Information and Incentives Inside the Firm: Evidence from Loan Officer Rotation*

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Abstract

We present evidence that reassigning tasks among agents can alleviate moral hazard in communication. Based on a commercial bank's internal reporting data we show that agents do not report bad news if it reflects poorly on their own ability. A rotation policy that routinely reassigns loan officers to borrowers changes this reporting behavior. When an officer anticipates rotation, reports are more accurate and contain more bad news about the borrower's repayment prospects. The threat of rotation improves communication because self-reporting bad news has a smaller negative effect on career prospects than bad news exposed by a successor. The successor's career is not hurt when she reports bad news within six months after rotation. Improved communication has first order effects on lending outcomes.

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In many economic relationships, agents are responsible for self-reporting on the performance of their assigned tasks. Anecdotal and systematic evidence suggest that agents in such relationships hide information that reflects poorly on their own performance. For instance, Arthur Andersen, was indicted for obstruction of justice in 2002 for destroying documentation of its audit of Enron. Lakonishok et al (1991) show that pension fund managers systematically sell losing stocks from their portfolio before their annual evaluation, and Musto (1999) shows that managers of retail money market funds switch into safe investments around disclosures.[1]

It is common for agents who report on the performance of their own tasks to undergo mandated rotation.[2] The idea that rotation, or the routine reassignment of tasks among agents, may mitigate agency problems has been long discussed in economics.[3] Holmstrom (1982: p. 338) suggests that rotation may provide "independent readings of the circumstances in which tasks are being carried out and thereby reduces moral hazard costs." New laws that mandate compulsory rotation of audit partners in France, Germany, Italy, and the United States has spurred the policy debate over the effectiveness of rotation during the last decade.[4] More recently, investor and regulatory pressure on rating agencies to reduce potential conflicts of interest led Moody's and S&P to periodically rotate analysts.[5] Despite widespread use of rotation policies, no empirical support exists for their effectiveness in providing incentives.

We present evidence that a rotation policy mitigates agency problems in communication. Our results show that an agent has reduced incentives to suppress bad news when the principal can compare

[1] In other contexts, it has been documented that police downgrade the classification of offences to understate the incidence of crime (see "As Crime Falls, Pressure Rises to Alter Data", New York Times, August 3 1998 and Seidman and Couzens (1974)). Jacob and Levitt (2003) document that school teachers cheat in standardized tests to improve student scores.

[2] Mandated monitor rotation exists for 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 Dunkelberg and Scott (1999)), boards of directors (Gregory (2001a,b)), US State Government auditors (Schelker (2007)), Foreign Service Officers (Fisher (1966)), and House Committees (Groseclose and Stewart (1998)). The 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 use rotation of high school classes between teachers over time to diagnose instances where teachers have manipulated test scores.

[3] Rotation can solve incentive problems due to the ratchet effect, as long as an agent's career prospects are unaffected by her perceived performance on past assignments. This argument is found in Ickes and Samuelson (1987), Hirao (1993), Arya and Mittendorf (2004), and Prescott and Townsend (2006). In the sociology and political science literature, Max Weber ([1922] 1968) points out that rotation facilitates monitoring within bureaucracies (see also Niskanen (1971), and the discussion in Kiser (1999)).

[4] For accounts on this debate see Arrunada and Paz-Ares (1997); Dopuch, King, and Schwartz (2001); Myers, Myers, and Omer (2003); and Enriques and Volpin (2007)).

[5] See press article: Lucchetti, A., "S&P Plans Series of Moves to Counter Conflict Claims", Wall Street Journal, February 7 2008. Also, see S&P press release at:
http://www2.standardandpoors.com/spf/pdf/media/Leadership_Actions_Full_Update.pdf.

her report with that issued by her successor. We use detailed internal records from the operations of a large multinational commercial bank that uses a three year loan officer rotation rule. Each loan officer is assigned to multiple corporate borrowers. Officers make lending recommendations based on their assessment of each firm's creditworthiness, and communicate their assessment by assigning monthly risk ratings. The rotation rule implies that at the end of the third year of a relationship between a loan officer and a firm, there is a sharp and temporary increase in the probability that the firm is reassigned to a different officer. The rule induces exogenous time series variation in the probability of rotation at the loan officer-firm relationship level that we exploit to identify the effect of rotation on communication. Specifically, we document systematic temporary changes in a loan officer's rating behavior as a relationship approaches three years.

As a framework for the empirical analysis, we model this environment as one where a loan officer performs a dual role: she is responsible for managing the relationship with a firm so as to maintain high repayment prospects (active monitoring) and obtaining and reporting information about the firm's repayment prospects (passive monitoring).[6] A loan officer in this setting may suppress unfavorable information about repayment prospects because it will reflect poorly on how she has performed as an active monitor. 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 it will not reflect poorly upon her performance. 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.

We start our empirical analysis by considering two aspects of loan officers' reporting behavior: information content and bias. We measure information content as the ability of the reported internal risk ratings to discriminate between high and low default probability firms. For example, internal ratings are uninformative if firms with a risk rating of 1 (the lowest risk in a scale of 5) default with the same probability as firms with a rating of 2, after controlling for the external risk rating assigned to the same firms by other banks. Similarly, reporting bias is measured as the average level of internal risk ratings, relative to external ones. External ratings are obtained by name-matching every borrower

[6] Our framework draws upon the literature on career concerns for experts. An expert is an agent whose type determines her ability to understand the state of the world. See for example Holmstrom and Costa (1986), Scharfstein and Stein (1990), Prendergast and Stole (1996), Ely and Valimaki (2003), Prat (2005), Levy (2007), Li (2007), and Gromb and Martimort (forthcoming). Although we borrow the terms active and passive monitoring from Tirole (2001), several other theoretical papers have explored the incentive problem that exists when agents perform such dual role. See for example Boot (1992), Levitt and Snyder (1997), Laux (2001), Inderst and Mueller (2006).

with a Public Credit Registry in Argentina and are observed at the same monthly frequency as internal ratings. Controlling for external ratings allows us to further disentangle changes in officer reporting behavior from changes in firm creditworthiness or its predictability.

Our first set of results measures the causal effect of anticipated rotation on these two dimensions of communication. We find that the predictive power of internal ratings declines, and that ratings become more optimistic relative to external ones, during the first two years of a relationship. This trend reverts sharply and temporarily in the third year of the relationship, during which the optimistic bias disappears and ratings regain their predictive power. The magnitude of the time series variation in reporting behavior is economically significant. For example, if firms are classified with ratings assigned at the end of the second year of a relationship (when rotation is unlikely), the default probability of firms with a 2 rating is the same as those rated 1, after controlling for external ratings. When firms are classified with ratings assigned at the end of the third year of the relationship (when rotation is imminent), the difference is 28 percentage points. The ability of internal ratings to discriminate between high and low default probability firms increases by an order of magnitude when rotation becomes imminent. Our findings suggest that loan officers report bad news about firm repayment prospects more accurately in anticipation of imminent rotation.

The probabilistic nature of the rotation rule allows us to further verify that the temporary changes in reporting behavior are induced by the ex ante threat of rotation (as opposed to the ex post incidence of rotation). The same temporary changes in informativeness and bias are present in the subset of loan officer-firm relationships that are not reassigned during the third year. We also use an alternate set of risk ratings based on firm repayment history and financial statement data to perform a placebo test. We find that these ratings, which are assigned by a proprietary computer algorithm and do not contain inputs under the discretion of the loan officer, present no systematic pattern during a relationship's third year. We further verify that no such pattern exists in firm creditworthiness, demand for credit or the timing of loan terminations, and that the results are not driven by firm selection. The overall evidence is consistent with the hypothesis that the temporary increase in the threat of rotation induces loan officers to more accurately communicate bad news.

We then investigate how loan officer rotation impacts the capital allocation decisions of the bank. To identify changes in credit supply, firm debt is measured relative to debt for the same firm with other banks. We show that the bank's lending decisions become increasingly responsive to changes in

internal ratings, and that the average amount of lending expands towards the end of the third year of a loan officer-firm relationship. Because lending decisions incorporate all the information communicated by the loan officer, the results corroborate that the increase in informativeness of ratings does not merely substitute for other channels of communication. The overall results are consistent with the long-standing view in corporate finance that declines in information asymmetry lead to increased lending in equilibrium.[7]

These results demonstrate that rotation affects the reporting behavior of loan officers, but cannot identify the underlying mechanism. Next, we provide evidence that rotation alters loan officer reporting incentives due to reputation based career concerns consistent with our framework.[8] Although we do not observe compensation we can follow the careers of loan officers, since all but one remain employed at the bank until the end of the seven year sample. This allows us to track the size of the lending portfolio assigned to a loan officer over her career. In line with Berk and Green (2004), we expect that in equilibrium more assets are assigned to loan officers with higher perceived ability.

Our stylized reputation concerns framework provides equilibrium predictions that we take to the data. For example, when an officer has overseen a firm for several years and bears some responsibility for its repayment prospects, downgrading the firm should have a negative effect on her career. We corroborate that an officer's future assets under management decline when she downgrades a firm after the first six months of her assignment. Downgrading a firm during the third year of a relationship results in a 15% decline in the number of firms under the officer's management. This demonstrates the fundamental motivation for a loan officer to conceal bad news about the firms to which she is assigned. The fact that downgrades at the beginning of a relationship do not affect an officer's career verifies that newly assigned loan officers after rotation have no reputation incentives to withhold bad news.[9] Another prediction of our framework is that a loan officer prefers to reveal bad news herself rather than have it exposed by her successor. Consistent with this, we show that the negative effect on an officer's career from having bad news exposed by her successor is two to four times larger than when the incumbent loan officer reveals bad news herself before rotation. This provides a rationale for the fact that downgrades during the third year of a loan officer-firm relationship are ten times more

[7] See Jaffee and Russell (1976), Leland and Pyle (1977), Stiglitz and Weiss (1981), and Myers and Majluf (1984).

[8] For examples of other papers in finance that use reputation based career concerns see Boot (1992), Holmstrom (1999), Inderst and Mueller (2006), and Rajan (1994).

[9] We verify that ratings assigned by both the exiting and the incoming loan officers around a rule induced rotation are equally informative about the future probability of default. This indicates that newly assigned loan officers do not manufacture unfavorable information at the beginning of the assignment.

likely than after rotation.

We study the cross section of loan officers to further validate the link between the observed officer behavior and reputation concerns. In theory, career concerns can distort the behavior of younger managers whose reputations are less well established, a prediction that has been exploited in previous empirical work (see Chevalier and Ellison (1999), Hong, Kubik, and Solomon (2000), and Lamont (2002)). We corroborate that rotation does not affect the reporting behavior or career prospects of officers in the top age quartile. Also, our framework suggests that only officers who have played a significant active monitoring role through loan origination have incentives to hide bad news. We confirm that the pattern of rating informativeness and bias is stronger among loan officers who have presided over above median levels of origination in the sample.

To our knowledge, this is the first paper to provide direct quantitative evidence that moral hazard limits the effectiveness of communication within the firm. Corporate decisions commonly rely on information produced and reported by privately informed agents. It is often presumed in finance and economics that this information flows without frictions within the boundaries of the firm. For example, Alchian (1969) and Williamson (1970) explain the prevalence of internal capital markets by arguing that these are not subject to the same informational problems that plague external markets. This view is challenged by theories which argue that agency problems constrain communication within a firm (for example, Aghion and Tirole (1997), Dessein (2002), Stein (2002)). However, systematic data on communications inside a firm is seldom available, and, when available, measurement of the amount or quality of information in communications is usually unfeasible. A key advantage in our empirical setting is that it is straightforward to quantify communication, measure its precision, and study its impact on investment. Prior to the present paper, the agency argument has found support indirectly through evidence on the investment activity of internal capital markets in conglomerates (surveyed in Stein (2003)), and the relationship between bank function and organizational design (Berger et. al. (2005), Liberti and Mian (2008), Mian (2006)).

A number of recent papers provide evidence of implicit incentives inside organizations.[10] 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

[10] See for example Chevalier and Ellison (1999) on career concerns; Bandiera, Barankay and Rasul (2005) on social preferences; and Falk and Ichino (2006), and Mas and Moretti (2006) on peer effects.

relative to the large body of evidence on the incentive effect of explicit performance based pay.[11] The present paper is a first step to fill this gap by providing a direct account of the incentive effects of organizational design. In particular, our results extend the literature on career concerns by providing the first account of how organizational design can be used to counter the agency problems first identified by Holmstrom (1999).[12]

The rest of this paper proceeds as follows. Section I describes the empirical setting and provides a framework for understanding the effect of rotation upon loan officers' reporting decisions. Section II describes the data and the identification strategy. We also use this section to document our motivating fact, the bank's routine use of loan officer rotation, and show preliminary evidence that rotation affects loan officer reporting behavior. Section III presents the empirical results on the effect of rotation on loan officer reporting behavior, and Section IV shows that rotation affects the career incentives of loan officer to communicate. Section V concludes.

I. Environment and Theoretical Framework

A. Empirical Setting

We analyze the reporting behavior of loan officers in the small and medium business division of a large multinational bank operating in Argentina (The Bank). Each corporate borrower in this division is assigned to a single loan officer, and each loan officer is responsible for monitoring multiple firms. For each firm assigned to an officer, she performs two tasks: 1) recommends an amount of lending and 2) assesses the repayment prospects and communicates this assessment to The Bank by assigning an internal risk rating. The dual role served by loan officers makes this environment ideal for studying the incentive problem that arises when an agent is asked to communicate information that reflects on her own performance.

The scope for agency problems in communication is compounded by the fact that officers collect private information about the firms they manage.[13] The officer's assessment of the firm's repayment

[11] For evidence on explicit incentives see, for example, Jones and Kato (1995); Paarsch and Shearer (1999, 2000); Lazear (2000); and Bandiera, Barankay, and Rasul (2007). For evidence of agents gaming explicit incentives see Oyer (1998) and Courty and Marschke (2004).

