 and take advantage of the interest rate subsidy. Hence, the bank which *privately* observes ϕ will always offer the contract $\{F_G^*, \bar{r}\}$ regardless of the observed ϕ. This means it earns zero expected profit when ϕ=G because competition will force F_G^* to be set exactly equal to the present value of the interest rate subsidy to a ϕ=G borrower. But it will earn *positive* expected profit when ϕ=B.

The borrower will wish to minimize the bank's positive profit. The way to do this is to minimize the interest rate subsidy by setting $\bar{r} = r^*$. Since r* > C_H, the G borrower will find it cheaper to borrow in the spot credit market at C_H by having another bank perform credit analysis and discover it is G.

D. The Reputational Equilibrium With a Loan Commitment

I now examine what happens when the bank cares about its payoffs beyond t=2 and hence its reputation at t=1.

It is possible that a bank with reputational concerns may wish to behave differently from what we have characterized in Proposition 3. If it observes ϕ=G, then it is clear it will wish to give a commitment since extending credit at t=1 has reputational benefits for the bank. If it observes $\phi = B$, it may wish to decline to sell a commitment because of the high probability that the borrower will turn out to be a B borrower at t=1 and refusing to lend to such a borrower may impose too much reputational damage on the bank. We now state our final two parameteric restrictions:

$$\beta < \frac{p}{p+q} \tag{PR-2}$$

This restriction ensures that signal $\phi = G$ at t=0 conveys more favorable information about the bank's talent than a signal $\phi = B$. Further,

$$\frac{\alpha}{1-\alpha} > \beta \text{ and } \alpha < 1/4 \tag{PR-3}$$

This restriction is sufficient for the bank to make a negative expected profit on selling a loan commitment to a ϕ=B borrower and collecting a commitment fee appropriate for a ϕ=G borrower, ignoring reputational payoffs.

Proposition 4: *In a loan commitment equilibrium with reputational concerns on the part of the bank that uses a loan commitment contract with a MAC clause, the following constitutes a universally divine sequential equilibrium under the appropriate constellation of exogenous parameter values:*[17]

[17] See Kreps and Wilson (1982) and Banks and Sobel (1987).

(i) *At t=0, the bank sells a loan commitment to a borrower on which $\phi = G$ is observed and denies a loan commitment to a borrower on which $\phi = B$ is observed.*

(ii) *At t=1, the bank honors the commitment and lends when θ=H is realized, regardless of the borrower's observed type at t=1. When θ=L is realized, it lends only if the borrower is G and invokes the MAC clause whenever the borrower is B.*

(iii) *A borrower purchasing a loan commitment experiences a positive stock price reaction at t=0. Before banks' lending decisions under previously-sold commitments become known at t=1, borrowers' stock prices are higher if θ=H than if θ=L. While there is no stock price reaction to a borrower receiving credit when θ=H, the borrower's stock price increases upon receiving credit when θ=L.*

(iv) *When a bank sells a loan commitment at t=0, it will experience a positive price reaction in its own stock, and a further positive price reaction when it honors the commitment at t=1.*

(v) *The market revises its beliefs using Bayes rule whenever it observes an equilibrium move. If the bank invokes the MAC clause and denies credit when θ=H, the market's posterior belief is that the bank is N with probability one.*

This proposition indicates five key points. First, the result that the bank sells a loan commitment when $\phi = \text{G}$ and not when $\phi = \text{B}$ is predicated solely on reputational concerns. That is, the bank does not wish to sell a commitment when $\phi = \text{B}$ because of the potential damage to its future reputation. This is in sharp contrast to the case in which the bank has no reputational concerns. The key here is that a ϕ=B signal elevates the likelihood of encountering a B borrower at t=1. Because the reputational damage in invoking the MAC clause then, the banks knows it will lend even to a B borrower in the θ=H state. To avoid this future financial loss, the bank prefers to not sell a commitment to a ϕ=B borrower.

Second, the basic rationale for purchasing a loan commitment as partial insurance against quantity credit rationing during an economic downturn holds. When θ=L, and the stock market is "bearish," more credit is available with a loan commitment than in the spot credit market.

Third, the loan-commitment equilibrium involves an inefficiency in that credit is provided to a B borrower in the θ=H state. That is, there is an oversupply of credit under loan commitments during bull stock markets. This happens solely due to the reputational concerns of the bank. Since such an inefficiency is not encountered with the myopic equilibrium, it would be tempting to think of a bank precommiting to ignore its credit-analysis signal ϕ and extending credit to all borrowers who purchased the loan commitment. However, as long as the commitment has a MAC clause,[18] such a precommitment is not credible (see proof of Proposition 4).

Fourth, because the bank's decision to sell a commitment at t=0 is based on an informative signal, the borrower will experience a positive stock price reaction at t=0 when it purchases a commitment. Moreover, when borrowers obtain loans under previously-purchased commitments, they do not experience any stock price reaction during a bull stock market because banks don't reject any borrowers when θ=H; consequently, there is no information content in the extension of credit. There is, however, a positive stock price reaction if the borrower receives credit during a bear stock market because the equilibrium entails bad borrowers being denied credit when θ=L.

Fifth, like the borrower, the bank too experiences a positive stock price reaction when it sells a loan commitment at t=0 and then another positive reaction when it honors the commitment at t=1. The reason is that in each case the bank's reputation as a T bank improves, leading to a higher expectation of future reputation-related rents.

