Lending Relationships and Information Rents: Do Banks Exploit Their Information Advantages?

Author(s): Carola Schenone

Source: *The Review of Financial Studies*, Vol. 23, No. 3, Corporate Governance (March 2010), pp. 1149-1199
Published by: Oxford University Press. Sponsor: The Society for Financial Studies.
Stable URL: http://www.jstor.org/stable/40604783
Accessed: 12-06-2017 13:20 UTC

Lending Relationships and Information Rents: Do Banks Exploit Their Information Advantages?

Carola Schenone
McIntire School of Commerce, University of Virginia

In the process of lending to a firm, a bank acquires proprietary firm-specific information that is unavailable to nonlenders. This asymmetric evolution of information between lenders and prospective lenders grants the former an information monopoly. This article empirically investigates whether relationship banks exploit this advantage by charging higher interest rates than those that would prevail were all banks symmetrically informed. My identification strategy hinges on the notion that large information shocks that level the playing field among banks erode the relationship bank's information monopoly. I use the borrower's initial public offering (IPO) as such an information-releasing event, and build a panel dataset in which the unit of observation is a firm's lending relationships before and after its IPO. Prior to a firm's IPO, I find a U-shaped relation between borrowing rates and relationship intensity. After the IPO, interest rates are decreasing in relationship intensity. Furthermore, mean interest rates drop after an IPO. The results are robust to firm and loan-year fixed effects, and to controls for firm leverage pre- and post-IPO. Thus, the reported interest rate pattern is clean of any confounding effects that might arise from changes in financial risk. (*JEL* D82, G21, G24, G32)

1. Introduction

In the process of lending to a firm, the lending bank acquires a firm-specific information advantage over nonlenders.[1] As a banking relationship deepens and

I am grateful to Allen Berger, Federico Ciliberto, Matt Clayton, Mark Flannery, Paolo Fulghieri, Rick Green, Robert Hauswald, Joel Houston, Ravi Jagannathan, Wei Liu, Felicia Marston, Kieron Meagher, Mitchell Petersen, Manju Puri, David C. Smith, Greg Nini, Jay Ritter, Claire Rosenfeld, Patrik Sandås, Phil Strahan, Anjan Thakor, Bill Wilhelm, and Andy Winton for helpful discussions. I also thank Jörg Rocholl for his discussion at the 2007 Western Finance Association Meetings in Montana, and Ayako Yasuda for her discussion at the Fifth Corporate Finance Conference in Olin. I benefited from suggestions by seminar participants at the Federal Reserve Board, the New York Federal Reserve Bank, the University of Florida–Gainesville, the Stockholm School of Economics, the Securities and Exchange Commission, American University, the University of Ohio, and the Norwegian School of Management in Oslo; the 2007 WFA Meetings in Montana; the 44th Annual Bank Structure and Competition Conference of the Federal Reserve Bank of Chicago; and the Fifth Annual Conference in Corporate Finance at Olin, Washington University. Evan Kwiatkowski and Katie Rohyans provided outstanding research assistance. Mary Summers provided outstanding editorial assistance. I gratefully acknowledge financial support from the Pettit-DeMong Faculty Fellowship Fund and the Walker Summer Research Grant from the McIntire School of Commerce at the University of Virginia. All errors are my own. Send correspondence to Carola Schenone, McIntire School of Commerce, University of Virginia, Rouss and Robertson Halls, 125 Ruppel Drive, Charlottesville, VA 22903; telephone: (434) 924-4184; fax: (434) 924-7074. E-mail: schenone@virginia.edu.

[1] On the idea that a bank that actually lends to a firm learns more about that borrower's characteristics than do other banks, see, for instance, Kane and Malkiel (1965); Fama (1985); Greenbaun, Kanatas, and Venezia (1989); Sharpe (1990); Rajan (1992); and Petersen and Rajan (1994, 1995).

doi:10.1093/rfs/hhp080 Advance Access publication October 20, 2009

information asymmetries between lenders and nonlenders grow, nonlenders face an adverse selection problem that deters competition for the lending relationship from nonlenders. Consequently, borrowers face high costs of switching lenders and relationship lenders have greater opportunities for extracting rents from informationally captured borrowers. This article investigates whether relationship banks exploit this advantage by charging higher interest rates than would prevail were all banks symmetrically informed, using a new dataset that tracks a firm's lending relationship and borrowing rates through an information-releasing event that levels the information field across lenders and prospective lenders.

Several theories explain why borrowing rates should change as lending relationships intensify, but they disagree as to *how* they should change. For example, Sharpe (1990) and Greenbaum, Kanatas, and Venezia (1989) predict that interest rates will *increase* with the intensity of a banking relationship, while Boot and Thakor (1994) predict they should *decrease*. The first prediction arises because banks expect to earn monopoly rents from the information advantage they acquire through a lending relationship. Thus, they compete for firms at the outset of a relationship, initially subsidizing borrowers offering rates below market spot-borrowing costs. In equilibrium, borrowing rates rise over the course of a relationship. The second prediction arises because borrowing firms face above-market spot-borrowing rates until they prove successful. Following a first success, firms pay below-market spot rates.

Borrowers are not powerless in the banking relationship. Rajan (1992) and Diamond (1991) argue that the firm's option to issue public debt limits the relationship bank's monopoly power. Hauswald and Marquez (2003, 2006) and Padilla and Pagano (1997) suggest means by which information acquired through a banking relationship can spill over to nonlenders, thereby increasing competition among lenders and diminishing the borrower's cost of switching lenders.

Empirical work on this question is similarly diverse in its conclusions if not its methods. The extant literature rests largely on comparing borrowing rates for long- and short-term maturity loans, for a cross-section of firms. The interpretation of the empirical results is based on the premise that the relationship bank's cost of lending to its client *decreases* with the length of the lending relationship (Diamond 1991). Petersen and Rajan (1994) find that borrowing costs are *unrelated* to the length of the lending relationship. If lending costs decrease with relationship length, Petersen and Rajan's evidence suggests that banks extract rents from their informationally captured borrowers. Degryse and Van Cayseele (2000) report that interest rates *increase* with the length of the lending relationship, suggesting that banks exploit their information advantage. In contrast, Berger and Udell (1995) find that firms with longer lending relationships pay *lower* interest rates than firms with shorter relationships, suggesting that banks share with their clients the benefits of their privileged

information.[2] These articles use loan maturity to capture the strength of a lending relationship. Instead, I use a new measure of relationship intensity: The frequency with which the borrower turns to the same lender. This measure captures how dependent the firm is on its lender, and hence how locked in the firm is to its lending relationship.

I take a different approach to address whether relationship banks exploit their privileged information. I focus on bank loan pricing around a significant information-releasing event in the life of a borrower, an event that changes the information structure among lenders and alters the relationship bank's ability to extract rents from the relationship firm. Specifically, I study changes in bank-loan pricing around initial public offerings of equity. Prior to going public, firms are not required to broadly and systematically disclose information, and do not face a regulatory threat for misleading disclosure. In the course of the public offering, a substantial amount of information about the firm is revealed and the firm is held accountable by the Securities and Exchange Commission (SEC) for its reporting. After the initial public offering (IPO), the firm must comply with ongoing disclosure requirements mandated by the SEC and the stock exchange where its shares trade. The firm's public share price yields another piece of the informational puzzle facing outsiders.

In this context, I predict that evidence of informational rent extraction will be concentrated before the firm's IPO. As the IPO leads to wider dissemination of information that was previously held private by the firm's relationship bank, the adverse selection problem facing outside lenders diminishes. This increases competition for the lending relationship from outside lenders, and decreases the firm's cost of switching lenders. As a result, the firm's cost of borrowing is expected to decline in relationship intensity.

I investigate this hypothesis by building a panel dataset in which the unit of observation is a firm's lending relationships before and after its IPO. IPO firms, identified using the Securities Data Company (SDC) database, are hand-matched with loan information from the Dealscan database. To control for changes in financial risk that may occur around the firm's IPO date, I use data from COMPUSTAT and the firm's IPO prospectus to measure the firm's leverage ratio on the year the loan was taken. The use of panel data on firm-loan observations is new to the empirical literature examining the linkage between informational rent extraction and borrowing rates and carries several advantages.[3]

---

[2] On the firm's choice of private vs. public debt to mitigate being locked in, Santos and Winton (2008) show that during recessions banks raise rates more for bank-dependent borrowers than for those with access to the bond markets. Houston and James (1996) show that multiple bank relationships, and borrowing from the public markets, can mitigate such problems. Ongena and Smith (2001) find that firms are more likely to leave a bank as their banking relationship matures.

[3] Ongena and Smith (2001) and Houston and James (1996) use a panel of firms to address issues associated with relationship banks' information monopolies, but do not tackle the loan-pricing issue. Berger and Udell

First, the panel enables the firm-bank relationship to be tracked as it evolves, allowing me to construct a new measure of relationship strength that captures the degree to which a firm depends on its lending bank. Empirically, it is measured as the ratio of the number of loans that a firm has drawn to date from the current lender, to the total number of loans the firm has taken to date.[4] Intuitively, it captures the frequency with which the firm borrows from the same bank, and how concentrated a firm's loans are with any one lender. This new way to measure relationship intensity departs from the traditional measure, which focuses on the length (maturity) of the firm's loan with a particular lender.

Second, the panel structure of the data can be exploited to estimate a firm fixed-effects model of interest rate on relationship intensity. This allows me to control for unobservable firm characteristics that can affect the firm's cost of borrowing (the ability of managers to negotiate new loans, the firm's corporate governance structure, the firm's credit risk when private and when public, and the firm's optimal choice of relationship intensity with any given lender). If these firm-specific unobservables are correlated with the lender's ability to extract information rents and are not controlled for in the econometric analysis, they introduce an endogeneity problem that leads to inconsistent estimates of the role of information rents. Since firm fixed-effects regressions are regressions on deviations from firm means, the coefficients are estimated from *within-firm* variation. I also use loan-year fixed effects to control for unobservable year-specific effects.

The article reports three main findings. First, prior to the firm's IPO, interest rates as a function of relationship intensity exhibit a U-shaped pattern. Second, after the firm's IPO, interest rates are monotonically decreasing in relationship intensity. Third, the average interest rate the firm pays prior to its IPO is significantly higher than that paid after going public, even after controlling for changes in the firm's leverage following the IPO.

To interpret these results, I draw on the theories of Hauswald and Marquez (2003, 2006), specifically, on the notions of information spillovers and the relationship bank's information-processing capacity as two countervailing forces that bear on the degree of asymmetric information between the relationship lender and the outside lenders (and hence the competitiveness of the borrower's credit market). As the lending relationship evolves, firm-specific information can spill over to nonlenders, reducing the latter's adverse selection problem and increasing the competitiveness of the firm's credit market.

(1995) and Petersen and Rajan (1994) use data from the NSSBF, so neither of these papers has a panel of firms (inferences are made comparing firms at different points of their lending relationship). Elsas and Krahnen (1998) and Degryse and Van Cayseele (2000) use a panel of firm-loan data on German and Belgian firms, respectively, but do not exploit the panel structure in their empirical work. Pagano, Paneta, and Zingales (1998) use a panel of Italian firms going through the IPO to disentangle the determinants of a firm's decision to go public, but do not examine the pre- and post-IPO *pattern of borrowing rates*.

[4] For example, if the firm has 10 loans, and 7 are granted by the same lead lender, then relationship intensity with that lender is 7/10.