[12] For other examples of empirical research that document the implicit incentives of career concerns see Gibbons and Murphy (1992); Ehrbeck and Waldmann (1996); Graham (1999); Hong, Kubik, and Solomon (2000); Brown, Goetzmann and Park (2001); Lamont (2002); and Hong and Kubik (2003).

[13] Both theory and empirical research have emphasized the role of banks in collecting private or 'soft' information (see for example Petersen and Rajan (1994), Berger et. al. (2005), and Stein (2002)). This private information includes

prospects is based on verifiable (i.e., value of collateral, cash flows, leverage) as well as non-verifiable (i.e., reliability of the financial statements, competence and trustworthiness of the firm's management) information. Both types of information are obtained through the officer's regular personal contact with the borrower and are communicated to The Bank monthly through two different ratings. The *internal risk rating*, assigned by the loan officer making use of all the information available to her. The non-verifiable component of information provides substantial latitude to officers in the assignment of this rating. And a *computer risk rating*, which results from feeding the verifiable information into a proprietary algorithm. The fact that verifiable information must be collected each month to produce this rating limits the officer's discretion over the effort and time she devotes to monitoring the firm.

All the officers in the small and medium business division are located in the same building. Assignment of firms to officers is not based on firm location or industry. There is a division of labor among officers in the management of firms in default. When a firm is in default (more than 30 days of interest in arrears) the firm is often reassigned to a risk manager with expertise in restructuring and foreclosure. As a result, changes in firm creditworthiness will often induce rotation in our data. This fact highlights why the causal effect of rotation on reporting behavior cannot be identified looking at the average officer reassignment.

For identification, we exploit The Bank's rotation policy that induces firm reassignment plausibly unrelated to changes in firm characteristics. The Internal Credit Policies of The Bank, which apply to its lending operations in all countries and all divisions, state that "the maximum length of a business relationship for Account Managers (AM) is recommended to be 3 years." We verify in Section II that a substantial amount of rotation occurs at the end of the third year of a loan officer-firm relationship. As a result of the rotation policy an officer can anticipate the timing of rotation for each of the firms under her management. Unlike rotation induced by rating changes, the timing of rule-induced rotations depends on the calendar date the loan officer-firm relationship began and is independent of changes in firm characteristics. Since different firms are added to the loan officers' portfolio at different calendar dates, rule-induced rotations are staggered for any given loan officer. The empirical analysis exploits this rule-induced variation in the likelihood of rotation to identify the effect of rotation on loan officer reporting behavior.

Although we do not have access to compensation data, we obtained a description of loan officer

opinions or commentaries, cannot easily be transmitted in numbers, must be collected in person, and it is difficult to compare since it is subject to interpretation (Petersen (2004)).

pay contracts' basic features from the Internal Credit Policies. Compensation consists of a fixed wage and a year-end bonus. The bonus amount is determined at The Bank's discretion. The Internal Policies imply that the expected bonus amount is increasing in the total revenue from firms managed by the loan officer, which creates incentives for the loan officer to originate lending. We take this force as given throughout the analysis. Officer compensation is not tied contractually to the accuracy of ratings. Absent explicit incentives, loan officers are likely to take into account the effect of their rating behavior on their reputation within The Bank. This motivates the career concerns framework we develop next.

B. Framework: Loan Officer Reporting Incentives and Rotation Rule

We present a simple theoretical framework to illustrate how the environment's particular features can be used to characterize the incentive problem and measure the impact of rotation on loan officers' reporting behavior. We build a stylized model where officers take into consideration the bank's assessment of their ability when making reporting decisions. The framework formalizes the intuition that an officer will have incentives to conceal poor firm repayment prospects when these prospects are in part the officer's responsibility. The framework also illustrates how a fixed rotation policy such as the one observed in the empirical context can increase an officer's incentives to truthfully reveal her private information about her assigned firms. Because our specific goal is to show how the three-year rotation rule can be exploited to assess empirically the incentive effects of rotation, we abstract from many of the features of a lending relationship. Instead, we focus on the officer's role in collecting and transmitting information about the firm to her superiors. We do not model the use of this information explicitly but rather assume that the bank prefers more information to less.

B-1. Set-Up

Consider a bank that assigns an officer to monitor a borrower. We suppose that there are three periods (denoted $t = 1, 2, 3$) and that the bank must assign one officer to monitor the borrower in each period. The bank has two officers (labelled x and y) who can be assigned to the borrower, and must commit in advance to an assignment policy. The same officer can be assigned each period, $\{x, x, x\}$; we refer to this as "no rotation." Alternately, the borrower can be reassigned to a new officer at $t = 3$,

$\{x, x, y\}$; we refer to this as "rotation."[14] We explicitly assume that x remains assigned to the task for two periods to characterize how the behavior of an incumbent officer changes over time with the proximity to rotation.

To capture the effect of career concerns, we assume that officers have heterogeneous skill. Each officer can be either of high or low type denoted by $i \in \{h, l\}$. Each officer and the bank share a common prior belief that an officer is of high or low type with equal probability.

In our empirical setting an officer plays a dual role: active and passive monitoring (as per Tirole 2001). Active monitoring captures the officer's role in recommending the amount of new lending to a borrower. We capture this by supposing that in each period the repayment prospects of the borrower can be either good or bad: $\theta^t \in \{\theta_g, \theta_b\}$. At the beginning of $t = 1$, officer x sets the terms of lending. We model the effect of x's skill on this task in a reduced form way by supposing that at $t = 1$ the borrower's true repayment prospects will be good θ_g with probability p if officer x is high type ($1 - p$ if low type). A highly skilled officer is more likely to set lending terms that lead to high repayment prospects ($p > \frac{1}{2}$).

Passive monitoring captures the role of the officer acquiring information about the borrower's prospects. The borrower's true repayment prospects θ^t are not directly observed by either the officer or the bank. In each period the officer assigned to the loan privately observes a signal s^t of the true repayment prospects. The officer either observes bad news s_b, or nothing s_n.[15] Bad news is fully revealing for the borrower's true repayment prospects at t: the officer only observes s_b when the true repayment prospects at t are θ_b. If the borrower's repayment prospects are bad, then the unconditional probability that an officer will observe s_b at t is q if she is high type ($1 - q$ if low type), and nothing otherwise. Assume $q > \frac{1}{2}$ to capture the fact that high type officers are better passive monitors and hence are more likely to detect the borrowers' true repayment prospects.

After $t = 1$ the repayment prospects of the borrower θ^t evolve randomly, which reflects the fact that the borrower may be affected by positive or negative shocks. In particular we assume that between period $t = 1$ and $t = 2$ the borrower's repayment prospects can change with probability $\phi \in \left(0, \frac{1}{2}\right)$. This probability allows us to study the timing of an officer's reporting decisions. For simplicity we

[14] Without loss of generality, we adopt the convention that loan officer x is assigned in the first period.

[15] For ease of exposition we rule out the possibility of seeing verifiable good news when the borrower's payment prospects are high. This does not alter the model's qualitiative results. Inutitively, the important asymmetry in the model comes from the fact that the officer wishes to hide bad repayment prospects since they reflect poorly on her ability. No such conflict exists for good news and hence can be ignored. A version of the model that contains both good and bad signals is available from the authors.

assume that repayment prospects cannot change between $t = 2$ and $t = 3$.[16] If an officer has detected the true prospects of the loan at t she will continue to receive the bad signal as long as she is assigned to the borrower and the borrower's prospects remain the same. Similarly, if an officer fails to detect the borrower's prospects she will continue to receive no signal s_n while θ^t remains unchanged.

The officer's only decision in each period is whether to report any bad news she has detected to the bank. Following Stein (2002), we suppose that an officer who has privately observed bad news s_b can submit a verifiable report of r_b to her superiors. Conversely she can suppress this information and report nothing which we denote by r_n. If the officer observes no news (s_n), she can only report no news (r_n). The key distinction is that a report of r_n is not verifiable and hence can be made falsely to conceal bad news. This assumption captures the limitations faced by officers to manufacture bad news (cheap talk) and is validated empirically in Section IV, where we show that rating downgrades are informative and affect officers' careers.[17]

We focus on how career concerns affect an officer's reporting decisions. We assume that the officer's sole objective is to maximize the bank's assessment of her ability: an officer's utility is increasing linearly in her reputation.[18] We explicitly rule out the possibility that the bank compensates an officer based directly on the reports she makes. One motivation for this assumption is that the ratings assigned by an officer are uncontractible, either because they contain information not easily verified in court, or that the bank does not want revealed publicly.[19] In Section IV we provide evidence for the career concerns assumption by showing that officers who accumulate observable events that are good (bad) for their reputation, as predicted by the model, go on to manage larger (smaller) lending portfolios.

[16] Qualitatively the model's results are unaltered if the borrower's repayment prospects are also allowed to change with probability ϕ between $t = 2$ and $t = 3$. We ignore this possibility so as to simplify exposition.

[17] Our most direct evidence comes from focusing on the ratings assigned by a newly assigned officer after rotation who has strong incentives to reveal any bad news possible. We rule out that these downgrades are cheap talk because they occur rarely, are informative for the borrower's repayment prospects, and affect the career of the loan officer assigned to the borrower before rotation.

[18] The assumption of linearity is not important for the analysis. We obtain similar qualitative results if we assume a more general utility function that is increasing in reputation.

[19] Alternately the bank may not wish to pay an officer directly based on these reports so as to avoid distorting her other actions as per Holmstrom and Milgrom (1987). Rewarding a loan officer for downgrading a loan will give her perverse incentives when recommending lending terms. Gromb and Martimort (forthcoming) study a similar reporting problem where compensation is made contingent upon reports but there agents do not have career concerns. They show that even with optimal compensation that organizational design can be used to mitigate agency problems.

B-2. Equilibrium Reporting and Rotation

We begin by showing how career concerns can distort the officer's willingness to report bad news in the absence of rotation. If x observes the bad signal s_b at $t = 1$, there are two opposing forces that affect the officer's decision of whether to reveal or conceal bad news (reporting r_b or r_n):

- Because a highly skilled officer is more likely to set lending terms that lead to good repayment prospects ($p > \frac{1}{2} > 1 - p$), the fact that repayment prospects are bad (θ_b) is informative for the officer being the low type. This provides incentives for the officer to hide bad news to avoid damaging her reputation as an active monitor.[20]

- Because a highly skilled officer is more likely to detect bad news ($q > \frac{1}{2} > 1 - q$), reporting bad news is informative for the officer being high type. The officer has incentives to report bad news to demonstrate her ability as a passive monitor.[21]

The officer has incentives to conceal bad news so as to maintain her reputation when $p > q$. In other words, when the borrower's repayment prospects are more informative about an officer's type than her ability as a passive monitor. We focus the rest of the analysis on this case, and corroborate in Section IV that reporting bad news about a firm negatively affects officers' career within The Bank.

In the Appendix, we demonstrate formally that when $p > q$, x will always conceal bad news in the first period to preserve her reputation.[22] Absent rotation, the reporting behavior in the second and third periods depends on the relative magnitudes of p and q. When q is low relative to p, the unique equilibrium is for x to always hide bad news.[23] In this case, her role in affecting the borrower's repayment prospects is far more informative for her type than her ability to detect bed news. In contrast, when q is close to p, x has relatively stronger incentives to reveal bad news and the unique equilibrium is for x to reveal any bad news she detects at $t = 2$ and $t = 3$.[24] She is willing to reveal bad news at $t = 2$ and not earlier (at $t = 1$), because the true repayment prospects of the borrower

[20] This incentive to conceal bad news is the same as in Rajan (1994) who argues that a bank may choose to roll over bad loans so as to maintain the perception that it is highly skilled in originating lending. Similarly in Boot (1992), managers persist with bad projects in order to preserve their reputation for choosing profitable investments.

[21] This is akin to the force studied in papers such as Holmstrom and Costa (1986), Prendergast and Stole (1996), Prat (2005), and Scharfstein and Stein (1990) who argue that managers will distort investment decisions so as to demonstrate they have a high ability to learn.

[22] All proofs are contained in the Mathematical Appendix, available from:
http://www0.gsb.columbia.edu/faculty/dparavisini/Mathematical%20Appendix%20Rotation.pdf.

[23] Specifically when $q \in \left[\frac{1}{2}, \overline{q}^{NR}\right]$ where $\overline{q}^{NR} \equiv p - \phi\,(2p-1) \in \left(\frac{1}{2}, p\right)$.

[24] This equilibrium holds when $q \in \left[\overline{q}^{NR}, p\right]$. In the limit, as $\phi \longrightarrow 0$, the parameter space for which reporting at $t = 2$ is an equilibrium absent rotation disappears.

are less correlated with her type. This follows from the fact that with probability ϕ the borrower's repayment prospects deteriorate between $t = 1$ and $t = 2$ for reasons unrelated to the officer's ability.

