

INFORMATION AND INCENTIVES INSIDE THE FIRM: EVIDENCE FROM LOAN OFFICER ROTATION

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Abstract

It has long been recognized that agency problems constrain the communication of information within organizations. This paper proposes that reassigning tasks among agents who collect information can be used to alleviate moral hazard. Using a proprietary monthly panel of internal risk rating data, we provide evidence that a bank policy that routinely reassigns loan officers to different borrowers acts as an incentive device. We argue that the new loan officer who is assigned to the task has no reputation incentive to hide bad news. As a result, the threat of rotation induces the incumbent to reveal bad news so as to avoid being uncovered by her successor. We show that a three-year rotation rule induces incumbent loan officers to temporarily produce more accurate reports about borrower creditworthiness. On average, loan officers downgrade firms leading up to rule induced rotations. The evidence indicates that the bank's lending decisions respond to the increased information induced by rotation. Finally, we show that rotation provides incentives through reputation concerns: loan officers who fail to report bad news and are subsequently exposed by a successor, go on to manage smaller lending portfolios.

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I. Introduction

Many economic relationships involve one agent collecting and reporting information to another. These arrangements are often plagued by moral hazard when the principal and the monitor have conflicting objectives regarding the use of that information. The theoretical literature has suggested a number of organizational solutions to mitigate this problem.¹ Rotation policies, whereby a task is routinely reassigned from one delegated monitor to another, are an organizational response to the problem that are widely used in practice. Audit partners, board of directors committee members, corporate loan officers, government auditors are examples of delegated monitors commonly subject to mandated task rotations.² We show in this paper that the monitor has reduced incentives to misreport when the principal is able to compare her report with that issued by her successor after rotation. In *Economy and Society*, Max Weber points out this rationale for rotation within government agencies and bureaucracies.³ Holmstrom (1982: 338) suggests that rotation may provide “independent readings of the circumstances in which tasks are being carried out and thereby reduces moral hazard costs”.⁴⁵ We formalize this logic and provide the first empirical evidence that rotation can be used to limit agency problems in the context of delegated monitoring.

This paper evaluates the incentive effect of rotation using data from the operations of large multinational commercial bank in Argentina that employs a 3-year loan officer rotation rule. Loan officers are employed to collect information about the firms they oversee, communicate this information to the bank through the monthly assignment of risk ratings, and make lending recommendations on the basis of their assessment of the firm’s creditworthiness. When a loan officer has overseen a firm for three years, the rotation rule implies a high likelihood that this firm will be allocated to a different loan officer. To provide a theoretical framework for the empirical analysis, we model this environment as one where a loan officer performs a dual role (as per Tirole (2001)): she is responsible for obtaining and reporting information about the repayment prospects of a loan (passive monitoring); she is also

¹See for example Aghion and Tirole (1997), Dessein (2002), Stein (2002) and the work recently surveyed by Mookherjee (2006).

²Mandated rotation of monitors exists in the context of audit partners of publicly traded firms (e.g. Section 203 of Sarbanes Oxley Act of 2002), corporate loan officers (Berney, Haynes, and Ou (1999) and Dunkleberg and Scott (1999)), boards of directors (Gregory (2001a,b)), US State Government auditors (Schelker (2007)), and Government Committees (Grosche and Stewart (1998)).

³See Weber ([1922] 1968) and the discussion in Kiser (1999).

⁴Holmstrom and Milgrom (1991) also speculate that rotation may be an important aspect of job design.

⁵The idea that rotation can be used by a principal to facilitate relative performance evaluation of delegated monitors is implicitly supported by the empirical methodology of Jacob and Levitt (2003). They make use of rotation of high school classes between teachers over time to diagnose instances where teachers have manipulated test scores.

responsible for managing the relationship with a firm so as to maintain high repayment prospects (active monitoring). A potential incentive problem arises as a result of this dual role: the loan officer may want to avoid reporting unfavorable information because it will reflect poorly on her active monitoring ability. Rotation can reduce this incentive to hide information by temporarily separating the active and passive monitoring roles. A newly assigned officer is more willing to immediately report bad news because this does not reflect poorly upon her own active monitoring abilities. On the contrary, she demonstrates her ability to detect bad information. As a result the threat of being uncovered by the newly assigned loan officer will reduce the incentive of an incumbent officer to conceal bad news.

The 3-year rotation rule provides a unique opportunity to assess empirically the incentive effects of rotation on the reporting behavior of loan officers. First, it induces a sharp and temporary increase in the probability of rotation: the quarterly rotation hazard rate increases sixfold to 60% during the last quarter of a three year relationship. Second, the timing of the hazard rate increase is plausibly unrelated to the time variation of firm characteristics, since it is determined by the date a loan officer-firm relationship begins. Finally, the increase in the rotation hazard is predictable both by loan officers and the econometrician. This allows us to study the reporting behavior of loan officers in anticipation of rotation.

The paper exploits the rule-induced variation in rotation to test the two main implications of our theoretical framework. The first implication is that the imminent threat of rotation increases the incentives of a loan officer to produce informative ratings. One of the key advantages of focusing on communication through risk ratings is that their information content can be directly measured as the ability of the rating to predict future default. Using actual loan performance data, we measure how rating informativeness changes with time to the next high rotation quarter within a loan officer-firm relationship. We find that the predictive power of internal ratings temporarily increases during the year prior to rotation. The non-monotonic pattern is also present in the subset of loan officers that face an *ex ante* threat of rotation but are not reassigned *ex post*, due to the probabilistic nature of the rotation rule. The overall evidence corroborates the hypothesis that the *ex-ante* expected threat of rotation induces more accurate reporting by loan officers.

The effect of rotation is identified by estimating within-firm variations in ratings. Firms in the sample borrow from multiple banks and are matched with a Central Bank Credit Registry which

provides risk ratings by all other banks in the financial system. We show that one year prior to the high rotation quarter, internal ratings contain no information beyond that provided by external ratings. Instead, the quarter prior to rotation an internal risk rating change from 1 to 2 in a scale of 5 (one standard deviation in the sample) predicts a 20% increase in the probability of default, holding external ratings constant.

The second implication of our framework is that internal ratings contain an optimistic bias and that the imminent threat of rotation induces loan officers to reveal bad news. We find that internal ratings become more optimistic until four quarters prior to rotation, when the trend reverts and firms are downgraded on average. The evidence suggests that the bias begins to build up again after the threat of rotation has passed. This pattern matches that of informativeness, suggesting that the increased precision in ratings comes from the release of bad news.

We measure the economic impact of the incentive effect of rotation by looking at credit allocation decisions by the bank, which use all the information communicated by the loan officer. The bank's lending decisions become increasingly sensitive to internal ratings leading up to rotation, reflecting the fact that they contain more information about borrower creditworthiness. Also, the bank responds to the increased information by expanding the total amount of lending during the year prior to rotation. Firm borrowing increases by 11% during this period. These results indicate that the increase in informativeness of ratings does not merely substitute for other channels of communication. The results are also consistent with the long-standing view in the macroeconomics and corporate finance literatures that decreases in information asymmetry lead to increased lending in equilibrium.⁶

Finally we demonstrate that rotation provides implicit incentives through reputation concerns. We show that the bank uses rotation as a means to obtain information about the relative monitoring abilities of loan officers, and then reallocates assets towards the most proficient monitors. Our theory predicts that when a firm is downgraded by the new loan officer after a rotation, the perceived ability of the previous loan officer (her reputation) suffers. This event signals that she was managing a low quality loan and failed to detect and report it. The results indicate that loan officers who accumulate more of such negative reputational events go on to manage less firms and smaller loan portfolios. Conversely, we show that when a new loan officer downgrades a firm her career is unaffected. This confirms that rotation temporarily removes the disincentive of the new loan officer to reveal bad news

⁶See for example Leland and Pyle (1977), Myers and Majluf (1984), and Stiglitz and Weiss (1981).

unreported by the preceding loan officer.

A number of recent papers provide evidence of implicit incentives inside organizations due to career concerns, peer effects, and social preferences.⁷ However, the question of whether organizational design can be used to ameliorate or take advantage of implicit incentives has received little attention in the empirical literature. This gap is salient when considered relative to the large body of research devoted to studying the incentive effect of explicit performance based pay.⁸ The present paper is a first step to fill this gap by providing a direct account of the incentive effects of organizational design.

The practical implications of our results are broad given the widespread use of rotation as an organizational device to provide incentives to monitors. The debate over the effectiveness of rotation has taken on significant policy importance due to the passing of laws that mandate compulsory rotation of audit partners in France, Germany, Italy and the United States during the last decade.⁹

The key theoretical insight in our paper is that rotation can mitigate agency problems which arise due to career concerns. Meyer (1994) argues that organizations use rotation to learn about the ability of individual team members and shape their career prospects, but sets aside agency problems. A number of papers highlight agency problems as the rationale for rotation in delegated monitoring (Prescott and Townsend (2006), Arya and Mittendorf (2004), Hirao (1993), Ickes and Samuelson (1987)). However, these theories rely on the assumption that an agent's career prospects are unaffected by her perceived performance on past assignments. Our framework brings together these two previously unconnected and opposed theoretical accounts of rotation.

The rest of this paper proceeds as follows. Section II sets out our theoretical explanation for the way that rotation can be used to induce loan officers to reveal private information. We form a set of empirical predictions to test our theory. Section III describes the data and sets out our identification strategy. We also use this section to document our motivating fact, the routine use of loan officer rotation within the bank, and show preliminary evidence on the incentive effect of rotation. Section IV presents our key empirical results. Most importantly we show that the threat of rotation induces loan officers to issue ratings that are more informative about the state of the loan. We show that this

⁷See for example Falk and Ichinio (2006), and Mas and Moretti (2006) on peer effects; Bandiera, Barankay and Rasul (2005) on social preferences; and Berk and Green (2004), Chevalier and Ellison (1999) on career concerns.

⁸See for example Bandiera, Barankay and Rasul (2007), Lazear (2000), Jones and Kato (1995), Paarsch and Shearer (1999, 2000) for evidence on explicit incentives. Liberti (2006) shows that implicit incentives are affected through the allocation of authority.

⁹For accounts on this debate see Section 203 of Sarbanes Oxley Act of 2002, Arrunada and Paz-Ares (1997), Dopuch King and Schwartz (2001), Enriques and Volpin (2007) and Myer, Myer, and Omer (2003))

comes through the release of bad news about the borrowers to which they have been assigned. We also document the effect of rotation on lending. Section V provides evidence that ratings issued by loan officers affect their future career in the bank. Section VI provides a brief conclusion.

II. Theoretical Framework

In this section we build a stylized model of delegated monitoring to demonstrate that rotation can be used to increase a monitor’s incentives to truthfully reveal her private information about the projects to which she is assigned. The particular application we have in mind is a commercial bank (the principal) that delegates the monitoring of corporate lending relationships to loan officers (the monitors). We abstract from many of the features of a lending relationship and focus on the loan officer’s role in collecting and transmitting information about the loan to her superiors. We presume that these reports are used by the bank in the process of approving the terms of lending to each client. We do not model the use of this information explicitly but rather assume that the bank prefers more information to less. Our goal is to show how a policy of rotation can induce a loan officer to hand over information and to use the model to make several empirical predictions about the effect of rotation which we will test in the remainder of the paper.

A. Set-Up

Consider a bank that must assign a loan officer to monitor a loan. We suppose that there are three periods (denoted $t = 1, 2, 3$) and that the bank must assign one officer to the loan in each period.¹⁰ The bank has two officers labelled x and y who can be assigned to the loan. The bank must commit in advance to an assignment policy. The same officer can be assigned in each period, $\{x, x, x\}$, we will refer to this as “no rotation”. Alternately, the loan can be reassigned to a new loan officer at $t = 3$, $\{x, x, y\}$, we will refer to this as “rotation”.¹¹ We rule out the possibility that the loan can be reassigned at $t = 2$. We make this assumption because we want to study how the behavior of an incumbent loan officer changes as they approach the threat of rotation. This will allow us to build testable implications for the pattern of loan officer’s reporting decisions.

We assume that loan officers have heterogeneous skill. To capture this suppose that each officer

¹⁰We rule out the possibility of assigning more than one officer to the loan in each period. We know that this does not occur in our sample.

¹¹Without loss of generality we adopt the convention that loan officer x is assigned in the first period.

can be either of high or low type denoted by $i \in \{h, l\}$. Alternately, a loan officer's type can be interpreted more broadly as her willingness to collude with the borrower (although we do not model the relationship between the officer and the borrower here). Under this interpretation a low type is more willing to collude with the borrower. At the beginning of the model the loan officer and the bank are symmetrically uninformed about the type of each officer. Let $\mu^i \in (0, 1)$ be the common prior belief about each officer's type.

We follow Tirole (2001) and suppose that the loan officer's monitoring role has two distinct components: active and passive monitoring. Active monitoring captures the loan officer's role in recommending the terms of new loans. When these tasks are performed by a highly skilled loan officer the expected profitability of the loan is higher. We will refer to this as the state of the loan in each period, which we denote by θ^t . The state of the loan in each period can be either good or bad: $\theta^t \in \{\theta_g, \theta_b\}$ where θ_g (θ_b) refers to the good (bad) state. At the beginning of $t = 1$ loan officer x sets the terms of the loan. As a result the true state of the loan will be good θ_g with probability p ($1 - p$) if loan officer x is high (low) type. Assume $p > \frac{1}{2}$ to ensure that a highly skilled loan officer is more likely to set lending terms which produce a profitable loan for the bank. After the loan is set the profitability of the loan evolves randomly, which reflects the fact that the borrower may be affected by positive or negative shocks which affect the expected profitability of the loan. In particular we assume that between period $t = 1$ and $t = 2$ the state of the loan can change with probability ϕ , where ϕ is small. This probability is used to generate an option value of waiting for a loan officer in deciding when to reveal that the loan is performing poorly, since it is possible that the problem can "go away". For simplicity we assume that the state of the loan cannot change between $t = 2$ and $t = 3$.¹²

The true state of the loan is not directly observed by either the loan officer or the bank. The loan officer, in her passive monitoring role, acquires information about the profitability of the borrower and potential problems with the loan indirectly through soft information. We model this in the following way. In each period the officer assigned to the loan privately observes a signal s^t of the true state of the loan. The officer either detects bad news, which we denote by s_b , or detects nothing which we denote by s_n . Suppose that at time t a loan enters the bad state (θ_b) or is reassigned to a new loan officer. The officer assigned to the loan in period t will detect this and receive the bad signal s_b with

¹²Qualitatively the results of the model are unaltered if the state of the loan is also allowed to change again with probability ϕ between $t = 2$ and $t = 3$. Since randomness in the state of the loan between these periods is not crucial for our story we ignore it so as to simplify exposition.

probability q ($1 - q$) if she is high (low) type. Assume $q > \frac{1}{2}$ to capture the fact that high type loan officers are better passive monitors and hence are more likely to detect that a loan is in the bad state. Once a loan officer has detected a problem she does not forget it and hence will continue to receive the bad signal s_b as long as she is assigned to the loan and the loan remains in the bad state. Similarly, if a loan officer fails to detect that a loan is in the bad state she will continue to receive no signal s_n while the loan remains in the bad state. For simplicity we assume that if $\theta^t = \theta_h$ then the loan officer detects nothing $s^t = s_n$ with certainty.

The loan officer's only decision in each period is whether or not to report bad news to her principal. Following Stein (2002) the loan officer can harden the soft information she has observed and pass it on to her superiors. If the loan officer observes no bad news she must report nothing which we denote by r_n .¹³ Conversely if the loan officer has privately observed bad news she can decide whether or not to pass this information on. The loan officer can pass this information on by issuing the bad report (denoted r_b) or she can choose to suppress this information and report nothing (denoted r_n).