Yet, as the lending relationship evolves, the relationship bank becomes more efficient and effective at gathering and processing firm-specific information. This widens the information gap with nonlenders, worsens the latter's adverse selection problem, and decreases competition for the firm's lending business.

The U-shaped pattern of interest rates on relationship intensity observed prior to the firm's IPO can be rationalized as follows. For low values of relationship intensity, the spillover effect dominates the information-processing capacity effect. Consequently, information asymmetries between relationship and outside banks are not large enough to allow the relationship bank to internalize the benefits from continued lending, and the lender shares with the borrower the lower cost of continued lending. As the firm continues to borrow from the same lender, information-processing capacity dominates spillover effects. The lender can now extract rents from its information advantage.

During and after the IPO, the firm constantly discloses information to the public capital markets. This is equivalent to a huge information spillover effect. This spillover lessens the lender's information advantage and further weakens the lender's return from acquiring firm-specific information, resulting in the lender reducing its investment in acquiring borrower-specific information. As information between current and prospective lenders becomes more symmetric and the adverse selection problem facing potential competitors of the relationship bank shrinks, the firm's costs of switching lenders falls. This allows the firm to shop for better rates from competing banks, and thus explains the decreasing pattern of interest rates.

These results are robust to controls for firm leverage both before and after the IPO, and so do not reflect changes in financial risk that may occur with the public offering. They are also robust to controls for a variety of other changes in firm characteristics following its IPO, as well as to firm and loan-year fixed effects.

The change in the *pattern* of spreads, as well as in the *average* spread, is consistent with relationship banks exploiting the benefits of their information-based monopoly. I contrast this hypothesis with two alternative hypotheses that could explain the reported interest rate pattern. First, I consider a risk-sharing hypothesis: Prior to the IPO the lead lender might not be able to form a large syndicate precisely due to the lack of information about the borrower, and hence might not be able to engage in risk sharing; following the firm's IPO, the lead lender might be able to form a larger syndicate, consequently lowering the cost of lending to the firm. While the risk-sharing measures appear to impact interest rates, once I also control for the relationship-intensity measures capturing how locked in the firm is to its relationship lender, these risk-sharing measures lose explanatory power. This evidence cannot dismiss the rent-extraction hypothesis. Next, I consider the concurrent lending and underwriting hypothesis. According to this alternative explanation, lending banks might offer the issuing firm an interest rate discount on loans in lieu of the firm's underwriting business. I do not find evidence to support this hypothesis.

The remainder of this article is organized as follows. Section 2 relies on existing theoretical work to trace the article's hypothesis. Section 3 describes the article's identification strategy and empirical test design. Section 4 describes the sample and reports summary statistics. Section 5 presents the econometric specifications, empirical predictions, and estimation results. Section 6 explores the alternative hypotheses and deals with robustness analysis. Section 7 concludes.

2. Evolution of Lending Costs and Asymmetric Information

Determining whether relationship banks extract rents from their client firms requires untangling the effects of changes in the relationship-lender's cost structure as the relationship deepens, and the changes in a potential competitor's cost structure as the degree of asymmetric information changes.

Regarding changes in the relationship lender's cost structure, this article maintains that the lender's cost of lending decreases with *relationship intensity* (loan concentration). Previous literature has argued that the lender's cost of lending decreases with *loan maturity*. Petersen and Rajan (1995) state, "The longer a borrower has been servicing its loans, the more likely the business is viable and its owner trustworthy (Diamond 1991). Conditional on its past experience with the borrower, the lender now expects loans to be less risky. This should reduce its expected cost of lending and increase its willingness to provide funds." I use this argument, together with the argument in Goswami, Noe, and Rebello (1995), to claim that lending costs fall as the borrower turns to the same lender more frequently. To see this, consider a bank granting different loans to two otherwise equal firms. One firm receives a one-year loan and the other firm receives four three-month loans. Prior work claims that a lender's cost of lending decreases with loan maturity, so that the bank's cost of lending to the first firm falls as the one-year loan approaches maturity. I claim that the lender's cost of lending also falls the more frequently the firm turns to the bank. Thus, I claim that lending costs fall as the bank grants the second firm subsequent short-term loans. In this case, the bank has three months to acquire information on the firm. After this, it observes the resolution of uncertainty regarding the firm's repayment ability. This allows the lender to accurately assess the firm's creditworthiness before granting a subsequent loan. Consequently, when the bank grants the borrower a subsequent loan, increasing relationship intensity as measured in this article, the bank can do so at a lower cost. Furthermore, as the firm concentrates its borrowing in one (or a few) lender, the overall due diligence and monitoring costs decline as these efforts are not duplicated. The first loan that a firm takes requires substantial due diligence and monitoring from the lender, but when the firm renews its loan or takes a new loan from that same lender, past experience

with the firm will make due diligence and monitoring more efficient and less costly.

As for changes in a prospective lender's cost structure, this article claims that the nonlenders' cost of lending is a function of the degree of asymmetric information between an existing lender and prospective ones, since this determines the latter's adverse selection problem (Sharpe 1990). The greater the information gap between lenders and nonlenders, the larger the nonlender's adverse selection problem, which grants lenders a greater opportunity for rent extraction.

Unfortunately, changes in lenders' and nonlenders' costs of lending to a firm are unobservable. Still, we can draw broad inferences about the presence of rent extraction by following the evolution of a lending relationship and the borrower's cost of borrowing.

(1) If, all else equal, borrowing rates decline with the intensity of a banking relationship, either information asymmetries among lenders and nonlenders are diminishing or relationship banks are strategically sharing the surplus granted by the relationship with the borrowing firm.
(2) Alternatively, borrowing rates that remain stable or rise with relationship intensity suggest that relationship banks engage in information rent extraction.

We can make sharper inferences if it is possible to isolate changes in the degree of asymmetric information between lenders and potential lenders. Hauswald and Marquez (2003) illustrate the difficulty in doing so that arises from two countervailing forces that bear on the degree of asymmetric information between lenders and potential lenders as a lending relationship evolves: advances in information-processing capacity and information spillover effects.

As the relationship deepens, advances in information processing capacity *increase* asymmetric information between lenders and prospective lenders by improving the relationship bank's capacity for gathering, processing, and interpreting firm-specific information. To see this, consider a firm that concentrates its borrowing with one relationship lender. During the first loan the bank learns how to deal with the firm's management, whose data to trust, what data to ask for, where to acquire the data, how to interpret the data, and how to evaluate the firm's repayment ability. At maturity, the realization of the firm's repayment ability teaches the bank how successful it was at gathering and processing information to predict the firm's risk and repayment potential. When the bank grants another loan to the firm, increasing its relationship intensity as defined here, it will concentrate its information-gathering efforts on what previous interactions had revealed to be relevant and informative in accurately assessing the firm's risk. Further, as Hauswald and Marquez (2003) show, there is a positive self-feeding mechanism involved in gathering and processing information: "As banks become better at processing information, the return to exerting effort

increases, so that banks choose a higher effort level. Hence an inside bank's information advantage should increase as well."[5] This increased information gap between lenders and prospective lenders worsens the latter's adverse selection problem and increases the borrower's cost of switching banks. This increases the barriers to entering the firm's lending market and allows the lender to extract rents from its client, demanding higher rates on subsequent loans.

In contrast, information spillovers *reduce* the degree of asymmetric information between lending and nonlending banks. When a lender grants its current borrower a loan renewal or a new loan, increasing relationship intensity, some firm-specific information is transmitted to nonlending banks (in fact, simply observing the loan renewal or a new loan reveals relevant borrower-specific information). Such a spillover levels the information field between the relationship bank and outside banks, ameliorates the latter's adverse selection problem, and increases competition for the lending relationship. To keep competing banks at arm's length, the relationship bank might share any gains from continuing the lending relationship. One such gain is the lender's lower cost of lending as the relationship intensifies. Therefore, in the presence of the spillover effects, the relationship bank shares with the firm the surplus from continued lending, offering lower interest rates on subsequent loans.[6,7] Furthermore, as Hauswald and Marquez (2003) show, information spillovers have a reenforcing effect on the information gap between lenders and nonlenders: "Since increased spillovers of information decrease the returns to effort spent on gathering and interpreting information, banks exert lower levels of effort when such effort is costly. Note that this consequence of easier information dissemination also implies that inside banks' informational advantage shrinks even further."[8]

The interaction of these two effects determines the competitiveness of the firm's credit market and the firm's opportunity to benefit from declining lending costs. When information spillovers dominate, the firm's credit market is more competitive and rates decrease as the relationship evolves. But when the lender's information-processing capacity effect dominates, rates increase in relationship strength. In this article, one effect need not dominate the other effect over all ranges of relationship intensity. For low values of relationship intensity, spillovers are likely to dominate information-processing capacity as nonlenders learn more from observing a first loan renewal than they would learn from the tenth loan renewal, and lenders are still learning how to deal with the firm and become effective and efficient in processing firm-specific information. For large

[5] See Hauswald and Marquez (2003), pp. 929–30, Corollary 1.

[6] Hauswald and Marquez (2003, 2006) do not offer specific predictions along these lines. The authors' theories, under the assumption that the spillover effects dominate advances in information-processing capacity at low relationship-intensity values, fit my empirical findings.

[7] The effect of spillovers on reducing asymmetric information will be the largest when less is known about the firm. Outside banks learn relatively more about the firm when they observe that the firm receives a second or third loan from the same lender than when they observe a tenth or eleventh loan from the same lender.

[8] See Hauswald and Marquez (2003), pp. 932–33, Corollary 2.

values of relationship intensity, the relationship bank's information-processing capacity is likely to dominate spillover effects as the bank has gathered firm-specific expertise over the course of the relationship, which allows it to be an increasingly efficient information acquirer, and the information that a tenth loan renewal spills over to nonlenders is relatively small. In this case, we'd observe a decreasing pattern of interest rates for low values of relationship intensity and an increasing pattern of interest rates for large values of relationship intensity.

3. Identification Strategy and Empirical Test Design

This article's identification strategy hinges on the notion that large information shocks that level the playing field among banks erode the lender's information monopoly. I focus on lending relationships that undergo a large informational shock that exogenously levels the information field on which current and potential lenders compete, the firm's IPO. Prior to going public, firms lack a credible and established mechanism for disseminating information, which aggravates the adverse selection problem among current and potential lenders and secures the former's information advantage. In this scenario, relationship banks might exploit their information monopoly. The IPO credibly reveals to the public capital markets a large amount of information previously bound up within the firm's banking relationship. After the IPO, constant information disclosure keeps any particular lender from acquiring an information monopoly. In this scenario relationship banks lose their information advantage and might share the surplus generated from a lending relationship with the borrowing firm. Though it is plausible that the IPO might not be an entirely exogenous event, the empirical evidence in Pagano, Paneta, and Zingales (1998) shows that pre-IPO borrowing costs appear *not* to significantly determine the firm's decision to go public.[9]

4. Data

4.1 The sample

The data are a hand-matched sample of IPOs listed in SDC with loan data reported in Dealscan.[10] Using the SDC database, I select all IPOs between 1998 and 2003 that satisfy the standard researcher's requirements (excluding ADRs, closed-end funds, REITS, financial institutions, private placement,

[9] On the determinants of the firm's decision to go public, see, for instance, Benveniste, Busaba, and Wilhelm (2002); Pagano, Paneta, and Zingales (1998); Chemmanur and Fulghieri (1999); Maksimovic and Pichler (2001); Schenone (2004); and Benzoni and Schenone (2009).