Rotation changes equilibrium reporting decisions. Consider first officer y, who is assigned to the borrower at $t = 3$. The borrower's repayment prospects are unrelated to officer y's ability hence she has no reason to hide that it is performing poorly. She will receive full credit as a passive monitor for being able to detect bad news and hence in any equilibrium will report any bad news she can detect.[25] This changes x's reporting incentives. When x observes bad news at $t = 2$ she knows that with probability $\frac{1}{2}$ officer y will also detect it next period and, if she does, will report that the borrower's repayment prospects are poor. Faced with the threat of exposure by her successor, x has stronger incentives to report bad news herself. By revealing bad news herself, x at least demonstrates her ability as a passive monitor and thus avoids the bank inferring that she has performed poorly in both her active and passive monitoring roles. We formally show in the Appendix that rotation reduces the parameter space for which it is an equilibrium for x to always conceal any bad news she detects.[26]

Our simple framework demonstrates that rotation can reduce an agent's incentive to conceal information that reflects poorly on her own performance because the principal can compare the agent's report with that of her successor. We do not address here an important and related question: what is the optimal time for the bank to reassign the borrower from x to y? In our model the bank can maximize truthful reporting by rotating as often as possible (i.e., after $t = 1$). However, our stylized framework does not consider any of the potential costs to rotation. For example, rotation may result in the loss of private information or expertise that the incumbent officer has accumulated. Also, a long assignment may provide the officer with the incentives to obtain borrower specific information. Our empirical strategy only allows estimating the local effect of rotation after three years of an assign-

[25] A second motivation for y to report bad news emerges in an extension of the model that include y's full assignment: by reporting bad news early she prevents being held responsible for this bad news later. The strong incentive for y to report bad news early in her assignment are the reason it is important to our theory that bad news must be made verifiable. We provide evidence of this force in Section IV.

[26] With rotation, x's equilibrium reporting decisions can be described formally by two cutoff values $\overline{q}^{R1}$ and $\overline{q}^{R2}$ that obey the following ordering:

$$p > \overline{q}^{NR} > \overline{q}^{R1} > \overline{q}^{R2} > \frac{1}{2}.$$

There exists an equilibrium in which x truthfully reveals any bad news she detects at $t = 2$ if and only if $q \in \left[\overline{q}^{R2}, p\right]$. Since $\overline{q}^{R2} < \overline{q}^{NR}$ this demonstrates that the effect of rotation is to increase the set of parameter values for which it is an equilibrium for x to reveal that the borrower's repayment prospects are poor. Conversely, it is an equilibrium for x to always conceal any bad news she detects if and only if $q \in \left[\frac{1}{2}, \overline{q}^{R1}\right]$. The fact that $\overline{q}^{R1} < \overline{q}^{NR}$ shows that rotation reduces the set of cases where it is an equilibrium for x to always conceal any news she detects. We show in the appendix that when $q \in \left[\overline{q}^{R1}, p\right]$ the equilibrium in which x reports bad news at $t = 2$ is unique. Similarly when $q \in \left[\frac{1}{2}, \overline{q}^{R2}\right]$ the equilibrium in which x always conceals bad news is unique. When $q \in \left[\overline{q}^{R2}, \overline{q}^{R1}\right]$ then both of these equilibria exist and no other equilibrium exists.

ment, which prevents commenting on the counterfactual case where rotation is more (or less) frequent. These unmodelled costs of rotation provide a rationale for The Bank's choice to reassign borrowers after three years and, as we show later, to tolerate some misreporting in equilibrium.

C. Empirical Implications

Our framework predicts that the three-year rotation rule can induce temporary changes in officers' reporting behavior, which can be exploited to identify the effects of rotation. Rotation changes the reporting behavior of officer x only when the threat of rotation is imminent (at $t = 2$). Rotation does not induce an officer to reveal at $t = 1$, because doing so destroys the option value of delaying the report. This option is valuable because with probability ϕ the borrower's repayment prospects will improve and the poor initial performance will never be observed by the bank. At $t = 2$, the option value of hiding bad news disappears and the officer reveals any remaining problems. Period $t = 2$ in the model corresponds, in our empirical context, to the third year of a relationship, when the threat of rotation induced by the rule becomes imminent. Period $t = 1$ corresponds to some earlier time in the middle of a loan officer-firm relationship (e.g. second year) when the officer bears significant responsibility for the state of the loan through her past active monitoring. At this point, the officer still has an option value of suppressing bad information in case the borrower's repayment prospects improve. Finally, $t = 3$ represents an officer recently assigned to a firm, with minimal responsibility for the borrower's repayment prospects, 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 borrower she will begin to be bear more responsibility for its prospects and this will return to the scenario captured in the model at $t = 1$.

The framework gives rise to two sets of empirical predictions. The first is related to the reporting behavior of the officer. The fact that at $t = 1$ officers hide bad news implies that ratings will be poor predictors of default and will be systematically optimistic during the middle of a relationship. The ability of internal risk ratings to predict default should increase, and the optimistic bias disappear, when the threat of rotation increases at the end of an assignment's third year. Following rotation, the new officer should produce informative ratings without a bias, but the information content should begin to deteriorate again once she starts to bear increased responsibility for the borrower's repayment prospects. In Section III we show evidence of such non-monotonic reporting behavior in the data.

The second set of predictions is related to the question of how an officer's reputation is affected when she reveals bad news about a firm she manages. Our framework postulates that career concerns will lead an officer to conceal bad news and that rotation will temporarily mitigate this problem. Thus, downgrading a firm that has been assigned to her for several years should have a negative impact upon her career. Doing so reveals that she has performed poorly in her active monitoring role. In contrast, when a newly assigned officer downgrades a borrower, her career should not suffer. Intuitively, rotation temporarily removes the new officer's responsibility for the borrower's repayment prospects. Finally, rotation affects the incumbent officer's reporting decisions through the threat of exposure by her successor. The direct implication is that if a loan is downgraded by a new officer, then the career of the previous officer should be negatively affected. Moreover, that effect should be larger than the reputational cost when x reveals bad news herself so that the threat is effective. Related, if rotation is an effective threat, we expect in equilibrium downgrades around rotation to be more common by incumbent officers before rotation than by their successors. We test this second set of predictions in Section IV.

II. Data and Empirical Strategy

A. Data

We hand collect data from the internal records of The Bank to construct a unique monthly panel of loan officer-firm relationships (relationships). The sample covers the seven-year period from December 1997 to December 2004 and includes all lending to firms with net sales below $50 million. We observe 1,248 firms and 100 loan officers in 4,191 non-censored loan officer-firm relationships. Each of these firms began borrowing from The Bank in 1997 following an expansion of its operations.

The descriptive statistics related to loan officer-firm assignments are shown in 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 officer is observed for 47 months. Slightly above 70% of the firms have two or more distinct relationships, the average firm has 3.19 relationships and sees 3.04 different officers during the entire seven-year sample period.[27] The number of firms under management of the median officer on any given month is 10, and the median number of firms under an officer's

[27] 12% of the firms encounters the same loan officer more than once in two non-consecutive relationships.

responsibility that is reassigned in any single month is 3, conditional on any reassignment.[28]

For each firm-month pair, we also observe the amount of lending outstanding, the internal risk rating, and the computer risk rating. The internal risk rating reflects the officer's assessment of the probability of default of a firm. The assessment is based on qualitative and quantitative information from financial statements, and visits and interviews with the firm's management. The computer risk rating is generated by a proprietary algorithm that uses as inputs borrower financial statements, past repayment history, and posted collateral value. The computer generated risk rating does not include discretionary input by the loan officer.

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 access to the CDSF database was withdrawn by the Central Bank between January 2002 and March 2003. To identify the effect of rotation using within-firm estimates we require contemporaneous information on the firm's outcomes with others in the financial system. For that reason, the analysis is 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 (i.e., default transition rate, assets under a loan officer's management).

Table II presents the summary statistics of 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 seven banking relationships, a total bank debt of \$1.3 million, and obtains 17.3% of its bank debt from The Bank.

Both the internal and CDSF risk ratings are a number between 1 and 5 assigned monthly by loan

[28] 90% of the relationships that end during the sample period are due to loan officer rotation (reassignment of firms to a different loan officer). The relationship turnover not due to rotation is due to firms exiting the sample or loan officer promotion. A total of 26 firms and 18 loan officers (2% and 18% in the sample) exit the sample before 2002 (the analysis period, see below).

officers to each of their firms. Ratings of 1, 2, and 3 are assigned discretionarily by the 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 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 rating, is 8.6%.[29] We define a firm 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 average rate of transition to default in the panel is 12.8%. The transition rate is useful to measure the ability of credit ratings to predict default in the near future. The bottom of Table II shows the probability of defaulting within 12 months conditional on the current risk rating. Firms with a rating of 1, 2 and 3 default within 12 months with a 10%, 37% and 49% probability respectively. This indicates that risk ratings are informative about the default probability on average in the sample. In the extreme case where ratings are completely uninformative, the probability of default would be independent on the initial risk rating. Also, the default probabilities for firms with ratings of 2 and 3 indicate that not all firms with a poor risk rating default (the probability of defaulting within 24 months is 44% and 56% respectively). This suggests that the likelihood that a borrower's repayment prospects improve after a poor initial assessment is non-trivial.

B. Identification: Three-Year Rotation Rule

We test whether the anticipated threat of rotation induces officers to make informative (negative) reports about the creditworthiness of borrowers under their management. The main identification problem involves distinguishing changes in an officer's reporting behavior that are due to rotation from those due to variation in a firm's creditworthiness. A second identification problem stems from the fact that we are interested in measuring reporting behavior changes *in anticipation* of rotation. Thus, identification requires a source of variation in rotation that is uncorrelated with firm creditworthiness,

[29] Using the Central Bank data Paravisini (forthcoming) documents an average default rate of 12% and an average loan size of $16,000.

and whose timing is predictable both by officers and the econometrician.

As discussed in Section I, The Bank's internal rules provide such a potential source of variation. A three-year rotation policy induces an increase in the unconditional probability of rotation between months 34 to 36 of a loan officer-firm relationship. Conditional on reaching 34 months, a relationship is terminated with a 58% probability within the next three months.[30] Figure 1.b plots the hazard rate of relationship terminations. The conditional probability of rotation increases sharply as a relationship approaches three years. The monthly hazard rate is below 5% throughout the first two and a half years of a relationship, and increases to greater than 15% in the three months before rotation. The hazard rate then drops by half during the six months following the 36 month cut-off.

The timing of the increase in the unconditional probability of rotation induced by the rule 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.

Two additional features of the empirical setting are ideally suited for testing the incentive effects of rotation. First, the three-year rule is probabilistic: a fraction of officers is actually reassigned at the third year of a relationship. Changes in the reporting behavior among officers that are not reassigned can be purely attributed to the threat of rotation.[31] Second, the probability of rotation increases and then declines around 36 months. This should induce temporary changes in reporting behavior inconsistent with alternate explanations that predict monotonic effects on reporting behavior (e.g., learning).

Two caveats are also in order. First, we can estimate the effect of rotation locally for relationships that reach at least 33 months. We verify in several specification tests that selection on relationship duration does not drive our results. However, we cannot extrapolate the impact of rotation at other relationship lengths or ascertain the counterfactual behavior of loan officers in the absence of a rotation policy. For this reason, we do not derive normative implications about an optimal rotation frequency. Second, due to CDSF sample attrition we cannot obtain within-firm estimators after December 2001. For this reason we limit the analysis to six months after the quarter of high rule-induced rotation. Since

[30] We plot relationships shorter than 48 months because the analysis period (December 1997 to December 2001) will only include such relationships.

[31] We verify in the results that selection into rotation is uncorrelated to the outcomes of interest.

attrition is solely determined by the starting date of relationships, it is unlikely to be systematically related to outcomes or to introduce bias.

C. Implementation and Preliminary Evidence

We analyze the changes in loan officer reporting behavior when the probability of rotation increases and subsequently declines as the relationship with a firm approaches 3 years. A rule-induced quarter of high rotation is determined for each loan officer-firm relationship as follows. Assume that an 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 before (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 two features of officer reporting behavior vary with quarter-to-rotation. First, the correlation of internal risk ratings and a dummy equal to one if a firm defaults in the next twelve months (a proxy for the information content of risk ratings) is shown in column 2. The correlation is not significant three or four quarters before the high rotation quarter ($q_R = \{-3, -4\}$), but it is positive and significant during the two quarters before, 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 indicates that officers produce internal risk ratings that are better predictors of default at the end of a relationship's third year. Next, column 3 of Table III shows the average level of ratings by quarter-to-rotation, and column 4 the differences in average ratings in consecutive quarters. Risk ratings are on average significantly higher, indicating higher default risk, during the two quarters before the high rotation quarter in a relationship. The overall patterns are consistent with our hypothesis that officers report bad news more accurately in anticipation of rotation.

In Section III, we show that these unconditional patterns hold after controlling for unobserved cross sectional and time series heterogeneity. We use within-firm estimates to account for unobserved firm specific changes in creditworthiness or demand for credit. For example, we measure the correlation of

internal risk ratings issued by an 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. Changes in the relevant outcomes in all specifications are measured relative to changes in the outcome for the same firm with other banks. As long as changes in firm creditworthiness and credit demand affect ratings and borrowing with all lenders, the effect of rotation (which is specific to loan officer-firm relationship) is identified.

The fact that a single officer handles multiple relationships at any given time allows us to account for unobserved officer heterogeneity that may arise due to specialization or ability. In some specifications we will also account for officer time varying factors (i.e., due to changes in officer work load). Finally, we include in all specifications a full set of industry-month interactions to control for any macroeconomic and industry level shocks.

III. Effect of Rotation on Reporting Behavior

In this section we study the effect of rotation on loan officer reporting behavior. We show that the information content and bias in risk ratings varies systematically with the time to rotation. We also show how The Bank's lending decisions take this into account. We then discuss the consistency of the findings with our framework in Section I, and provide some additional evidence from the cross section of loan officers. We defer direct evidence on the mechanism which drives this reporting behavior until Section IV.