In the H state, there is an oversupply of credit in the sense that the bank is extending loans on which it makes an expected loss. The intuition is as follows. A bank that observes a B borrower in the θ=H state knows that it is type N, since in this state of the economy a type-T bank would never have encountered a B borrower (see *Figure 2*). So if it invokes the MAC clause and denies credit to the borrower, it unambiguously identifies itself as an N bank. By lending, it has a probability δ of avoiding this fate.

Why is there an oversupply of credit in the H state and not the L state? The reason is that the reputational loss to the bank from invoking the MAC clause differs across the H and L states. For one thing, in the L state, even a talented (T) bank may encounter a bad (B) borrower, so the reputational damage from telling the market that the borrower is B is relatively low. By contrast, in the H state it is impossible for a T bank to encounter a B borrower, so acknowledging such a borrower is reputationally relatively more costly. More importantly, the interest (discount) rate is lower in the H state, leading to $b(C_H) > b(C_L)$, and hence the *present value* of the bank's future reputational rents is higher when θ=H than when θ=L. That is, the marginal value of developing a reputation is higher for the bank in the H state.

Thus, we have an interesting contrast between the spot credit and loan commitment cases. In the spot credit case, there is too little credit extended. In the loan commitment case, too much credit is extended.

This result, while derived in the context of a specific model of the credit market, has broader implications for the career-concerns literature. In particular, it highlights the importance of the impact of *observable* state variables on *unobservable actions* that have reputational consequences. The reason why the overlending distortion occurs in the θ=H state is that in this state, the value of reputation is greater. This strengthens the incentive of some of the banks to

[18] I do not address the question of why the loan commitment has a MAC clause, since I take the contract as given.

hide what they see. Specifically, the bank that has discovered it is N wants to protect its reputational capital by mimicking the actions of the T bank, even if this entails lending to a bad borrower. Taken to a principal-agent setting, this means that observable realizations of state variables that make observable decisions reveal "too much" information about unobservable signals cause career-conscious agents to engage more strongly in signal-jamming. A potentially important implication of this is that the principal may want to condition a host of things—incentive contracts, extent of agent monitoring and task assignments—on the observed realizations of some state variables.

IV. WELFARE COMPARISONS AND IMPLICATIONS FOR BANK REGULATORS

In this section I have three goals. First, I will compare the reputational equilibria in the spot-credit and loan-commitment cases from the standpoint of overall welfare. Second, I will discuss the implications of the analysis for bank regulators. And finally, I will explore the connotations of the analysis for stock market information disclosure rules and deposit insurance.

A. Welfare Comparison

The following result provides a welfare comparison.

Proposition 5*: Assuming that $(X - C_L + R)/R$ is large enough, welfare is higher in the reputational loan-commitment equilibrium than in the reputational spot credit equilibrium.*

The intuition for the condition under which a loan commitment Pareto dominates is as follows. The source of value enhancement with a loan commitment is the expanded availability of credit when θ=L. The value to the borrower of this expanded availability of credit is proportional to the surplus it loses when it is denied spot credit, which is $\frac{X - C_L + R}{C_L}$.

Boot, Greenbaum and Thakor (1993) endogenize the MAC clause in loan commitments.

We have assumed throughout that a bank with a better reputation at t=2 will enjoy higher profits beyond t=2. We now show that this is because more reputable banks produce higher expected utilities for borrowers even when they charge higher loan commitment prices commensurate with their reputations.

Proposition 6: *The borrower's welfare is increasing in the bank's reputation.*

The intuition is as follows. An increase in the bank's reputation makes it more likely that a borrower that has purchased a commitment at t=0 will actually receive credit at t=1 in states in which it should get a loan and less likely that it will be given credit at t=1 when θ=H and the borrower is B. Since the borrower has to pay *ex ante* a higher commitment fee for receiving credit in a state in which it should not, it prefers a transaction in which there is a stronger precommitment by the bank to not do so.

Since borrowers prefer to deal with more reputable banks, these banks will be able to charge higher prices at t=2 and earn reputational rents relative to *de novo* banks with reputations of α. This justifies the form of the objective function (1).

B. Regulatory Policy Implication

The analysis reveals that when the stock market is doing well and asset prices are high (θ=H and interest rates are low), banks lend excessively under previously-sold loan commitments. This means that the average credit quality of the borrower pool that obtains credit is worse during "bull" markets (θ=H) than during "bear" markets (θ=L). The impact of this worsening of credit quality through endogenous bank portfolio choices will be manifested in a higher incidence of borrower defaults *following* bull markets. This is a clear testable prediction of the model. I am unaware of any existing empirical evidence on this score.

This has an implication for a central bank like the U.S. Federal Reserve Bank. When asset prices are high, the Fed should anticipate that bank loan portfolios will worsen in credit quality and the effects of this will be observed in subsequent periods. In particular, the banking sector will suffer a decline in stability following a bull stock market. This creates a reason for the Fed to be "concerned" about the level of the market and the oversupply of credit during bull markets. The policy prescription from this is that regulatory auditing of bank loan portfolios should intensify during bull stock markets. This could involve more frequent examinations of banks, closer scrutiny of loan portfolios, and the like, with possible implications for bank ratings and capital requirements.