[10] SDC is compiled from regulatory filings, news sources, company press releases, and the firm's IPO prospectus. Dealscan is compiled by the Loan Pricing Corporation and records information on loans to private and public firms, that are at least $100,000.

rights and unit issues, and best efforts, nonfirm commitment, and auctioned offers) and for which Dealscan reports a loan. For loans greater than $100,000, and granted in 1986 or later, Dealscan reports the structure of the lending syndicate and the identity of the syndicate members, as well as loan characteristics such as interest rates (the all-in-spread-drawn and the all-in-spread-undrawn), the loan amount, time to maturity, the S&P senior debt ratings at the onset of the loan and at the time of the loan's cancellation, any fees that the borrower must pay the lender, and the type and purpose of the loan. Of the firms going public between 1998 and 2003, Dealscan shows that at least one loan was made in the case of 411 firms, about 35% of the IPO firms in the sample period. For these 411 firms, there are 981 loans for which the all-in-drawn variable is available. Of these loans, 511 loans are pre-IPO loans, while the remaining 470 loans are post-IPO. Only 104 firms have exclusively pre-IPO loans, and only 28 firms have exclusively post-IPO loans. This leaves 250 firms with at least one loan before and one loan after the IPO.[11] For these, I searched in COMPUSTAT and in each firm's prospectus for the firm's debt, asset, and equity values in the year in which the loan was taken, to build leverage ratios that can control for the firm's financial risk at the time that the loan was taken.[12]

Two notes on sample selection are warranted. First, only firms that have gone through the IPO process have been selected for the sample. Indeed, the article's experiment precisely focuses on a significant information-releasing event in the firm's life that can eliminate the relationship bank's information monopoly, and an IPO is such an event. Thus, by design, IPO firms were selected. Yet IPO firms are rather different from other private firms: they are mature firms that actually "made it" to the IPO. Consequently, these firms are relatively less obscure than other private firms. Therefore, the market has more information about these firms, making them less subject to asymmetric information problems between lenders and prospective lenders. By selecting a sample of IPO firms, I am choosing a sample that is biased against finding evidence of information-based rent extraction.

Second, the sample is restricted to firms with bank loans reported in Dealscan. Selecting firms with bank loans is a necessary condition for monitoring changes in interest rate patterns as the banking relationship evolves. Using Dealscan to identify bank loans might introduce a selection bias since Dealscan reports only loans in excess of $100,000, and firms garnering such loans might share a specific set of firm characteristics. For example, they might be "bigger and better" than the average IPO firm (James and Weir 1990).[13] However,

[11] For a detailed explanation of syndicate loan structures, see Sufi (2007). For the effects of pre-IPO syndicated loans on IPO characteristics, see, for instance, Schenone (2004) and Benzoni and Schenone (2009).

[12] For pre-IPO data I use COMPUSTAT and the firm's IPO prospectus. Note that COMPUSTAT back files balance sheet data from pre-IPO years using the data reported in the firm's IPO prospectus. When COMPUSTAT data are missing, I check the IPO prospectus to confirm the missing data or complete the missing information. Post-IPO data are comprehensively covered in COMPUSTAT.

[13] See also Mikkelson and Partch (1986); James (1987); and Lummer and McConnell (1989).

larger-than-average firms might be better known by lenders and nonlenders, consequently reducing the lender's rent-extraction ability. Selecting larger-than-average firms biases the sample against finding evidence of information-based rent extraction. Evidence of rent extraction would likely be larger if smaller and lesser-known firms were included in the sample.

To further address any possible sample selection issue, and to capture firm characteristics common to firms in Dealscan, the econometric specification includes firm fixed effects.[14]

4.2 Lending relationship variables

Previous research by Petersen and Rajan (1994); Berger and Udell (1995); Elsas (2005); Degryse and Van Cayseele (2000); and Ongena and Smith (2001) has measured the strength of the relationship by the length of time over which the lender and the firm have been doing business with one another (loan maturity). While this measure provides a meaningful estimate of relationship strength, it might not fully capture how dependent the firm is on its current lead lender. First, a longer loan maturity, or a longer-lasting lending relationship, does not preclude the firm from having many such relationships and therefore not becoming dependent on any one lender that can amass an information monopoly on the firm, hence locking in the borrower. Second, a firm might cancel the loan with the lender prior to the maturity date, or the bank might terminate the loan before maturity if the firm violates a loan agreement or covenant. Finally, the firm might only draw on the loan early on, and stop drawing on it as maturity approaches. In these cases, loan maturity overestimates the period of time over which the firm and lender interact, and hence overestimates the true relationship strength. More important, loan maturity does not precisely capture how locked in the firm is in its current lending relationship.

This article introduces a new measure of relationship intensity that captures the degree to which a firm is dependent and relies on its bank for subsequent loans. It is defined as the number of loans that a firm has drawn from its current lead lender as a proportion of the total number of loans that the firm has drawn to date.

For each firm i, the firm's loans are ordered chronologically from $l = 1$ to $l = L$, where L is the maximum number of loans observed for firm i. $Prior\_by\_Lead_{i,l}$ is defined as the total number of loans in which the lead lender for loan l has participated, up to loan number l. For the first loan that firm i takes, $Prior\_by\_Lead_{i,l} = 0$ by definition. And for each firm i, and loan l, $Loans\_to\_Date_{i,l} = l$. The relationship intensity variable is defined as

$$Intensity_{i,l} = \left(\frac{Prior\_by\_Lead}{Loans\_to\_Date}\right)_{i,l}.$$

[14] On dealing with selectivity bias using a panel dataset, see Veerbek and Nijman (1992).

The borrower is more dependent on the current lender for higher values of $Intensity_{i,l}$. When counting the number of prior loans that a relationship firm has taken from the current lead lender, $Prior\_by\_Lead_{i,l}$, it is important to account for bank mergers and for loans granted by a subsidiary of a parent bank.

Bank mergers can potentially disrupt a preexisting lending relationship.[15] Because the information that a bank has regarding its client is likely to be inherited by the merged entity, I count loans that a firm took from a bank that subsequently merged as prior loans from the merged entity. For instance, the information that Chase Manhattan Bank had about its client is likely to have been transferred to JPMorgan Chase following the JPMorgan-Chase merger. Accordingly, a loan granted by Chase Manhattan Bank would be counted as a prior loan to any loan subsequently granted by the merged entity, JPMorgan Chase.

Loans granted by either a parent bank or a subsidiary are treated as loans originating from the *same* lead lender, since it is likely that different sections of the same financial holding company share information about common clients (especially because such information sharing could substantially reduce the cost of doing business with the firm in several different departments).[16] This article uses the most recent data on subsidiaries of bank holding companies, obtained from the Federal Reserve Board Web site.[17]

5. Empirical Analysis

5.1 Univariate results: Pre- and post-IPO loan characteristics

The Dealscan item "all-in-spread-drawn" (spread hereafter) is the interest rate that the borrower pays to the lender on the amount drawn on the loan, measured as a markup over LIBOR. This spread is a comprehensive measure of the interest rate and fees that the firm pays on its bank loan, and includes the fees paid by the borrower to the lender (annual fees and commitment fee). Dealscan defines this spread as: "The amount the borrower pays in basis points over LIBOR for each dollar drawn down. It adds the spread of the loan with any annual (or facility) fee paid to the bank group." When a loan has several facilities, the spread is the weighted average of the spreads for each facility, where the weights are the amount of the loan in that facility relative to the total amount of that loan. Dealscan also records the names of all the banks involved in the loan and specifies the role of each of the lending banks (e.g., lead lender, co-lead lender, and other loan participants). Other relevant loan characteristics reported include the amount of the loans, their time to maturity, the firm's debt rating at the time

[15] See, for instance, Ongena and Smith (2001); Sapienza (2002); and Karceski, Ongena, and Smith (2005).

[16] Such information transfers are even more likely following the Gramm-Leach-Bliley Act of 1999, when the firewalls that previously existed between commercial banks and their subsidiaries came down. When a firm receives a loan from a parent commercial bank, e.g., Citibank, and later receives a loan from one of its subsidiaries, e.g., Salomon Smith Barney, these loans are treated as originating from the *same* lead lender.

[17] See http://www.federalreserve.gov/generalinfo/subsidiaries/.

Table 1
Summary statistics for key loan characteristics

	Overall sample (1)	Before IPO (2)	After IPO (3)	Difference (4)
Interest rates				
All-in-spread drawn	238.06	248.22	227.01	−21.21***
Interest rate spread on drawn funds, in basis points above LIBOR	(111.38)	(106.81)	(115.25)	(7.11)
	981	511	470	981
All-in-spread un-drawn (basis points total)	41.74	42.80	40.81	−2.00
	(28.62)	(31.24)	(26.13)	(2.30)
	640	298	342	640
Fees				
Up-front fees (basis points)	60.72	57.11	67.63	10.52
	(59.08)	(52.96)	(69.07)	(7.81)
	297	195	102	297
Commitment fees (basis points)	46.17	46.80	45.61	−1.19
	(28.16)	(31.39)	(24.80)	(2.49)
	526	248	278	526
More loan characteristics				
Secured (1 if secured, 0 o/w)	0.86	0.88	0.84	−0.04*
	(0.35)	(0.32)	(0.37)	(0.03)
	688	372	316	688
Loan amount (millions of U.S. dollars)	209.92	190.52	231.16	40.64*
	(386.74)	(412.48)	(355.67)	(24.39)
	993	519	474	993
Maximum loan maturity (months)	44.91	46.57	43.11	−3.47**
	(28.15)	(30.80)	(24.85)	(1.77)
	989	515	474	989
Number lending banks	5.51	4.96	6.10	1.14***
	(6.78)	(7.37)	(6.04)	(0.43)
	981	508	473	981
Pct lead lender lent	61.63	67.63	55.26	−12.38***
	(37.03)	(36.50)	(36.55)	(2.61)
	786	405	381	786

The entries in each cell correspond to the mean, standard deviation in parentheses, and number of observations for each loan characteristic. The interest rates for the loans (all-in-spread drawn, all-in-spread undrawn, and LIBOR), and all fees (commitment and up-front fees) are specified in basis points. When a loan has several facilities, these interest rates and fees are the weighted average of the interest rates of each facility where the weights are the amount of the loan in that facility relative to the total loan amount. Loan maturity is measured in months, and for the loans where there are multiple facilities, the length of the loan corresponds to the maximum between the lengths of the facilities. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

it took the loan, and whether or not the loan was collateralized. Information on the specific amount that each lender contributed toward the loan is available for about half of the sample. The loan's time to maturity is measured in months, and for loans with multiple facilities, the maturity corresponds to the longest maturity. The amount of the loans is measured in millions of U.S. dollars, and when a loan has several facilities, the loan amount is the sum of the amounts in each facility.

Table 1 reports summary statistics for loan characteristics. Column 1 reports characteristics for the full sample. The mean spread on drawn funds is 238.06 basis points above LIBOR, and the mean fee on the undrawn portion of the loan is 41.74 basis points total. The average up-front and commitment fees are

60.72 and 46.17 basis points of the total loan amount, respectively. On average, there are more than five lending banks per loan, and the lead lender contributes slightly over 60% of the total loan amount. The mean loan amount is U.S. $209.92 million, and the average loan maturity is about 44 months.