We now describe the incentives of a loan officer when she is deciding whether or not to pass bad news to her superiors in the bank. We assume that the bank is unable to compensate a loan officer based directly on the report she makes. One obvious motivation for this assumption is that the reports are unverifiable either because (i) they contain soft information or (ii) they contain information which the bank does not want to reveal publicly.¹⁴ We know in the case of the bank that we study that loan officers are not paid directly based on the ratings they issue for the loans under their control. Absent any direct incentives the loan officer will decide what report to issue so as to maximize her reputation at the end of the third period (i.e. the bank's assessment of her type). The bank will update its belief about the type of a loan officer based on the report issued in each period. We suppose that a loan officer with a higher reputation can expect to obtain more favorable employment from the bank (higher pay, less likely to be fired, better tasks) in the future. We do not model the reward to a high reputation directly and instead simply assume that a loan officer's utility is increasing linearly¹⁵ in this

¹³We assume that the loan officer is unable to fabricate bad news (no cheap talk). In practice the loan officer will have to justify any claim that she makes about the state of the loan. However, less specific justification is required for reporting no news at all. From a modelling perspective this assumption is important. Without it the loan officer's report will never be informative - all loan officers will issue the same cheap talk to maximize their reputations. This assumption makes it possible for the report to be informative.

¹⁴Alternately the bank may not wish to pay an officer directly based on these reports so as to avoid distorting her other actions (Holmstrom Milgrom (1987)).

¹⁵The assumption of linearity is not important for the analysis. We would obtain similar qualitative results if we assumed a more general utility function that is increasing in reputation.

reputation. Later in the paper we provide evidence for this career concerns assumption by showing that loan officers who accumulate observable events that are good (bad) for their reputation go on to manage larger (smaller) total lending portfolios.

B. No Rotation

Suppose that the bank chooses a policy of no rotation thereby assigning officer x to the loan in all three periods. If x observes the bad signal s_b at $t = 1$ there are two opposing forces which affect the loan officer's decision to reveal bad news by reporting r_b as opposed to concealing this information and reporting nothing r_n :

- the fact that the loan entered the bad state (θ_b) is informative for the loan officer being low type (since $p > \frac{1}{2} > 1 - p$). This is the force which may lead the loan officer to hide bad news so as not to damage her reputation as an active monitor.
- conditional upon the loan performing poorly, seeing bad news is informative for the loan officer being high type (since $q > \frac{1}{2} > 1 - q$). This is the force which may lead the loan officer to pass on bad news since it demonstrates her ability as a passive monitor.

The loan officer's decision to reveal bad news will balance these two forces. We assume that $p > q$ which ensures that the state of the loan is more informative about a loan officer's type than her ability as a passive monitor.¹⁶ On balance this provides an incentive for a loan officer to hide bad news so as to maintain her reputation. We show in the Appendix that this condition is sufficient to ensure that it cannot be optimal for the loan officer to reveal bad news at $t = 1$. The following Proposition extends this logic for the entire three period model.

Proposition 1 *Suppose there is no rotation. If $p > q$ and*

$$\phi \leq \phi' \equiv \frac{p - q}{2p - 1} \in \left(0, \frac{1}{2}\right)$$

then the unique perfect Bayesian equilibrium is for the loan officer to always report no news r_n .

Proof. See Appendix. ■

¹⁶Our results in Section V verify this ordering.

The second condition in Proposition 1 requires that the transition probability ϕ is sufficiently low so as to ensure that the state of the loan in period two and three is still highly correlated with the loan officer's type. If for example $\phi = \frac{1}{2}$ then the state of the loan at $t = 2$ and $t = 3$ would be uncorrelated with the ability of loan officer x and hence she would have no reason to hide bad news in these periods since it would not reflect upon her ability as an active monitor. We assume that this condition holds for the remainder of the analysis so that we are studying conditions where absent rotation no information is passed from the loan officer to the bank. We now ask whether the bank can induce truthful reporting by committing to a policy of loan officer rotation.

C. Rotation and Equilibrium Reporting

Now suppose that the bank commits to a policy of rotation. Rotation effects the incentives for both loan officers to report bad news. Consider first officer y , who is assigned to the loan at $t = 3$. She is not responsible for the true state of the loan and hence has no reason to hide any information that indicates it is performing poorly. Moreover, she receives full credit as a passive monitor for being able to detect bad news. Thus she is willing to truthfully report bad news whenever she observes it. The threat that officer y will reveal bad news also alters x 's incentives to report. When x observes bad news at $t = 2$ she knows that officer y is likely to also see bad news next period and reveal that the loan is performing poorly. Faced with the threat of being exposed by her successor, x has stronger incentives to report bad news (this at least demonstrates her ability as a passive monitor). Define

$$\bar{q}^y = \mu^y q + (1 - \mu^y)(1 - q).$$

In words, \bar{q}^y is the ex-ante expected probability that y will detect bad news if the loan is in the bad state at $t = 3$. If \bar{q}^y is sufficiently high then under a policy of rotation officer x is likely to be exposed if she conceals bad news at $t = 2$ and hence will optimally choose to admit bad news herself. This logic is formalized in the following Proposition.

Proposition 2 *Suppose that the bank commits to a policy of loan officer rotation. There exists a $\bar{q}^* \in (0, 1)$ such that the unique perfect Bayesian Nash equilibrium is for loan officer x to conceal bad news at $t = 1$, truthfully reveal bad news at $t = 2$, and for y to truthfully reveal bad news at $t = 3$ if $\bar{q}^y \geq \bar{q}^*$.*

Proof. See Appendix. ■

It follows directly that the bank benefits from a policy of rotation because it induces x and y to truthfully reveal their private information about the state of the loan in periods $t = 2$ and $t = 3$ respectively. An important feature of the equilibrium highlighted in this Proposition is that the threat of rotation induces the incumbent loan officer (x) to reveal bad news at $t = 2$ but not at $t = 1$. Thus, if the loan officer observes bad news in the first period she decides to wait, hoping that the problem will get better. This option value of waiting is captured by the transition probability $\phi > 0$. If the state of the loan does get better then rotation cannot expose the officer's original lie. Conversely if the loan remains in the bad state, which occurs with probability $1 - \phi$, the loan officer will admit this at $t = 2$ because she knows the loan is about to be rotated and hence her lie might be exposed by her successor. This feature of the model allows us to make testable empirical predictions about how the behavior of a loan officer will alter as the threat of rotation approaches.

An important question which we have not addressed is: when should the bank optimally choose to reassign the loan from x to y ? In the current set-up reassigning the loan at $t = 2$ can induce truthful reporting in each period. Intuitively, the bank wishes to separate the role of passive and active monitoring as much as possible so as to minimize any conflict of interest in reporting. In practice this could be achieved by constantly rotating the officers assigned to each loan, or perhaps reassign a loan immediately after an officer originates any lending (i.e. begins to bear active monitoring responsibility for the loan). However, this conclusion is primarily driven by the fact that we have not considered any of the obvious costs to rotation. For example, rotation may result in the loss of private information or expertise which the incumbent loan officer has accumulated. In addition, following the logic of Aghion and Tirole (1997), the bank may need to commit to keep a loan officer assigned to the same loan in order to provide her with the incentives to exert effort to learn about the client. Combining passive and active monitoring may also be necessary to ensure that the client has sufficient incentives to hand over information to the loan officer. The bank will set its optimal rotation policy to balance these costs with the benefit of inducing loan officers to truthfully report. As will become obvious in the next section we are only able to assess the causal effect of rotation at one point in time during a relationship (after three years) and hence we are unable to empirically evaluate the optimality of the bank's rotation policy. For this reason we leave modelling this decision for future work. Instead we use these unmodelled costs of rotation as justification for why the bank may only choose to reassign

the loan at $t = 3$ and hence may, in equilibrium, tolerate some misreporting.

D. Testable Implications

In the next section we document the widespread practice of rotating loans across officers within the bank. Moreover we show that the bank recommends to a three-year rotation rule, which means that a loan is likely to be re-assigned to a new loan officer after it has been in the hands of a loan officer for three years. Our model provides an explanation for the policy: the bank uses rotation as a way of inducing loan officers to divulge information about their clients. To test our theory empirically we make use of a key implication of Proposition 2: as the threat of rotation approaches (when an assignment approaches three years of age) a loan officer will have a stronger incentives to divulge unfavorable information about the loan to which they have been assigned. In our empirical setting the report will take the form of a monthly internal risk rating which the loan officer assigns to each loan to which she has been assigned.

Translating the model with rotation into empirical predictions, we think of the first period ($t = 1$) representing the middle of a loan officer's assignment. At this point she already bears significant responsibility for the state of the loan through her past active monitoring, however is still far from the increased threat of rotation which comes after three years. As such, this loan officer still has an option value of suppressing bad information in case the state of the loan improves. The second period ($t = 2$) represents a relationship that is approaching the threat of rotation at three years. A loan officer in this position fears the possibility of soon being exposed by her successor and hence is willing to reveal bad news about the loan. Finally, we think of ($t = 3$) as a loan which has been recently reassigned to a new loan officer who has minimal responsibility for the current state of the loan and is hence willing to divulge any bad news she may discover early in her assignment. After this new officer has spent more time with the loan she will begin to bear more responsibility for the state of the loan and this will return to the scenario captured in the model at $t = 1$. This gives rise to the following empirical predictions:

1. *Informativeness.* The informativeness of the internal risk ratings which loan officers assign will increase as the threat of rotation approaches. In the equilibrium highlighted in Proposition 2 the covariance between the report issued by the loan officer and the true state of the loan is zero at $t = 1$. However at $t = 2$, when rotation is nearby, all private information is communicated

to the bank and hence there is a strictly positive covariance between the officer's report and the true state of the loan. Empirically we will test this by looking at how well the internal rating assigned by the officer helps predict default. Our theory predicts that the ability of this rating to predict default should increase as the threat of rotation approaches. Similarly we predict that the informativeness of these ratings should gradually decline after rotation as with time the new officer has increased incentive to conceal bad news.

2. *Bias.* Since at $t = 1$ loan officers will wish to hide bad news so as to maintain their reputation as active monitors this introduces a positive bias to ratings. Thus we predict that the ratings assigned by loan officers will be systematically optimistic during the middle of their assignment (captured by $t = 1$) and this bias will disappear as the threat of rotation approaches ($t = 2$). Moreover we should not see this bias for newly assigned loan officers ($t = 3$) however it should begin to reappear once they start to bear increased responsibility for the state of the loan. The model also predicts that this pattern should be most prevalent in loans where the officer has played a significant role as an active monitor and hence has strong incentives to hide poor performance (i.e. only where $p > q$). Empirically we will proxy this by looking at the extent of origination that a loan officer approved during her assignment and predict that the pattern of bias ($t = 1$) and its reversal ($t = 2$) should be most prevalent where origination was high.
3. *Career Concerns.* The model assumes that career concerns are a key force that motivates loan officers. A loan officer will choose what information to report based on how it will affect the public assessment of her type. We have justified this by assuming that the bank will use this information in the future when renewing the terms of the loan officer's employment. To confirm this assumption we look for evidence that loan officers are in fact rewarded (punished) for reports which increase (decrease) their reputation. The model makes clear predictions about reporting patterns which will raise or lower an officer's reputation. Consider the equilibrium defined in Proposition 2. The posterior beliefs which arise in that equilibrium have the following ordering¹⁷:

$$\mu^x > \hat{\mu}^x(r_n^x, r_n^x, r_b^y).$$

In words, the bank's assessment of x 's type will fall if she does not report bad news at $t = 2$ and,

¹⁷The notation we employ here is as follows: $\hat{\mu}^x(r_n^x, r_n^x, r_b^y)$ is the bank's posterior belief about x 's type after x has reported r_n at $t = 1$ and $t = 2$ and y reported r_b at $t = 3$.

after rotation, the new loan officer discovers and reports bad news. This lowers x 's reputation for two reasons. First, the new officer's report indicates that the state of the loan x was bad. Second, it indicates that x was unable to detect this bad news and hence has performed poorly in both her passive and active monitoring role. The counterpart to this is:

$$\hat{\mu}^y (r_n^x, r_n^x, r_b^y) > \mu^y.$$

An officer who reports bad news early in her assignment will increase her reputation. This occurs because early in the assignment the state of the loan is not related to y 's type whereas she is able to demonstrate that she was able to detect the bad signal. The model also predicts

$$\mu^x > \hat{\mu}^x (r_n^x, r_b^x, r_b^y) > \hat{\mu}^x (r_n^x, r_n^x, r_b^y).$$

This says that a loan officer's reputation is less adversely affected when she reveals bad news herself at $t = 2$ than when she is exposed by her successor at $t = 3$. This is because the revelation at least demonstrates her ability as a passive monitor. This ordering is the reason why the threat of rotation induces a loan officer to reveal bad news since it is worse for an officer to be exposed by her successor. We confirm these orderings in Section V by showing how these reputational events relate to the future career outcomes of loan officer as measured by the size and number of clients under their control.

III. Data, Identification and Estimation

A. Data

To document loan officer rotation we assembled a unique unbalanced monthly panel, covering the 7-year period from December 1997 to December 2004, of loan officer-firm relationships (relationships, henceforth) from a multinational bank's operations in Argentina (The Bank, henceforth). Our sample includes all lending by The Bank to firms with net sales below \$50 million.¹⁸ At each point in time there is a single loan officer responsible for monitoring and originating loans for each borrower in the sample.

¹⁸By comparison, according to the Small Business Administration's size definitions, a small business in the US has less than \$6.5 million of average annual revenue for retail and service industries.

The data allows observing which borrowers were assigned to each loan officer every month. We observe 1,248 firms and 100 loan officers in 4,191 non-censored firm-loan officer relationships. Slightly above 70% of the firms have two or more distinct relationships. The average firm has 3.19 relationships and sees 3.04 different loan officers during the entire 7 year sample period. The difference is due to the fact that 12% of the firms encounter the same loan officer more than once in two non-consecutive relationships (Table I).

The average length of non-censored relationships is 22.1 months (median of 18 months). The median firm is observed for 62 months, and the median loan officer is observed for 47 months. Above 90% of the relationships that end during the sample period are due to loan officer rotation (reassignment of firms to a different loan officer within the sample).¹⁹ Rotation also occurs gradually: the median number of firms under a loan officer's responsibility that gets reassigned in any single month is 3, conditional on any reassignment, which represents around 12% of the average number of firms under management (25).

For each loan officer, firm, month combination, we also observe the amount of the loans approved and outstanding and a two sets of internal credit ratings. The first one is the internal risk rating produced by the loan officer that manages the account. This risk rating reflects the assessment of the loan officer about the probability of default of a loan, and is produced based on qualitative and quantitative information obtained from financial statements, visits and interviews with the management of the firm. The second one is a proprietary computer generated risk rating that uses borrower financial statement information and past repayment history.²⁰

The internal Bank database is name-matched with the records of the Argentinean Central Bank Public Credit Registry (CDSF - Central de Deudores del Sistema Financiero) to obtain information on the relationships of the borrowers in the sample with other financial institutions. The CDSF provides monthly information on the amount of loans outstanding and standardized credit ratings issued by every financial institution to every borrower in the sample.

The CDSF information is generally released to the public with a four month lag. However, public

¹⁹The relationship turnover not due to rotation is due to firms or loan officers exiting the sample. A total of 26 firms and 18 loan officers, 2% and 18% of firms and loan officers in the sample, exit during the analysis period (before 2002, see below).

²⁰Loan officers responsible for lending to firms with net sales below \$50 million have complete discretion in terms of their actions and duties. Particularly there is no overruling or overlapping of their actions (as in Aghion and Tirole (1997) or Stein (2002)). On the contrary, Liberti (2004) and Liberti and Mian (2006) focus *only* on the large corporate lending portfolio of this financial institution where specific loan approval rules have to be complied with.

access to the CDSF database was withdrawn by the Central Bank between January 2002 and March 2003. As will be discussed later, identification of the effect of rotation is achieved through within-firm estimates, which require contemporaneous information on outcomes of the firm with the rest of the financial system. For that reason, the analysis will be focused on the subsample up to December 2001. The post January 2002 internal Bank data is used to construct measures of future outcomes in some specifications (e.g. default transition rate, assets under management of a loan officer).