One of the important issues currently being debated within the Federal Reserve System is whether it makes sense to make bank regulation "state contingent", i.e., whether its stringency should vary with the state of the economy. What my analysis shows is that there is a theoretical justification for making the supervision aspect of bank regulation more stringent during economic (and stock market) booms, particularly for banks with larger relative (to spot lending) loan commitment exposures.

C. Stock Market Information Disclosure Rules and Deposit Insurance

How would information disclosure requirements faced by firms in the stock market affect the equilibrium in this model? Assuming that those firms that purchase loan commitments from banks are traded in the stock market, more stringent information disclosure rules will lead to more being known about these firms. This means that it will be more difficult for a bank to lend to a B borrower in the θ=H state in order to protect the value of its reputational capital; in a more general model, this might be a fewer number of states in which the inefficiency remains. The inefficiency stemming from the oversupply of credit during bull stock markets should therefore diminish as firms are required to disclose more information.

This has implications for federal deposit insurance. Apart from the Fed, the FDIC should also be concerned about the deterioration in bank loan portfolios during bull stock markets; this increases the contingent liability of the FDIC. More stringent stock market information disclosure requirements actually benefit the FDIC because they help arrest, to some extent, the credit quality decline engendered by the reputational concerns of banks.

Banks, of course, have at least three good reasons to resist more stringent disclosure requirements. First, these requirements would apply to traded banks as well, leading to possibly greater volatility in bank stock prices as the market reacts to new information. Second, greater information disclosure would reduce the informational advantage banks have over others, eroding their business. And third, banks would lose some of their ability to manage their own reputational capital.

Traditionally, bank regulators, like the Fed, have supported banks in their resistance to greater market disclosure (e.g. mark-to-market accounting). What our analysis reveals is that bank regulators may want to reconsider this view.

D. Empirical Predictions

The analysis produces numerous testable implications. First, as discussed earlier, bank asset portfolios are predicted to decline in credit quality during bull stock markets, so that the incidence of borrower defaults will be higher in periods following a bull market.

Second, borrowers will experience positive stock price reactions when they purchase loan commitments and then again when they exercise their commitments.

Third, the positive stock price reactions experienced by borrowers upon receiving loans under previously-purchased loan commitments will be greater during bear stock markets than during bull stock markets.

Fourth, receiving spot credit during a bull stock market will elicit a higher stock price reaction for a borrower than if the same borrower received a loan during a bull market under a previously-purchased loan commitment. The reason is that in the model there is no information conveyed by the bank lending to the borrower under a loan commitment when θ=H, whereas the extension of spot credit when θ=H indicates that the bank received a favorable signal.

Finally, a bank selling a loan commitment will experience a positive stock price reaction and then another positive stock price reaction when it honors the commitment.

V. CONCLUSION

I have developed a credit market model in which banks can lend either in the spot market or by selling loan commitments that create state-contingent obligations to lend in the future. In both cases, the focus of the analysis has been on the reputational equilibrium in which banks make decisions taking into account the impact of these decisions on future outcomes.

My motivation for developing such a model is to examine two seemingly-unrelated issues. One is the empirical observation that the most important reason borrowers give for purchasing loan commitments is that they provide (partial) insurance against future quantity rationing in the spot credit market. The model developed here provides a theoretical basis for this empirical regularity. The other is the much-discussed role of the Fed in terms of "targeting" the level of the stock market in its conduct of monetary policy, or more generally the issue of whether bank regulation should be contingent on the state of the economy. Those who believe the Fed is or should be concerned about the level of asset prices argue that there is an inflation-related link. When asset prices are high and the stock market is bullish, people who own equities are richer and are likely to spend more, fueling the threat of inflation. What I have shown is that even if one ignores this wealth and consumption effect—which has been hard to document empirically—there is a more direct relationship that should concern the Fed, and it comes from the potential impact of the stock market on bank asset-portfolio decisions. The tangible policy implication is that the frequency and stringency of regulatory examinations of bank loan portfolios should be greater during bull stock markets or asset pricing bubbles.

I have three main results. First, loan commitments expand the availability of credit by reducing quantity rationing of credit that would occur in the spot credit market during down markets. Second, due to the reputational concerns of banks, loan commitments lead to an oversupply of credit when the stock market is doing well. Third, under reasonable conditions, welfare is higher with loan commitments than with spot credit.

These results depend critically on two features that make banks different from other firms. One is that they operate largely in forward credit markets by selling commitments. The other is that these commitments are discretionary contracts that enable banks to void them at their discretion, providing banks with a tool to manage their reputational capital.

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Appendix

Proof of Proposition 1: We know that the lowest rate that the bank can charge when θ=L is C_L. But from (PR-1) we know that in this case the G borrower chooses the b project, in which case there is no interest rate at which the bank can break even. So credit is rationed when θ=L. Knowing this, no borrower bothers applying for credit. When θ=H, the bank can break even if it charges C_H and the borrower chooses the g project; (PR-1) ensures that it does. So, credit is extended when θ=H. The reason why it is extended at C_H is that banks are competitive and credit is extended in equilibrium to only G borrowers. Hence, given that the bank's credit-granting decision reveals that the borrower is G, any attempt to charge more than C_H will invite Bertrand undercutting by a competing bank. The stock price effects are obvious. In the θ=H state, if the bank accepts the borrower's credit request, the borrower can invest in the project and enjoy a positive NPV, which yields a higher stock price than if it does not receive credit (either because θ=L or because θ=H and the borrower is rejected) and has to forge the positive NPV. ■