Columns 2 and 3 report characteristics before and after the IPO, respectively, and column 4 shows the difference in the mean values of these variables as the firm goes public. For loans taken prior to the firm's IPO, the average spread on drawn funds is 248.22 basis points above LIBOR, and following the IPO the spread on drawn funds drops to 227.01 basis points above LIBOR. The difference, 21.21 basis points, is statistically significant at 1%. After the firm's IPO the number of banks from which the firm borrows increases, and the percentage of the total loan amount contributed by the lead lender decreases from 67.63% to 55.26%, a difference that is significant at the 1% level. This finding is consistent with Sufi's (2007) evidence that syndicated loans to firms *without* publicly available SEC filings are more concentrated, with the lead arranger holding 10% more of the loan.

The nonlinearity of the pre-IPO interest rate pattern and the monotonicity of the post-IPO pattern are further explored in the multivariate analysis that follows.

5.2 Multivariate Analysis

5.2.1 Interest rate dynamics leading up to the IPO. To focus on the pattern of interest rates *before* the firm's IPO, the sample is restricted to include *only the pre-IPO loans* and only the firms having a minimum of two such loans. This restricts the sample to 295 loans corresponding to 97 different firms, with an average of about three pre-IPO loans per firm. The regression equation of interest is

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{\text{Intensity}} Intensity_{i,l} + \beta_{\text{Intensity\_Sqrd}} \left(Intensity_{i,l}\right)^2 \\ & + \beta_{\text{Loan\_Characteristics}} \text{Loan Characteristics}_{i,l} \\ & + \beta_{\text{Firm\_Characteristics}} \text{Firm\_Characteristics}_{i,l} \\ & + \beta_{\text{Switched}} \text{Switched\_Lenders}_{i,l} + \beta_{\text{First\_Loan}} \text{First\_Loan}_{i,l} \\ & + \beta_{\text{Loan\_Yrs}} \text{Loan\_Year\_FE}_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned} \tag{1}$$

where i indexes the firm, and l indexes the loan number. $\text{Spread}_{i,l}$ is the all-in-spread drawn for firm i's loan l. $Intensity_{i,l}$ is as defined above, $(\frac{Prior\_by\_Lead}{Loans\_to\_Date})_{i,l}$, and measures, for each loan l, the number of prior loans that firm i has drawn from the current lead lender as a fraction of the total number of loans drawn to date. $\text{Loan\_Characteristics}_{i,l}$ is a vector of characteristics of loan number l taken by firm i, such as the number of lenders in the lending syndicate, the loan's maturity, the type of loan (e.g., whether the loan is a revolver line of credit, a term loan, etc.), and purpose of the loan. $\text{Firm\_Characteristics}_{i,l}$ is a vector of firm i's characteristics at the time when loan l was taken, such as the debt rating that firm i received when taking loan l. These debt ratings are S&P

senior debt ratings at the onset of the loan. Switched_Lenders$_{i,l}$ is a categorical variable equal to one when *i's* lead lender for loan *l* has not participated in any of the prior $l-1$ loans. First_loan$_{i,l}$ is a categorical variable equal to one when firm *i's* loan *l* is the firm's first loan. For these last two categorical variables the fraction of loans taken from the current loan's lead lender, *Intensity*$_{i,l}$, equals zero as the number of prior loans by lead lender is, by definition, zero. Loan_Year_FE$_{i,l}$ represents loan year fixed effects; ε_i represents firm-specific unobservable characteristics; and $\eta_{i,l}$ represents the idiosyncratic error term.

Equation (1) is estimated for different specifications under both a fixed effects and a random effects model. The Hausman specification test reveals that the random effect estimates are biased, and hence the fixed effects model fits the data better. By using the fixed effects specification, the coefficients are within estimators, and thus *identification comes from within-firm variation*: The coefficients $\beta_{\text{Intensity}}$ and $\beta_{\text{Intensity\_Sqrd}}$ measure how a firm's spread changes when *that* firm's relationship intensity changes. All reported results correspond to fixed effects estimates.

Results from estimating the baseline regression are reported in Table 2, panel A, column 1. It reveals a U-shaped pattern of interest rates on relationship

Table 2
Cost of loans, as a function on relationship intensity, *before* the firm's IPO

Panel A: Baseline regressions and loan characteristics

	Baseline (1)	Baseline (2)	Maturity (3)	Maturity × Intensity (4)
Relationship variables				
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$	−474.55***	−385.91**	−417.75**	−416.63**
	(179.87)	(178.56)	(174.84)	(175.19)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}\right)^2$	402.00**	303.94*	351.42**	367.00**
	(172.38)	(171.79)	(168.61)	(171.42)
Switched lenders	−98.28**	−80.37*	−85.64**	−87.58**
	(44.24)	(43.86)	(42.97)	(43.20)
Loan characteristics				
First loan	−121.83***	−98.15**	−102.11**	−104.56**
	(45.96)	(45.65)	(44.65)	(44.97)
Number of lending banks			−1.73**	−1.74**
			(0.68)	(0.69)
Loan maturity			0.47***	0.53***
			(0.17)	(0.20)
Loan maturity * $\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$				−0.27
				(0.51)
Firm fixed effects	Yes	Yes	Yes	Yes
Loan year fixed effects	No	Yes	Yes	Yes
R^2 within	0.05	0.13	0.18	0.18
F-statistic	2.57	2.67	3.42	3.16
Number of firms	98	98	97	97
Number of loans	295	295	293	293
Average number of loans	3.01	3.01	3.02	3.02
Max. number of loans per firm	2	2	2	2
Min. number of loans per firm	9	9	9	9

(*continued overleaf*)

Table 2
(Continued)

Panel B: More loan and firm characteristics

	Loan type (1)	Loan type (2)	Loan purpose (3)	Rating (4)	Firm age (5)
Relationship variables					
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$	−348.62**	−331.27*	−370.34**	−377.31**	−394.21**
	(172.26)	(173.65)	(169.78)	(170.17)	(175.28)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}\right)^2$	276.70*	268.15*	303.29*	311.41*	327.18*
	(166.49)	(166.95)	(164.25)	(164.73)	(169.35)
Switched lenders	−71.68*	−70.60*	−82.04**	−83.13**	−87.55**
	(42.15)	(42.20)	(41.09)	(41.16)	(42.58)
Loan characteristics					
First loan	−84.60*	−86.32*	−95.97**	−97.53**	−103.02**
	(44.06)	(44.14)	(42.95)	(43.03)	(45.09)
Number of lending banks	−1.97***	−2.06***	−1.82***	−1.76***	−1.73**
	(0.68)	(0.69)	(0.66)	(0.66)	(0.67)
Loan maturity	0.37**	0.39**	0.27	0.25	0.25
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
Loan type					
Term loan	9.36	11.91	18.36	17.64	17.13
	(15.77)	(16.07)	(15.50)	(15.54)	(15.63)
Revolver	−30.65***	−21.61	−26.07**	−25.70**	−26.00**
	(11.29)	(15.67)	(11.10)	(11.12)	(11.17)
Revolver * $\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$		−26.99			
		(32.39)			
Loan purpose					
Debt repayment			16.78	16.86	17.38
			(11.81)	(11.82)	(11.92)
Takeover			8.93	13.50	13.69
			(18.55)	(19.43)	(19.48)
Acquisition			32.92*	33.77*	34.61*
			(18.95)	(18.99)	(19.15)
LBO/MBO			73.80***	72.51***	72.26***
			(19.01)	(19.10)	(19.15)
Firm characteristics					
S&P Senior rating:				31.23	31.69
Vulnerable				(38.91)	(39.02)
Firm years at relationship					−1.80
					(4.30)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes
R^2 within	0.23	0.23	0.30	0.30	0.30
F-statistic	3.90	3.68	4.19	3.99	3.78
Number of firms	97	97	97	97	97
Number of loans	293	293	293	293	293
Average number of loans	3.02	3.02	3.02	3.02	3.02
Max. number of loans per firm	9	9	9	9	9
Min. number of loans per firm	2	2	2	2	2

(*continued overleaf*)

Table 2
(Continued)

Panel C: More relationship variables: Link between subsequent lenders and between the lead lender and the IPO underwriter

	Firm kept prior	
	Lead lender (1)	Lender (2)
Relationship variables		
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$	−356.92**	−340.35**
	(168.59)	(170.80)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}\right)^2$	295.56*	281.41*
	(163.19)	(164.43)
Switched lenders	−85.19**	−80.31*
	(41.28)	(40.96)
More relationship variables		
Kept immediate prior lead lender	−12.01	
	(13.44)	
Kept any of the immediate prior lender		−13.81
		(17.78)
Loan characteristics		
First loan	−102.35**	−100.75**
	(43.67)	(43.55)
Number of lending banks	−1.80***	−1.78***
	(0.66)	(0.66)
Loan maturity	0.25	0.26
	(0.17)	(0.17)
Loan type		
Revolver	−26.41**	−26.46**
	(11.14)	(11.16)
Term loan	19.28	19.65
	(15.47)	(15.51)
Loan purpose		
Debt repayment	14.71	14.56
	(11.53)	(11.54)
Acquisition	31.80*	31.09
	(18.82)	(18.86)
LBO/MBO	69.85***	70.52***
	(18.90)	(18.89)
Firm characteristics		
S&P Senior rating:	21.75	23.50
Vulnerabl	(37.21)	(37.19)
Firm fixed effects	Yes	Yes
Loan year fixed effects	Yes	Yes
R^2 within	0.30	0.30
F-statistic	4.02	4.00
Number of firms	97	97
Number of loans	293	293
Average number of loans	3.02	3.02
Max. number of loans per firm	2	2
Min. number of loans per firm	9	9

Only pre-IPO loans, and only firms with a minimum of *two* such loans, are included in the final regression sample. The reported results correspond to fixed effects estimates:

$$\begin{aligned} Spread_{i,l} &= \beta_0 + \beta_{Intensity} Intensity_{i,l} + \beta_{Intensity\_Sqrd}(Intensity_{i,l})^2 + \beta_{Switched} Switched_{i,l} \\ &+ \beta_{Loan\_Characteristics} Loan\_Characteristics_{i,l} + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} \\ &+ \beta_{Loan\_Yrs} Loan\_Years\_FE_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for the loan number. $Intensity_{i,l} = \left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}\right)_{i,l}$; $Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. When a loan has several facilities, the spread is the weighted average of the spread of each facility, where the weights are the amount of the loan in that facility relative to the total loan amount, and the time to maturity is the maximum between the maturities of each facility. $Switched\_Lenders_{i,l}$ is a binary variable equal to 1 when the firm drops all previous lenders and borrows from a new lender. $First\_Loan_{i,l}$ is a binary variable equal to 1 when firm i's loan l is the firm's first loan. For these last two variables, $Intensity_{i,l} = 0$ as the number of prior loans by lead lender is 0. $Loan\_Year\_FE_{i,l}$ is a vector of loan-year dummies. $Loan\_Characteristics_{i,l}$ is a vector of firm i's loan l's characteristics, such as time to maturity, and loan type and purpose. $Firm\_Characteristics_{i,l}$ is a vector of firm i's characteristics at the time loan l was taken, such as firm i's debt rating when taking loan l. Debt ratings are S&P senior debt ratings at the onset of the loan, as reported in Dealscan. Panel A presents the baseline regression. Panels B and C show further robustness checks. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

intensity: $\beta_{\text{Intensity}} = -474.55$ and $\beta_{\text{Intensity\_Sqrd}} = 402.00$, significant at 1% and 5% levels, respectively. For values of $Intensity_{i,l}$ less than 0.59, interest rates decrease as $Intensity_{i,l}$ rises; and for values of $Intensity_{i,l}$ greater than 0.59, the spread rises as $Intensity_{i,l}$ increases. This suggests that relationship banks can successfully lock in their clients after providing about 60% of the loans that the relationship firm takes. At this point, the bank's information monopoly is secured and the bank begins to extract rents.[18] Column 2 of panel A in Table 2 adds loan year fixed effects, and confirms the previous result. Hereafter, all reported regressions include relationship year fixed effects, as well as firm fixed effects.