A. Information Content of Ratings

To test whether rotation induces loan officers to produce more informative ratings, we estimate how the predictive power of internal credit ratings varies by quarter-to-rotation in a default probability model. From the discussion in Section I, we expect the ability of ratings to predict default to increase when rotation is imminent. We estimate the following random effects probit specification:[32]

[32] In unreported estimations we corroborate that the patterns in rating informativeness with quarter-to-rotation remain qualitatively unchanged when unobserved firm heterogeneity is accounted for using a conditional logit (or a linear probability model with firm fixed effects). We present probit results to obtain marginal probabilty estimates.

$$\Pr\left(Default12_{it}=1|.\right)=\Phi\left[\begin{array}{c}\sum_{s=-8}^{2}1\left[s=q_R\right]\left(\beta_s Internal\_RR_{it}+\zeta_s WExternal\_RR_{it}\right)+\\ \beta Internal\_RR_{it}+\zeta WExternal\_RR_{it}+\\ \alpha_{Loan\_Officer}+\alpha_{Industry\times t}\end{array}\right] \quad (1)$$

The outcome of interest is transition to default in one year, $Default12$, 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 likelihood of default. We allow the coefficient on internal risk rating to vary with quarter-to-rotation (β_{q_R}) by interacting $Internal\_RR$ with a set of quarter-to-rotation indicators. This specification allows us to estimate how rating predictive power changes with quarter-to-rotation, while imposing no structure in the time variation pattern. Due to sample restrictions discussed in Section II, we limit the analysis to the eight quarters before, and two quarters after the rule-induced high rotation quarter ($q_R \in [-8, 2]$). 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 before the high rotation period.

We add as a control $WExternal\_RR$, the average rating assigned by all other lenders to firm i at t, weighted by the amount of debt outstanding with each lender. Thus, the coefficient on internal ratings, β_{q_R}, measures the marginal predictive power of the ratings assigned by a loan officer in The Bank relative to the external ratings assigned to the same firm, and at the same time, by other banks. This specification controls for all firm-level time-series variation in creditworthiness or its predictability. For example, suppose that a firm's financial health deteriorates observably and the likelihood of default increases. Such firm level variation is captured by both internal and external ratings and does not influence the estimation of β_{q_R}.[33] Only variation that is specific to the relationship between the firm and The Bank will influence the estimation (i.e. loan officer rotation). As additional controls, the specification includes loan officer and industry-calendar month dummies. These controls take into

[33] The correlation between internal and external risk ratings is 0.78 in the sample. This raises the concern of possible mulicolinearity. In unreported results we show that the pseudo R^2 of estimating specification (1) decreases from 0.165 to 0.120 when internal risk ratings and its interactions are excluded. This verifies that internal risk ratings have a significant and independent contribution to the predictability of default, relative to external ratings.

account potential loan officer heterogeneity in rating style or ability, and industry-specific shocks to default rates or the ability of ratings to predict default.

By construction, q_R is defined only for the subsample of firms with relationships lasting 33 months or longer. The effect of rotation, which is identified through the time series variation in β_{q_R}, is measured only for this subsample. Efficient estimation of the parameters in the probit model calls for the use of the full sample of firms and does not, as we corroborate below, alter the results of the analysis. Thus, our preferred estimations are obtained using the full sample.

The full sample estimation of the coefficients and 95% confidence interval on internal risk ratings for each quarter-to-rotation q_R are plotted in Figure 2.a (also in Table IV, column 1). Risk ratings are standardized (zero mean, sd one) and standard errors 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 three-year rule. The estimated coefficients imply the following marginal relationship between ratings and default, calculated at the sample average. A point estimate of $\beta_{q_R} = 0$ implies that firms with a risk rating of 2 are 5 percentage points more likely to default than firms with a risk rating of 1.[34] An estimate of $\beta_{q_R} = 1$ implies that firms with a rating of 2 are 28 percentage points more likely to default than firms with a risk rating of 1. In words, lower values of β_{q_R} imply that differences in ratings across firms are less informative about the future probabilities of default.

We can distinguish three periods in the plot. In the first, from early in the loan officer-firm relationship and up to four quarters-to-rotation, rating informativeness is declining: the point estimates of β_{q_R} go from positive and significant to negative and not significant during this period. The decline in the coefficient is significant at the 1% level of confidence, even when estimated over the subsample of firms with relationships lasting 33 months or longer (see column 2 of Table IV). The point estimates indicate that the decline is also economically important. The difference in the probabilities of default between firms with a rating of 1 and a rating of 2, decreases from 20 percentage points at eight quarters-to-rotation (the end of the first year of the loan officer-firm relationship), to 0 at four quarters prior to rotation (end of the second year). The decline is substantial relative to the average unconditional difference in default rates between firms with a 1 rating and a 2 rating in the entire sample (27

[34] $\beta_{q_R} = 0$ implies that the predictive power in quarter-to-rotation q_R is not different from the baseline estimate. The baseline estimate is given by the coefficient on internal risk rating with no interaction (0.24) and implies that the difference in default probabilities between two contiguous risk ratings is, on average, 5 percentage points. The baseline estimate is obtained by construction over the subsample of firms for which we do not observe a relationship longer than 33 months in the sample.

percentage points, see Table II). The ability of internal risk ratings to discriminate between firms with high and low default probabilities decreases substantially between the first and second year of a loan officer-firm relationship.

The second period in the graph begins at four quarters-to-rotation, when the declining trend in rating informativeness reverses. The point estimates of β_{q_R} increases significantly during the last year of the relationship, reaching a peak around the rule-induced high rotation quarter. During the third year of a loan officer-firm relationship, the difference between the default probability of firms with a rating on 1 and a rating of 2 increases by 28 percentage points.

The findings suggest that imminent rotation induces loan officers to produce more informative reports about a firm's creditworthiness. The empirical specification, which controls for the external ratings assigned to the same firms by other banks, insures that the observed change is due to a change in the reporting behavior of the loan officer and not firm-level shocks. We verify at the end of this section that the observed pattern is not driven by changes in firm default rates or creditworthiness, or the timing of loan terminations. Also, the non-monotonic pattern in informativeness observed throughout the relationship is unlikely driven by the loan officer learning about firm creditworthiness. Learning would predict a gradual increase in the informativeness of reports, and not the observed abrupt trend change during the last year of the relationship.

One potential concern with the interpretation of the patterns in Figure 2 arises from the fact that the rotation rule creates variation in the workload of loan officers. Because reassignment of firms to officers is staggered, the rule induces time series variation in the number of firms under an officer's management. To verify that the results are not driven by this or other shocks to loan officer productivity, we introduce a full set of loan officer-month dummies in specification (1). The informativeness pattern observed in Figure 2 remains unchanged (see column 3 of Table IV).

To further validate the identification strategy we estimate specification (1) substituting the internal risk rating with the computer risk rating on the right-hand side. The estimated coefficients on the computer risk rating, reported in column 4 of Table IV, have no observable pattern around the high rotation quarter. This implies that there is no time series variation in the informativeness of verifiable information reported through the computer risk rating. Variation in internal risk ratings is thus driven by changes in discretionary loan officer reporting behavior, and not changes in the level or predictability of firm creditworthiness that would also be reflected in verifiable information.

Internal risk rating informativeness may vary over time for two reasons: because officers withhold information they obtain, or because they do not collect information in the first place. The fact that the predictive power of the computer risk rating is constant over time demonstrates that officers do not systematically vary the intensity with which they collect verifiable information. Since collection of this information entails considerable interaction with the firm, it is likely that the amount of information possessed by the loan officer does not vary over time. This suggests that the observed changes in rating informativeness are due to misreporting by the loan officer.

Our interpretation of the results raises the question of whether the three year frequency imposed by the rotation rule is optimal. If imminent rotation induces more accurate reporting, why not increase the rotation frequency and prevent uninformative reports? The most likely explanation is that rotation involves substantial costs. Loan officers may have specific knowledge about the borrower's creditworthiness that is difficult to communicate and is lost when she is reassigned. Further, the incentives of loan officers to invest in gathering such information may be diminished by short relationships.

The third and final period in the graph begins after the high rotation quarter, when rating informativeness declines again. Recall that the plot follows the set of firms that reach 33 month relationships with a loan officer, even if the loan officer is reassigned during the high rotation quarter. Thus, the informativeness estimates after the high rotation quarter reflect ratings reported by newly assigned loan officers (58%) and incumbent loan officers that were not reassigned. We turn to the analysis of the post-rotation period in next subsection, when we look at the informativeness of the rotation and no-rotation groups separately.

A-1. Ex ante Threat of Rotation: No-Rotation Subsample

Our framework suggests that the ex ante *threat* of rotation can induce officers to produce more informative ratings. The documented informativeness increase prior to the high rotation quarter is consistent with this hypothesis. It is also possible, however, that the informativeness increase occurs because incumbent loan officers correctly predict the impact that a newly assigned loan officer will have on the creditworthiness of a firm. New loan officers may be more likely to make mistakes or make conservative lending recommendations at the beginning of their assignments, and thus, directly affect a firm's repayment prospects. Under this interpretation the increase in rating informativeness prior to rotation is caused by the effect of rotation on creditworthiness.

We can empirically rule out the reverse causality hypotheses by looking at the subset of relationships that are not turned over during the high rotation quarter. Figure 2.b shows that the estimated coefficients on this subsample of firms follow the same pattern as in the full sample. The informativeness of ratings is initially declining, but increases sharply prior to the high rotation quarter even if the loan officer is not substituted for a new one ex post. This result is only consistent with the incentive interpretation: the anticipated threat of rotation induces loan officers to produce more informative ratings.

To test formally whether there are significant differences in rating informativeness between the rotation and no rotation subsamples, we augment specification (1) with an interaction between all the variables on the right and a dummy equal to one if the officer of firm i is not rotated during the high rotation quarter. The estimated coefficients on the interaction of internal risk ratings and the no-rotation dummy are all insignificant before the high rotation quarter (Table IV, column 6). This implies that the rating behavior of loan officers prior to the high rotation quarter is the same regardless of whether they are reassigned ex post or not. This represents strong evidence that the rotation rule is random, in the sense that the assignment of loan officers to the rotation and no-rotation subsamples is orthogonal to rating informativeness in the data. In Appendix Table A, we further verify that selection into rotation is uncorrelated with other observable firm characteristics.

Figure 2.b shows a second trend change in the informativeness of loan officer reports at the high rotation quarter. The increasing trend in rating informativeness just prior to rotation stops and flattens out at the high rotation quarter. There is only a temporary increase in the trend of informativeness, even when we focus on the subsample of firms that are managed by the same loan officers throughout the third year of the relationship. This pattern cannot be explained by loan officers learning over time, since learning would imply the increasing trend to continue past three years. Further, the increase and subsequent decline in the trend of informativeness coincides with the temporary increase in the hazard rate of rotation documented in Figure 1. These findings further corroborate the observed patterns in the informativeness of reporting behavior are driven by rotation.

B. Bias in Ratings

The observed changes in rating informativeness are due to misclassification of firms into risk categories: high default probability firms are classified as low risk, and viceversa. If both types of

misclassification are equally likely, then there should be no observable pattern in the average level of ratings with quarter-to-rotation. We explore in this section whether such patterns in the average level of risk ratings exist using the following firm fixed effects specification:

$$\begin{aligned} Internal\_RR_{it} &= \sum_{s=-8}^{2} \gamma_s .1\left[s = q_R\right] + \psi WExternal\_RR_{it} + \\ & \alpha_i + \alpha_{Loan\_Officer} + \alpha_{Industry \times t} + \upsilon_{it} \end{aligned} \tag{2}$$

The dependent variable is the internal risk rating of firm i at time t. To impose no structure on 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-to-rotation $q_R \in [-8, 2]$. 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 point estimates and 95% confidence intervals of the average ratings are plotted in Figure 3.a. Three periods can be identified in the plot. In the first one, between 6 and 8 quarters before rotation, average risk ratings are declining. Pairwise comparisons of the estimated averages indicate that the differences between consecutive quarters are statistically significant at the 1% level. This result implies that firms are upgraded on average, relative to the external rating. It also implies that the decline in rating informativeness documented in the previous section is due to a systematic misclassification of high default probability firms with low risk ratings. Risk ratings build up an *optimistic* bias during the first two years of the officer-firm relationship, in the sense that ratings systematically underpredict default.

The second period begins at four quarters prior to rotation, when average risk ratings sharply increase. Pairwise comparisons of consecutive quarters indicate that the average rating 3 and 4 quarters before rotation are smaller than one quarter before rotation at the 1% confidence level. The point estimates (Table V, column 1) increase by 0.12 during the year before the high rotation quarter. Given that ratings are standardized, this implies that risk ratings increase by 12% of a standard deviation during this period. This pattern indicates that firms are on average downgraded during the third year of the relationship, as the informativeness of ratings increases. It implies that the optimistic bias built up in ratings during the first two years of the relationship is reverted during the third year, as high default probability firms are correctly classified with high risk ratings. 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. Again, this coincides with the informativeness pattern reported above.

As before, we confirm that the same pattern in average ratings is present among the rotation and no-rotation subsamples. Figure 3.b. shows that the observed pattern in the average internal risk ratings is the same in the subsample of firms that do not experience rotation of the loan officer during the high rotation quarter. 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 Table V, columns 2 and 3. 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 before the high rotation period. This indicates that the patterns of average risk ratings with quarter-to-rotation are statistically indistinguishable for the rotation and no rotation subsamples.

The overall results indicate that loan officers tend to systematically misclassify high default probability firms with low risk ratings during the first two years of a relationship. The increase in ex ante threat of rotation during the third year induces loan officers officer to reveal bad news about the creditworthiness of firms.

C. Additional Identification Tests

We provide two additional pieces of evidence to validate our identification strategy. First we corroborate that other outcomes at the firm and relationship level do not vary with quarter-to-rotation. Appendix Table B shows that the average rating assigned by other banks to firms in our sample does not vary significantly as the high rotation quarter approaches (column 1). Similarly, lending by other banks does not vary by quarter-to-rotation (column 2). This implies that after controlling for industry month dummies, firm and loan officer heterogeneity, firm creditworthiness and demand for credit are not significantly correlated with our right hand side variable of interest.