Proof of Lemma 1: If the borrower takes a \$1 loan, its expected utility with a spot loan is:

$$EU_S = [1-q]\theta \left\{\frac{X - C_H + R}{R}\right\} + E.$$

If the borrower uses equity participation of E and takes a loan of \$1-E, its expected utility is:

$$E\hat{U}_S = [1-q]\theta \left\{\frac{X - C_H[1-E] + R}{R}\right\} + [1-[1-q]\theta \ ]E.$$

It is easy to verify that $EU_S = E\hat{U}_S$. ■

Proof of Proposition 2: Proposition 1 has established that, from the standpoint of ay, the first part of the bank's objective function, when θ=H the bank wants to lend to G borrowers and deny credit to B borrowers, and when θ=L it wants to deny credit to all borrowers. We show now that this decision rule is unaffected by the bank's reputational concern; i.e., bmax{[Pr(T | Ω) – α], 0}, the second part of its objective function. To see this, suppose θ=H. Note that the conjectured equilibrium strategy for each bank is such that no borrower default should be observed at t=2. So if no default is observed, the posterior beliefs of the market about the bank's type remain the same as the priors. Suppose a default is observed for some bank. Then there are two possibilities. One is that the bank made an out-of-equilibrium move and loaned to a B borrower. The other is that the bank loaned to a G borrower who chose the out-of-equilibrium move of selecting project b. However, there can be no reputational benefit to the borrower from doing this (recall the borrower has a single-period horizon), and (PR-1) guarantees that the borrower is better off choosing g when θ=H and the loan is priced at C_H. Thus, the only possibility is that the bank loaned to a B borrower. In this case, let the market adopt the following posterior belief:

$$\Pr(\text{bank is type N} \mid \text{borrower defaulted at t=2}) = 1. \tag{A-1}$$

If the bank, confronted with a B borrower, does not lend, then

$$\Pr(\text{bank is type N} \mid \text{no loan given}) = 1 - \alpha,$$

which is the prior belief. Thus, by lending to a B borrower, the bank's reputational payoff is

$$\begin{aligned} &b(C_H)\max\{\{\delta[\alpha-\alpha]+[1-\delta][0-\alpha]\}, 0\} \\ &= b(C_H)\max\{-[1-\delta]\alpha, 0\} = 0. \end{aligned}$$

If the bank does not lend to the B borrower, its reputational payoff is:

$$b(C_H)[\alpha-\alpha] = 0.$$

Hence, the bank chooses not to lend to a B borrower when θ=H, and this is part of a sequential equilibrium. Moreover, it is obviously a part of a sequential equilibrium for the bank to lend to a G borrower at C_H when θ=H because the market's posterior beliefs about the bank's type in both cases will be the same as the prior beliefs, so the bank is reputationally indifferent between lending and not lending.

Now consider θ=L. The equilibrium strategy is for no lending to occur. So if lending does take place, suppose the market assigns the out-of-equilibrium belief

$$\Pr(\text{bank's type N} \mid \text{lending when } \theta=L) = 1. \tag{A-2}$$

Then clearly no bank will wish to lend, and this too is part of a sequential equilibrium.

To see that the out-of-equilibrium beliefs in (A-1) and (A-2) survive the universal divinity refinement, note that *both* types of banks are *equally* skilled at distinguishing between G and B borrowers at t=1. So, the set of beliefs by the market in response to an out-of-equilibrium move that would cause type T to defect from the equilibrium with that move is identical to the corresponding set of beliefs for the N-type bank. Hence, neither type's set is nested within the other type's set, and neither type can be eliminated as a potential defector according to the universal divinity criterion. This means the sequential equilibrium is universally divine. ■

Proof of Proposition 3: We begin by observing that the bank must set the commitment borrowing rate at $\bar{r} \leq r^*$, because only then can it ensure that the G borrower will choose the g project. There are two feasible intervals for the values r can take: $\bar{r} = C_H$ and $\bar{r} \in [C_H, r^*]$. The reason is as follows. If $\bar{r} = C_H$, then the borrower will have no incentive to seek credit outside the loan commitment contract in any state of the world, as long as it is creditworthy (i.e., the bank's signal reveals the borrower is G at t=1) because no spot lender can give it cheaper credit. Any $\bar{r} < C_H$ continues to preserve this property and is thus at best a "wash" for the borrower because the interest rate subsidy will be reflected in F_G and F_B, the *ex ante* prices of the commitment. This would leave the borrower indifferent across values of $\bar{r}$ in the interval $[0, C_H]$. Of course, values of $\bar{r} > C_H$ can be chosen, but in this case the borrower will eschew borrowing under the commitment if θ=H because it will be able to get cheaper spot credit by having itself screened by another bank. This too will be reflected in the commitment fee paid up front.