Table II presents the summary statistics of all the firm level variables in the analysis sample. The internal Bank record data indicates that the mean outstanding loan amount is \$493,000 (median \$201,000). There is no significant difference between the amount reported in the internal Bank records and the amount reported in the CDSF database, which highlights the reporting accuracy of the latter source. Borrowers in the sample obtain finance from multiple banking sources. The median borrower has 7 banking relationships, a total bank debt of \$1.3 million, and obtains 17.3% of its bank debt from The Bank.

Risk ratings, both the internal one and the assigned by other banks, are a number between 1 and 5 assigned monthly by loan officers to every firm under management. Ratings of 1, 2 and 3 are assigned discretionarily by the loan officer and reflect the probability of default of the loan, with 1 representing the lowest probability of default and 3 the highest. Ratings of 4 and 5 are not discretionary and must be assigned to firms in default or foreclosure. The average internal risk rating in the sample is 1.5 (median 1). The average rating assigned by other banks to the firms in the sample, weighted by the amount of debt outstanding, is 1.4 (median 1). The computer generated risk rating differs from the internal risk rating in that it excludes all discretionary input by the loan officer. A proprietary algorithm classifies borrowers in 30 categories. When converted to a number scale from 0 to 29 (higher numbers are associated with higher probability of default), the median computer risk rating in the sample is 17 (sd 2.79).

The fraction of observations in the panel that is in default, as measured by the internal risk rate, is 8.6%.²¹ The average rate of transition to default in the panel is 12.8%. A firm is defined to transition into default at time t , if the firm is not in default at time t , but enters default between $t+1$ and $t+12$. The transition rate will be useful in the analysis of the ability of credit ratings to predict default in the near future.

²¹Using the Central Bank data Paravisini (2006) documents an average default rate of 12% and an average loan size of \$16,000.

B. Identification: Three-Year Rotation Rule

We test whether the anticipated threat of rotation induces loan officers to make informative (negative) reports about the creditworthiness of borrowers under their management. The main identification problem involves distinguishing changes in loan officer reporting behavior that are due to rotation, from changes that are due to variation in underlying firm creditworthiness. Declines in firm creditworthiness may trigger rotation if, for example, there are loan officers specialized in distressed firms. This would lead to an empirical correlation between rating changes and rotation even in the absence of the incentive effects of rotation. A second identification problem stems from the fact that we are interested in measuring reporting behavior changes *in anticipation* to rotation. Thus, identification requires a source of variation in rotation that is uncorrelated with firm creditworthiness, and whose timing is predictable both by loan officers and the econometrician.

The Bank's internal organizational policies include a 3-year rotation rule which provides such a plausible source of variation in probability of rotation. The following is an excerpt from the Internal Credit Policies of The Bank (March 2000):

The maximum length of a business relationship for Account Managers (AM) is recommended to be 3 years.

The internal rules of the bank suggest a three-year limit to the duration of a relationship between loan officers and borrowers. This rule induces a sharp increase in the probability of rotation when a relationship reaches three years. Panel A of Figure 1 plots the histogram of the length of non-censored loan officer-firm relationships shorter than 48 months.²² The histogram shows that the relationship length distribution is bimodal, with substantial mass between 1 and 6 months and between 31 and 36 months, and 83.3% of relationships end before 36 months. The importance of the 36 month rule in the duration histogram is masked by the large frequency of very short relationships, mostly due to transitions between longer relationships. Panel 2 of Figure 1 plots the hazard rate of relationship terminations. The conditional probability of rotation increases sharply as a relationship approaches 3 years. The monthly hazard rate is below 5% throughout the first two and a half years of a relationship, and increases up to more than 15% in the three months prior to rotation. Conditional on reaching

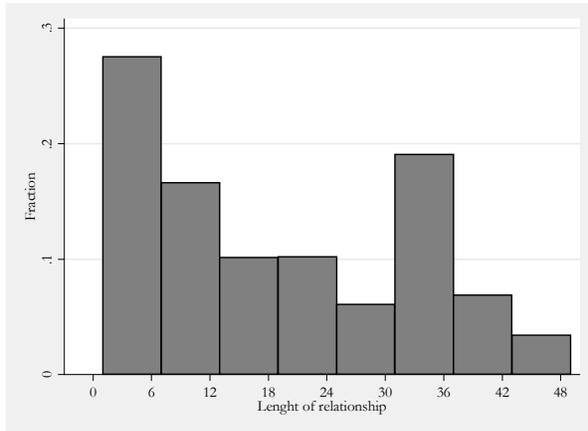
²²We plot the relationships shorter than 48 months because the analysis period from December 1997 to December 2001 will only include such relationships. Also, the same patterns documented here emerge when we look at the rotation and relationship length using the world-wide data for The Bank.

34 months, a relationship is terminated with a 58% probability within the next three months. The hazard rate then drops by half during the 6 months following the 36 month cut-off.

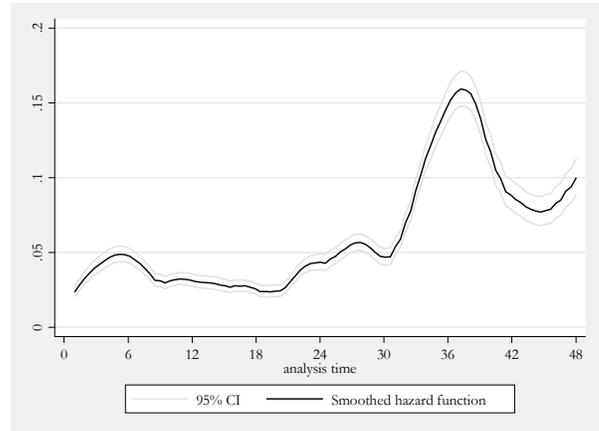
The 3-year rule induces an increase in the unconditional probability of rotation between months 34 to 36 of a relationship. The timing of this increase is entirely driven by the date the relationship initiated. It is thus plausible that the timing of rotation is unrelated to time-varying firm characteristics, a hypothesis that will be corroborated later. Also, the timing of the increase is predictable. Thus, the rule-induced variation in the probability of rotation provides a unique setting to identify the causal impact of rotation on loan officer reporting behavior.

FIGURE 1
RELATIONSHIP DURATION HISTOGRAM AND HAZARD RATE

Panel A: Duration Histogram, Uncensored Relationships



Panel B: Relationship Termination Hazard Rate



Two additional features of the empirical setting are ideally suited for testing the incentive effects of rotation. First, the 3-year rule is probabilistic. Thus, loan officers face and anticipate a high likelihood of rotation at three years in all the relationships they manage, but only a fraction of those are effectively reassigned. Changes in the reporting behavior in the subset of relationships where rotation does not happen at 36 months can be purely attributed to the threat of rotation.²³ The reporting behavior of the no-rotation subsample will allow distinguishing the incentive effects of rotation from the potential impact that an actual change of loan officer has on firm outcomes (e.g. due to learning).

Second, the fact that the probability of rotation increases and then drops when a relationship

²³This assumes that the selection of which relationships are rotated and which are not at 36 months is random. We show in the Appendix that such selection does not exist on observables which is consistent (although weaker than) with random assignment.

reaches 36 months, allows identifying in the data three distinct periods in a relationship akin to those in the theoretical model on Section II. An early period when rotation is distant and the option value for the loan officer to wait reporting bad news is high. A second period when the relationship approaches 3-years of age and the probability of rotation increases and the incentives to report increase. A final third period after 36 months when the probability of rotation declines and with it, the incentives to report. We expect the information content of ratings and the bias in reporting to follow such a non-linear pattern as a relationship progresses through these three periods. The predicted non-linearity in incentives is useful to distinguish empirically the rotation incentive effect from alternate explanations that predict monotonic effects on reporting behavior (e.g. learning).

Two caveats are in order regarding the identification strategy before proceeding. First, we can estimate the effect of rotation locally for relationships that reach at least 33 months. In other words, we will measure the impact of rotation on reporting behavior when rotation occurs at three years. It is not straightforward to extrapolate the impact of rotation at other relationship durations in this context. This limits our ability to derive normative implications about an optimal rotation rule.

The second caveat is related to sample attrition and the choice of analysis time. The sample period starts in December 1997, so we can predict rule-induced high rotation periods starting 34 months later (September 2000). This implies there are no censoring issues prior to predicted rotation ($q_R < 0$), and we will take advantage of this fact by analyzing reporting behavior up to two years prior to predicted rotation. On the other hand, the within-firm estimators require contemporaneous data from the CDSF which is available until December 2001. This implies that we will analyze high rotation periods up to this date. It also implies that the post-rotation sample will suffer from attrition the closer the predicted rotation period is to December 2001. Since attrition is solely determined by the starting date of relationships (t_0), it is unlikely to be systematically related to outcomes or to introduce bias. It will affect the standard error estimation nevertheless, and for this reason we limit the analysis to 6 months after the quarter of high rule-induced rotation .

C. Implementation and Preliminary Evidence

Our empirical strategy is to analyze how loan officer reporting behavior changes in the time series as the probability of rotation increases and subsequently declines at the 3-year threshold. A rule-induced quarter of high rotation is determined for each loan officer-firm relationship as follows. Assume that

a loan officer and a firm are paired at time $t = t_0$. The rule will induce high probability of rotation for t between $t_0 + 34$ and $t_0 + 36$, conditional on no rotation occurring before $t_0 + 33$. This period is labeled the *high rotation quarter*. The key analysis variable of interest, quarters-to-rotation (q_R), measures the time, in quarters, elapsed before and after the high rotation quarter. Time is measured in quarters for ease of exposition, since q_R can be normalized to zero at the high rotation quarter. We follow the convention that q_R is negative (positive) for quarters prior to (after) the high rotation quarter, such that $q_R = -s$ ($q_R = s$) refers to s quarters before (after) the high rotation quarter.

Table III shows how the correlation of internal risk ratings and the future probability of default, and average risk ratings change with quarter-to-rotation around the high rotation quarter. The statistics are calculated over the subsample of relationships that reach at least 33 months of duration. Column 2 shows the estimated correlation between internal risk ratings and a dummy equal to one if a firm defaults in the next 12 months. The correlation is not significant 3 or 4 quarters before the high rotation quarter ($q_R = \{-3, -4\}$), but it is positive and significant during the two quarters prior to, and the quarter of high rotation ($q_R = \{-1, -2, 0\}$). The correlation coefficient then drops, eventually becoming insignificant two quarters after the high rotation quarter. This stylized pattern is consistent with our prediction that imminent rotation induces loan officers to produce internal risk ratings that are better predictors of default. Columns 3 and 4 present a similar pattern for the level of ratings. Internal ratings risk ratings are significantly higher (indicating higher default risk) during the quarter of and the quarter prior to the high rotation quarter than in other periods. This pattern is consistent with the prediction that loan officers release bad news under the threat of rotation.

In the next section we show that these unconditional patterns hold after controlling for unobserved cross sectional and time series heterogeneity. The fact that a single loan officer handles multiple relationships at any given time allows us to account for unobserved loan officer heterogeneity that may arise due to specialization or ability using loan officer dummies. We will include in all specifications a full set of industry-month interactions to control for industry shocks to firm creditworthiness. Our main approach to account for unobserved firm specific and time varying creditworthiness (or demand for credit) is to focus on within-firm estimators. For example, we measure the information content of loan officer reports at time t as the correlation of the internal risk rating issued by the loan officer at time t and future defaults, conditional on the risk rating assigned *to the same firm* at time t by loan officers at other banks. That is, the relevant outcomes of interest in all specifications will be measured

relative to outcomes of the same firm with other banks. As long as changes in firm creditworthiness and credit demand affect ratings and borrowing will all lenders, the effect of rotation (which is specific to loan officer-firm relationship) is identified.

IV. Incentive Effects of Rotation

A. Information Content of Ratings

The main testable hypothesis derived from the discussion in Section II is that the imminent threat of rotation induces loan officers to produce ratings that are better predictors of the probability of a firm entering into default. We test this hypothesis by looking at how the predictive power of internal credit ratings in the cross section of borrowers changes with quarters-to-rotation (q_R), and in particular, as q_R approaches zero. We estimate the predictive power of internal ratings for every quarter-to-rotation up to eight quarters prior to, and two quarters after the high rotation quarter induced by the 3-year rule ($q_R \in [-8, 2]$), using the following random effects probit specification:²⁴

$$\Pr(Defaul12_{it} = 1|\cdot) = \Phi \left[\begin{array}{c} \sum_{s=-8}^2 1[s = q_R] (\beta_s Internal_RR_{it} + \zeta_s WExternal_RR_{it}) + \\ \alpha_{Loan_Officer} + \alpha_{Industry \times t} \end{array} \right] \quad (1)$$

The outcome of interest is transition to default in one year, $Defaul12$, a dummy equal to one if firm i is not in default at month t , but defaults between $t + 1$ and $t + 12$. The explanatory variable of interest, $Internal_RR$, is the risk rating assigned by The Bank's loan officer to firm i at time t . Higher values of the internal risk rating are intended to reflect a higher perceived likelihood of default. We add as a control $WExternal_RR$, the average rating assigned by all other banks to firm i at t , weighted by the amount of debt outstanding. Risk ratings are standardized to zero mean and standard deviation of one in all specifications to ease the interpretation of the results. The specification includes loan officer and industry-calendar month dummies to account for loan officer heterogeneity and industry specific shocks.

²⁴Note that specification (1) does not account for potential unobserved firm heterogeneity. The addition of firm dummies introduces a bias in all the parameters (incidental parameters problem). However, our main interest lies not in the magnitude of the coefficients but in their sign and significance. The random effects probit estimates consistently the average partial effect when the omitted heterogeneity is normally distributed and independent of the regressors (see Wooldridge, 2002).

We impose no structure on the time series pattern of variation of the predictive power of ratings by estimating a different coefficient on risk ratings for every quarter-to-rotation (β_{q_R}). The risk ratings in specification (1) are interacted with a set of quarter-to-rotation indicators, which turn to one for every value of $q_R \in [-8, 2]$.²⁵ The parameters are indexed using a Q next to the corresponding quarter-to-rotation to emphasize their quarterly nature. For example, β_{-1Q} denotes the parameter corresponding to one quarter prior to the high rotation period.

The magnitude of each β_{q_R} represents the predictive power of internal credit ratings relative to external ones on the transition to default. An estimate of $\beta_{q_R} > 0$ implies that higher internal risk ratings assigned by a loan officer can be associated with higher probability of default, for a given external rating assigned to the same firm by other banks. An estimate of $\beta_{q_R} = 0$ implies that internal ratings do not contribute to predict default beyond what is reflected in external ratings at the same calendar time.²⁶

To explore whether loan officers produce more informative reports as the threat of rotation draws near we plot the estimated coefficients on the internal risk rating from specification (1) on quarter-to-rotation q_R (Figure 2, and also column 1 of Table IV). For consistency, each quarter-to-rotation in the horizontal axis is labeled using a Q next to the corresponding q_R . The dashed lines around the estimates represent the 95% confidence interval. All the standard errors in this specification (and in every specification hereafter unless otherwise noted) are heteroskedasticity-robust and estimated allowing for clustering at the firm level. The two vertical dashed lines enclose the high rotation quarter as predicted by the 3-year rule.