Single banking relationships can further secure the inside bank's information monopoly. To avoid this, firms can attempt to borrow from multiple banks. Several articles have addressed the benefits and costs of multiple banking relationships (Rajan 1992; Bolton and Scharfstein 1996; Houston and James 1996; Detragiache, Garella, and Guiso 2000; Ongena and Smith 2001). If multiple banking relationships mitigate a bank's acquisition of *ex post* monopoly rents, firms that successfully switch lenders and borrow from multiple lenders should face lower interest rates. Table 2, panel A, includes the categorical variable $Switched_{i,l}$ equal to one when firm i's loan l is granted by a lead lender that has not been a lead lender in any of the prior $l - 1$ loans, and zero otherwise. When a firm switches lenders, rates drop significantly (β_{Switched} ranges from -80.37 in column 2 to -98.28 in column 1). This suggests that firms that are able to "free" themselves from their relationship lender can attain lower borrowing rates. Note that it might also suggest that firms that switch lenders are better at negotiating loans and might face lower switching costs in the first place. Yet because the regressions include firm fixed effects, there is no endogeneity concern since the firm fixed effects control for the unobservable characteristics of "firm smartness" and "low switching cost firm."

Longer-maturity loans might be riskier than shorter-maturity ones. Columns 3 and 4 of panel A in Table 2 show that interest rates are increasing with time to maturity. A longer relationship intensity does not alter this result (the interaction term between maturity and intensity is insignificant in column 4).

A firm's borrowing cost can differ depending on the structure of the loan taken (for example, it might be less expensive for the lender to grant the firm a revolver line of credit than to grant the firm a term loan, since the firm might not actually draw on the revolver line of credit but actually draws on the term loan). Therefore, I control for the type of loan that the firm takes. The most common types of loans taken by pre-IPO firms in my sample are revolving lines of credit (a firm's "credit card") and term loans (loans with fixed maturities on which interest and principal are paid on a regular basis). I include a binary variable to signal out the revolver loans from the term loans in column 1 in panel B of Table 2. Term loans do not impact borrowing rates significantly, but revolver

[18] The critical value of $Intensity_{i,l}$ after which relationship banks begin to exploit information rents, is recalculated for the different specifications and the results are consistent with those reported for the baseline regression (about 60%).

lines of credit do. Firms taking lines of credit pay, on average, interest rates that are 30.65 basis points lower than those paid by firms taking on other types of loans. To see if the effect of revolver lines of credit depends on relationship intensity, I interact the revolver binary variable with the relationship intensity measure. Column 2 shows that this interaction term is not significant.

The purpose of the loan might also impact the firm's borrowing cost. If the loan's funds are earmarked for a leveraged buyout (LBO), or a management buyout (MBO), the loan might be deemed riskier than if it is earmarked for general corporate purposes or working capital purposes. Column 3 in panel B of Table 2 includes loan-purpose fixed effects. Loans used for LBO/MBOs are associated with an interest premium of more than 70 basis points, and loans applied to acquisitions involve a premium of about 30 basis points.

Next, I control for loan risk in two ways. First, I use Dealscan to find the S&P senior debt rating that the firm received when the loan was taken. Column 4 in panel B of Table 2 shows that including a categorical variable indicating whether the firm's loan rating is vulnerable (between CCC+i and BBBis) does not affect the main result for interest rate dynamics. Second, since age has been reported to impact firm risk (Petersen and Rajan 1994), I include the firm's age at the time the loan was taken. To calculate this, I need data on the date when the firm was founded. I collect this date from SDC and complete the missing observations with data reported in the "History Overview" section of the firm's Web site. Column 5 shows that firm age at the time the loan is taken does not significantly affect the interest spread, nor does it alter the pattern of spreads as a function of relationship intensity.

Loan pricing might depend on whether the firm chooses to make use of the same relationship bank for loans immediately subsequent to the loan in question. It is possible that banks might offer their clients a menu of interest rates, and the pricing of one loan might depend on whether the bank will be providing the firm's next loan as well. Columns 1 and 2 in panel C of Table 2 include controls for whether the firm's lead lender in loan l is the same as the lead lender for loan $l-1$, as well as for whether any of the lenders in loan l are members of the syndicate of lenders for loan $l-1$, respectively. Neither factor appears to influence the spread paid by the relationship firm.

The results reported in Table 2 reveal a U-shaped relationship between rates and lending intensity. This suggests that spillover effects dominate over low values of intensity, and advances in information processing capacity dominate over larger values of intensity.

5.2.2 The pattern of interest rates following the IPO. This section focuses on the pattern in interest rates *following* the firm's IPO. Accordingly, the sample is restricted to *only those loans taken after the IPO*, and only those firms having a minimum of two such loans. These restrictions yield a sample of 367 loans corresponding to 116 firms. Table 3 reports estimates of fixed effects regression of Equation (1) for this sample.

Panel A shows that interest rates monotonically decrease in relationship intensity following the firm's IPO. Columns 1 and 2 show that when $Intensity_{i,l}$ and $(Intensity_{i,l})^2$ are included in the regression equation, neither term is significant; when only $Intensity_{i,l}$ is included, this term is significant. Thus, in subsequent tables the term $(Intensity_{i,l})^2$ is excluded. Column 3 includes fixed effects for the year in which the firm takes the loan.

The relative costs and benefits of multiple banking relationships might differ before and after a firm's IPO. If multiple relationships limit any one lender's acquisition of an information monopoly, then the effect of having multiple relationships might be more pronounced prior to the IPO (when information monopolies are stronger) than after the IPO (when the relationship bank's information advantage is lessened). Therefore, the benefit of adding one new lead lender to the set of known lead lenders is larger for pre-IPO loans than for post-IPO loans. Hence $\beta_{Switched}$ is predicted to be larger for pre-IPO loans than for post-IPO loans. Consistent with this, column 4 reveals that interest rates for post-IPO loans are not affected when a firm switches lenders, yet as reported for the pre-IPO loans, interest rates fall significantly when a firm switches lenders prior to the IPO (compare column 1 in Table 2, panel A, with column 4 in Table 3, panel A).

Panel B controls for further loan characteristics. Column 1 adds the loan's maturity. This variable is not economically or statistically significant. Column 2

Table 3
Cost of loans, as a function of relationship intensity, after the firm's IPO

Panel A: Baseline regressions and loan characteristics

	Baseline (1)	Baseline (2)	Baseline (3)	Switched lenders (4)
Relationship variables				
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$	−111.66*	−62.94***	−53.58**	−92.13***
	(63.25)	(22.80)	(22.64)	(34.41)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}\right)^2$	70.29			
	(85.12)			
Switched lenders				−29.09
				(19.59)
Loan characteristics				
First loan	−91.31***	−89.04***	−59.34**	−82.64***
	(22.78)	(22.59)	(25.13)	(29.57)
Firm fixed effects	Yes	Yes	Yes	Yes
Loan year fixed effects	No	No	Yes	Yes
R^2 within	0.07	0.07	0.12	0.13
F-statistic	6.14	8.88	4.08	3.89
Number of firms	116	116	116	116
Number of loans	367	367	367	367
Average number of loans	3.16	3.16	3.16	3.16
Max. number of loans per firm	13	13	13	13
Min. number of loans per firm	2	2	2	2

(continued overleaf)

Table 3
(Continued)

Panel B: More loan and firm characteristics

	Maturity (1)	Loan purpose (2)	Loan type (3)	Rating (4)	Firm age (5)	Leverage (6)
Relationship variables						
Number of prior loans by lead / Total number of loans to date	−44.66*	−43.65*	−50.09**	−49.82**	−49.48**	−40.11*
	(22.89)	(22.68)	(22.50)	(22.49)	(22.48)	(24.17)
Loan characteristics						
First loan	−57.66**	−47.26*	−48.34*	−48.28*	−51.85**	−41.50*
	(24.99)	(25.07)	(24.82)	(24.81)	(24.96)	(24.62)
Number of lending banks	−2.43**	−2.61**	−2.58**	−2.67**	−2.55**	−1.51
	(1.09)	(1.06)	(1.05)	(1.06)	(1.05)	(1.20)
Loan maturity	0.09					
	(0.25)					
Loan purpose						
Debt repayment		6.33	9.44	9.86	11.50	16.34
		(14.21)	(14.06)	(14.06)	(14.15)	(14.26)
LBO/MBO		77.10	65.34	66.04	67.63	1.81
		(51.73)	(51.23)	(51.21)	(51.22)	(78.69)
Takeover		71.03***	68.88**	69.17**	70.71***	83.17***
		(27.07)	(26.75)	(26.74)	(26.77)	(30.15)
Loan type						
Revolver			−31.06***	−30.39***	−33.50***	−47.88***
			(11.53)	(11.54)	(11.69)	(12.81)
Term loan			−37.61**	−37.36**	−38.67**	−23.97
			(18.45)	(18.44)	(18.45)	(19.30)
364-day facility			−14.47	−14.19	−14.89	−9.80
			(19.02)	(19.02)	(19.01)	(21.39)
Firm characteristics						
S&P Senior rating: Vulnerable				71.47		
				(65.54)		
Firm years at relationship					7.49	
					(6.18)	
Leverage ratio						−89.39
						(46.77)
Log (Sales)						−55.38***
						(16.93)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2 within	0.14	0.16	0.20	0.20	0.20	0.26
F-statistic	3.80	3.92	3.85	3.68	3.70	3.89
Number of firms	116	116	116	116	116	96
Number of loans	367	367	367	367	367	302
Average number of loans	3.16	3.16	3.16	3.16	3.16	3.08
Max. number of loans per firm	2	2	2	2	2	2
Min. number of loans per firm	13	13	13	13	13	9

(*continued overleaf*)

Table 3
(Continued)

Panel C: More relationship variables

	Firm kept prior	
	Lead lender (1)	Lender (2)
Relationship variables		
Number of prior loans by lead / Total number of loans to date	−52.70**	−38.40
	(25.18)	(24.04)
More relationship variables		
Kept immediate prior lead ender	2.74	
	(11.79)	
Kept any immediate prior lender		−22.14
		(16.24)
Loan characteristics		
First loan	−47.66*	−61.65**
	(25.04)	(26.63)
Number of lending banks	−2.59**	−2.57**
	(1.06)	(1.05)
Loan purpose and type		
Debt repayment	9.78	7.70
	(14.17)	(14.10)
LBO/MBO	67.51	53.37
	(52.17)	(51.89)
Takeover	68.69**	68.19**
	(26.82)	(26.71)
364-day facility	−14.52	−15.49
	(19.06)	(19.00)
Revolver	−31.14***	−32.50***
	(11.55)	(11.55)
Term loan	−37.88**	−36.00*
	(18.52)	(18.45)
Firm fixed effects	Yes	Yes
Loan year fixed effects	Yes	Yes
R^2 within	0.20	0.20
F-statistic	3.59	3.73
Number of firms	116	116
Number of loans	367	367
Average number of loans	3.16	3.16
Max. number of loans per firm	2	2
Min. number of loans per firm	13	13