At the relationship level we corroborate that the probability of default and the fraction of debt with a maturity less than a year do not vary with quarter-to-rotation (Table B, columns 3, 4, and 5). This implies that the results are not driven by systematic changes in the probability of default or in the timing of loan terminations related to the three-year rule. These tests provide the counterfactual for our empirical analysis: we would expect rating informativeness and levels to show no variation

around the high rotation quarter if rotation did not affect reporting behavior.

Second we verify that the observed patterns around the high rotation quarter are not driven by firm selection. Recall that quarter-to-rotation is defined only for relationships that last 33 months or longer. This selection may induce bias in the estimates if, for example, officer-firm relationships last longer when there is no bad news reported about the firm. We rule out this possibility by showing that selecting relationships that last to 21 months (rather than 33) does not induce a temporary increase in informativeness towards the end of the second year of a relationship. Moreover, we should continue to see an increase in informativeness at the end of the third year of a relationship for this sample. To do this we define the last quarter of the second year of a relationship as a placebo high rotation quarter, and use it to construct a *placebo quarter-to-rotation* variable (when placebo quarter-to-rotation is 0, actual quarter-to-rotation is -4). Placebo quarter-to-rotation is defined for every relationship that lasts at least 21 months. Column 1 of Table C of the Appendix shows the estimates of specification (1) using the placebo quarter-to-rotation variable, over the subsample of relationships that last at least 21 months. We report the estimates using the actual quarter-to-rotation over the subsample of relationships that last at least 33 months in column 2. To facilitate the comparison, the estimates of the two columns are matched by row to refer to the same quarter in a relationship (the coefficient corresponding to placebo quarter-to-rotation 0 is in the same row than the coefficient corresponding to quarter-to-rotation -4). The estimated coefficients indicate that the results are independent of firm selection: rating informativeness declines during the second year of a relationship and increases during the third regardless of the subsample choice. The results confirm that our findings are not driven by firm selection.

D. Information and Capital Allocation Decisions

We now explore whether the increased precision of ratings reported by loan officers is incorporated in lending outcomes ultimately approved by The Bank. Risk ratings are a key input for bank capital allocation decisions, and 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 (Jaffee and Russell (1976), Leland and Pyle (1977), Stiglitz and Weiss (1981), and Myers and Majluf (1984)). However, officers report to The Bank through means other than internal ratings. The observed increase in rating

informativeness may result from a substitution between communication channels. If rotation leads to improved communication by the officer, we expect to observe lending outcomes changing leading up to the high rotation quarter.

We proceed by estimating reduced form specifications similar to those in the previous subsections. The sensitivities of lending to changes in internal ratings by quarter-to-rotation are obtained using the following firm fixed effects specification:

$$\begin{aligned}\ln\left(debt\_Bank_{it}\right) = & \sum_{u=-8}^{2} 1\left[s = q_R\right]\left(\theta_s Internal\_RR_{it} + \zeta_s WExternal\_RR_{it}\right) + \\ & + \vartheta \ln\left(debt\_othbanks_{it}\right) + \alpha_i + \alpha_{Loan\_Officer} + \alpha_{Industry \times t} + \nu_{it}\end{aligned} \tag{3}$$

The dependent variable is the amount of credit allocated by The Bank to firm i at month t (in logs). The right hand side variable of interest is the internal risk rating, interacted with a full set of quarter-to-rotation dummies. The coefficients on these interactions represent the lending semielasticity to changes in the rating, after controlling for unobserved firm heterogeneity. We also include the external risk ratings interacted with the quarter-to-rotation dummies and the total amount of credit of firm i with other banks in the financial system at time t (in logs). These variables control for firm specific time series variation in the demand for credit or firm creditworthiness. As before, a full set of loan officer and industry-month dummies are included.

The estimated lending sensitivities to internal risk ratings by quarter-to-rotation (θ_{q_R}) are shown in Table VI, panel 1. A negative point estimate indicates that firm downgrades (increase in the risk rating) lead to a decline in The Bank's amount of lending. All the point estimates before the high rotation quarter are negative, and significant only during the year before the high rotation quarter. The estimated sensitivities are insignificant after the high rotation quarter. This pattern indicates that internal ratings and the credit allocation are significantly correlated precisely at the time when rating's informativeness is increasing. The evidence is consistent with The Bank incorporating the additional information in internal credit ratings induced by rotation into lending decisions.

To obtain a sense of the magnitude of this sensitivity, we can estimate the implied reduction in lending from the average downgrade before the high rotation quarter. From Figure 3, firm risk ratings were on average downgraded by 12% of a standard deviation during the year before the high rotation quarter. The point estimates of the sensitivity implies that The Bank will reduce lending between 5.2

and 8.5% to a firm experiencing such a downgrade.

We now study how the average level of lending changes with quarter-to-rotation. The previous back of the envelope calculation based on the average change in ratings potentially underestimates the total change in lending. It ignores the impact of the additional information contained in the ratings of firms that *are not* downgraded before rotation. These firms are now credibly distinguished from high default risk borrowers and are likely to experience an increase in the amount of credit. We obtain an unbiased estimate using the following firm fixed effects regression of the amount of lending (in logs) by The Bank on a full set of quarter-to-rotation dummies:

$$\begin{aligned} \ln\left(debt\_Bank_{it}\right) &= \sum_{s=-8}^{2} \varphi_s .1\left[s = q_R\right] + \vartheta \ln\left(debt\_othbanks_{it}\right) + \\ &\quad \alpha_i + \alpha_{Loan\_Officer} + \alpha_{Industry \times t} + \upsilon_{it} \end{aligned} \tag{4}$$

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 same firm's debt with all other banks. As in specification (2), pairwise comparisons of these coefficients provide information on how lending changes around the high rotation quarter.

The estimated parameters and standard errors are shown in panel 2 of Table VI. Pairwise comparisons indicate statistically significant lending increases between 5 and 2 quarters before rotation. The point estimates increase from 0.15 to 0.56 in this period, which corresponds to a 41% increase in lending relative to other banks. At the average fraction of debt that firms in the sample obtain from The Bank (27%), the estimates imply that overall firm borrowing increases by 11% during the year before 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 that passes from the officer to The Bank increases in response to the threat of rotation. Rotation induces officers to reveal bad news about borrowers, which allows ratings to discriminate good borrowers from bad. The additional information is incorporated into lending decisions, shifting credit towards good quality borrowers and raising the net supply of credit.

E. Discussion: Evidence from the Cross Section

The observed patterns in informativeness and bias are consistent with the career concerns framework of Section I. By this account, as a loan officer becomes increasingly responsible for the outcome of the lending relationship, her incentives to withhold bad news about repayment prospects increase. This is consistent with the optimistic bias that builds up in the reported ratings during the first two years of a relationship. Our results indicate that this bias occurs only through the component of information than can be manipulated by the officer, and suggest that it is not due to inattention, lack of effort, or changes in the opportunity cost of time. The framework also predicts that the imminent threat of being uncovered by a successor after rotation will induce a loan officer to reveal bad news about firms under her management. Consistent with this, we find that loan officers communicate ratings that are better predictors of default during the third year of the relationship, and that the increased predictive power comes from downgrading firms that are more likely to default ex post.

We now look into the cross section of loan officers for additional evidence that they have incentives to hide bad information because it reflects poorly on their ability to originate and manage successful lending relationships. Under this hypothesis we expect an officer to have stronger incentives to produce biased ratings for a firm when: 1) her reputation is less well established (Chevalier and Ellison (1999)), and 2) she has had a more substantial active monitoring role. We provide indirect evidence of these implications by looking at how the results vary in the cross section according to loan officer age and amount of prior origination in the relationship. For conciseness we present the results for bias, and in unreported regressions verify that same patterns hold with respect to the information content of risk ratings.

Columns 4 and 5 of Table V show the estimated coefficients of specification (2) augmented with an interaction of all variables on the right hand side and a dummy equal to one if the officer managing firm i at time t is in the top quartile of the age distribution (age>38 years in 2000). The main coefficients (Table V, column 4) describe the evolution of average ratings with quarter to rotation for young officers. The previously described pattern in rating bias is observed: firms are on average downgraded before the high rotation quarter. The interaction coefficients (Table V, column 5) indicate that the rating behavior of older officers, whose reputation is more established, does not vary systematically with the quarter-to-rotation variable.

Columns 6 of Table V shows the interaction effect with a high origination dummy that turns to

one if the origination rate is in the top quartile for all relationships that reach 33 months. Origination rate is measured as the average percentage increase in lending during a relationship prior to the high rotation quarter. The point estimates from four through six quarters before rotation are negative and statistically significant, and insignificant 1 through 3 quarters before rotation. This implies that the optimistic bias in ratings and the systematic downgrade during the months before rotation are starker for the subsample of relationships where the officer originated more lending before rotation.

The cross sectional patterns are consistent with the hypothesis that, absent rotation, officers have the strongest incentive to conceal bad news when the state of the loan is most informative for their type. Although the evidence is suggestive, it does not establish a causal link between age, origination, and rating behavior. The assignment of firms to officers of different experience, and the degree of origination before rotation, are plausibly related to past risk ratings in the cross section. In support of our interpretation however, we do not find evidence that age-based selection is driving our results: young and old loan officers manage firms with similar size and rating.[35]

IV. Rotation and Incentives: Career Concerns

To provide more direct evidence that loan officer career concerns discourage reporting bad news, and that this incentive problem is mitigated by rotation, we take three equilibrium implications of our career concerns account of rotation of Section I to the data. First, we test whether the reputation of an officer is hurt when she downgrades a firm later in an assignment. We argued that an officer has incentives to withhold bad news when she is responsible for the state of the loan because revealing bad news causes The Bank to lower its assessment of the active monitoring ability of the officer. This first prediction underscores the fundamental rationale for misreporting bad news. Second, we verify that the reputation of a loan officer is not adversely affected when she downgrades a firm early in an assignment. This prediction highlights how rotation removes the incentive of newly assigned loan officers to misreport, since they are not held responsible for the repayment prospects of the firm. Finally, we verify whether the threat of being uncovered by a successor provides incentives to an incumbent officer to reveal bad news at the end of an assignment. Specifically, we expect that when a successor downgrades a firm right after rotation, the incumbent officer's reputation suffers more than

[35] When firm characteristics are measured on the subsample of relationships that reach 34 months, the median firm's total bank debt and risk rating managed by a young (old) officer are \$2.05 million and 1 (\$2.02 and 1) respectively.

when the incumbent downgrades the firm herself.

Taking these predictions to the data poses two challenges. The first one is measuring loan officer's reputation. In line with Berk and Green (2004), we conjecture that in equilibrium The Bank will allocate more assets under the management of officers with a higher perceived monitoring ability.[36] As a consequence, an event that hurts an officer's monitoring reputation will result in a decline in the assets under her management. Following this logic, we use the assets under management of an officer as a proxy for The Bank's posterior beliefs about her monitoring ability.

The second challenge is identifying downgrade events in the data that trigger reputation updates consistent with our framework. Our predictions are derived from the assumption that officers fully anticipate the timing of rotation when deciding whether to downgrade a firm or not. For that reason, we focus on firm downgrades that occur during the six months before and after a high rotation quarter. The timing of rotations during this quarter are predictable, and as discussed in the previous section, unrelated to changes in the borrower's characteristics. $\#DGPRE_{jt}$ and $\#DGPOST_{jt}$, count the number of times up to time t that loan officer j has downgraded a firm during the six months before and after a high rotation quarter respectively.[37] We expect higher downgrade counts before the high rotation quarter (higher $\#DGPRE$) to lead to lower future assets under management. Downgrades after the high rotation quarter should be less likely, since loan officers will have revealed all bad news they are aware of prior to rotation. But when these occur, higher downgrade counts after the high rotation quarter should have no impact on an officer's career (or positive if reporting bad news at the beginning of an assignment improves passive monitoring reputation). We also construct a count for the number of downgrades by a successor after rotation, $\#DGSUCC_{jt}$. This variable considers the same downgrades as $\#DGPOST$ (i.e., downgrades after a high rotation quarter) but adds to the count of the loan officer managing the firm *before* the high rotation quarter. We expect higher counts on the number of downgrades by a successor to have a negative effect on future assets under management, and we expect the effect to be larger than that of the number of downgrades before the high rotation quarter.[38]

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

[37] Both counts 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.

[38] The three-year rule induces a discontinuity in relationship length as a function of quarter-to-rotation. The rule implies that 60% of firms are reassigned to a new officer during the last quarter of a relationship's third year. So the average relationship length when quarter-to-rotation is -1 (right before the high rotation quarter) is slightly above two and a half years, and it is less than one and a half years when quarter-to-rotation is 1 (six months later for the same set

The descriptive statistics of the three counts calculated over the loan officer-month panel between December 1997 and December 2001 are shown in Table VII. The average counts over the loan officer-month panel are small because they are zero by construction during the first three years of the sample, when no high rotation quarters occur. Several features of the descriptive statistics are suggestive about the incentives of rotation on reporting behavior. First note that the average number of pre-rotation downgrades is an order of magnitude larger than the number of post-rotation downgrades. This comparison is suggestive of the power of the incentives provided by rotation: officers avoid being exposed by their successors. To verify that the frequency of downgrades before rotation is high relative to earlier in the relationship we construct an additional count for the number of times up to time t that loan officer j has downgraded a firm during the seven to twelve months before a high rotation quarter ($\#DGPRE\_12$). The statistics indicate that downgrades during one to six months before the high rotation quarter are four times more likely than downgrades seven to twelve months prior. Also, downgrades seven to twelve months before the high rotation quarter are more than twice as likely than downgrades after the high rotation quarter. Newly assigned officers rarely downgrade a loan, which suggests that they are unable to falsely report bad news. This supports our assumption that downgrades require verifiable justification. The results in the previous section also corroborate this assumption: the informativeness and average level of ratings remain unchanged before and after the high rotation quarter. In addition, the results below corroborate that downgrades by newly assigned officers affect the career of the prior loan officer. This suggests that these reports are informative and not merely cheap talk.