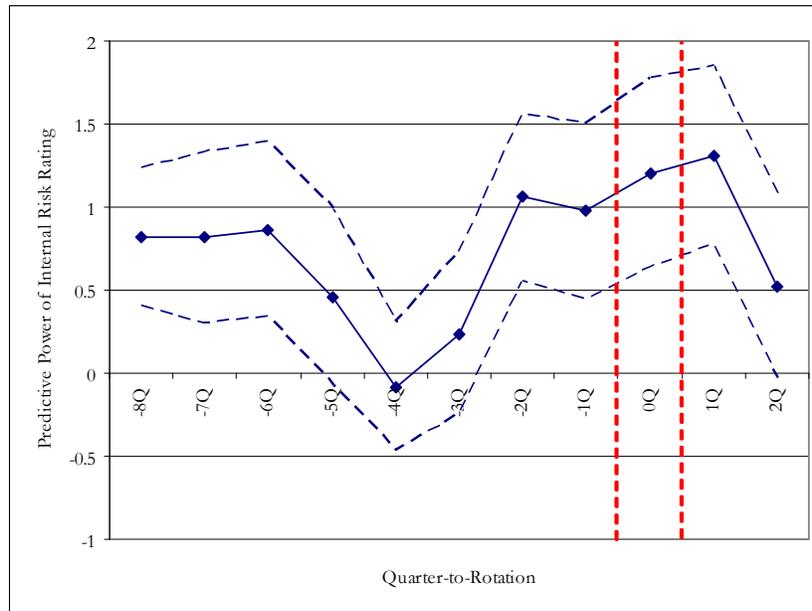
There are three distinct periods in the plot. Between 4 and 8 quarters prior to the high rotation quarter the point estimates of risk rating informativeness are declining ($\partial\beta_{q_R}/q_R = 0$). The estimates go from positive and significant to negative but not significant during this period. In fact, internal risk ratings are not significant predictors of default (after controlling for external risk ratings) at 3 and 4 quarters prior to rotation. The second period begins three quarters prior to the high rotation quarter, where the declining trend reverts and ratings become more informative as rotation draws near ($\partial\beta_{q_R}/q_R > 0$). The point estimates of β_{q_R} are positive during the two quarters prior to rotation

²⁵Note that a quarter defined by quarter-to-rotation does not coincide with a quarter defined by calendar time. q_R measures time before and after the high probability of rotation quarter induced by the 3-year rule, which occurs at different calendar times for different firms.

²⁶Recall that external ratings are publicly available with a four month lag, so an estimate of $\beta_{q_R} = 0$ does not imply that internal ratings do not provide information to The Bank.

and remain significant throughout the high rotation quarter. The point estimates of β_{qR} close to one in this period imply that an internal risk rating change from 1 to 2 in a scale of 5 (a one standard deviation change in the sample), predicts a 20% increase in the probability of default. The final period begins after the high rotation quarter ends. Internal rating informativeness declines again and becomes insignificant quarters after the high rotation quarter ($\partial\beta_{qR}/qR < 0$).

FIGURE 2
 PREDICTIVE POWER OF INTERNAL RATINGS BY QUARTER-TO-ROTATION



The temporary increase in β_{qR} with quarter-to-rotation is consistent with the prediction that the imminent threat of rotation induces loan officers to produce more accurate ratings. The initial downward trend is consistent with our claim that loan officers begin to hide information once they have been assigned long enough to bear responsibility for the state of the loan. As rotation draws near, the declining trend in rating informativeness reverts and ratings become better predictors of default. By our account this reflects that the threat of rotation induces loan officers to reveal information they were previously withholding. Once the high rotation quarter has passed the information content of the internal ratings declines with time. This is consistent with the hypothesis that after rotation the agency problem returns and loan officers begin to withhold new information that arrives.

Our framework suggests that it is the ex ante threat of rotation that induces loan officers to

produce more informative ratings. This implication can be further explored by looking at the subset of relationships that are not turned over during the high rotation quarter. We expect the same pattern of rating informativeness with quarter-to-rotation regardless of whether rotation occurred at the high rotation quarter or not. To test this we augment specification (1) with an interaction between all the variables on the right hand side and a dummy equal to one if the loan officer of firm i is not rotated during the high rotation period, Dum_NoRot_i . The main set of coefficients on internal risk ratings, β_{qR}^R , represents the predictive power of internal credit ratings for the rotation subsample. The coefficients on the interaction of internal risk ratings and the no-rotation dummy, β_{qR}^{NR} , represents the difference in predictive power of ratings between the rotation and the no rotation samples.

The estimated coefficients of the main and the interaction terms are reported in columns 2 and 3 of Table IV. The main coefficients, β_{qR}^R , have the same variation with quarter-to-rotation described before. The interaction coefficients, β_{qR}^{NR} , are all insignificant prior to the high rotation quarter. This implies that the informativeness patterns in the rotation and no rotation subsamples are not statistically distinguishable from each other in the period leading to high rotation. These results confirm that the *threat* of rotation induces an increase in the information content of ratings. This stands in contrast to theories of rotation that require that the loan officer and the firm must be separated in order for the officer to be willing to reveal her private information about that firm (Prescott and Townsend (2006), Arya and Mittendorf (2004), Hirao (1993), Ickes and Samuelson (1987)). We return to this in more detail in Section V.

The parallel non-linear patterns prior to rotation between the rotation and no-rotation subsamples also rule out that selection into rotation is related to rating informativeness. They suggest it is unlikely that The Bank chose to reassign loan officers on the basis of the informativeness of the ratings produced prior to the high rotation quarter. In the Appendix Table A we further verify that selection into the rotation is uncorrelated with other firm observable characteristics.

The results on the no-rotation subsample also allow ruling out that the temporary increase in informativeness prior to rotation is driven by reverse causality due to a direct effect of rotation on firm creditworthiness. This may occur if, for example, loan officers have project specific human capital, and newly assigned loan officers commit errors that lead to higher default rates. The observed increase in informativeness in the rotation subsample would result as a consequence of the incumbent loan officer anticipating this effect. However, this interpretation is difficult to reconcile with the observed pattern

in the no rotation sample. Any deterministic increase in default rates that is caused by rotation would not be observed in the no-rotation subsample.

We turn now to the estimated informativeness parameters at and after the high rotation quarter. Note that the post-rotation interaction coefficients can be interpreted as differences-in-differences estimators of the effect of a new loan officer on the informativeness of ratings. The documented parallel patterns prior to rotation represent strong evidence that assignment to the rotation and no rotation subsamples is orthogonal to rating informativeness. This assignment is effectively random for the purposes of comparing rating informativeness after rotation across the rotation and no-rotation subsamples.

Three results are worth emphasizing. First, Table IV shows that the interaction coefficients corresponding to the high rotation quarter and the first quarter after rotation are not significant at the standard levels. This implies that immediately after rotation, recently appointed loan officers produce internal ratings that are as informative as those produced by incumbent officers that were not reassigned. The fact that newly assigned loan officers produce informative ratings supports our account of the incentive effect of rotation. It is the threat of accurate information being released by the new loan officer which induces an incumbent officer to reveal her private information prior to rotation.

Second, the increase in informativeness of ratings leading up to the high rotation quarter is temporary for the no rotation subsample. This shows that the informativeness increase prior to rotation is not driven by the loan officer learning over time about the firm. Learning is inconsistent with the decline of the information content of ratings after the threat of rotation has passed.

Finally, the estimated interaction coefficient is positive and significant two quarters after the high rotation quarter. This implies that ratings by loan officers who were not reassigned during the high rotation quarter become more informative about future default than those of the newly assigned loan officers. This suggests that the ability of newly assigned loan officers to produce ratings as informative as those of incumbent ones is short lived. In fact, the main effect during this quarter is statistically insignificant, indicating that ratings assigned by newly assigned loan officers contain no information beyond that in external ratings. This finding highlights the potential costs of rotation. Newly assigned loan officers appear to be at a disadvantage relative to incumbent ones when interpreting the new information that arrives about firm creditworthiness. Data limitations preclude us from exploring these costs further in the current setting, but their presence indicates that an optimal rotation policy

must balance the incentive effects on reporting against the loss of project specific human capital.

B. Bias in Ratings

The second testable implication of the theory in Section II is that loan officers withhold bad news about firm repayment prospects. Our claim is that the increase in the informativeness in ratings when rotation is imminent comes from loan officers revealing these bad news. If loan officers release bad news under the threat of rotation we expect to observe firms being downgraded close to the high rotation quarter. We test for reporting bias by looking at how the average level of risk ratings varies with quarter-to-rotation using the following firm FE specification:

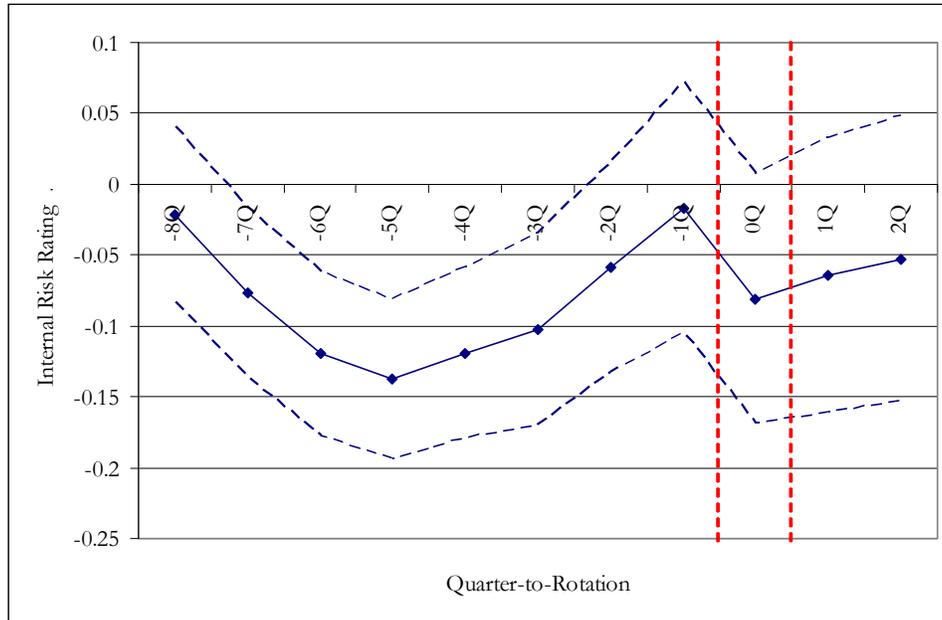
$$\begin{aligned}
 Internal_RR_{it} = & \sum_{s=-8}^2 \gamma_s \cdot 1[s = q_R] + \psi WExternal_RR_{it} + \\
 & \alpha_i + \alpha_{Loan_Officer} + \alpha_{Industry \times t} + v_{it}
 \end{aligned} \tag{2}$$

The dependent variable is the internal risk rating of firm i at time t . Again, to impose no structure to the time series pattern of average ratings the right hand side includes a full set of quarter-to-rotation dummies. The estimated parameters on these dummies, γ_{q_R} , represent the average internal rating for every quarter prior and after the high rotation period ($q_R \in [-8, 2]$). We control for the weighted average external risk rating assigned to firm i at time t by other banks to control for firm specific variation in creditworthiness. As in specification (1), loan officer fixed effects and industry-month dummies are included. The fixed effects specification ensures that the averages are measured as deviations from firm and loan officer means. The industry-month dummies imply that we measure deviations relative to the average firm in the same industry and during the same month.

The point estimates and 95% confidence intervals of the average ratings are plotted in Figure 3. As in the previous subsection, three regions can be identified in the plot. The first one, between 6 and 8 quarters prior to rotation, average risk ratings are declining (firms are upgraded). Pairwise comparisons of the estimated averages indicate that the differences between consecutive quarters are statistically significant at the 1% level. This is consistent with the hypothesis that, absent an immediate threat of rotation, loan officers have incentives to withhold bad news about the firm creditworthiness. Risk ratings build up an "optimistic" bias relative to ratings issued by other banks with time when rotation is far away. This corresponds to the same period during which ratings become less informative (from Figure 2).

FIGURE 3

INTERNAL RISK RATINGS BY TIME-TO-ROTATION (IN QUARTERS)



Average risk ratings then remain stable until 4 quarters prior to rotation, when they begin to increase. Pairwise comparisons of consecutive quarters indicate that the average rating 3 and 4 quarters prior to rotation are smaller than one quarter prior to rotation at the 1% confidence level. This pattern suggests that on average firms are downgraded as quarter-to-rotation approaches zero. This is in line with the predictions of the model in Section II: the threat of being uncovered by the new loan officer after rotation induces reporting of bad news. The point estimates (from column 1 of Table V) increase by 0.12 during the year prior to the high rotation quarter. Given that ratings are standardized, this implies that risk ratings increase by 12% of a standard deviation during this period. Finally, there is a trend break at the high rotation quarter, when the upward trend in average risk ratings stops. This implies that no additional systematic downgrades occur after the threat of rotation subsides.

The pattern in average ratings does not imply that all firms are downgraded in anticipation to rotation. The previous subsection showed that risk ratings become more informative about the probability of default. The two results together imply that firms with a higher likelihood of default were downgraded in anticipation to the threat of rotation. In the absence of the threat of rotation, loan officers make good and bad firms indistinguishable by giving bad firms good ratings. The threat of

rotation induces loan officers to downgrade bad firms, and as a consequence, the ability of ratings to discriminate firm quality improves. In the next section we show additional evidence on lending outcomes that is consistent with this interpretation of the results.

As before we confirm that the same pattern in average ratings is present among the rotation and no-rotation subsamples. The parameters of specification (2) including the interaction of all variables on the right hand side with the no-rotation dummy (Dum_NoRot_i) are shown in columns 2 and 3 of Table V. The estimated main effects present the same pattern described for the overall sample: average risk ratings decline and then increase as rotation approaches. The interaction effects are all insignificant prior to the high rotation period. As before, this indicates that the patterns of average risk ratings with quarter-to-rotation are statistically indistinguishable for the rotation and no rotation subsamples. This corroborates that it is the increase in the *ex-ante* probability of rotation which induces a loan officer to reveal bad news about the creditworthiness of firms.

Our theoretical framework suggested that loan officers have incentives to hide bad information about borrowers because this reflects poorly on the loan officer’s ability to originate and manage successful lending relationships (active monitoring). If this hypothesis is true, we expect that a loan officer will have stronger incentives to produce biased ratings for a firm when she has originated more lending since she has had a more substantial active monitoring role. We provide indirect evidence of this implication by looking at how the previously described average risk rating patterns vary according to the amount of origination in the relationship. We classify relationships by creating a dummy $HighOrigination_i$ that turns to one for every firm that has a relationship in the top quintile of the origination rate distribution prior to the high rotation period. Specification (2) is then augmented with an interaction between all variables on the right hand side and the high origination dummy.

Column 3 of Table V shows the estimated average risk ratings with (γ_{qR}^{HO}) and without (γ_{qR}^{LO}) the interaction. The estimate with the interaction represents the difference in the average ratings by quarter-to-rotation between the high origination and the low origination samples. The estimates of γ_{qR}^{HO} for 4 through 6 quarters prior to rotation are negative and statistically significant, and insignificant 1 through 3 quarters prior to rotation.²⁷ This implies that the optimistic bias in ratings and the systematic downgrade during the months prior to rotation are starker for the high origination

²⁷In unreported regressions we verify that the same pattern holds with respect to the information content of risk ratings. It is in the high origination subgroup where we see increased informativeness of ratings leading up to the high rotation period.

subsample. These results are consistent with the hypothesis that, absent rotation, loan officers have the strongest incentive to conceal bad news when the state of the loan is most informative for their type. Although this evidence is suggestive, it does not establish a causal link between origination and rating behavior. A causal relationship cannot be plausibly established in the present empirical context because the degree of origination prior to rotation in the cross section is dependent on past risk ratings.