Only post-IPO loans, and only firms with a minimum of *two* such loans, are included in the final sample. Results correspond to fixed effects estimates of:

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{Intensity} Intensity_{i,l} + \beta_{Intensity\_Sqrd} (Intensity_{i,l})^2 + \beta_{Switched} Switched_{i,l} \\ & + \beta_{Loan\_Characteristics} Loan\_Characteristics_{i,l} + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} \\ & + \beta_{Loan\_Yrs} Loan\_Years\_FE_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for the loan number. $Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. $\text{Switched\_Lenders}_{i,l}$ is a categorical variable equal to 1 when the firm drops all previous lenders and borrows from a new lender, and 0 otherwise. $\text{First\_Loan}_{i,l}$ is a categorical variable equal to 1 for firm i's first loan (l=1), and 0 otherwise. $\text{Loan\_Year\_FE}_{i,l}$ is a vector of loan-year dummy variables. $\text{Loan\_Characteristics}_{i,l}$ is a vector of firm i's loan l's characteristics, such as the number of lenders in the lending syndicate, the loan's maturity. $\text{Firm\_Characteristics}_{i,l}$ is a vector of firm i's characteristics at the time loan l was taken, such as firm i's debt rating when taking loan l. These debt ratings are S&P senior debt ratings at the onset of the loan. When a loan has several facilities, the spread is the weighted average of the spread of each facility, and weights are the amount of the loan in that facility relative to the total loan amount, and loan maturity is the maximum of the facilities' maturity. Panel A presents the baseline regression. Panels B and C show further robustness checks. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

includes categorical variables for the purpose of the loan, and shows that loans used for takeovers demand higher spreads. Column 3 controls for the type of loan the firm takes. As with the pre-IPO loans, revolver lines of credit are associated with lower spreads ($\beta_{\text{Revolver}} = -31.06$, significant at 1%). Term loans are also characterized by lower spreads ($\beta_{\text{Term\_Loan}} = -37.61$, significant at 5%). I do not find evidence that a greater relationship intensity changes the spread on revolver lines of credit or on term loans (results, not reported, on the interaction between loan types and intensity are not significant).

Neither the firm's debt rating (column 4) nor the firm's age on the date when the loan was taken (column 5) has a significant impact on interest rate. Results (not reported) on the interaction between debt rating and intensity are not statistically significant. To further control for the firm's financial risk, column 6 of Table 3, panel B, includes the firm's leverage ratio on the year the loan was taken. Results are robust, $\beta_{\text{Intensity}} = -40.11$, significant at 10%.

Panel C of Table 3 shows that whether the firm kept the immediate prior lead lender as lead lender (column 1), or kept any of the immediate lenders as lenders (column 2) in the current syndicate, does not significantly alter the loan's rate.

These estimates reveal a decreasing pattern of interest rates for post-IPO loans. The firm's information disclosure and its publicly available stock price limit the lender's ability to keep firm-specific information private. Lower asymmetric information between lenders and prospective lenders increases the competitiveness of the lending relationship. This result coupled with lending costs that decrease in relationship intensity explain the decreasing pattern of interest rates.

5.2.3 The pattern of interest rates across the IPO event. I estimate a firm-fixed-effects regression on a sample that includes pre- *and* post-IPO loans and that controls for any regime switch following the IPO with a categorical variable, $After\_IPO_{i,l}$, which is equal to one when firm i's loan l is taken after the IPO, and zero otherwise (and clearly, $Before\_IPO_{i,l} = 1 - After\_IPO_{i,l}$). I define

$$\begin{aligned} Intensity\_After_{i,l} &= Intensity_{i,l} * After\_IPO, \\ Intensity\_Before_{i,l} &= Intensity_{i,l} * Before\_IPO. \end{aligned} \tag{2}$$

The regression equation of interest is

$$\begin{aligned} Spread_{i,l} &= \beta_0 + \beta_{\text{Intensity\_After}} Intensity\_After_{i,l} \\ &+ \beta_{\text{Intensity\_Sqrd\_After}} (Intensity\_After_{i,l})^2 \\ &+ \beta_{\text{Intensity\_Before}} Intensity\_Before_{i,l} + \beta_{\text{Intensity\_Sqrd\_Before}} (Intensity\_Before_{i,l})^2 \\ &+ \beta_{\text{After\_IPO}} After\_IPO_{i,l} + \beta_{\text{Loan\_Characteristics}} \text{Loan\_Characteristics}_{i,l} \\ &+ \beta_{\text{Firm\_Characteristics}} \text{Firm\_Characteristics}_{i,l} + \beta_{\text{Switched}} \text{Switched\_Lenders}_{i,l} \\ &+ \beta_{\text{First\_Loan}} \text{First\_Loan}_{i,l} + \beta_{\text{Loan\_Yrs}} \text{Loan\_Year\_FE}_{i,l} + \varepsilon_i + \mu_{i,l}. \end{aligned} \tag{3}$$

Some loan and firm characteristics might have different effects on loan pricing depending on whether the loan is pre- or post-IPO. Therefore, I interact the control variables with the $After\_IPO_{i,l}$ categorical variable, as in expression (2).

5.2.3.1 Changes in firm characteristics around the IPO date. Changes in the borrower's leverage following the firm's IPO can change the firm's default risk and consequently the loan's interest rate. Thus, for each loan I record the S&P senior debt ratings at the onset of the loan from Dealscan, and report them in Table 4.[19] Panel A classifies the loans in two broad groups: *Rated* and *Not Rated*. *Rated* loans are further classified as *Above BBB*, *Vulnerable*, and *Below Vulnerable*. Panel B explicitly specifies the ratings and distinguishes the loans rated in the As, BBBs, BBs, Bs, CCCs, and CCs and below. Panel C reports the number of secured and unsecured loans. I further report the number of pre- and post-IPO loans that fall within each category.

Table 4 shows that the absolute number of loans and the mean number of loans within each classification are not significantly different before and after the IPO, suggesting that the IPO does not significantly affect the firm's loan ratings. This might not be surprising in light of Alti's (2006) results. Alti shows that capital structure changes after an IPO are short lived: though a firm's leverage changes in the immediate aftermath of its IPO, such a change is transitory since firms revert to their pre-IPO leverage ratio. Therefore, the IPO might not create long-term changes in the firm's default risk. It is therefore unlikely that the change in the firm's leverage ratio during the IPO drives the post-IPO drop in interest rates. Still, to confirm the robustness of my results to changes in a firm's financial risk following its IPO, the regression equations include firm leverage for the year in which the loan was taken, as well as the S&P loan rating. My results are robust to the inclusion of these variables.

Table 5, panel A, reports results for several specifications to allow for non-linearities, and under different data restrictions. Columns 1 and 2 restrict the sample to those firms with a minimum of two loans: One originating before, and one after, the firm's IPO. The next four columns further restrict the sample to firms with a minimum of three loans: two originating before and one after the IPO (columns 3 and 4), and one originating before and two after the IPO (columns 5 and 6). The last two columns report results when the sample is restricted to firms with a minimum of four loans: two before and two after the IPO. The sample size decreases as the required quantity of loans increases. In these regressions, the average number of loans per firm ranges from 4.12 to 6.16. The key fact to note across the estimated regressions is that the results for the main variables of interest, $Intensity\_After_{i,l}$, $(Intensity\_After_{i,l})^2$, $Intensity\_Before_{i,l}$, and $(Intensity\_Before_{i,l})^2$, are consistent throughout the different sample sizes and thus the identification of these variables is not dependent upon the use

[19] Note that the loans in the sample are senior bank loans, and these are high-priority loans. Hence, their default risk is not likely to be affected by the firm's change in capital structure following the firm's IPO.

Table 4
Changes in loan risk following the borrower's IPO

Panel A: S&P Senior debt rating at the onset of the bank loan

	(1) Not Rated		(2) Rated					
			(a) Above BBB		(b) Vulnerable		(c) Below vulnerable	
Number of loans	Before IPO 309	After IPO 268	Before IPO 38	After IPO 54	Before IPO 167	After IPO 143	Before IPO 5	After IPO 8

Panel B: S&P senior debt rating at the onset of the bank loan

	(1) As		(2) BBBs		(3) BBs		(4) Bs		(5) CCCs		(6) CC and below	
	Before IPO	After IPO	Before IPO	After IPO	Before IPO	After IPO	After IPO	After IPO	Before IPO	After IPO	Before IPO	After IPO
Loans	12	9	17	26	58	55	87	71	10	14	5	7
Mean	0.023	0.019	0.033	0.055	0.112	0.116	0.168	0.150	0.019	0.030	0.010	0.015
Std dev	(0.150)	(0.137)	(0.178)	(0.228)	(0.315)	(0.321)	(0.374)	(0.357)	(0.138)	(0.169)	(0.098)	(0.121)

Panel C: Secured and unsecured debt prior to, and after, the fir's IPO

	(1) Before IPO	(2) After IPO
Secured	328	265
Unsecured	44	51
Unspecified	147	158
Total number of loans	519	474

Entries in panel A show the number of firms *without* an S&P senior debt rating at the time the loan was taken, for both pre- and post-IPO loans (column 1), as well as the number of firms *with* a debt rating before and after the IPO (column 2). For loans with a debt rating, the rating is classified as *Above BBB* (column a), *Vulnerable* (column b), and *Below Vulnerable* (column c). Entries in panel B show S&P senior debt ratings at the onset of the loan, classified for whether the loan is pre- or post-IPO. Entries in panel C show the number of loans in the final sample that are secured and unsecured (for several loans it is unspecified whether they are secured or not, and no inference can be made, since the source of ambiguity originates in the loan agreement itself). Loans are classified by pre- and post-IPO. Information on whether the loan is secured or unsecured is from the Dealscan database.