The previous discussion motivates the following specification of assets under management on the three downgrade counts:[39]

$$\begin{aligned} \ln(A_{jt}) = \quad & \theta_1 [\#DGPRE_{jt-6}] + \theta_2 [\#DGPOST_{jt-6}] + \theta_3 [\#DGSUCC_{jt-6}] + \\ & \gamma X_{jt} + \alpha_j + \alpha_t + \upsilon_{jt} \end{aligned} \tag{5}$$

The left hand side variable is a measure of assets under management of loan officer j at time t (in logs). Two measures of assets under management are used: the number of firms and the total amount

of firms).

[39] This specification follows directly from extending the model in Section I 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.

of loans outstanding under the management of loan officer j at month t. These measures are obtained by aggregating the data across all firms under the management of each officer. The three variables of interest on the right hand side are the downgrade counts, lagged six months to allow for a response time between changes in reputation and the reassignment of assets. The results that follow are robust to the lag choice. Also, we include loan officer fixed effects and month dummies (additional controls are discussed below). The fixed effects specification accounts for unobserved loan officer heterogeneity, stemming for example from age or experience, and the month dummies account for common shocks to assets under management in the cross section.

The estimated coefficients on the specifications using number of firms and total debt are shown in Table VIII (columns 1 and 5). All standard errors are estimated allowing for clustering at the loan officer level. The point estimate on the number of times an officer downgrades a firm before the high rotation quarter ($\#DGPRE$) is negative and significant in all specifications. This indicates that when an officer downgrades a firm at the end of a relationship her future career suffers. We verify that downgrading a firm seven to twelve months before the high rotation quarter also leads to a decline in future assets under management (see Table VIII, column 3). In contrast, the sign of the coefficient on $\#DGPOST$ can be positive or negative, but the point estimate is insignificant in all specifications. This implies that downgrading a firm at the beginning of a relationship does not damage an officer's reputation.

It is important to keep in mind when interpreting these coefficients that specification (5) documents equilibrium behavior by loan officers when they fully anticipate a high likelihood of rotation. The comparison of the point estimates has three important implications for our analysis. First, the fact that an officer's reputation suffers when she reports bad news after the first six months of her assignment underscores the source of the agency problem. In terms of our theory, an officer's active monitoring role is more informative for her type than her passive monitoring role ($p > q$), which creates the basic incentive to hide bad news. The negative impact on her career is increasing in the time she has been assigned to the firm, as she bears more responsibility for the repayment prospects of the borrower. These facts are at odds with alternate accounts of the source of an officer's incentive to underreport bad news (e.g., collusion, effort). By these accounts, a bad news report in the middle of a relationship is the clearest signal of good behavior. This interpretation is difficult to reconcile with our finding that the officer's career suffers when she reports bad news at this time.

The second implication is that an officer has strong incentives to reveal bad news early in her assignment. If a new officer were to conceal bad news and be forced to reveal it later, her career would suffer. In contrast, revealing bad news at the beginning of an assignment bears no consequences on her career. Finally, these results are inconsistent with accounts of rotation based on the assumption that an agent is unaffected by information she reveals at the end of her assignment (e.g., Prescott and Townsend (2006)).

Now we turn to the estimated parameter on the proxy for number of downgrades by a successor, $\#DGSUCC$. The point estimate is negative and significant in all specifications, indicating that an officer's future assets under management are negatively affected when a firm she managed is downgraded by a successor. Moreover, the magnitude of the coefficient is four to five times larger than that of the coefficient on $\#DGPRE$, the number of downgrades before the high rotation quarter.[40] Consistent with our hypothesis, an officer is better off when she reveals bad news herself than when news is uncovered by a successor. This result also highlights the mechanism through which rotation provides incentives to reveal bad news. Rotation allows The Bank to compare the reports issued by the incumbent officer with those issued by the new officer who faces strong incentives to reveal bad news. In an unreported regression we repeat this analysis also using events where a successor upgrades after rotation. We find that these events do not impact the previous officer's career. This asymmetry implies that our results are not due to mere rating corrections.

These results are inconsistent with explanations for rotation based on collusion between the officer and the firm that rely on folk theorem arguments (see Tirole (1986)). By demonstrating how The Bank uses the comparison of reports before and after rotation, we have shown that rationales based merely on the termination of relationships are, at best, an incomplete account of the way in which rotation mitigates agency conflicts.

We add two controls to verify the robustness of the estimates. First, the total number of high rotation quarters 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 an officer handles a larger portfolio of firms.[41] And second, the average risk rating assigned to the

[40] The relative magnitude of the two parameters remains the same after rescaling to obtain semi-elasticities of assets to number of bad news reports.

[41] It also accounts for the fact that rotations provide information about a loan officer's type even when no reputation event occurs. Most obviously, rotations that are not followed by a downgrade lead The Bank to improve its assessment of the loan officer.

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 coefficient estimates become more precisely estimated, and their sign and magnitude remains unchanged (Table VIII, columns 2 and 6).

Finally we explore how the results vary in the cross section with officer age.[42] The reputation of older officers is more established and less influenced by new events. As a result, we expect that bad news reports by older officers will have a smaller or no impact on their future careers in The Bank. To verify this we augment specification (5) with the interaction of all the variables on the right hand side with a dummy equal to one if loan officer j is in the top quartile of the age distribution. All the estimated interaction coefficients have the opposite sign to the main effects, which indicates that reporting bad news has a smaller influence on the career of older officers (Table VIII, columns 4 and 8). The estimates suggest that neither revealing bad news before rotation nor being uncovered by a successor significantly affect the future assets under management of older officers. These results are in line with the earlier results in the paper, where we document that officers on the top age quartile do not modify their reporting behavior in anticipation of the threat of rotation. Although these cross sectional results must be interpreted with caution due to the possibility of unobserved firm heterogeneity, they suggest rotation provides incentives through career concerns. Rotation affects the reporting incentives and behavior of officers earlier in their career when marginal reputation payoffs are larger.

V. Conclusion

We provide evidence that rotation can be used to limit agency problems in communication due to career concerns. We explore this in the context of a commercial bank that routinely reassigns loan officers to different borrowers using a three-year rotation rule. The effect of rotation is identified using rule-induced variation in the probability of rotation, and by comparing the reports on borrower creditworthiness issued by a loan officer, with those issued by other financial institutions on the same borrowers. When faced with the imminent threat of rotation, officers temporarily issue more informative internal risk ratings. The additional information comes from the release of bad news about

[42] Existing empirical work on career concerns relies on an implication of the model in Holmstrom (1999) that the incentive effects of reputation concerns diminish with age (see Chevalier and Ellison (1999)).

the borrower's repayment prospects. We show that the agency problem in communication stems from the negative effect of reporting bad news upon a loan officer's career. Rotation is effective because officers who fail to report bad news about a borrower and are exposed by a successor go on to manage smaller lending portfolios.

Several of our findings have important implications for organizational design. We show that the ex ante threat of rotation induces truthful reporting by incumbent loan officers. This implies that randomized rotation rules can provide incentives, while lowering the costs associated with task reassignment. The fact that the bank tolerates misreporting in equilibrium suggests that there are significant costs that make using rotation at higher frequency suboptimal. Finally, our results indicate that rotation works by facilitating the comparison of the performance of an incumbent monitor with her successor. This suggests that the effectiveness of rotation may be enhanced by punishment schemes that penalize an agent when she is exposed by her successor.

A related organizational question is why combine the roles of active and passive monitoring. One possible answer is that important complementarities exist between these two roles. In a banking context, a borrower may be unwilling to cooperate with a loan officer whose only role is to detect bad news. Providing an answer to this question is, however, beyond the scope of the present paper.

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.

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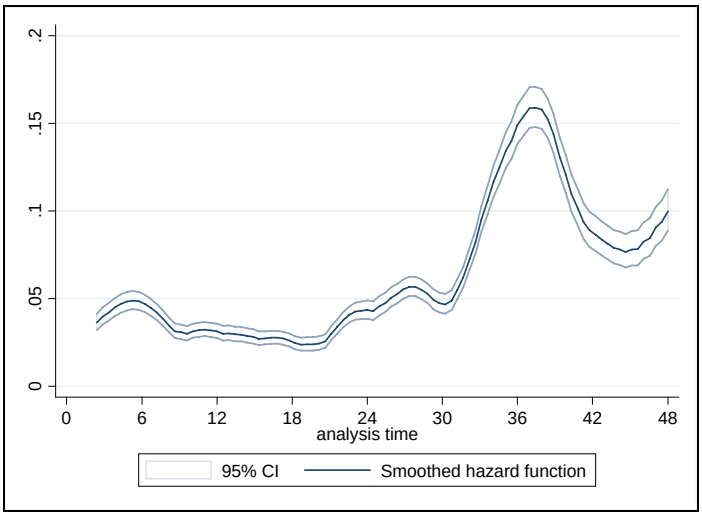
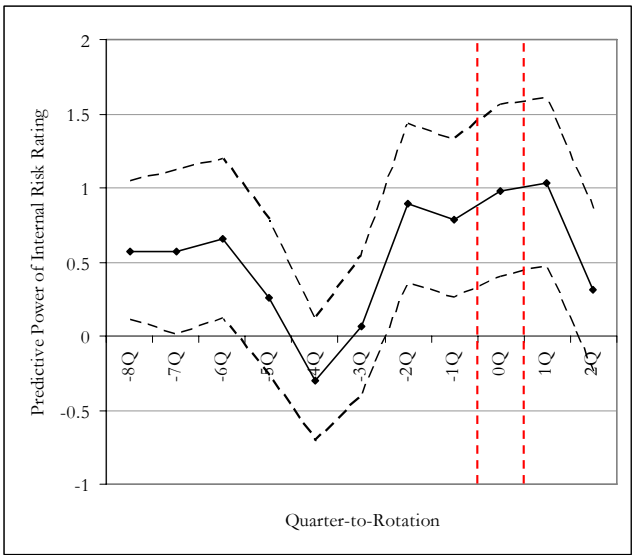
FIGURE 1
Loan Officer-Firm Relationship Termination Hazard Rate



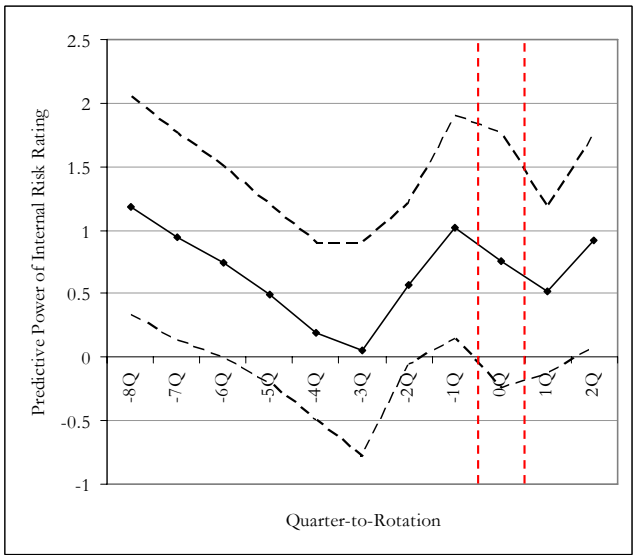
The horizontal axis measures time since the beginning of a loan officer-firm relationship. The plot represents the smoothed conditional hazard rate of relationship termination.

FIGURE 2
Predictive Power of Internal Ratings by Quarter-To-Rotation

2.a. Sample: All



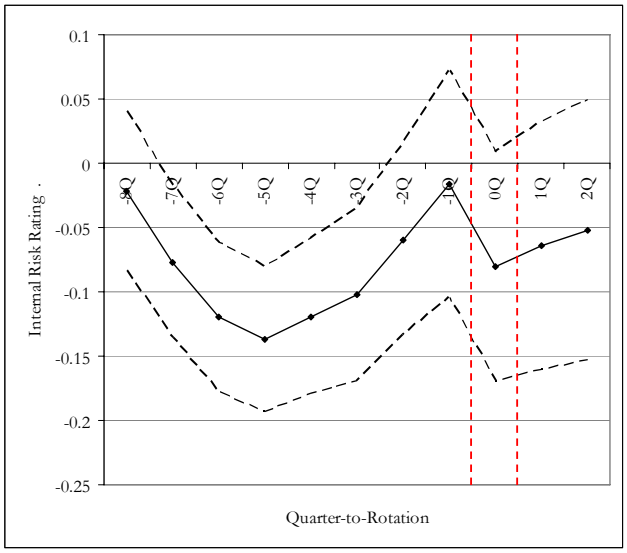
2.b. Sample: No Rotation at High-Rotation-Quarter



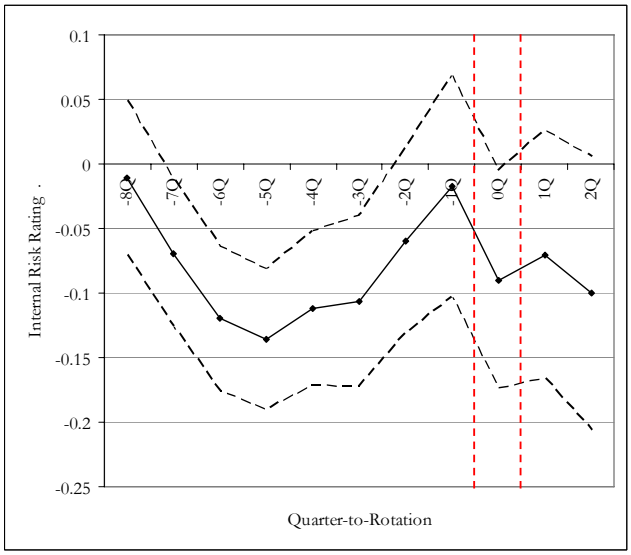
The graphs plot the point estimates and 95% confidence intervals of the coefficients on internal risk ratings interacted with quarter-to-rotation, obtained from the estimation of the probit model of default in specification (1). Panel 2.a plots the estimates using the full sample and Panel 2.b. plots the estimates using the subsample of loan officer-firm relationships that is not rotated during a relationship's third year.