C. *Information and Capital Allocation Decisions*

So far the analysis has focused on the incentive effects of rotation on the information content of borrower risk ratings, a key input for bank capital allocation decisions. In this section we explore whether the increased precision of ratings reported by loan officers is incorporated in lending outcomes ultimately approved by The Bank.²⁸ On the one hand we expect the amount of credit to be more sensitive to changes in ratings when the information content of ratings increases. Moreover, more precise signals about borrower creditworthiness can lead to an increase in the overall supply of credit (Leland and Pyle (1977), Myers and Majluf (1984), Stiglitz and Weiss (1981)). On the other hand, loan officers communicate information to The Bank through means other than internal ratings. The observed increase in rating informativeness may simply represent a substitution between communication channels. If substitution accounts for the results discussed so far and the overall precision of communication does not change, rotation should have no impact on lending outcomes.

We use reduced form specifications similar to those in the previous subsections to measure how the sensitivity of lending to rating changes and the total amount of lending vary with quarter-to-rotation. The following firm fixed effects specification is used to estimate the sensitivity of lending to internal ratings, conditional on external ratings:

$$\begin{aligned} \ln(\text{debt_Bank}_{it}) = & \sum_{u=-8}^2 1[s = q_R] (\theta_s \text{Internal_RR}_{it} + \zeta_s \text{WExternal_RR}_{it}) + \\ & + \vartheta \ln(\text{debt_othbanks}_{it}) + \alpha_i + \alpha_{\text{Loan_Officer}} + \alpha_{\text{Industry} \times t} + \nu_{it} \end{aligned} \quad (3)$$

The dependent variable is the amount of credit allocated by The Bank to firm i at month t (in

²⁸ Loan officers in our sample recommend the terms of lending but the final approval of lending is done by The Bank using all the information provided by the loan officer.

logs). Following specification (1), the right hand side includes the internal and the external risk ratings assigned to firm i at time t . As before, both variables are interacted with a set of quarter-to-rotation dummies, which allows the parameters on internal risk ratings to vary with quarter-to-rotation. To control for firm specific time series variation in the demand for credit we include as a control the total amount of credit of firm i with other banks in the financial system at time t (in logs). Loan officer heterogeneity and industry specific shocks are saturated by a full set of loan officer and industry-month dummies.

The set of parameters of interest are the lending sensitivities to internal risk ratings, one for each quarter-to-rotation (θ_{qR}). We expect the lending sensitivity to increase when internal ratings become more informative, which occurs during the period leading to the high rotation quarter. The estimated sensitivities by quarter-to-rotation are shown in column 1 of Table VI. All the point estimates prior to the high rotation quarter are negative, which indicates that increases in the internal risk rating (firm downgrades) are correlated with declines in the amount of lending. This holds after taking into account changes in the external rating assigned to the firm by other banks.

The estimates for the sensitivity are significant only during the year prior to the high rotation quarter. The magnitude of the estimated sensitivities imply that a firm that suffered the average downgrade during the year prior to the high rotation quarter (12% of a standard deviation) would see the amount of credit it receives from The Bank reduced by 5.2 to 8.5%. The estimated sensitivities become insignificant after the high rotation quarter. This pattern indicates that internal ratings and the allocation of credit are significantly correlated precisely at the time when the informativeness of ratings is increasing. The evidence suggests that The Bank's lending decisions incorporate the additional information in internal credit ratings induced by rotation.

We now turn to studying how the average level of lending is affected by rotation. The previous back of the envelope calculation based on the average change in ratings gives a biased estimate of the lending change. That calculation ignores the increase in lending to firms that are not downgraded prior to rotation. We expect firms that are not downgraded to experience an increase in lending because they are now credibly distinguished from low quality borrowers. We obtain a direct unbiased estimate using a variation of (2), a firm fixed effects regression of the amount of lending (in logs) on a full set of quarter-to-rotation dummies:

$$\ln(\text{debt_Bank}_{it}) = \sum_{s=-8}^2 \varphi_s \cdot 1[s = q_R] + \vartheta \ln(\text{debt_othbanks}_{it}) + \alpha_i + \alpha_{\text{Loan_Officer}} + \alpha_{\text{Industry} \times t} + v_{it} \quad (4)$$

As before, the specification includes the log of the total amount of credit of firm i with other banks, loan officer dummies, and a full set of industry-month interactions. The parameters of interest, φ_{q_R} , represent the mean (log) debt by quarter-to-rotation, conditional on the amount of debt of the same firm with all other banks. As in specification (2), pairwise comparisons of these coefficients provide information on how the level of lending evolves around the high rotation quarter.

The estimated parameters and standard errors are shown in column 2 of Table VI. A pairwise comparison of the estimates points to a statistically significant lending increase between 5 and 2 quarters prior to rotation. The point estimates increase from 0.15 to 0.56 in this period, which corresponds to a 41% increase in the amount of lending relative to other banks. A rule of thumb calculation using the average fraction of debt that firms in the sample obtain from The Bank (27%) indicates that overall firm borrowing increases by 11% during the year prior to the high rotation quarter. The point estimates suggest that lending declines after the high rotation quarter, but the differences in pairwise comparisons are not statistically significant.

The overall results on lending are consistent with the hypothesis that the precision of all information which passes from the loan officer to the bank increases in response to the threat of rotation. Rotation induces loan officers to reveal bad news about borrowers, which allows ratings to discriminate good borrowers from bad ones. The additional information is incorporated into lending decisions by shifting credit away from poor quality borrowers and towards good quality ones. In response to the additional information, the net supply of credit increases.

V. Rotation and Career Concerns

The results so far demonstrate that imminent rotation induces loan officers to report bad news more accurately. In this section we explore the mechanism through which rotation provides incentives to reveal bad news. Our theoretical framework relied on career concerns as the source of the incentive problem and an explanation for why rotation works. A loan officer has incentives to hide bad news because it reflects poorly on her ability as an active monitor. Rotation works because the newly

assigned loan officer has minimal responsibility for the current state of the loan, and revealing bad news demonstrates her ability as a monitor. The threat of being uncovered by the new loan officer provides incentives to the incumbent loan officer to reveal bad news.

This rationale differs sharply from that in existing theoretical accounts of the incentive effects of rotation (Prescott and Townsend (2006), Arya and Mittendorf (2004), Hirao (1993), Ickes and Samuelson (1987)). In these, the incumbent monitor (loan officer) reveals information truthfully prior to rotation because the principal (The Bank) commits not to use this information against her in the future. Thus, rotation works because it breaks the link between the current performance of the monitor and her future rewards.

The career concerns and commitment accounts of the incentive effects of rotation are mutually exclusive. More importantly, the two accounts have drastically different implications regarding the design of rotation policies.²⁹ This highlights the importance of distinguishing empirically the channel through which rotation operates. This section sheds light on this issue by testing directly the implications of rotation in the career concerns framework discussed in Section II.

Career concerns exist when The Bank updates its beliefs about the monitoring ability of a loan officer after observing her reporting behavior. The Bank then acts upon these beliefs in a way that affects the future payoffs of loan officers. In line with Berk and Green (2004), we conjecture that in equilibrium The Bank allocates more assets under the management of loan officers with higher perceived monitoring abilities.³⁰ This reasoning suggests that under career concerns, events that affect the reputation of a loan officer will also affect the assets under her management in the future.

We test this implication in the data by, first, identifying the events related to rotation that convey information about a loan officer's monitoring ability to The Bank. We initially set aside endogeneity concerns and estimate a linear projection of asset allocation decisions across loan officers on lagged reputation event counts. Then we construct reputation counts based on rotations induced by the three year rule, and use them to measure the causal impact of reputation events on loan officer's assets under

²⁹Both accounts are mutually exclusive because under the commitment hypothesis, rotation cannot provide incentives to reveal information when agents have career concerns. In terms of policy implications, under career concerns the incentives of rotation can be enhanced by explicitly punishing the loan officer when she is exposed by her successor. Such a punishment scheme would be counterproductive under the commitment hypothesis. Further, under career concerns the threat of rotation acts as an incentive device, which allows randomized rotation rules to be effective. Since the commitment hypothesis relies on an indifference argument, randomized rotations would not provide incentives to divulge information.

³⁰In Berk and Green (2004) a competitive capital market allocates resources to fund managers of heterogeneous abilities. In the present setting, resources are allocated across loan officers by a profit maximizing bank.

management.

A. Reputation Events

Rotation produces information about monitoring ability because it enables the comparison of ratings assigned by two different loan officers to the same firm i . Define the pre-rotation (post-rotation) period for firm i as the 6 months prior (after) firm i is reallocated to a different loan officer. Consider the event where a newly assigned loan officer downgrades a firm during the post-rotation period. The theoretical framework produces clear predictions on how this event affects The Bank's beliefs about the monitoring abilities of both the pre-rotation and post-rotation loan officers.

Regarding the pre-rotation loan officer, the event demonstrates that: (i) the state of the loan was poor and (ii) she was unable to detect this. Thus, the event leads to a downward revision of the Bank's assessment of the active and passive monitoring abilities of the pre-rotation loan officer. For the post-rotation loan officer, the event demonstrates she was able to detect bad news regardless of being newly assigned to the task. As a result, the event improves the Bank's beliefs on the monitoring ability of the post-rotation loan officer.

The Bank's posterior beliefs about the monitoring ability of a loan officer are a function of the number of observed post-rotation downgrade events. We keep track of the number of these reputation events experienced by pre-rotation and post-rotation loan officers separately by defining the variables $\#POST_DG_{jt}^{LOpre}$ and $\#POST_DG_{jt}^{LOpost}$. The variable name reflects the reputation event being counted (post-rotation downgrades). The subindexes j and t represent loan officer and month. And the superscript indexes whether loan officer j was the pre-rotation or the the post-rotation loan officer associated with the rotation event.

To understand how these counts are constructed, suppose that a post-rotation downgrade event happens at time t . Then $\#POST_DG_{jt}^{LOpre}$ ($\#POST_DG_{jt}^{LOpost}$) increases by one between $t - 1$ and t if loan officer j was managing the firm in the *pre-rotation* (*post-rotation*) period. If loan officer j was neither the incumbent or the newly assigned loan officer both variables remain unchanged between $t - 1$ and t . The variables are constructed to reflect the fact that the same event affects the monitoring reputation of both the pre and post-rotation loan officers at time t .

Events are defined using the internal risk ratings of The Bank based solely on downgrades to ratings of 2 or 3 to avoid mechanical changes in the variables due to defaults or foreclosures. The

descriptive statistics of the two counts calculated over the loan officer-month panel between December 1997 and December 2002 are shown in panel 1 of Table VII. The average loan officer in the panel has experienced 2.7 events where a firm under her management is downgraded post-rotation. As the counterpart to this, the average loan officer has downgraded a firm 2.5 times during the 6 months after a rotation. Note that both counts are based on an identical set of events: post-rotation downgrades. Thus, the difference between the two counts represents the differential distribution and concentration of the events across loan officers. The median count is zero and the distribution in the panel is right-skewed, since counts start at zero and remain at that level until a reputation event occurs for any given loan officer.

B. Naive Specification

Our interest is to assess whether reputation events have an effect on the assets under management of a loan officer. A first naive estimation of this effect, which assumes that reputation events and rotation are exogenous, can be obtained through a log linear projection of asset allocation decisions of The Bank on lagged reputation event counts:³¹

$$\ln(A_{jt}) = \theta_1 \left[\#POST_DG_{jt-6}^{LOpre} \right] + \theta_2 \left[\#POST_DG_{jt-6}^{LOpost} \right] + \gamma X_{jt} + \alpha_j + \alpha_t + v_{jt} \quad (5)$$

The variable on the left hand side is the log of a measure of assets under management of loan officer j at time t . Two measures of assets under management are used: the total amount of loans outstanding and the number of firms under management of a loan officer on a given calendar month. The variables on the right hand side are the two reputation event counts, loan officer fixed effects and month dummies (additional controls will be included and discussed below). The fixed effects specification accounts for unobserved loan officer heterogeneity and the month dummies account for common shocks to assets under management in the cross section. The reputation counts are lagged 6 months to allow for a response time between changes in reputation and the reassignment of assets (although the results that follow are robust to this choice). All standard errors in what follows are

³¹This specification follows directly from extending the model in Section II to an environment where N signals are released about the loan officer's type. In such a setting, the log likelihood ratio of the posterior belief about the loan officer's type is linear in the log likelihood of the prior and the number of signals of each kind (good or bad). Thus, the linear specification is appropriate assuming that asset allocations are proportional to the log likelihood ratios of posteriors. Loan officer fixed effects account for the unobserved heterogeneity in the priors across loan officers.

estimated allowing for clustering at the loan officer level.

Post-rotation downgrade events affect negatively (positively) the monitoring reputation of the pre-rotation (post-rotation) loan officer. We expect the reputation events to have opposite effects on the assets under management of pre and post-rotation loan officers ($\theta_1 < 0$ and $\theta_2 > 0$ in specification (5)). The OLS point estimates of these parameters, shown in columns 1 through 4 of the top panel of Table VIII, are consistent with this prediction. The estimated semi-elasticities imply that when a firm is downgraded immediately after rotation, the amount of loans (number of firms) under management of the pre-rotation loan officer declines by 10.1% (5.4%). On the contrary, the amount of loans (number of firms) under management of the loan officer who downgraded the firm increases by 3.2% (2.6%).

We add two controls to verify the robustness of the naive estimates. First, the total number of rotations loan officer j has experienced up to time t where no reputation event occurred, $NRot_{jt}$. This variable controls for the mechanical effect on the reputation counts that results when a loan officer handles a larger portfolio of firms, and accounts for the fact that rotations provide information about a loan officer's type even when no reputation event occurs.³² And second, the average risk rating assigned to the firms under management of loan officer j by all other banks (using Central Bank data), weighted by the amount of loans outstanding of each firm. This control is meant to account for observable time varying characteristics of firms in the loan portfolio of the officer that may also affect future assets under management. After including these controls the sign and magnitude of the point estimates remains unchanged (columns 2 and 4).

C. Identification: Rule-Based Reputation Events

The sign of the estimated semi-elasticities is consistent with the predictions of the career concerns framework. However, the possibility that The Bank updates beliefs about the ability of a loan officer through means other than rotation implies that the estimates cannot be given a causal interpretation. Such updates would induce unobserved and time varying heterogeneity in beliefs, potentially correlated with the error term in (5). For example, suppose The Bank rotates a loan officer because she received a poor customer evaluation, which reflects the overall ability of the loan officer. This rotation would induce a new reputation event for the loan officer with no corresponding additional asset reallocations, which would lead to a downward bias in the estimates of θ_1 and θ_2 . On the contrary, if the rotation

³²Most obviously, rotations that are not followed by a downgrade lead the Bank to improve its assessment of the loan officer.

is followed by additional reallocations of assets, we would interpret those as a consequence of rotation when in fact they are triggered by the unobserved evaluation.

The identification problem stems from the fact that rotations in general are endogenous to The Bank’s prior’s about the loan officer’s ability. We exploit again the 3-year rotation rule as an exogenous source of variation in the probability of rotation to identify the causal link between reputation and assets under management. The identifying assumption is that reputation events triggered by the rotation rule are unrelated to The Bank’s priors about the loan officer’s reputation, an assumption that we corroborate below.

Define the pre-high rotation (post-high rotation) period for firm i as the 6 months prior (after) firm i reaches a high rotation quarter as predicted by the 3-year rule. Consider the event where a loan officer downgrades a firm during the post-high rotation period. As before, we construct counts of these rule-based reputation events on the pre and post-high rotation loan officers ($\#POST_DG_HROT_{jt}^{LOpre}$, $\#POST_GD_HROT_{jt}^{LOpost}$). For consistency, the names of the variables denote that events based on the high rotation period are counted. The superscripts index whether loan officer j managed the firm during the pre or the post-high rotation period. The descriptive statistics of the rule-based event counts are shown in panel 2 of Table VII. The average rule-based event counts in the panel are smaller than the actual rotation-based counterparts since rule-based events do not occur, by construction, during the first three years of the sample.