Table 5
Cost of loans as a function of relationship intensity, both before and after the firm's IPO

Panel A: Baseline regressions

	One loan before, and one after		Two loans before and one after		One loan before, and two after		Two loans before, and two after	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relationship variables								
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{After\_IPO}$	−252.13**	−79.53***	−174.55	−130.90***	−279.24**	−76.84**	−193.82	−134.21***
	(118.03)	(28.17)	(139.11)	(32.90)	(134.61)	(30.63)	(158.95)	(36.28)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{After\_IPO}\right)^2$	178.53		45.24		209.28		62.00	
	(118.57)		(140.06)		(135.55)		(160.97)	
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}$	−405.33***	−267.04**	−426.88***	−397.40***	−436.85***	−267.54**	−426.46**	−382.19***
	(139.65)	(105.34)	(149.57)	(118.30)	(168.44)	(128.09)	(181.64)	(140.36)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}\right)^2$	360.99**	219.15*	362.97**	332.39***	370.29*	194.09	329.61	282.98*
	(151.90)	(119.32)	(158.47)	(126.89)	(191.48)	(154.05)	(199.73)	(158.56)
Switched lenders	−86.21***	−52.80***	−86.39***	−79.31***	−91.54***	−51.52***	−89.27**	−78.91***
	(28.30)	(17.59)	(31.68)	(22.85)	(32.61)	(19.82)	(37.53)	(26.10)
Loan characteristics								
Loan is after IPO	−61.12***	−65.29***	−50.36**	−51.98**	−67.72***	−71.10***	−52.36*	−53.46
	(20.39)	(20.23)	(25.34)	(24.80)	(24.49)	(24.43)	(29.57)	(29.37)
First loan	−101.17***	−67.54***	−118.57***	−111.79***	−105.45***	−65.04**	−116.10***	−106.04***
	(34.13)	(25.84)	(37.01)	(30.44)	(39.72)	(29.93)	(44.12)	(35.49)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 within	0.09	0.08	0.12	0.12	0.09	0.08	0.12	0.12
F-statistic	3.58	3.68	3.18	3.45	2.70	2.72	2.32	2.51
Number of firms	160	160	69	69	91	91	44	44
Number of loans	659	659	375	375	467	467	271	271
Average number of loans per firm	4.12	4.12	5.43	5.43	5.13	5.13	6.16	6.16
Min. number of loans per firm	2	2	3	3	3	3	4	4
Max. number of loans per firm	14	14	12	12	14	14	12	12

Panel B: More loan and firm characteristics

	Maturity (1)	Purpose (2)	Type 1 (3)	Type 2 (4)	Rating 1 (5)	Rating 2 (6)	Firm Age (7)	Leverage (8)
Relationship variables								
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * After_IPO	−73.10***	−69.21**	−65.60**	−67.25**	−70.47***	−75.51***	−74.35***	−80.34**
	(28.13)	(27.62)	(27.44)	(27.48)	(27.13)	(27.35)	(27.69)	(35.80)
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * Before_IPO	−244.95**	−250.93**	−237.44**	−234.91**	−249.93**	−252.76**	−253.00**	−266.31**
	(104.99)	(103.04)	(102.52)	(102.64)	(101.26)	(101.22)	(101.32)	(127.41)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}\right)^2$	210.84*	211.93*	207.43*	207.79*	214.16*	219.49*	221.03*	235.32*
	(118.58)	(116.38)	(115.60)	(115.75)	(114.13)	(114.11)	(114.36)	(141.57)
Switched lenders	−49.72***	−51.31***	−50.46***	−49.61***	−54.26***	−55.25***	−54.76***	−62.94***
	(17.53)	(17.21)	(17.15)	(17.21)	(16.96)	(16.97)	(17.08)	(20.90)
Loan characteristics								
First loan	−59.55**	−68.37***	−62.39**	−61.06**	−66.85***	−71.47***	−70.77***	−84.29**
	(25.80)	(25.40)	(25.36)	(25.41)	(25.06)	(25.21)	(25.36)	(33.21)
After IPO	−59.13***	−69.25***	−63.84***	−62.95***	−65.72***	−74.53***	−74.76***	−52.75**
	(20.21)	(20.12)	(20.04)	(22.85)	(19.79)	(20.53)	(20.56)	(26.61)
Number of lending bank	−1.63**	−1.76***	−1.67***	−1.75***	−1.59**	−1.62***	−1.63***	−0.80
	(0.65)	(0.64)	(0.63)	(0.64)	(0.62)	(0.62)	(0.62)	(0.81)
Loan maturity	0.36**	0.24						
	(0.16)	(0.16)						
Loan purpose and type								
LBO_MBO		82.48***	80.76***	79.35***	81.20***	80.27***	80.03***	32.58
		(19.69)	(19.40)	(19.45)	(19.15)	(19.15)	(19.19)	(29.15)
Takeover * After IPO		48.82**	43.14*	44.32*	44.56*	41.26*	41.08*	41.79*
		(23.65)	(23.47)	(23.52)	(23.18)	(23.32)	(23.36)	(24.50)
Term loan			−1.67	8.77	1.45	2.71	2.59	−1.39
			(12.02)	(17.65)	(11.89)	(11.92)	(11.94)	(13.59)
Term loan * After IPO				−25.53				
				(24.69)				
364-day facility			−32.03**	−45.72**	−24.20	−26.35	−26.68	−88.97***
			(15.96)	(22.90)	(15.90)	(16.17)	(16.23)	(24.58)

(*continued overleaf*)

Table 5
(Continued)

Panel B: More loan and firm characteristics

	Maturity (1)	Purpose (2)	Type 1 (3)	Type 2 (4)	Rating 1 (5)	Rating 2 (6)	Firm Age (7)	Leverage (8)
364-day facility * After IPO				22.90				
				(26.52)				
Revolver			−26.55***	−28.91**	−21.60**	−21.42**	−21.63**	−37.35***
			(8.51)	(13.37)	(8.50)	(8.53)	(8.57)	(10.94)
Revolver * After IPO				3.94				
				(16.14)				
Firm characteristics								
S&P Senior rating:								
Above BBB					−59.06	−74.93*	−75.15*	
					(40.92)	(43.86)	(43.91)	
Above BBB * After IPO						22.02	22.26	
						(22.16)	(22.20)	
Vulnerable					100.77***	92.08***	92.68***	
					(34.26)	(34.73)	(34.83)	
Vulnerable * After IPO						20.64	20.74	
						(13.84)	(13.86)	
Firm years at relationship							0.67	
							(2.42)	
Leverage ratio								56.22*
								(32.94)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 within	0.10	0.14	0.16	0.16	0.18	0.18	0.18	0.22
F-statistic	3.84	4.77	4.90	4.32	5.26	4.90	4.68	3.48
Number of firms	159	159	159	159	159	159	159	97
Number of loans	657	657	657	657	657	657	657	318
Average number of loans	4.13	4.13	4.13	4.13	4.13	4.13	4.13	3.5
Max. number of loans per firm	14	14	14	14	14	14	14	10
Min. number of loans per firm	2	2	2	2	2	2	2	2

Panel C: More relationship variables

	Firm kept prior	
	Lead lender (1)	Lender (2)
Relationship variables		
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * After_IPO	−70.86**	−73.99***
	(27.44)	(27.40)
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * Before_IPO	−249.09**	−250.44**
	(101.05)	(101.26)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}\right)^2$	220.62*	222.11*
	(113.90)	(114.16)
Switched lenders	−62.60***	−59.00***
	(17.49)	(17.43)
More relationship variables		
Kept immediate prior lead lender	−16.10*	
	(9.60)	
Kept any immediate prior lender		−11.19
		(11.85)
Loan characteristics		
First loan	−81.16***	−79.33***
	(25.82)	(26.55)
After IPO	−73.88***	−73.47***
	(20.49)	(20.56)
Number of lending banks	−1.61***	−1.59**
	(0.62)	(0.62)
Purpose: LBO/MBO	78.42***	79.72***
	(19.15)	(19.16)
Purpose: Takeover * After IPO	43.79*	42.28*
	(23.33)	(23.35)
Type: Term loan	3.33	3.40
	(11.90)	(11.94)

(*continued overleaf*)

Table 5
(Continued)

Panel C: More relationship variables

	Firm kept prior	
	Lead lender (1)	Lender (2)
Type: 364-day facility	−27.05*	−27.01*
	(16.15)	(16.19)
Type: Revolver	−21.55**	−21.65**
	(8.51)	(8.54)
S&P Senior rating: Above BBB	−79.31*	−75.58*
	(43.86)	(43.87)
S&P Senior rating: Vulnerable	91.40***	93.19***
	(34.67)	(34.75)
Firm fixed effects	Yes	Yes
Loan year fixed effects	Yes	Yes
R^2 within	0.19	0.19
F-statistic	4.83	4.73
Number of firms	159	159
Number of loans	657	657
Average number of loans	4.13	4.13
Max. number of loans per firm	14	14
Min. number of loans per firm	2	2

Only firms with pre- and post- IPO loans, and firms *with at least one loan before and one after the IPO*, are considered. Results correspond to fixed effects estimates of:

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{Intensity\_After}(Intensity_{i,l} * After\_IPO_{i,l}) + \beta_{Intensity\_After}(Intensity_{i,l} * After\_IPO_{i,l})^2 + \beta_{Intensity\_Before}(Intensity_{i,l} * Before\_IPO_{i,l}) \\ & + \beta_{Intensity\_Before\_Sqrd}(Intensity_{i,l} * Before\_IPO)^2_{i,l} + \beta_{Switched} Switched_{i,l} + \beta_{Loan\_Characteristics} Loan\_Characteristics_{i,l} \\ & + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} + \beta_{Loan\_Yrs} Loan\_years_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for the loan number; $Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. $Switched\_Lenders_{i,l}$ equals one when the firm drops all previous lenders and borrows from a new lender. $First\_loan_{i,l}$ is a categorical variable equal to one when firm i's loan l is the firm's first loan. $Rel\_Yrs_{i,l}$ is a vector of loan year dummy variables. $Loan\_Controls_{i,l}$ is a vector of firm i's loan l's characteristics. $Firm\_Controls_{i,l}$ is a vector of firm i's characteristics at the time loan l was taken. Debt ratings are S&P senior debt ratings at the onset of the loan. When a loan has several facilities, the spread and fees are the weighted average of the spread of each facility, and time to maturity is the maximum between the maturities of each facility. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

of a larger sample size. However, some control variables are more precisely estimated when using a larger sample size.

Table 5, panel A, also reports that the *mean interest spread* paid by relationship firms falls significantly, by 50.36 basis points (column 3), to about 71.10 basis points (column 6), after the firm goes public, depending on the particular regression specification.[20]

Panels B and C of Table 5 confirm the article's prior findings. Spreads decrease when a firm switches lenders and spreads increase with the loan's maturity (column 1). The effect of switching lenders is not different depending on whether the loan is pre- or post-IPO (unreported estimates of the interaction term of *After_IPO* and *Switched_Lender* are not significant).

With regard to the loan purpose, column 2 in panel B shows that loans used for LBO/MBOs pay on average higher rates, and post-IPO loans used for takeovers also pay significantly higher rates, consistent with the previous findings in Tables 2 and 3 above. As for loan types, column 3 reports that interest rates on revolver lines of credit and 364-day facility are lower than for other types of loans (term loans, notes). Column 4 interacts loan type with the categorical variable indicating if the loan is after the IPO.

Columns 5 and 6 of Table 5, panel B, control for loan risk using S&P senior debt rating at the time the loan originated. Firms rated "Vulnerable" pay 100.77 basis points more than firms with no rating or with ratings between BBB and BBBis. This result does not distinguish between pre- and post-IPO loans. To distinguish between them, column 6 interacts the $After\_IPO_{i,l}$ categorical variable with the debt rating variable. The results show that prior to the IPO, a firm with debt rating above BBB paid significantly lower spreads than firms without rating, or with ratings below BBB ($\beta_{AboveBBB} = -74.93$). Column 7 adds the firm's age (in years) at the loan origination time, and shows that age does not impact interest rates. Finally, column 8 includes a measure of the firm's leverage ratio at the time when the loan was taken. This variable controls for any potential changes in the firm's leverage ratio and financial risk that might arise following the firm's IPO. Firms with higher leverage ratios pay higher interest rates on their loans. Even when controlling for changes in the firm's leverage ratio at the time the loan was taken, the results on the relationship intensity variable hold: $\beta_{\text{Intensity\_Before}} < 0$, $\beta_{\text{Intensity\_Sqrd\_Before}} > 0$, and $\beta_{\text{Intensity\_After}} < 0$, and are statistically significant.

Panel C of Table 5 controls for whether the firm's current lender is the firm's immediate prior *lead* lender (column 1), or any of the firm's immediate prior lenders (column 2). The main results of the article hold. Further, keeping the firm's immediate prior lead lender can reduce spreads by about 16 basis points.