Consider now a borrower on which ϕ=G is observed at t=0. The bank's expected profit from giving the borrower a commitment at $\bar{r} = C_H$ is:

$$\Pr(G \mid \phi = G)\left\{\theta\left[\frac{C_H}{C_H}\right] + [1-\theta]\left[\frac{C_H}{C_L}\right] - 1\right\}$$

$$+\Pr(B \mid \phi = G)\{0\} + F_G \tag{A-3}$$

if at t=1 it lends to a G borrower and denies credit to a B borrower, which is optimal when the bank has no reputational concerns. Note that Pr(i | ϕ=G) is the probability (assessed at t=0) that the bank will discover at t=1 that the borrower is type i when the signal ϕ at t=0 indicated G. The smallest value of F_G is the one that yields the bank a zero expected profit on the commitment. That is, defining $\lambda \equiv C_H / C_L < 1$, we have:

$$F_G \geq \Pr(G \mid \phi = G)[1-\theta][1-\lambda] \tag{A-4}$$

We similarly show that, for a borrower on which ϕ=B is observed at t=0, the smallest commitment fee with $\bar{r} = C_H$ would be:

$$F_B \geq \Pr(G \mid \phi = B)[1-\theta][1-\lambda] \tag{A-5}$$

Since $\Pr(G \mid \phi = G) > \Pr(G \mid \phi = B)$, it is clear that min F_G > min F_B. In a perfectly competitive loan commitment market, the bank will thus post two contracts, $\{F_G^*, \bar{r}\}$ and $\{F_B^*, \bar{r}\}$, where F_G^* and F_B^* are the values of F_G and F_B in (A-4) and (A-5) respectively when these hold as equalities. However, the bank will always claim that ϕ=G was observed because it earns a higher profit by doing so. When ϕ=G is actually observed, the bank's expected profit is zero, but when a contract $\{F_G^*, \bar{r}\}$ is sold to a borrower on which ϕ=B is observed, the bank's expected profit is positive.

Consider now $\bar{r} \in (C_H, r^*]$. Since the commitment will not be drawn down when θ=H, the bank's expected profits for ϕ=G can be written as:

$$\Pr(G \mid \phi = G)\left\{[1-\theta]\left[\frac{\bar{r}}{C_L} - 1\right]\right\} + F_G.$$

If the bank earns zero expected profit on such a borrower,

$$F_G^* = \Pr(G \mid \phi = G)[1-\theta]\left[\frac{C_L - \bar{r}}{C_L}\right] \tag{A-6}$$

Similarly, for a borrower on which ϕ=B is observed,

$$F_B^* = \Pr(G \mid \phi = B)[1-\theta]\left[\frac{C_L - \bar{r}}{C_L}\right] \tag{A-7}$$

Since $F_G^* > F_B^*$, again the bank will claim ϕ=G regardless of the observed ϕ. Recognizing this, the borrower will have an incentive to minimize the amount of positive profit earned by the bank. The bank's positive profit is $F_G^* - F_B^*$ when ϕ=B and the contract $\{F_G^*, \bar{r}\}$ is sold. Thus,

$$F_G^* - F_B^* = [\Pr(G \mid \phi = G) - \Pr(G \mid \phi = B)][1-\theta]\left[\frac{C_L - \bar{r}}{C_L}\right].$$

Clearly, this expression is minimized by increasing $\bar{r}$ to its maximum feasible value, r*. This means that in a competitive loan commitment market, the *unique* commitment rate that will emerge in equilibrium is r* since that will be strictly preferred by borrowers to all other rates. F_G^* and F_B^* will satisfy (A-6) and (A-7) with $\bar{r} = r^*$. The bank will earn a zero expected when ϕ=G and a positive expected profit when ϕ=B. ■

Proof of Proposition 4: We will work backwards following a dynamic programming approach. Consider first what happens at t=1 in the θ = L state. If the borrower is G, there is no question about invoking the MAC clause because the bank can't possibly win in a dispute with the borrower. So lending occurs to such a borrower. If the borrower is B, then the bank's reputation if it rejects the borrower, using the market's equilibrium belief that a rejected borrower must be B, is:

$$\Pr(T \mid L, \text{borrower rejected at t=1}) \; \frac{\alpha[1-p-q]}{\alpha[1-p-q]+[1-\alpha][1-p]} \tag{A–8}$$

If this borrower is given a loan, then either state S or state F will be observed at t=2. If state S is observed, the bank's reputation will be:

$$\Pr(T \mid L, S) = \frac{\alpha p + \alpha[1-p-q]\beta\delta}{\{\alpha p + [1-p-q]\beta\delta + [1-\alpha]p\beta + [1-\alpha]q\beta\delta\}} \tag{A–9}$$

If state F is observed, the bank's reputation will be:

$$\Pr(T \mid L,F) = \frac{\alpha[1-p-q]}{\alpha[1-p-q]+[1-\alpha][1-p]} < \alpha \tag{A–10}$$

which is the same as $\Pr(T \mid L$, borrower rejected at t=1). Thus, rejecting the borrower leads to a sure reputation of $\Pr(T \mid L,F)$, with a reputation-related payoff of 0 because $\Pr(T|L, F) < \alpha$, and lending leads to an expected reputation of $\delta\Pr(T \mid L,S) + [1 - \delta]\Pr(T \mid L, F)$, with a reputation-related payoff of $b(C_L)\delta[\Pr(T \mid L, S) - \alpha]$. Hence, the expected loss from lending to a B borrower in the L state is:

$$b(C_L)\delta[\Pr(T \mid L,S) - \alpha] > 0. \tag{A–11}$$

Now consider the $\theta = H$ state. Again, a G borrower is given credit. If the bank rejects a B borrower, then its reputation at t=1 becomes $\Pr(T \mid H$, borrower rejected at t=1), which is 0 since a T bank would never encounter a B borrower in the $\theta = H$ state; we will check later this belief on the part of the market in response to the bank's out-of-equilibrium move is justified under universal divinity. Thus, the expected loss in the bank's reputation-related payoff from denying credit to a B borrower in $\theta = H$ state is

$$\delta b(C_H)[\Pr(T \mid H, S) - \alpha] > 0, \tag{A–12}$$

where

$$\Pr(T \mid H,S) = \frac{\alpha p + \alpha[1-p-q]\beta}{\{\alpha p + [1-p-q]\beta + [1-\alpha]p\beta + [1-\alpha]q\beta\delta\}} \tag{A–13}$$