Table IX shows the estimated parameters of a first stage regression of the rotation-based counts on the high rotation-based counts. The first stage estimation includes all the controls in (5): loan officer fixed effects, month dummies, the total number of rotations and the average risk rating assigned to the firms under management. The estimates indicate there is a strong partial correlation between the reputation event counts based on the high rotation period and their counterparts based on actual rotations.

To validate the identifying assumption we test whether loan officer reputation predicts rotation during the last quarter of a three year relationship. In the Appendix we estimate a probability model of rotation during the high rotation quarter, conditional on the reputation event counts of the incumbent loan officers in the previous quarter. We find that neither of the counts predicts which loan officers are reassigned during the high rotation quarter. This implies that rotations induced by the three-year rule are unrelated to The Bank’s priors about loan officer reputation, and confirms that the rule-based

reputation events are plausibly exogenous.

D. The Effect of Reputation on Assets Under Management

The parameters of specification (5) are estimated using the rule-based reputation event counts as instruments for the actual rotation based ones (columns 5 through 8 of Table VIII). The effect of a downgrade by a newly assigned loan officer on the assets under management of the pre-rotation loan officer is negative and significant using both measures. The estimates of θ_1 indicate that one additional downgrade by a successor leads the pre-rotation loan officer to handle 15.9% less loans and 5.5% fewer firms. The estimates of θ_2 , the effect of one additional downgrade by a newly assigned loan officer on her own assets under management are not significantly different from zero in all specifications.

The negative sign of θ_1 is consistent with our career concerns account of rotation: downgrades by a successor signal poor active and passive monitoring abilities and subsequently lead to a decline in assets under management. The decline in the total loans and number of firms when rotation reveals poor monitoring ability is substantial. The fact that the estimated semi-elasticity is larger in the debt specification suggests that it is the largest accounts that are reallocated away from loan officers with poor monitoring reputation.

The statistically insignificant estimates of θ_2 indicate that the same post-rotation downgrades bear no consequences on the assets under management of the loan officers who perform them. This result implies that rotation removes the disincentive of the new loan officer to reveal bad news by temporarily separating the responsibility for active and passive monitoring. In addition, the new loan officer has strong incentives to reveal bad news to avoid taking responsibility for the bad state of the loan later in her assignment.

This raises the question of whether the pre-rotation loan officer bears consequences when she downgrades a firm. We explore the consequences of downgrades in the pre-rotation period by augmenting specification (5) with a third reputation event count. $\#PRE_DG_{jt}$ is a count of the number of times until time t , that loan officer j has downgraded a loan under her management during the 6 months prior to a rotation. The name and indexes of the variable follows the same logic as before: the name indicates that the variable counts downgrades in the pre-rotation period; subindexes represent loan officer j at month t ; and there is no superscript because downgrades before rotation only bear consequences for the pre-rotation loan officer. In a similar fashion, $\#PRE_DG_HROT_{jt}$, counts the

number of events when a loan officer downgrades a loan during the pre-high rotation quarter.

To study the effect of pre-rotation downgrades on assets under management we limit our attention to the reduced form specification using $\#PRE_DG_HROT_{jt}$. This variable cannot be excluded from specification (5) because downgrades prior to the high rotation quarter affect loan officer reputation regardless of whether rotation occurs ex post or not. Since $\#PRE_DG_HROT_{jt}$ affects directly assets under management it cannot be used as an instrument for $\#PRE_DG_{jt}$ in (5).³³ The reduced form specification provides information about the direction of the effect of pre-rotation downgrades on assets under management. Rotations induced by the three year rule are exogenous and thus the impact on assets under management can be interpreted causally. The sign of the reduced form coefficients will be correct, although the magnitude does not have a straightforward interpretation.

Table X shows the estimated parameters of both the OLS and reduced form regressions of assets under management on the three reputation event counts. The OLS specification uses the rotation-based events and the reduced form the high rotation quarter-based events. As before, all estimations include loan officer fixed effects and year dummies, and controls are added to verify robustness.

The sign of the parameter on the pre-rotation count is negative in all specifications. It is significant when the (log) number of firms under management is used as a measure of assets under management. This indicates that when a loan officer downgrades a loan in the months prior to the high rotation quarter, she goes on to manage a smaller number of firms in the future.

This result has three important implications for our analysis. First, the fact that a loan officer's career suffers when she reports bad news underscores the cause of the agency problem in this context. Holding all else equal, a loan officer would prefer not reveal bad news about a loan to which she has been assigned for several years. In terms of our theory, this indicates that an officer's active monitoring role is more informative for her type than her passive monitoring role ($p > q$) and hence creates the basic incentive for her to hide bad news.

The second implication is that existing theories of rotation in delegating monitoring are not applicable in our empirical context (Prescott and Townsend (2006), Arya and Mittendorf (2004), Hirao (1993), Ickes and Samuelson (1987)). Those theories rely on the assumption that an agent is willing to reveal her private information at the end of an assignment because this will have no impact on her

³³We showed in Section IV that on average loan officers downgrade firms prior to the high rotation quarter. From this event The Bank can infer that the loan officer was managing a poor quality loan, but also that she was able to detect it. Such an event decreases the active monitoring reputation and increases the passive monitoring reputation of the loan officer even if the firm is not reassigned afterwards.

future career prospects. To the contrary, our results indicate that the future career of a loan officer is affected by the information she releases at the end of her assignment. The finding suggests that career concerns should be incorporated in accounts of rotation in delegated monitoring.

The third implication is that a loan officer has strong incentives to reveal bad news early in her assignment. If a new loan officer were to conceal bad news and be forced to reveal it later her career would suffer. On the contrary, revealing bad news at the beginning of an assignment bears no consequences on career prospects. The highly motivated new officer provides the incentive for the incumbent officer to change her reporting behavior in anticipation of rotation.

A question that arises from this result is why does a loan officer reveal bad news about the firm prior to rotation when this has a negative impact on her career? The statistics in Table V indicate that loan officers are 10 times more likely to downgrade themselves prior to rotation than to be uncovered by a successor. Our model provides an explanation: by revealing bad news herself the loan officer at least signals her high passive monitoring ability. The reduced form estimates suggest that the negative consequences of revealing bad news prior to rotation are an order of magnitude smaller than being uncovered by a successor ($\theta_2 \gg \theta_3$ in columns 5 through 6 of Table X).

VI. Conclusion

This paper provides a new theoretical account of rotation as an incentive device and the first empirical evidence that rotation can be used to limit agency problems in the context of delegated monitoring. Our results show that when faced with the imminent threat of rotation loan officers temporarily issue more informative internal ratings. This additional information comes from the release of bad news. Our results show that the bank responds to this increase in the precision of communication: lending becomes more sensitive to ratings and, on average, the bank takes advantage of this information by increasing lending. In addition, our paper provides direct evidence of the way in which rotation affects loan officer incentives. Our results show that loan officers who fail to report bad news and are exposed by a successor go on to manage smaller lending portfolios. Moreover, we show that rotation creates incentives for a newly assigned loan officer to reveal bad news.

Our findings have a number of important implications for organizational design. First, the ex ante threat of rotation provides incentives to the incumbent monitor. This implies that randomized rotation rules (such as the one used by The Bank) can be effective. Randomized rules will lower

the costs associated with rotation when, for example, there is project specific expertise. Second, rotation works by facilitating relative performance evaluation: the comparison of the performance of an incumbent monitor with her successor. This suggests that the effectiveness of rotation can be enhanced by punishment schemes that penalize an agent when she is exposed by her successor.

Next, our results are suggestive about the costs that determine the optimal frequency of rotation. The three year rotation policy does not prevent misreporting in the middle of a relationship. This suggests that there are significant costs to rotation which make using it at higher frequency suboptimal. We show some evidence that rotation brings with it a loss in project specific human capital. A newly assigned loan officer is less capable of producing informative ratings than an incumbent.

A related organizational question beyond the scope of this paper is why combine the roles of active and passive monitoring. One simple answer is that this might involve costly duplication of tasks. In addition, there may be other important complementarities between these two roles. For example, in the context of banking a borrower may be unwilling to cooperate with a loan officer whose only role is to detect bad news.

Our results provide direct evidence that agency problems constrain communication in organizations. The choice between rotation and other organizational responses remains an open question for future work. The fact that rotation is widely observed in practice suggests that it is often an effective response to this problem.

VII. Mathematical Appendix

A. Proof of Proposition 1

We want to show that absent rotation it is an equilibrium to always report r_n in each period. Note that absent rotation period $t = 2$ and $t = 3$ are identical so we can just focus on the reporting decision of an officer who observes bad news at $t = 1$ and $t = 2$. If the officer follows the proposed equilibrium she obtains a reputation of $\hat{\mu}^x(r_n^x, r_n^x, r_n^x) = \mu^x$. Alternately, if the officer deviates from the proposed equilibrium and reveals bad news at $t = 2$ this generates a reputation of

$$\hat{\mu}^x(r_n^x, r_b^x) = \frac{\mu^x}{\mu^x + (1 - \mu^x) \frac{(1-q)((1-p)\phi + p(1-\phi))}{q(p\phi + (1-p)(1-\phi))}}.$$

She has no incentive to deviate at $t = 2$ if

$$\hat{\mu}^x(r_n^x, r_b^x) \geq \mu^x \Leftrightarrow \frac{q(p\phi + (1-p)(1-\phi))}{(1-q)((1-p)\phi + p(1-\phi))} \leq 1$$

which holds if and only if

$$\phi \leq \phi' \equiv \frac{p - q}{2p - 1}.$$

Note that $2(p - q) < 2p - 1 \Leftrightarrow 2q > 1$ which establishes that $\phi' \in (0, \frac{1}{2})$. We assume that $\phi < \phi'$ and hence this ensures that the officer has no incentive to report r_b at $t = 2$ or $t = 3$. Next consider the officer's decision to deviate and report r_b at $t = 1$. Regardless of her reporting strategy at $t = 2$ and $t = 3$ (by the law of iterated expectations) this will generate an expected reputation of

$$\widehat{\mu}^x(r_b^x) = \frac{\mu^x}{\mu^x + (1 - \mu^x) \frac{(1-q)p}{q(1-p)}}.$$

The officer will only choose to deviate if

$$\widehat{\mu}^x(r_b^x) \geq \mu \Leftrightarrow \frac{(1 - q)p}{q(1 - p)} \leq 1$$

which cannot hold because $p > q$. This establishes that reporting nothing in all periods is an equilibrium. Now to show this is unique. Can it be an equilibrium that the loan officer conceals bad news at $t = 1$ and always reports bad news at $t = 2$ (and $t = 3$)? Reporting r_b at $t = 2$ generates a reputation of

$$\widehat{\mu}^x(r_n^x, r_b^x) = \frac{\mu}{\mu + (1 - \mu) \frac{(1-q)((1-p)\phi + p(1-\phi))}{q(p\phi + (1-p)(1-\phi))}}$$

conversely if the loan officer reports r_n at $t = 2$ this generates a reputation of

$$\widehat{\mu}^x(r_n^x, r_n^x) = \frac{\mu^x}{\mu^x + (1 - \mu^x) \frac{1 - (1-q)((1-p)\phi + p(1-\phi))}{1 - q(p\phi + (1-p)(1-\phi))}}$$

however our assumption that $\phi < \phi'$ ensures that $\widehat{\mu}^x(r_n^x, r_b^x) > \mu > \widehat{\mu}^x(r_n^x, r_n^x)$ and hence the officer will deviate from the proposed equilibrium. Finally, there cannot be any equilibrium in which the loan officer reports bad news at $t = 1$ (no matter what the proposed reporting strategy after $t = 1$). This is easily seen by noticing that the expected reputation from reporting r_b at $t = 1$ is

$$\widehat{\mu}^x(r_b^x) = \frac{\mu^x}{\mu^x + (1 - \mu^x) \frac{(1-q)p}{q(1-p)}} < \mu^x$$

and the officer can generate an expected reputation of

$$\widehat{\mu}^x(r_b^x) = \frac{\mu^x}{\mu^x + (1 - \mu^x) \frac{1 - (1-q)p}{1 - q(1-p)}} > \mu^x$$

is she deviates and reports r_n at $t = 1$. Thus it cannot be that there is any equilibrium in which the agent truthfully reports bad news at $t = 1$. This establishes Proposition 1.

B. Proof of Proposition 2

Begin by noting that since $q > \frac{1}{2}$ it is clearly optimal for y to report r_b at $t = 3$ whenever she has the chance. This must be the case in any equilibrium. Now consider the proposed equilibrium where x reveals bad news at $t = 2$ and conceals at $t = 1$. Is the officer reports bad news at $t = 2$ and reports

r_b her reputation will be

$$\hat{\mu}^x(r_n^x, r_b^x) = \frac{\mu}{\mu + (1 - \mu) \frac{(1-q)((1-p)\phi + p(1-\phi))}{q(p\phi + (1-p)(1-\phi))}}$$

regardless of the report issued by y at $t = 3$. Now suppose she deviates and reports r_n . With probability \bar{q}^y she will be exposed by y and hence will have a reputation of

$$\hat{\mu}^x(r_n^x, r_n^x, r_b^x) = \frac{\mu}{\mu + (1 - \mu) \frac{q((1-p)\phi + p(1-\phi))}{(1-q)(p\phi + (1-p)(1-\phi))}} < \hat{\mu}^x(r_n^x, r_b^x)$$

where the inequality comes directly from the fact that $q > \frac{1}{2}$. With probability $(1 - \bar{q}^y)$ she will not be discovered and will generate a reputation of

$$\hat{\mu}^x(r_n^x, r_n^x, r_n^y) = \frac{\mu}{\mu + (1 - \mu) \frac{1 - (\phi(1-p) + p(1-\phi))((1-q) + q\bar{q}^y)}{1 - (\phi p + (1-p)(1-\phi))(q + (1-q)\bar{q}^y)}}.$$

Define the expected reputation gain from deviating as

$$\Delta DEV(\bar{q}^y) = \bar{q}^y \hat{\mu}^x(r_n^x, r_n^x, r_b^y) + (1 - \bar{q}^y) \hat{\mu}^x(r_n^x, r_n^x, r_n^y) - \hat{\mu}^x(r_n^x, r_b^x).$$

The above inequalities show demonstrate that $\Delta DEV(\bar{q}^y = 1) < 0$. Since $\Delta DEV(\bar{q}^y)$ is continuous in \bar{q}^y it follows directly that there exists a $\bar{q}^{y*} \in (0, 1)$ such that it will be optimal for x to report r_b at $t = 2$. Next we have to check that it is optimal for x to conceal bad news at $t = 1$. If x decides to deviate from the proposed equilibrium and report r_b at $t = 1$ she will generate a reputation of

$$\hat{\mu}^x(r_b^x) = \frac{\mu^x}{\mu^x + (1 - \mu^x) \frac{(1-q)p}{q(1-p)}}.$$

If instead she reports r_n at $t = 1$, in accord with the proposed equilibrium, then with probability $1 - \phi$ she will end up reporting r_b at $t = 1$ and generate a reputation of $\hat{\mu}^x(r_n^x, r_b^x)$. With probability ϕ the state will change and she will generate a reputation of $\hat{\mu}^x(r_n^x, r_n^x, r_n^y)$. It is straightforward to show that $\phi > 0 \implies \hat{\mu}^x(r_b^x) < \hat{\mu}^x(r_n^x, r_b^x)$ and in addition that $\hat{\mu}^x(r_b^x) < \hat{\mu}^x(r_n^x, r_n^x, r_n^y)$. It follows then that x will strictly prefer to conceal bad news at $t = 1$. This establishes the proposed equilibrium.