FIGURE 3
Average Internal Risk Ratings by Quarter-To-Rotation

3.a. Sample: All



3.b. Sample: No Rotation at High-Rotation-Quarter



The graphs plot the point estimates and 95% confidence intervals of the coefficients on quarter-to-rotation, in a regression with internal risk ratings as the left hand side variable (specification (2)). Panel 2.a plots the estimates using the full sample and Panel 2.b plots the estimates using the subsample of loan officer-firm relationships that is not rotated during a relationship's third year.

TABLE I
Summary Statistics on Loan Officer Rotation

Summary statistics of a monthly panel of loan officer-firm assignments between December 1997 and December 2001 from a multinational bank in Argentina (The Bank). Each firm is assigned to a single loan officer, and each loan officer is responsible for monitoring multiple firms. There are 1,248 firms and 100 loan officers in 4,181 non-censored firm-loan officer relationships. The average firm in the sample is observed for 67 months. *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.

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

TABLE II
Summary Statistics on Borrower Level Information

Statistics based on 22,659 firm-month-year observations corresponding to a panel of 1,248 firms between December 1997 and December 2001. All loan amounts expressed in thousand of dollars. *Outstanding Amount* is the total amount of credit disbursed to the borrower by The Bank. *Outstanding Reported by Central Bank* is the total amount disbursed to the borrower in the CDSF database by The Bank. *Total Bank Debt Reported by Central Bank* is the total amount disbursed to each borrower by all lenders (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 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 represent defaults and write-offs. *Weighted External Risk Rating by Other Banks* is the average risk rating all other financial institutions assign to the firms in the sample, weighted by the amount of debt outstanding. The numerical rating is also expressed on a scale of 1 (Current) to 5 (Uncollectible). *Computer Generated Risk Rating* numerical indicator on a scale of 0 (best) to 29 (worse), generated by a proprietary algorithm based on the borrower's financial statement information and past repayment history. *Default* takes a value of 1 if *Internal Risk Rating* is greater than 3, and 0 otherwise. *Default within 12 Months* takes a value of 1 if *Default* is zero at time t, and is one anytime between t+1 and t+12. Default measures for observations dated between January and December of 2001 use out of sample default data from January 2002 to December 2002.

Variable	Mean	Median	SD	Min	Max
LENDING LEVELS ($000)					
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 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					
In Default	0.09				
		Subsample: Internal Risk Rating =			
	All	1	2	3	4, 5
Defaults within 12 Months	0.13	0.10	0.37	0.49	1.00

TABLE III
Risk Rating Predictive Power and Average: By Quarter-To-Rotation

This table shows the correlation between internal risk ratings and the future probability of default, and average risk ratings by quarter-to-rotation. The statistics are computed over the subsample of relationships that reach at least 33 months. 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 before (after) the high rotation quarter. Column (2) reports the correlation between internal risk ratings and an indicator variable equal to 1 if firm i is not in default at t, defaults 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	0.029
			(1.26)	
Quarter-to-rotation = -2	930	0.130 ***	1.68	0.042
			(1.29)	
Quarter-to-rotation = -1	932	0.132 ***	1.81	0.130 **
			(1.35)	
High Rotation Quarter	935	0.168 ***	1.97	0.157 **
			(1.41)	
Quarter-to-rotation = 1	877	0.091 *	2.05	0.080
			(1.46)	
Quarter-to-rotation = 2	648	0.052	1.65	-0.402 ***
			(1.19)	
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):

$$\Pr(Default12_{it} = 1|.) = \Phi\left[\sum_{s=-8}^{2} 1[s = q_R](\beta_s Internal\_RR_{it} + \zeta_s WExternal\_RR_{it}) + \beta Internal\_RR_{it} + \zeta WExternal\_RR_{it} + \alpha_{Loan\_Officer} + \alpha_{Industry \times t}\right]$$

q_R measures the time, in quarters, elapsed before and after the high rotation quarter induced by the three-year rotation rule (zero for the high rotation quarter, and negative (positive) before (after) the high rotation quarter). $Default12_{it}$ is equal to 1 if firm i is not in default at t, but defaults between t+1 and t+12. All columns include Internal Risk Ratings, Weighted External Risk Rating, Loan Officer Dummies and Industry-Calendar Month Dummies. Columns (1) and (2) report the interaction of the Internal Risk Ratings with a set of q_R indicators, estimated on the full sample and the subsample of relationships that reach 33 months respectively. Column (3) repeats the estimation in column (1) adding loan officer-month dummies. Column (4) reports the results of a placebo test using a computer generated risk rating in place of the internal risk rating. Columns (5) and (6) 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 reassigned during the high rotation quarter. Standard errors (in parenthesis) are heteroskedasticity-robust and clustered at the firm level. *, ** and *** statistical significance 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 Assigned by:	**Loan Officer**			**Computer**	**Loan Officer**	
Reported coefficient	**Main**	**Main**	**Main**	**Main**	**Main**	**× No Rotation**
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Rating	0.243***		0.165**	0.137***	0.247***	-0.076
	(0.066)		(0.079)	(0.038)	(0.066)	(0.078)
1(Quarter-to-Rotation = -8) × Risk Rating	0.574**	0.555	0.599**	-0.144	0.263	0.995
	(0.236)	(0.349)	(0.260)	(0.119)	(0.283)	(0.589)
1(Quarter-to-Rotation = -7) × Risk Rating	0.566**	0.670*	0.444	0.205	0.421	0.492
	(0.282)	(0.363)	(0.324)	(0.174)	(0.354)	(0.528)
1(Quarter-to-Rotation = -6) × Risk Rating	0.655**	0.834***	0.591**	-0.169	0.644*	0.075
	(0.272)	(0.290)	(0.285)	(0.099)	(0.352)	(0.511)
1(Quarter-to-Rotation = -5) × Risk Rating	0.255	0.347	0.123	-0.004	0.166	0.326
	(0.268)	(0.314)	(0.276)	(0.128)	(0.332)	(0.486)
1(Quarter-to-Rotation = -4) × Risk Rating	-0.301	-0.216	-0.371*	0.031	-0.534**	0.720
	(0.207)	(0.223)	(0.218)	(0.199)	(0.253)	(0.443)
1(Quarter-to-Rotation = -3) × Risk Rating	0.065	0.195	0.148	0.407	0.006	0.206
	(0.242)	(0.266)	(0.262)	(0.278)	(0.270)	(0.532)
1(Quarter-to-Rotation = -2) × Risk Rating	0.892***	1.160***	1.105***	0.051	1.023***	-0.467
	(0.275)	(0.279)	(0.290)	(0.165)	(0.368)	(0.475)
1(Quarter-to-Rotation = -1) × Risk Rating	0.790***	0.957***	0.810***	0.047	0.652**	0.428
	(0.272)	(0.271)	(0.290)	(0.166)	(0.323)	(0.610)
1(Quarter-to-Rotation = 0) × Risk Rating	0.979***	1.128***	1.062***	0.238	1.067***	-0.318
	(0.297)	(0.300)	(0.301)	(0.189)	(0.357)	(0.579)
1(Quarter-to-Rotation = 1) × Risk Rating	1.036***	1.290***	1.107***	0.125	1.498***	-0.919
	(0.286)	(0.313)	(0.308)	(0.251)	(0.553)	(0.639)
1(Quarter-to-Rotation = 2) × Risk Rating	0.309	0.493*	0.351	0.063	-0.03	0.965*
	(0.281)	(0.288)	(0.288)	(0.588)	(0.391)	(0.558)
External Rating × Quarter-to-Rotation Interactions	Yes	Yes	Yes	Yes	Yes	
Loan Officer dummies	Yes	Yes		Yes	Yes	
Loan Officer × month dummies			Yes			
Industry × Month dummies	Yes	Yes	Yes	Yes	Yes	
Observations	18,255	4,838	17,202	18,255	18,255	
Pseudo R-Sq	0.157	0.263	0.196	0.138	0.164	

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):

$$Internal\_RR_{it} = \sum_{s=-8}^{2} \gamma_s . 1[s = q_R] + \psi WExternal\_RR_{it} + \alpha_i + \alpha_{Loan\_Officer} + \alpha_{Industry \times t} + \upsilon_{it}$$

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 three-year rotation rule (zero for the high rotation quarter and negative (positive) before (after) the high rotation quarter). The estimates represent the average internal risk rating by quarter-to-rotation. Columns (2) through (7) report the parameters of an augmented specification that includes the interaction of all right hand side variables with a dummy equal to one if: the loan officer of firm i is not rotated during the high rotation period [(2) and (3)]; if the loan officer of firm i has age greater than 38 years in 2000 [(4) and (5)]; if firm i has an origination rate in the top quintile before the high rotation period [(6) and (7)]. Columns (2), (4), and (6) present the parameters on the terms without interactions and Columns (3), (5), and (7) the terms with interactions. All regressions include Loan Officer and Industry-Month Dummies. Standard errors (in parenthesis) are heteroskedasticity-robust and clustered at the firm level. *, ** and *** statistical significance at the 10, 5 and 1 percent levels. All significant estimates are in bold typeface.

Dependent Variable	**Internal Risk Rating**						
Reported Coefficient	**Main**	**Main**	**× No Rotation**	**Main**	**× Old Loan Officer**	**Main**	**× High Origination**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1(quarter-to-rotation = -8)	-0.022	-0.009	-0.045	-0.02	-0.02	**-0.069****	0.013
	(0.031)	(0.038)	(0.044)	-0.032	-0.054	**(0.034)**	(0.037)
1(quarter-to-rotation = -7)	**-0.077****	**-0.074****	-0.028	**-0.099*****	0.063	**-0.113*****	-0.046
	(0.030)	**(0.035)**	(0.044)	**(0.029)**	-0.054	**(0.031)**	(0.037)
1(quarter-to-rotation = -6)	**-0.120*****	**-0.140*****	0.023	**-0.096*****	-0.032	**-0.108*****	**-0.106*****
	(0.030)	**(0.033)**	(0.044)	**(0.030)**	-0.056	**(0.034)**	**(0.035)**
1(quarter-to-rotation = -5)	**-0.137*****	**-0.146*****	-0.001	**-0.097*****	-0.056	**-0.111*****	**-0.145*****
	(0.029)	**(0.031)**	(0.042)	**(0.032)**	-0.057	**(0.039)**	**(0.032)**
1(quarter-to-rotation = -4)	**-0.119*****	**-0.105*****	-0.052	**-0.088****	-0.035	**-0.122*****	**-0.097*****
	(0.031)	**(0.030)**	(0.042)	**(0.036)**	-0.061	**(0.033)**	**(0.039)**
1(quarter-to-rotation = -3)	**-0.103*****	**-0.074****	0.033	**-0.074***	-0.039	**-0.121*****	-0.071
	(0.034)	**(0.037)**	(0.034)	**(0.041)**	-0.069	**(0.039)**	(0.048)
1(quarter-to-rotation = -2)	-0.059	-0.001	0.033	-0.001	**-0.132***	-0.066	-0.019
	(0.038)	(0.044)	(0.033)	-0.044	**(0.069)**	(0.044)	(0.056)
1(quarter-to-rotation = -1)	-0.016	0.062	-0.012	0.022	**-0.140***	-0.048	0.092
	(0.045)	(0.056)	(0.033)	-0.051	**(0.076)**	(0.055)	(0.082)
1(quarter-to-rotation = 0)	**-0.081***	-0.042	-0.085	-0.035	**-0.137****	-0.036	-0.013
	(0.045)	(0.055)	(0.073)	-0.05	**(0.068)**	(0.053)	(0.086)
1(quarter-to-rotation = 1)	-0.064	-0.010	-0.105	-0.014	**-0.159***	-0.063	-0.029
	(0.049)	(0.056)	(0.080)	-0.061	**(0.084)**	(0.052)	(0.094)
1(quarter-to-rotation = 2)	-0.053	0.036	**-0.146***	-0.008	**-0.166***	-0.052	-0.022
	(0.051)	(0.065)	**(0.083)**	-0.058	**(0.090)**	(0.058)	(0.099)
External Rating Control	Yes	Yes		Yes		Yes	
Firm FE	Yes	Yes		Yes		Yes	
Loan Officer Dummies	Yes	Yes		Yes		Yes	
Industry × Month Dummies	Yes	Yes		Yes		Yes	
Observations	21,400	21,400		21,400		21,400	
R-Sq	0.79	0.79		0.80		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):

$$\ln(debt\_Bank_{it}) = \sum_{u=-8}^{2} 1[s = q_R](\theta_s Internal\_RR_{it} + \zeta_s WExternal\_RR_{it}) + \vartheta \ln(debt\_othbanks_{it}) + \alpha_i + \alpha_{Loan\_Officer} + \alpha_{Industry \times t} + \nu_{it}$$

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 three-year rotation rule (zero for the high rotation quarter and negative (positive) before (after) the high rotation quarter). The 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):

$$\ln(debt\_Bank_{it}) = \sum_{s=-8}^{2} \varphi_s . 1[s = q_R] + \vartheta \ln(debt\_othbanks_{it}) + \alpha_i + \alpha_{Loan\_Officer} + \alpha_{Industry \times t} + \upsilon_{it}$$

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 (in parenthesis) are heteroskedasticity-robust and clustered at the firm level. *, ** and *** statistical significance at the 10, 5 and 1 percent levels. All significant estimates are in bold typeface.