If the bank cared solely about its reputation-related payoff, our analysis above reveals that it would never reject a borrower at t=1 by invoking the MAC clause. However, in its objective function in (1) it cares about both its payoff at t=2 and its own reputation-related payoff. Thus, if $a/b(C_L)$ is large enough, the bank will reject a B borrower in the $\theta = L$ state. However, the equilibrium also requires the bank manager to extend credit to a B borrower in the $\theta = H$ state. For the manager to reject the B borrower in the $\theta = L$ state and lend to it in the $\theta = H$ state, it should be parametrically possible to accommodate a greater reputation-related payoff loss to the bank from denying credit when $\theta = L$ than when $\theta = H$. That is, we must have

$$\delta b(C_H)[\Pr(T \mid H, S) - \alpha] > \delta b(C_L)[\Pr(T \mid L, S) - \alpha] \tag{A–14}$$

Since $b(C_H) > b(C_L)$, this inequality holds for $b(C_H)/b(C_L)$ large enough.

Given that it is in the best interest of the bank to deny credit to a borrower with $\phi = B$, it will *not* be subgame perfect for the bank to precommit *ex ante* to always extend credit ex post regardless of the signal, as long as the loan commitment includes the MAC clause. That is, any such precommitment will lack credibility.

Now consider t=0. If the bank observes $\phi = G$ and extends a loan commitment, its expected reputation at t=2 is $E_{\tilde{x}}(\Pr(T \mid \phi_m = G, \phi = G, \tilde{x}))$, where ϕ_m is the signal the market believes the bank saw, ϕ is the actual signal seen by the bank, and $\tilde{x} \in \{S,F\}$ is the outcome at t=2. Since the bank's action is an equilibrium action, beliefs form a martingale and we have

$$E_{\tilde{x}}(\Pr(T \mid \phi_m = G, \phi = G, \tilde{x})) = \Pr(T \mid \phi = G) \; \frac{\{p + [1-p-q]\beta\}\alpha}{\alpha\{p + [1-p-q]\beta\} + [1-\alpha]\beta} \tag{A–15}$$

Similarly, if the bank observes a $\phi = B$ signal and rejects the borrower, its expected reputation at t = 2 can be written as:

$$E_{\tilde{x}}\,(\Pr(T \mid \phi_m = B, \phi = B, \tilde{x})) = \Pr(T|\phi = B) = \frac{\{[1-p-q][1-\beta]+q\}\alpha}{\alpha\{[1-p-q][1-\beta]+q\}+[1-\beta][1-\alpha]} \qquad \text{(A–16)}$$

Comparing (A–15) and (A–16), we see that (PR–2) guarantees that $\Pr(T \mid \phi = G) > \alpha > \Pr(T \mid \phi = B)$. This means the bank will never refuse to sell a commitment to a borrower on which $\phi = G$ has been observed since selling a commitment leads to an expected reputation of $\Pr(T|\phi = G)$ and not selling it leads to an expected reputation of $\Pr(T|\phi = B)$.

Now suppose the bank decides to sell a commitment to a borrower on which it has observed $\phi = B$. Its expected reputation at t=2 from doing so at t=0, taking the t=1 equilibrium behavior as given, is:

$$E_{\tilde{x}}\,(\Pr(T \mid \phi = B \text{ and sell loan commitment at t=0}, \tilde{x}))$$

$$\begin{aligned}
&= \alpha[1-p-q][1-\beta]D^{-1}[\theta\Pr(T \mid H,S)+[1-\theta]\Pr(T \mid L,F)] \\
&\quad + \alpha q D^{-1}[\theta\delta\Pr(T \mid H,S)+[1-\theta]\Pr(T \mid L,F)] \\
&\quad + [1-\alpha]p[1-\beta]D^{-1}[\theta\Pr(T \mid H,S)+[1-\theta]\Pr(T \mid L,S)] \\
&\quad + [1-\alpha][1-p-q][1-\beta]D^{-1}[\theta\Pr(T \mid H,S)+[1-\theta]\Pr(T \mid L,F)] \\
&\quad + [1-\alpha]q[1-\beta]D^{-1}[\theta\delta\Pr(T \mid H,S)+[1-\theta]\Pr(T \mid L,F)]
\end{aligned} \qquad \text{(A–17)}$$

where $D \equiv \alpha[1-p-q][1-\beta]+\alpha q+[1-\alpha][1-\beta]$, and $\Pr(T \mid H,S)$, $\Pr(T \mid L,F)$, and $\Pr(T \mid L,S)$ are the same as before. It is easy to verify that there is a non-empty set of exogenous parameter values for which $\Pr(T \mid \phi = B) > E_{\tilde{x}}\,(\Pr(T \mid \phi = B \text{ and sell loan commitment at t=0}, \tilde{x}))$.