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TABLE I
SUMMARY STATISTICS ON LOAN OFFICER ROTATION

This table presents summary statistics of the loan officer rotation and loan officer-firm relationships. The data is an unbalanced monthly panel covering a 4-year period from December 1997 to December 2001 from a multinational bank in Argentina (The Bank). At each point in time there is a single loan officer per firm. The data allows observing which borrowers are assigned to each loan officer every month. Borrowers are defined as small business firms with net sales less than \$50 million. There are 1,248 firms and 100 loan officers in our sample corresponding to 4,181 non-censored firm-loan officer relationships. The average firm in the sample is observed for 67 months. Loan Officer Statistics include the “Number of Firms in Loan Officer Portfolio” and the “Length of Loan Officer-Firm Relationship”. “Number of Relations per Firm” represents the number of loan officer changes a borrower experiences through out the sample period. “Number of Different Loan Officers per Firm” represents the number of different loan officers a borrower experienced in the sample. “% Firms Repeat Loan Officer” represents the percentage of firms that encounter the same loan officer more than once in two non-consecutive relationships. A total of 26 firms and 18 loan officers exit during the sample period under analysis.

Variable	Mean	Median	SD	Min	Max
LOAN OFFICER STATISTICS					
Number of Firms in Loan Officer Portfolio	25.57	10.0	36.14	1	221
Length of Loan Officer-Firm Relationship	22.11	18.0	18.04	1	84
FIRM STATISTICS					
Number of Relationships per Firm	3.04	3.0	1.29	1	7
Number of Different Loan Officers per Firm	3.19	3.0	1.43	1	9
% Firms Repeat Loan Officer	28%	0.0	0.45	0	1

TABLE II
SUMMARY STATISTICS ON BORROWER LEVEL INFORMATION

The table presents summary statistics for selected firm level variables used in the paper. The reported statistics are based on 22,659 firm-month-year observations corresponding to a panel of 1,248 firms between December 1997 and December 2001. All “Level of Borrowing Measures” are expressed in thousand of dollars. “Approved Loan Amount” is the total amount of loans approved internally by The Bank. “Outstanding Amount” is the total amount of credit facilities that have been previously disbursed to the borrower by The Bank. These two measures are from the internal bank records. In order to check for consistency of the “Outstanding Amount” we name-matched the internal bank database with the records of the Argentinean Central Bank Public Credit Registry (Central de Deudores del Sistema Financiero; CDSF). “Outstanding Reported By Central Bank” is the total amount of credit facilities that have been previously disbursed to the borrower in the CDSF database by The Bank. “Total Bank Debt Reported By Central Bank” corresponds to the total amount of credit facilities disbursed to each borrower by all banks (including The Bank). “Debt Bank/Total Debt” is the share of The Bank’s debt over the total amount of debt reported in the CDSF. “Number of Other Lending Relationships” represents the number of financial institutions each firm has a lending relationship with. “Internal Risk Rating” is a number between 1 (best) and 5 (worse) assigned on a monthly basis by loan officers to every firm in their portfolio. Classifications 1, 2 and 3 are under the discretion of the loan officer and reflect the probability of default of the loan. Classifications 4 and 5 are not discretionary and represent a situation when the borrower defaults/write-off. “Weighted External Risk Rating By Other Banks” is a standardized credit rating that each financial institution reports on a monthly basis to the CDSF. The numerical rating is expressed on a scale of 1 (Current) to 5 (Uncollectible). Each of these ratings is weighted by the amount of debt outstanding with each bank. “Facility Risk Rating” is the bank’s numerical indicator on a scale of 0 (best) to 29 (worse) to identify the overall risk associated with each specific firm in terms of maturity and degree of collateral following the credit manual policy guidelines. “Default Rate” is a dummy variable that takes a value of 1 if “Internal Risk Rating” is less than 4 and it is 0 otherwise. “Default Rate In Next 12 Months” is a dummy variables that takes a value of 1 if the firm is not in default at time t but enters in default (“Internal Risk Rating” $>$ 4) anytime between $t + 1$ and $t + 12$. To construct these measure for observations dated between January and December of 2001, we used additional out of sample default data from the CDSF for the period January 2002 to December 2002.

Variable	Mean	Median	SD	Min	Max
LEVEL OF BORROWING (\$000)					
Approved Loan Amount	1,111	628	2,972	0	285,564
Outstanding Amount	493	201	1,273	0	72,205
Outstanding Reported by Central Bank	513	226	936	0	34,922
Total Bank Debt Reported by Central Bank	2,941	1,336	4,882	0	83,139
Debt Bank/Total Debt	0.27	0.17	0.27	0	1
Number of Other Lending Relationships	7.52	7.00	4.08	1	34
INTERNAL-EXTERNAL BANK RATINGS					
Internal Risk Rating	1.54	1.00	1.11	1	5
Weighted External Risk Rating By Other Banks	1.41	1.00	1.03	1	5
Computer Generated Risk Rating	17.61	17.00	2.79	0	29
DEFAULT MEASURES					
Default Rate	0.09	0.00	0.28	0	1
Default Rate In Next 12 Months	0.13	0.00	0.33	0	1

TABLE III
RISK RATING PREDICTIVE POWER AND AVERAGE, BY QUARTER-TO-ROTATION

This table shows preliminary evidence of the incentive effects of rotation. It shows how the correlation of internal risk ratings and the future probability of default, and average risk ratings vary with quarter-to-rotation around the high rotation quarter induced by the 3-year rule. The statistics are computed over the subsample of relationships that reach at least 33 months of duration. Quarter-to-rotation measures the time, in quarters, elapsed before and after the high rotation quarter. Quarter-to-rotation is zero for the high rotation quarter and negative (positive) for quarters prior to (after) the high rotation quarter. Column (1) reports the correlation between internal risk ratings and an indicator variable equal to 1 if firm *i* is not in default at *t*, but goes into default anytime between *t* + 1 and *t* +12. *, ** and *** indicate that the correlation calculated in column (1) [average difference in column (4)] is statistically significant at the 10, 5 and 1 percent levels.

Sample Quarter, measured relative to High Rotation Quarter	N	Correlation of Internal Risk Rating and Default in next 12 months	Average Internal Risk Rating (stdev)	Average Rating Difference between Consecutive Quarters
	(1)	(2)	(3)	(4)
Quarter-to-rotation = -4	872	0.044	1.61 (1.23)	
Quarter-to-rotation = -3	916	-0.018	1.64 (1.26)	0.029
Quarter-to-rotation = -2	930	0.130 ***	1.68 (1.29)	0.042
Quarter-to-rotation = -1	932	0.132 ***	1.81 (1.35)	0.130 **
High Rotation Quarter	935	0.168 ***	1.97 (1.41)	0.157 **
Quarter-to-rotation = 1	877	0.091 *	2.05 (1.46)	0.080
Quarter-to-rotation = 2	648	0.052	1.65 (1.19)	-0.402 ***
Overall	6,110	0.052 ***	1.78 (1.33)	

TABLE IV
HOW INFORMATIVE ARE CREDIT RATINGS?

This table tests how the predictive power of Internal Risk Ratings and Computer Generated Risk Ratings change with quarter-to-rotation (q_R) following the random effects probit specification (1):

$$\Pr(\text{Default12}_{it} = 1 | \cdot) = \Phi \left[\sum_{s=-8}^2 1[s = q_R](\beta_s \text{Internal_RR}_{it} + \zeta_s \text{WExternal_RR}_{it}) + \alpha_{\text{Loan_Officer}} + \alpha_{\text{Industry} \times t} \right]$$

q_R measures the time, in quarters, elapsed before and after the high rotation quarter induced by the 3-year rotation rule. q_R is zero for the high rotation quarter and negative (positive) for quarters prior to (after) the high rotation quarter. The dependent variable (Default12_{it}) is an indicator variable equal to 1 if firm i is not in default at t , but goes into default anytime between $t + 1$ and $t + 12$. All columns include Internal Risk Ratings, Weighted External Risk Rating, Loan Officer Dummies and Industry-Calendar Month Dummies. Column (1) reports the interaction of the Internal Risk Ratings with a set of q_R indicators. Columns (2) and (3) report the parameters of an augmented specification that includes the interaction of all variables in the right hand side with a dummy equal to one if the loan officer of firm i is not rotated during the high rotation period. Column (2) presents the parameters on the terms without interactions and Column (3) the terms with interactions. Standard errors reported in parenthesis are estimated accounting for heteroskedasticity and are clustered at the firm level. *, ** and *** indicate that the point estimate is statistically significant at the 10, 5 and 1 percent levels. All significant estimates are in bold typeface.

Dependent Variable	Probability of Entering Default in Next 12 Months			
	Internal Risk Rating	Internal Risk Rating		Computer Generated Risk Rating
Risk Rating Measure			× No Rotation	
Reported coefficient	Main	Main		Main
	(1)	(2)	(3)	(4)
1(quarter-to-rotation = -8) × Risk Rating	0.823*** (0.211)	0.860*** (0.285)	0.106 (0.407)	0.046 (0.120)
1(quarter-to-rotation = -7) × Risk Rating	0.817*** (0.263)	0.696** (0.345)	0.421 (0.522)	0.411** (0.159)
1(quarter-to-rotation = -6) × Risk Rating	0.863*** (0.269)	0.867** (0.355)	0.018 (0.515)	-0.046 (0.106)
1(quarter-to-rotation = -5) × Risk Rating	0.457* (0.270)	0.391 (0.350)	0.244 (0.482)	0.142 (0.121)
1(quarter-to-rotation = -4) × Risk Rating	-0.082 (0.197)	-0.3 (0.266)	0.674 (0.415)	0.218 (0.198)
1(quarter-to-rotation = -3) × Risk Rating	0.239 (0.247)	0.215 (0.274)	0.063 (0.521)	0.412 (0.279)
1(quarter-to-rotation = -2) × Risk Rating	1.060*** (0.257)	1.186*** (0.343)	-0.349 (0.454)	0.139 (0.186)
1(quarter-to-rotation = -1) × Risk Rating	0.974*** (0.266)	0.775** (0.333)	0.663 (0.623)	0.062 (0.185)
1(quarter-to-rotation = 0) × Risk Rating	1.206*** (0.291)	1.248*** (0.358)	-0.127 (0.593)	0.318 (0.208)
1(quarter-to-rotation = 1) × Risk Rating	1.310*** (0.275)	1.685*** (0.500)	-0.729 (0.588)	0.066 (0.196)
1(quarter-to-rotation = 2) × Risk Rating	0.523* (0.285)	0.197 (0.392)	0.999* (0.568)	-0.187 (0.626)
Loan Officer dummies	Yes		Yes	Yes
Industry × Month dummies	Yes		Yes	Yes
Observations	18,255		18,255	18,255
Pseudo R-Sq	0.165		0.170	0.149

TABLE V
EFFECT OF ROTATION ON AVERAGE RATINGS

This table estimates the effect of loan officer rotation on ratings. It reports OLS-firm FE coefficients of specification (2):

$$Internal_RR_{it} = \sum_{s=-8}^2 \gamma_s \cdot 1[s = q_R] + \psi WExternal_RR_{it} + \alpha_i + \alpha_{Loan_Officer} + \alpha_{Industry \times t} + v_{it}$$

The dependent variable is the Internal Risk Rating of firm i at time t . Column (1) reports the parameters on the set of quarter-to-rotation dummies (q_R). q_R measures the time, in quarters, elapsed before and after the high rotation quarter induced by the 3-year rotation rule. q_R is zero for the high rotation quarter and negative (positive) for quarters prior to (after) the high rotation quarter. The coefficient estimates represent the average internal risk rating for every quarter prior and after the high rotation period (from $q_R = -8$ to $q_R = 2$). Columns (2) and (3) [(4) and (5)] report the parameters of an augmented specification that includes the interaction of all variables in the right hand side with a dummy equal to one if the loan officer of firm i is not rotated during the high rotation period [if firm i has an origination rate in the top quintile prior to the high rotation period]. Column (2) and (4) presents the parameters on the terms without interactions and Column (3) and (5) the terms with interactions. All regressions include Loan Officer and Industry-Month Dummies. Standard errors reported in parenthesis are estimated accounting for heteroskedasticity and are clustered at the firm level. *, ** and *** indicate that the point estimate is statistically significant at the 10, 5 and 1 percent levels respectively. All significant estimates are in bold typeface.

Dependent Variable	Internal Risk Rating				
	Main	Main	× No Rotation	Main	× High Origination
Reported Coefficient	(1)	(2)	(3)	(4)	(5)
1(quarter-to-rotation = -8)	-0.022 (0.031)	-0.009 (0.038)	-0.045 (0.044)	-0.069** (0.034)	0.013 (0.037)
1(quarter-to-rotation = -7)	-0.077** (0.030)	-0.074** (0.035)	-0.028 (0.044)	-0.113*** (0.031)	-0.046 (0.037)
1(quarter-to-rotation = -6)	-0.120*** (0.030)	-0.140*** (0.033)	0.023 (0.044)	-0.108*** (0.034)	-0.106*** (0.035)
1(quarter-to-rotation = -5)	-0.137*** (0.029)	-0.146*** (0.031)	-0.001 (0.042)	-0.111*** (0.039)	-0.145*** (0.032)
1(quarter-to-rotation = -4)	-0.119*** (0.031)	-0.105*** (0.030)	-0.052 (0.042)	-0.122*** (0.033)	-0.097*** (0.039)
1(quarter-to-rotation = -3)	-0.103*** (0.034)	-0.074** (0.037)	0.033 (0.034)	-0.121*** (0.039)	-0.071 (0.048)
1(quarter-to-rotation = -2)	-0.059 (0.038)	-0.001 (0.044)	0.033 (0.033)	-0.066 (0.044)	-0.019 (0.056)
1(quarter-to-rotation = -1)	-0.016 (0.045)	0.062 (0.056)	-0.012 (0.033)	-0.048 (0.055)	0.092 (0.082)
1(quarter-to-rotation = 0)	-0.081* (0.045)	-0.042 (0.055)	-0.085 (0.073)	-0.036 (0.053)	-0.013 (0.086)
1(quarter-to-rotation = 1)	-0.064 (0.049)	-0.010 (0.056)	-0.105 (0.080)	-0.063 (0.052)	-0.029 (0.094)
1(quarter-to-rotation = 2)	-0.053 (0.051)	0.036 (0.065)	-0.146* (0.083)	-0.052 (0.058)	-0.022 (0.099)
Firm FE	Yes		Yes		Yes
Loan Officer Dummies	Yes		Yes		Yes
Industry × Month Dummies	Yes		Yes		Yes
Observations	21,400		21,400		21,400
Pseudo R-Sq	0.79		0.79		0.79

TABLE VI
EFFECT OF ROTATION ON SENSITIVITY OF LENDING TO RATINGS AND TOTAL LENDING

This table measures how the sensitivity of lending to rating changes and the total amount of lending vary with quarter-to-rotation. Panel 1 reports OLS estimates of coefficients on the interaction between quarter-to-rotation dummies and Internal Risk Ratings in specification (3):

$$\ln(\text{debt_Bank}_{it}) = \sum_{s=-8}^2 1[s = q_R](\theta_s \text{Internal_RR}_{it} + \zeta_s \text{WExternal_RR}_{it}) + \vartheta \ln(\text{debt_othbanks}_{it}) + \alpha_i + \alpha_{\text{Loan_Officer}} + \alpha_{\text{Industry} \times t} + v_{it}$$

The dependent variable is the log of debt of firm i at time t with The Bank. q_R measures the time, in quarters, elapsed before and after the high rotation quarter induced by the 3-year rotation rule. q_R is zero for the high rotation quarter and negative (positive) for quarters prior to (after) the high rotation quarter. The coefficient estimates represent the sensitivity of lending to internal risk ratings for every quarter-to-rotation. The regression also includes the Weighted External Risk Rating assigned to firm i at time t by other banks interacted with the set of quarter-to-rotation dummies (not reported). Panel 2 reports OLS estimates of coefficients on quarter-to-rotation dummies in specification (4):

$$\ln(\text{debt_Bank}_{it}) = \sum_{s=-8}^2 \varphi_s \cdot 1[s = q_R] + \vartheta \ln(\text{debt_othbanks}_{it}) + \alpha_i + \alpha_{\text{Loan_Officer}} + \alpha_{\text{Industry} \times t} + v_{it}$$

The coefficient estimates represent the average (log) lending for every quarter-to-rotation. Both panels include Firm Fixed Effects, Loan Officer and Industry-Month Dummies, and the log of the total debt of firm i with other banks in the financial system. Standard errors reported in parenthesis are estimated accounting for heteroskedasticity and are clustered at the firm level. *, ** and *** indicate that the point estimate is statistically significant at the 10, 5 and 1 percent levels respectively. All significant estimates are in bold typeface.