Panel 1: Sensitivity of Lending to Ratings

Dependent Variable	**ln(Debt)**
1(quarter-to-rotation = -8) × Risk Rating	-0.147
	(0.291)
1(quarter-to-rotation = -7) × Risk Rating	-0.129
	(0.343)
1(quarter-to-rotation = -6) × Risk Rating	-0.236
	(0.326)
1(quarter-to-rotation = -5) × Risk Rating	-0.278
	(0.329)
1(quarter-to-rotation = -4) × Risk Rating	**-0.714*** **
	(0.265)
1(quarter-to-rotation = -3) × Risk Rating	**-0.571*** **
	(0.206)
1(quarter-to-rotation = -2) × Risk Rating	**-0.572*** **
	(0.197)
1(quarter-to-rotation = -1) × Risk Rating	**-0.446** **
	(0.186)
1(quarter-to-rotation = 0) × Risk Rating	**-0.444***
	(0.245)
1(quarter-to-rotation = 1) × Risk Rating	-0.395
	(0.276)
1(quarter-to-rotation = 2) × Risk Rating	0.97
	(0.764)
ln(Debt other Banks)	Yes
Risk Rating other Banks × quarter-to-rotation Dummies	Yes
Firm FE	Yes
Loan Officer Dummies	Yes
Industry × Month Dummies	Yes
Observations	20,272
Pseudo R-Sq	0.460

Panel 2: Average Lending

	ln(Debt)
1(quarter-to-rotation = -8)	-0.172
	(0.168)
1(quarter-to-rotation = -7)	-0.106
	(0.162)
1(quarter-to-rotation = -6)	-0.073
	(0.167)
1(quarter-to-rotation = -5)	0.150
	(0.157)
1(quarter-to-rotation = -4)	**0.378*** **
	(0.139)
1(quarter-to-rotation = -3)	**0.464*** **
	(0.142)
1(quarter-to-rotation = -2)	**0.565*** **
	(0.156)
1(quarter-to-rotation = -1)	**0.381** **
	(0.190)
1(quarter-to-rotation = 0)	0.269
	(0.214)
1(quarter-to-rotation = 1)	0.286
	(0.235)
1(quarter-to-rotation = 2)	0.204
	(0.273)
ln(Debt other Banks)	Yes
Firm FE	Yes
Loan Officer Dummies	Yes
Industry × Month Dummies	Yes
Observations	20,272
Pseudo R-Sq	0.21

TABLE VII
Summary Statistics on Loan Officer Reputation Event Counts Based on High Rotation Quarter

The table presents summary statistics for the count of the number of downgrades that occur during the twelve months before and six months after a high rotation quarter between December 1997 and December 2001. *DGPRE* (*DGPRE_12*) and *DGPOST*, count the number of times up to time t that loan officer j has downgraded a firm during the six (seven to twelve) months before and after a high rotation quarter respectively. *DGSUCC* counts the number of downgrades by a successor after a high-rotation-quarter. 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.

Variable	Mean	Median	SD	Min	Max
# events pre-High Rotation Quarter loan officer downgrades firm firm 1-6 months prior (#*DGPRE*)	0.436	0	1.78	0	14
# events pre-High Rotation Quarter loan officer downgrades firm firm 7-12 months prior (#*DGPRE_12*)	0.103	0	0.87	0	9
# events post-High Rotation Quarter loan officer downgrades firm 1-6 months after (#*DGPOST*)	0.043	0	0.28	0	4
# events pre-High Rotation Quarter loan officer's firm downgraded post-High Rotation Quarter (#*DGSUCC*)	0.081	0	0.52	0	5
# of High Rotation Quarters with no downgrade	2.237	1	4.43	1	31

TABLE VIII
The Effect of Firm Downgrade Events on Loan Officer's Assets under Management (Reduced Form)

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

$\ln(A_{jt}) = \theta_1[\#DGPRE_{jt-6}] + \theta_2[\#DGPOST_{jt-6}] + \theta_3[\#DGSUCC_{jt-6}] + \gamma X_{jt} + \alpha_j + \alpha_t + \upsilon_{jt}$

The left hand side variable is the log of a measure of assets under management of loan officer j at time t (number of firms under management and total amount of debt). *#DGPRE* , *#DGPRE_12* and *#DGPOST*, count the number of times up to time *t* that loan officer *j* has downgraded a firm during the six months before, 7 to 12 months before, and 6 months after, a high rotation quarter. *#DGSUCC*, counts the number of times a firm under the management of loan officer j before the high rotation quarter is downgraded during the six months after the high rotation quarter. It is based on the same events as *#DGPOST*, but it imputes the events to the loan officer managing the firm before the high rotation quarter. Two additional controls are used in specifications 2-4 and 6-8: number of High Rotation Quarters where no 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 (in parenthesis) are heteroskedasticity-robust and clustered at the loan officer level. *, ** and *** statistical significance at the 10, 5 and 1 percent levels. All significant estimates are in bold typeface.

Dependent Variable (logs)	**# Firms**				**Debt**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
# events pre-High Rotation Quarter loan officer downgrades firm firm 1-6 months prior (*#DGPRE*)	**-0.104*** (0.036)**	**-0.145*** (0.023)**		**-0.135*** (0.028)**	-0.170 (0.108)	**-0.184** (0.073)**		**-0.173** (0.060)**
# events pre-High Rotation Quarter loan officer downgrades firm firm 7-12 months prior (*#DGPRE_12*)			**-0.079** (0.037)**				-0.078 (0.069)	
# events post-High Rotation Quarter loan officer downgrades firm 1-6 months after (*#DGPOST*)	0.083 (0.127)	-0.038 (0.083)	-0.056 (0.105)	-0.040 (0.099)	0.171 (0.289)	0.294 (0.277)	0.293 (0.281)	0.141 (0.499)
# events pre-High Rotation Quarter loan officer's firm downgraded post-High Rotation Quarter (*#DGSUCC*)	**-0.466*** (0.074)**	**-0.330*** (0.071)**	**-0.355*** (0.090)**	**-0.310*** (0.075)**	**-0.701*** (0.176)**	**-0.681*** (0.142)**	**-0.728*** (0.114)**	**-0.592*** (0.154)**
#DGPRE × (Dummy=1 if loan officer in highest age quartile)				0.085 (0.138)				0.104 (0.261)
#DGPOST × (Dummy=1 if loan officer in highest age quartile)				-0.058 (0.122)				0.254 (0.488)
#DGSUCC × (Dummy=1 if loan officer in highest age quartile)				**0.241*** (0.141)**				**0.653*** (0.243)**
Additional Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Controls × (Dummy=1 if loan officer in highest age quartile)				Yes				Yes
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	0.87	0.90	0.90	0.90	0.79	0.83	0.83	0.83

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 three-year rule, on firm observable characteristics and downgrade events that affect loan officer reputation. 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 the three reputation event counts used in the career concerns section but where the events are measured relative to actual rotations instead of the high rotation quarter, and the internal risk rating of the firm. All explanatory variables are measured 6 months before 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 post-rotation downgrade	(0.0009)	(0.0060)	(0.0021)	(0.0188)
	(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

TABLE B
Other Firm and Bank-Firm Relationship Level Outcomes by Quarter to Rotation

This table provides the results of identification tests based on estimating the following regression of firm level outcomes on quarter-to-rotation dummies, firm fixed effects, loan officer fixed effects and industry-month dummies:

$$Y_{it} = \sum_{s=-8}^{2} \varphi_s . 1[s = q_R] + \alpha_i + \alpha_{Loan\_Officer} + \alpha_{Industry \times t} + \upsilon_{it}$$

The left hand side variables are: ratings assigned by other banks (1), log lending by other banks (2), probability of entering default at t (3), probability of entering default between t+1 and t+12 (4), percentage of debt with less that a year of maturity at t (5). There is no significant difference in the point estimates of any two consecutive quarters to rotation. This indicates that changes in firm creditworthiness and demand for credit, or the timing of loan origination and termination, are not driving the results documented in Section III.

Dependent Variable	**External Risk Rating**	**ln(Debt other Banks)**	**Dummy=1 if Defaults this Month**	**Dummy=1 if Defaults in next 12 months**	**Percentage Debt with Maturity < 1 Year**
	(1)	(2)	(3)	(4)	(5)
1(quarter-to-rotation = -8)	-0.017	0.159	0.005	-0.008	-9.089**
	(0.073)	(0.221)	(0.003)	(0.027)	(4.243)
1(quarter-to-rotation = -7)	0.015	0.192	0.005	-0.055	-8.851*
	(0.069)	(0.232)	(0.003)	(0.021)	(4.526)
1(quarter-to-rotation = -6)	0.069	0.358	0.000	-0.029	-10.160**
	(0.076)	(0.232)	(0.003)	(0.020)	(4.466)
1(quarter-to-rotation = -5)	0.068	0.248	-0.001	-0.010	-9.276**
	(0.076)	(0.231)	(0.003)	(0.021)	(4.497)
1(quarter-to-rotation = -4)	0.050	0.174	0.000	-0.010	-8.636*
	(0.078)	(0.234)	(0.003)	(0.021)	(4.511)
1(quarter-to-rotation = -3)	0.077	0.306	-0.001	-0.027	-10.181**
	(0.082)	(0.259)	(0.003)	(0.023)	(4.501)
1(quarter-to-rotation = -2)	0.046	0.279	-0.005	0.002	-10.692**
	(0.080)	(0.273)	(0.004)	(0.025)	(4.622)
1(quarter-to-rotation = -1)	0.032	0.514	-0.005	0.004	-10.897**
	(0.092)	(0.283)	(0.004)	(0.027)	(4.798)
1(quarter-to-rotation = 0)	0.082	0.370	0.003	0.001	-10.678**
	(0.106)	(0.297)	(0.005)	(0.032)	(5.137)
1(quarter-to-rotation = 1)	0.089	0.445	0.003	-0.036	-11.966**
	(0.144)	(0.290)	(0.007)	(0.037)	(5.568)
1(quarter-to-rotation = 2)	0.141	0.508	0.001	-0.002	-10.121*
	(0.109)	(0.325)	(0.005)	(0.049)	(5.423)
Firm FE	Yes	Yes	Yes	Yes	Yes
Loan Officer Dummies	Yes	Yes	Yes	Yes	Yes
Industry × Month Dummies	Yes	Yes	Yes	Yes	Yes
Observations	21,477	21,608	21,608	20,080	22,329
R-Sq	0.09	0.14	0.09	0.16	0.60

TABLE C
Firm Selection Bias Test: Placebo Quarter-to-Rotation

Column (1) shows the estimated coefficients of specification (1) using a placebo quarter-to-rotation measure defined assuming that high rotation quarter occurs during the last quarter of the second year of a relationship, over the subsample of relationships that last at least 21 months. Column (2) reproduces the coefficients in column (2) of Table IV, estimated over the subsample of relationships that last at least 33 months. To facilitate the comparison, the coefficients on column (1) are matched by row so that they refer to the same quarter in a relationship (the coefficient corresponding to placebo quarter-to-rotation 0 is in the same row than the coefficient corresponding to quarter-to-rotation -4). The estimated coefficients indicate that the results are independent of firm selection.

Dependent Variable	**Probability of Entering Default in Next 12 Months**		
	Placebo High Rotation Quarter: End of Second Year Subsample: relationships that last 21 months or longer		**Actual High Rotation Quarter: End of Third Year** Subsample: relationships that last 33 months or longer
	(1)		(2)
1(Placebo Quarter-to-Rotation = -4) × Risk Rating	0.791***	1(Quarter-to-Rotation = -8) × Risk Rating	0.555
	(0.268)		(0.349)
1(Placebo Quarter-to-Rotation = -3) × Risk Rating	0.700***	1(Quarter-to-Rotation = -7) × Risk Rating	0.670*
	(0.270)		(0.363)
1(Placebo Quarter-to-Rotation = -2) × Risk Rating	0.922***	1(Quarter-to-Rotation = -6) × Risk Rating	0.834***
	(0.246)		(0.290)
1(Placebo Quarter-to-Rotation = -1) × Risk Rating	0.672**	1(Quarter-to-Rotation = -5) × Risk Rating	0.347
	(0.274)		(0.314)
1(Placebo Quarter-to-Rotation = 0) × Risk Rating	-0.011	1(Quarter-to-Rotation = -4) × Risk Rating	-0.216
	(0.244)		(0.223)
1(Placebo Quarter-to-Rotation = 1) × Risk Rating	0.28	1(Quarter-to-Rotation = -3) × Risk Rating	0.195
	(0.221)		(0.266)
1(Placebo Quarter-to-Rotation = 2) × Risk Rating	0.919***	1(Quarter-to-Rotation = -2) × Risk Rating	1.160***
	(0.259)		(0.279)
1(Placebo Quarter-to-Rotation = 3) × Risk Rating	0.786***	1(Quarter-to-Rotation = -1) × Risk Rating	0.957***
	(0.230)		(0.271)
1(Placebo Quarter-to-Rotation = 4) × Risk Rating	1.259***	1(Quarter-to-Rotation = 0) × Risk Rating	1.128***
	(0.279)		(0.300)
1(Placebo Quarter-to-Rotation = 5) × Risk Rating	1.511***	1(Quarter-to-Rotation = 1) × Risk Rating	1.290***
	(0.252)		(0.313)
1(Placebo Quarter-to-Rotation = 6) × Risk Rating	0.743**	1(Quarter-to-Rotation = 2) × Risk Rating	0.493*
	(0.291)		(0.288)
External Rating × Quarter-to-Rotation Interactions	Yes		Yes
Loan Officer dummies	Yes		Yes
Industry × Month dummies	Yes		Yes
Observations	7,560		4,838
Pseudo R-Sq	0.255		0.263