For example, the following parameter values suffice: $\alpha = 0.249$, $\beta = 0.33$, $p = 0.4$, $q = 0.5$, $\theta = 0.3$, $\delta = 0.001$ (note $\beta < p/(p+q)$).

What has been established then is that, *purely out of reputational concerns*, the bank will deny a loan commitment when ϕ = B and extend it when ϕ = G. Moreover, since Pr(T | ϕ = G) > Pr(T | ϕ = B), the bank will experience a positive stock price reaction when it sells a commitment at t=0. Further, since Pr(T | G, θ) > Pr(T | B, θ), the bank will experience a further positive price reaction when it honors the commitment at t=1, proving part (iv) of the proposition.

So will the bank not extend a loan commitment to a ϕ=B borrower if we take into account its entire objective function in (1)? Since $\alpha > \Pr(T \mid \phi = B) > E_{\tilde{x}}(\Pr(T \mid \phi = B$ and sell loan commitment at t=0, $\tilde{x}$)), the reputational payoff for the bank is zero regardless of whether it extends a commitment to a ϕ=B borrower or doesn't. The expected loss to the bank at t=0 from extending a commitment to a ϕ=B borrower, *given* the bank's equilibrium behavior at t=1, is:

$$E(\text{Loss} \mid \phi = B) = \frac{[1-\delta]C_H\theta}{C_H}[\alpha q + [1-p][1-\beta]] + \left[\frac{C_L - C_H}{C_L}\right][1-\theta]p[1-\beta][1-\alpha] \quad \text{(A-18)}$$

The expected loss to the bank at t=0 from extending a commitment to a ϕ=G borrower, *given* the bank's equilibrium behavior at t=1, is:

$$E(\text{Loss} \mid \phi = G) = \left[\frac{C_L - C_H}{C_L}\right][\alpha p[1-\theta] + [1-\alpha][1-\theta]\beta p] + \frac{[1-\delta]C_H[1-\alpha]q\beta\theta}{C_H} \quad \text{(A-19)}$$

In equilibrium, the loan commitment fee, F, will be set equal to E(Loss | ϕ=G) to allow the bank to exactly break even. Given (PR-3), however, it is easy to verify that

E(Loss | ϕ=B) > E(Loss | ϕ=G).

So the commitment fee will not be enough to compensate the bank if it sells a commitment to a ϕ=B borrower. Thus, the bank will refuse to sell commitments to ϕ = B borrower.

With a = 1, b(C_H) = 7000, b(C_L) = 700, $\bar{r}$ = C_H = 1.22, C_L = 1.3, and the other exogenous parameters as chosen above, we see that the bank chooses to sell a loan commitment when ϕ =

G, deny it when $\phi = B$, and then deny credit at t = 1 if $\theta = L$ and the borrower is B but extend credit if $\theta = H$ and the borrower is B. That is, (A–14) satisfied along with

$$a\left[\frac{\delta\bar{r} - C_H}{C_H}\right] + b(C_H)\delta[\Pr(T \mid H, S) - \alpha] > 0 \tag{A–20}$$

and

$$a\left[\frac{\delta\bar{r} - C_L}{C_L}\right] + b(C_L)\delta[\Pr(T \mid L, S) - \alpha] < 0 \tag{A–21}$$

Part (iii) of the proposition regarding borrower stock price reactions is obvious given the bank's equilibrium behavior. At t=0, because the bank's loan commitment decision is based on an informative signal of borrower quality, there will be a positive reaction in the borrower's stock price if it is able to purchase a commitment. And at t=1, the bank's decision to lend under the commitment conveys further positive information. All that remains is to consider out-of-equilibrium moves. The only out-of-equilibrium move is that the bank denies credit at t=1 when $\theta = H$. If such a move is observed, we can use the Banks and Sobel (1987) universal divinity criterion to ask: What kind of bank is such a move more likely to come from? It is obvious that a T bank would never observe a B borrower when $\theta = H$. Thus, the market must assign a posterior probability Pr(bank is N | $\theta = H$, borrower denied credit at t=1) = 1. Knowing this, no bank will deny credit. ■

Proof of Proposition 5: Under the spot market equilibrium, the borrowers' *ex ante* (t=0) expected utility is:

$$EU_S = [1 - q]\theta\left\{\frac{X - C_H + R}{C_H}\right\} \tag{A–22}$$

Under the loan commitment equilibrium, the borrower's *ex ante* (t=0) expected utility is:

$$EU_L = -F + \{\alpha p\theta + \alpha[1-p-q]\beta\theta + [1-\alpha]p\beta\theta + [1-\alpha][1-p-q]\beta\theta\} \times \left\{\frac{X-\bar{r}+R}{C_H}\right\}$$

$$+ \{\alpha p[1-\theta] + [1-\alpha]p[1-\theta]\beta\}\left\{\frac{X-\bar{r}+R}{C_L}\right\}$$

$$+ [1-\alpha]q\beta\theta\left\{\frac{\delta\{X-\bar{r}\}+NR}{C_H}\right\} \quad \text{(A–23)}$$

where F must be set to allow the bank to break even. That is,

$$F = \{\alpha p[1-\theta] + [1-\alpha][1-\theta]\beta p\}\left\{\frac{C_L - C_H}{C_L}\right\} + \frac{[1-\delta]C_H[1-\alpha]q\beta\theta}{C_H} \quad \text{(A–24)}$$