Panel 1: Sensitivity of Lending to Ratings		Panel 2: Average Lending	
Dependent Variable	ln(Debt)		ln(Debt)
1(quarter-to-rotation = -8) × Risk Rating	-0.147 (0.291)	1(quarter-to-rotation = -8)	-0.172 (0.168)
1(quarter-to-rotation = -7) × Risk Rating	-0.129 (0.343)	1(quarter-to-rotation = -7)	-0.106 (0.162)
1(quarter-to-rotation = -6) × Risk Rating	-0.236 (0.326)	1(quarter-to-rotation = -6)	-0.073 (0.167)
1(quarter-to-rotation = -5) × Risk Rating	-0.278 (0.329)	1(quarter-to-rotation = -5)	0.150 (0.157)
1(quarter-to-rotation = -4) × Risk Rating	-0.714*** (0.265)	1(quarter-to-rotation = -4)	0.378*** (0.139)
1(quarter-to-rotation = -3) × Risk Rating	-0.571*** (0.206)	1(quarter-to-rotation = -3)	0.464*** (0.142)
1(quarter-to-rotation = -2) × Risk Rating	-0.572*** (0.197)	1(quarter-to-rotation = -2)	0.565*** (0.156)
1(quarter-to-rotation = -1) × Risk Rating	-0.446** (0.186)	1(quarter-to-rotation = -1)	0.381** (0.190)
1(quarter-to-rotation = 0) × Risk Rating	-0.444* (0.245)	1(quarter-to-rotation = 0)	0.269 (0.214)
1(quarter-to-rotation = 1) × Risk Rating	-0.395 (0.276)	1(quarter-to-rotation = 1)	0.286 (0.235)
1(quarter-to-rotation = 2) × Risk Rating	0.97 (0.764)	1(quarter-to-rotation = 2)	0.204 (0.273)
ln(Debt other Banks)	Yes	ln(Debt other Banks)	Yes
Risk Rating other Banks × quarter-to-rotation Dummies	Yes		
Firm FE	Yes	Firm FE	Yes
Loan Officer Dummies	Yes	Loan Officer Dummies	Yes
Industry × Month Dummies	Yes	Industry × Month Dummies	Yes
Observations	20,272	Observations	20,272
Pseudo R-Sq	0.460	Pseudo R-Sq	0.21

TABLE VII
SUMMARY STATISTICS ON LOAN OFFICER REPUTATION EVENT COUNTS

The table presents summary statistics for the count of the number of reputation events accumulated by every loan officer in the sample. Statistics are calculated over 1,306 loan officer-month observations corresponding to 100 loan officers observed between December 1997 and December 2001. Reputation events in Panel 1 are defined as firm downgrades occurred during the 6 months prior or after actual rotations (pre-rotation and post-rotation downgrades respectively). If a post-rotation downgrade event happens at time t , then *# events post-rotation loan officer downgrades firm* (*# events pre-rotation loan officer's firm experiences post-rotation downgrade*) increases by one for loan officer j at time t if j managed the firm in the post-rotation (pre-rotation) period. The variables are constructed to reflect the fact that the same event affects the monitoring reputation of both the pre and post-rotation loan officers at time t . Events are defined using the internal risk ratings of The Bank, based solely on downgrades to ratings of 2 or 3, to avoid mechanical changes in the variables due to defaults or foreclosures. *# events pre-rotation loan officer downgrades firm* is a count of the number of times until time t , that loan officer j has downgraded a loan under her management during the 6 months prior to a rotation. Reputation events in Panel 2 are defined as firm downgrades occurred during the 6 months prior or after a high rotation quarter induced by the 3-year rule (pre-High Rotation Quarter and post- High Rotation Quarter downgrades respectively).

Variable	Mean	Median	SD	Min	Max
Panel 1: Reputation Event Counts Based on Actual Rotations					
# events post-rotation loan officer downgrades firm	2.46	0	8.82	0	84
# events pre-rotation loan officer's firm experiences post-rotation downgrade	2.71	0	7.86	0	66
# events pre-rotation loan officer downgrades firm	1.71	0	4.93	0	44
# of rotations with no reputation event	44.19	5	70.29	1	343
Panel 2: Reputation Event Counts Based on High Rotation Quarter					
# events post-High Rotation Quarter loan officer downgrades firm	0.04	0	0.28	0	4
# events pre-High Rotation Quarter loan officer's firm experiences post-High Rotation Quarter downgrade	0.08	0	0.52	0	5
# events pre-High Rotation Quarter loan officer downgrades	0.44	0	1.78	0	14
# of High Rotation Quarters where no reputation event occurred	2.24	1	4.43	1	31

TABLE VIII
THE EFFECT OF REPUTATION ON LOAN OFFICER'S ASSETS UNDER MANAGEMENT (OLS, IV)

This table estimates the effect of reputation events on measures of the assets under management of a loan officer using specification (5):

$$\ln(A_{jt}) = \theta_1 [\#POST_DG_{jt-6}^{LOpre}] + \theta_2 [\#POST_DG_{jt-6}^{LOpost}] + \gamma X_{jt} + \alpha_j + \alpha_t + v_{jt}$$

The left hand side variable is the log of a measure of assets under management of loan officer j at time t. Two measures are used: total amount of debt (Debt) and the number of firms under management (# of Firms). The right hand side variables of interest are counts of loan officer reputation events (firm downgrades) occurred during the 6 months after actual rotations. If a post-rotation downgrade event happens at time t, then # events post-rotation loan officer downgrades firm (# events pre-rotation loan officer's firm experiences post-rotation downgrade) increases by one for loan officer j at time t if j managed the firm in the post-rotation (pre-rotation) period. Columns (1) through (4) [(5) through (8)] present the OLS [IV] estimates. IV estimates are obtained using event counts based on downgrades occurred during the 6 months prior and after the high rotation quarter induced by the 3-year rotation rule. The first stage results are presented in Table IX. The even numbered columns present the estimates when two control variables are included: the number of rotations where no reputation event (downgrade) occurred, and the average risk rating assigned to the firms under management of loan officer j by all other banks (using Central Bank data), weighted by the amount of loans outstanding of each firm. All specifications include loan officer fixed effects and month dummies. Standard errors reported in parenthesis are estimated accounting for heteroskedasticity and are clustered at the loan officer level. *, ** and *** indicate that the point estimate is statistically significant at the 10, 5 and 1 percent levels respectively. All significant estimates are in bold typeface.

Estimation Method	OLS				2SLS			
	Debt		# of Firms		Debt		# of Firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
# events post-rotation loan officer downgrades firm	0.032** (0.013)	0.032* (0.017)	0.026*** (0.004)	0.013 (0.008)	-0.017 (0.279)	0.034 (0.248)	-0.025 (0.057)	-0.131 (0.139)
# events pre-rotation loan officer's firm experiences post-rotation downgrade	-0.101** (0.039)	-0.100** (0.047)	-0.048*** (0.007)	-0.054*** (0.007)	-0.159* (0.091)	-0.156* (0.093)	-0.055*** (0.015)	-0.074* (0.038)
# of rotations with no reputation event		0.003 (0.009)		0.005 (0.004)		0.007 (0.049)		0.033 (0.028)
Weighted External Risk Rating		1.614* (0.947)		0.098 (0.442)		1.511 (1.191)		-0.289 (0.563)
Loan Officer FE	Yes			Yes	Yes			Yes
Month Dummies	Yes			Yes	Yes			Yes
Observations	944	944	944	944	944	944	944	944
R-Sq	0.72	0.73	0.88	0.91				

TABLE IX
FIRST STAGE: REPUTATION BASED ON ACTUAL ROTATIONS AND ON HIGH ROTATION
QUARTERS INDUCED BY 3-YEAR RULE

This table presents the first stage regression for the IV estimation of specification (5). The dependent variables are counts of loan officer reputation events (firm downgrades) occurred during the 6 months after actual rotations. If a post-rotation downgrade event happens at time t , then *# events post-rotation loan officer downgrades firm* (*# events pre-rotation loan officer's firm experiences post-rotation downgrade*) increases by one for loan officer j at time t if j managed the firm in the post-rotation (pre-rotation) period. The instruments are similarly constructed reputation event counts, but where the events are downgrades occurred during the 6 months prior and after the high rotation quarter induced by the 3-year rotation rule. All estimates include the same control variables as specification (5): the number of rotations where no reputation event (downgrade) occurred, and the average risk rating assigned to the firms under management of loan officer j by all other banks (using Central Bank data), weighted by the amount of loans outstanding of each firm. Standard errors reported in parenthesis are estimated accounting for heteroskedasticity and are clustered at the loan officer level. *, ** and *** indicate that the point estimate is statistically significant at the 10, 5 and 1 percent levels respectively. All significant estimates are in bold typeface.

Dependent Variable	# events post-rotation loan officer downgrades firm (1)	# events pre-rotation loan officer's firm experiences post-rotation downgrade (2)
# events post-High Rotation Quarter loan officer downgrades firm	1.060* (0.546)	-1.487*** (0.257)
# events pre-High Rotation Quarter loan officer's firm experiences post-High Rotation Quarter downgrade	-1.555 (1.256)	7.366*** (1.843)
# of High Rotation Quarters where no reputation event occurred	0.199*** (0.065)	0.054*** (0.013)
Weighted External Risk Rating	-1.226 (1.289)	-0.222 (0.534)
Loan Officer FE	Yes	Yes
Month Dummies	Yes	Yes
Observations	1,242	1,242
R-Sq	0.88	0.93

TABLE X
THE EFFECT OF REPUTATION ON LOAN OFFICER'S ASSETS UNDER MANAGEMENT (OLS, REDUCED FORM)

This table estimates the effect of reputation events on measures of the assets under management of a loan officer using an augmented version of specification (5):

$$\ln(A_{jt}) = \theta_1[\#POST_DG_{jt-6}^{LOpre}] + \theta_2[\#POST_DG_{jt-6}^{LOpost}] + \theta_3[\#PRE_DG_{jt}] + \gamma X_{jt} + \alpha_j + \alpha_t + v_{jt}$$

The left hand side variable is the log of a measure of assets under management of loan officer j at time t . Two measures are used: total amount of debt (Debt) and the number of firms under management (# of Firms). The OLS estimates presented in columns (1) through (5) include as right hand side variables of interest counts of loan officer reputation events (firm downgrades) occurred during the 6 months prior and after actual rotations. If a post-rotation downgrade event happens at time t , then *# events post-rotation loan officer downgrades firm* (*# events pre-rotation loan officer's firm experiences post-rotation downgrade*) increases by one for loan officer j at time t if j managed the firm in the post-rotation (pre-rotation) period. *# events pre-rotation loan officer downgrades firm* is a count of the number of times until time t , that loan officer j has downgraded a loan under her management during the 6 months prior to a rotation. The reduced form estimates presented in columns (1) through (5) define reputation events in a similar way, but relative to the high rotation quarter induced by the 3-year rotation rule. The even numbered columns present the estimates when two control variables are included: the number of rotations where no reputation event (downgrade) occurred, and the weighted average risk rating assigned to the firms under management of loan officer j by all other banks. All specifications include loan officer fixed effects and month dummies. Standard errors reported in parenthesis are estimated accounting for heteroskedasticity and are clustered at the loan officer level. *, ** and *** indicate that the point estimate is statistically significant at the 10, 5 and 1 percent levels respectively. All significant estimates are in bold typeface.

Estimation Method Dependent Variable (logs)	OLS				Reduced Form			
	Debt		# of Firms		Debt		# of Firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
# events post-rotation loan officer downgrades firm	0.033*** (0.011)	0.031* (0.017)	0.029*** (0.004)	0.013** (0.005)				
# events pre-rotation loan officer's firm experiences post-rotation downgrade	-0.092 (0.061)	-0.093 (0.064)	-0.038*** (0.006)	-0.030*** (0.007)				
# events pre-rotation loan officer downgrades firm	(0.018)	(0.016)	(0.022)	-0.057*** (0.009)				
# events post-High Rotation Quarter loan officer downgrades firm					0.227** (0.107)	0.247** (0.109)	0.039 (0.046)	0.025 (0.043)
# events pre-High Rotation Quarter loan officer's firm experiences post-High Rotation Quarter downgrade					-1.513** (0.585)	-1.480** (0.563)	-0.447*** (0.062)	-0.348*** (0.068)
# events pre-High Rotation Quarter loan officer downgrades firm					-0.022 (0.089)	-0.028 (0.085)	-0.060* (0.036)	-0.118*** (0.029)
# of rotations with no reputation event		0.003 (0.008)		0.007** (0.003)		0.003 (0.004)		0.005*** (0.001)
Weighted External Risk Rating		1.597* (0.952)		0.041 (0.398)		1.525* (0.892)		0.057 (0.435)
Loan Officer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	944	944	944	944	944	944	944	944
R-Sq	0.72	0.73	0.89	0.92	0.74	0.74	0.87	0.90

TABLE A
PROBABILITY OF ROTATION DURING HIGH ROTATION QUARTER

This table presents the estimation of probability models of rotation at the high rotation quarter induced by the 3-year rule, on firm observable characteristics and loan officer reputation events. The probability models are estimated on a cross section of relationships that reach 33 months of duration before December 2001. The dependent variable of interest is a dummy equal to one if the incumbent loan officer is reassigned during months 34 through 36 of the relationship. The explanatory variables are: three loan officer reputation counts used in the career concerns section, and the internal risk rating of the firm. All explanatory variables are measured 6 months prior to the high rotation quarter (month 28 of a relationship). Both linear probability and probit estimates are reported. Models are also reported with and without loan officer dummies. Standard errors reported in parenthesis are estimated accounting for heteroskedasticity and are clustered at the loan officer level. *, ** and *** indicate that the point estimate is statistically significant at the 10, 5 and 1 percent levels respectively. Neither the loan officer reputation counts nor the internal risk rating of the firm are good predictors of rotation at the rule. The inclusion of loan officer dummies increases the predictive power of the probability models, which suggests the presence of unobserved loan officer heterogeneity.

Probability model	Pr(Rotation Occurred during High Rotation Quarter)			
	Linear		Probit	
	(1)	(2)	(3)	(4)
# events post-rotation loan officer downgrades firm	(0.0022)	(0.0265)	(0.0072)	(0.1041)
	(0.0013)	(0.0186)	(0.0052)	(0.0676)
# events pre-rotation loan officer's firm experiences	(0.0009)	(0.0060)	(0.0021)	(0.0188)
post-rotation downgrade	(0.0048)	(0.0040)	(0.0162)	(0.0151)
# events pre-rotation loan officer downgrades firm	(0.0055)	0.0108	(0.0216)	0.0381
	(0.0042)	(0.0090)	(0.0181)	(0.0347)
# of rotations with no reputation event	0.0014	0.0001	0.0044	0.0018
	(0.0009)	(0.0038)	(0.0031)	(0.0143)
Internal Risk Rating	(0.0143)	0.0211	(0.0876)	0.1050
	(0.0408)	(0.0729)	(0.1934)	(0.2800)
Loan Officer Dummies	No	Yes	No	Yes
Observations	284	284	284	250
R-Sq (pseudo R-Sq in probit)	0.05	0.23	0.05	0.18