Substituting (A–16) in (A–15) and recognizing that $\bar{r} = C_H$ yields the borrower's expected utility as:

$$EU_L = \{\alpha p\theta + [1-p-q]\beta\theta + [1-\alpha]p\beta\theta\}\left\{\frac{X-C_H+R}{C_H}\right\}$$

$$+ \{\alpha p[1-\theta] + [1-\alpha]p[1-\theta]\beta\}\left\{\frac{X-C_L+R}{C_L}\right\} + [1-\alpha]q\beta\theta\left[\frac{\delta X - C_H + NR}{C_H}\right] \quad \text{(A–25)}$$

Comparing (A–22) and (A–25), we see that the borrower's expected utility with a loan commitment is strictly higher than with spot credit if $(X - C_L + R) / R$ is large enough. ■

Proposition 6: Differentiating (A-25) with respect to α yields:

$$\partial EU / \partial\alpha = p\theta[1-\beta]\left\{\frac{X-C_H+R}{C_H}\right\} + p[1-\theta][1-\beta]\left\{\frac{X-C_L+R}{C_L}\right\}$$

$$- q\beta\theta\left[\frac{\delta X - C_H + NR}{C_H}\right]$$

> 0 since $\delta X - C_H + NR < 0$. ■

FIGURE 1: SEQUENCE OF EVENTS IN THE SPOT CREDIT MARKET EQUILIBRIUM

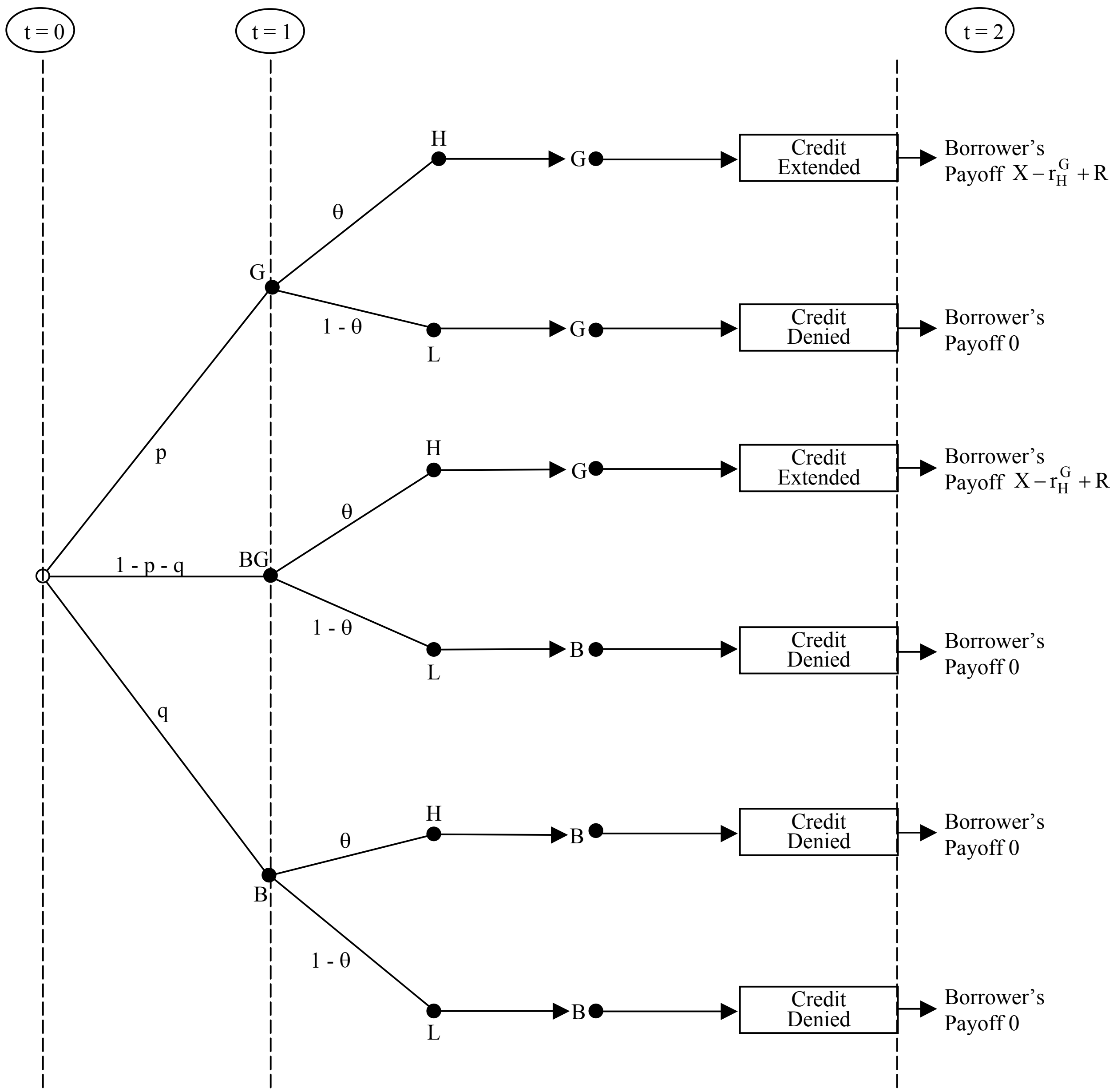

FIGURE 2: SEQUENCE OF EVENTS WITH A LOAN COMMITMENT