---

[20] This is consistent with Sunder's (2002) finding: post-IPO loans exhibit a spread of about 39–76 basis points lower (Table 4).

6. Robustness Analysis

6.1 Alternative measures of relationship intensity

I define an alternative measure of relationship intensity that also captures how dependent the firm is on its current relationship lender: the amount of funds that the firms borrowed from the current lead lender, as a fraction of the total amount of funds borrowed by the firm to date. For each firm i's loan l:

$$Intensity\_Amount_{i,l} = \left(\frac{\text{Total amount borrowed from current lead lender to date}}{\text{Total amount borrowed to date}}\right)_{i,l}$$

I interact the above alternative measure of relationship intensity with the categorical variables $Before\_IPO_{i,l}$ and $After\_IPO_{i,l}$ in Equation (3). Results are reported in Table 6. The main difference with the previously reported results is that when the quadratic term for pre-IPO intensity variable is included in the regression, it does not appear statistically significant. However, the linear terms are in line with prior findings. The reported results correspond to estimates when only linear terms are included. The results are consistent with the information-based rent extraction hypothesis. Prior to the firm's IPO, interest rates increase with relationship intensity: The more dependent the firm is on its lender, the higher the rate on the firm's loans: $\beta_{\text{Intensity\_Amount\_Before}} > 0$, ranging from 27.91 in the baseline specification to 32.52 in the third one. Post-IPO, once the lender loses its information monopoly, interest rates decline in intensity: $\beta_{\text{Intensity\_Amount\_After}} < 0$, ranging from -23.79 in the fourth specification to -31.35 in the baseline specification.

6.2 Alternative hypotheses

I present, and empirically test, two alternative explanations for the findings of this article.[21] First, I explore a risk-sharing argument. I find evidence that risk sharing among lenders can explain part of the post-IPO drop in interest rates. But even after accounting for this, I cannot dismiss the information-based rent extraction hypothesis. Second, I explore the concurrent lending and underwriting hypothesis, and find no evidence supporting this hypothesis.

6.2.1 Risk sharing. Larger lending syndicates allow for risk sharing among lenders. Therefore, larger syndicates can achieve a lower overall cost of lending relative to smaller lending syndicates.[22] If the firm's lead lender is unable to

[21] I thank an anonymous referee, and the Editor, Paolo Fulghieri, for encouraging me to develop this section.

[22] The size of the lending syndicate might not be entirely up to the lead lender. The lead arranger establishes a relationship with the firm, and then turns to other banks to fund part of the loan. However, the firm is not powerless in the formation of the syndicate. Borrowing firms can hire more than one lead lender and can assign different roles to each lead lender. For a detailed analysis on the structure of the syndicate loan market, see Sufi (2007).

Table 6
Robustness analysis: Alternative measure of relationship intensity

	Baseline (1)	Rating (2)	Maturity (3)	Loan purpose (4)	Firm age (5)
Relationship intensity					
Intensity_Amount * After_IPO	−31.35**	−28.48*	−26.53*	−23.79*	−26.85*
	(15.03)	(14.87)	(14.83)	(14.47)	(14.86)
Intensity_Amount * Before_IPO	27.91*	32.07**	32.52**	30.41**	32.04**
	(15.67)	(15.53)	(15.46)	(15.08)	(15.51)
Loan characteristics					
Loan number	13.12***	12.74***	12.50***	13.55***	12.64***
	(2.68)	(2.65)	(2.64)	(2.59)	(2.67)
Ln (Loan amount)	−5.04	−4.79	−7.54*	−9.09**	−7.32*
	4.24	(4.19)	(4.33)	(4.23)	(4.37)
SP Rating: Vulnerable		122.03***	114.74***	115.40***	113.17***
		(33.45)	(33.45)	(32.64)	(33.67)
Loan maturity			0.36**	0.25*	0.36**
			(0.15)	(0.15)	(0.15)
Loan purpose: LBO/MBO				103.71***	
				(19.56)	
Loan purpose: Takeover				21.12	
				(15.17)	
Firm characteristics					
Firm age at time of loan					−1.11
					(2.57)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes
R^2 within	0.12	0.14	0.15	0.20	0.15
F-statistic	7.06	7.78	7.66	8.97	7.07
Number of loans	878	878	874	874	874
Number of firms	358	358	354	354	354
Average number of loans per firm	2.45	2.45	2.47	2.47	2.47

The reported results correspond to fixed effects estimates of regression equations of the type:

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{Intensity\_Amount\_After}(Intensity\_Amount_{i,l} * After\_IPO_{i,l}) \\ & + \beta_{Intensity\_Amount\_Before}(Intensity\_Amount_{i,l} * Before\_IPO_{i,l}) + \beta_{Switched} Switched_{i,l} \\ & + \beta_{Loan\_Characteristics} Loan\_Characteristics_{i,l} + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} \\ & + \beta_{Loan\_Yrs} Loan\_years\_FE_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for the loan number.

$$Intensity\_Amount_{i,l} = \left(\frac{Total\ amount\ borrowed\ from\ current\ lead\ lender\ to\ date}{Total\ amount\ borrowed\ to\ date} \right)_{i,l}$$

$Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. $Switched\_Lenders_{i,l}$ is a categorical variable equal to 1 when the firm drops all previous lenders and borrows from a new lender. $Loan\_Yrs\_FE_{i,l}$ is a vector of firm i's loan l's characteristics, such as the number of lenders in the lending syndicate, the time to maturity (in months), and the type and purpose of the loan. $Firm\_Characteristics_{i,l}$ is a vector of firm i's characteristics at the time loan l was taken, such as the debt rating firm i received when taking loan l. Debt ratings are S&P senior debt ratings at the onset of the loan. When a loan has several facilities, the spread and fees are the weighted average of the spread of each facility, where the weights are the amount of the loan in that facility relative to the total loan amount. Also in the case of several facilities, the time to maturity is the maximum between the maturities of each facility; and the amount of the loan is the sum of the amounts in each facility. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

(or chooses not to) engage in risk sharing, then most of the loan's risk will be borne by the lead bank, which will then demand a higher risk premium from the borrowing firm.[23] Loans to pre-IPO firms are likely to require closer monitoring and due diligence, creating the incentive for a smaller lending syndicate in which the lead lender holds a large stake in the loan. Furthermore, the lack of publicly available information on these firms might limit the lead arranger's ability to enroll other banks in the syndicate. After the IPO, the availability of audited and certified public data, together with the firm's market price, reduces the need for the lead lender to form a small syndicate in order to guarantee close and tight monitoring, and also enables the lead lender to enroll more banks in the syndicate.

I measure the size of the lending syndicate using two measures: First, the number of banks in the syndicate, and second, the concentration of the loan in the hands of the lead lender, measured by the fraction of the loan contributed by the firm's lead lender. Consistent with the risk-sharing argument and with the results reported in Sufi (2007), I find that after the IPO the mean number of syndicate members increases significantly and the percentage of the loan contributed by the lead lender drops significantly. Table 1 shows that prior to the IPO, there are on average 4.96 lenders per loan, and the lead lender contributes 67.6% of the loan. Following the IPO, the mean number of lenders rises to 6.10 and the lead lender's contribution drops by over 12%, to 55.3% of the total loan amount. Furthermore, after the firm's IPO, the lead lender can syndicate larger loans by an average of U.S. $40.64 million. This evidence suggests that the IPO alters the composition of the lending syndicate in a way that is consistent with the risk-sharing argument. Therefore, the lower interest rates on post-IPO loans could be explained by the lead lender's ability to engage in risk sharing once the firm is public.

To disentangle the rent-extraction hypothesis from the risk-sharing hypothesis, I collected data from Dealscan to construct three measures of risk sharing: $\text{Nu\_Lenders}_{i,l}$, the number of banks participating in firm i's loan l; $\text{Pct\_LeadLent}_{i,l}$, the percentage of the total loan amount of firm i's loan l contributed by the lead syndicate lender; and $\text{HHI}_{i,l}$, the concentration of the syndicate as measured by the syndicate's Herfindahl index (calculated as the sum of the squared percentage of the loan contributed by each of the lending banks in the syndicate). I estimate a firm, loan-year, fixed effects regression of

[23] The lead syndicate lender might be *unable* to enlist other banks in the lending syndicate when information about the borrower cannot be credibly made available to all syndicate members. Dennis and Mullineaux (2000) and Sufi (2007) show that a loan is more likely to be syndicated as information about the borrower becomes more transparent. However, the lead arranger might *choose* a more concentrated syndicate and retain a larger share of the loan when the borrower requires intense due diligence and monitoring. This concentrated syndicate is an attempt to ameliorate the agency problem between itself and the other banks participating in the syndicate (Sufi 2007). Whatever the reason for a concentrated syndicate, the lead lender's higher risk exposure to the borrower commands a higher premium, and thus a higher interest rate.

the type

$$\begin{aligned}\text{Spread}_{i,l} = {} & \beta_0 + \beta_{\text{After\_IPO}} \textit{After\_IPO}_{i,l} \\ & + \beta_{\text{Risk\_Sharing}} \textit{Risk\_Sharing}_{i,l} \\ & + \beta_{\text{Risk\_Sharing\_After\_IPO}} (\textit{Risk\_Sharing}_{i,l} * \textit{After\_IPO}_{i,l}) \\ & + \varepsilon_i + \eta_{i,l}, \end{aligned} \tag{4}$$

where $\textit{Risk\_Sharing}_{i,l}$ is one of the three risk-sharing measures mentioned above. The coefficient $\beta_{\text{Risk\_Sharing}_{i,l}}$ measures the effect of the relevant risk-sharing measure on the firm's overall borrowing cost both before and after the IPO, and $\beta_{\text{Risk\_Sharing\_After\_IPO}}$ captures the marginal effect of this risk-sharing measure on the firm's post-IPO borrowing costs. If the interest rate on the loan depends on the lead lender's ability to engage in risk sharing, then we would expect to find the following:

1. Interest rates are lower for larger lending syndicates, $\beta_{\text{Nu\_Lenders}} < 0$;
2. Interest rates are higher when the lead lender retains a larger share of the loan, $\beta_{\text{Pct\_Lead\_Lent}} > 0$;
3. Interest rates are higher when the syndicate is concentrated, $\beta_{\text{HHI}} > 0$;
4. If the bank's risk-sharing ability changes following the firm's IPO and this change has an impact on the interest rate on these post-IPO loans, then this should be captured by the interaction terms of the risk-sharing measure and the *After_IPO* dummy variable, and measured by the coefficient $\beta_{\text{Risk\_Sharing\_After\_IPO}}$.

The results are reported in Table 7. In columns 1 and 2, the risk-sharing measure is $\text{Nu\_Lenders}_{i,l}$. As predicted, the firm's borrowing costs drop in the number of lending banks: when one more bank joins the syndicate, the interest rates fall by 1.58 basis points, which, though statistically significant, is economically a relatively small amount. Further, the number of lenders in the syndicate has a marginal effect on post-IPO borrowing costs, $\beta_{\text{Nu\_Lenders\_After\_IPO}} = -0.47$, which is both economically and statistically insignificant. In columns 3 and 4, the risk-sharing measure is $\text{Pct\_Lead\_Lent}_{i,l}$. The effect is positive and statistically significant, but economically negligible: A 1% increase in the lead lender's participation raises interest rates by 0.61 basis points ($\beta_{\text{Pct\_Lead\_lent}} = 0.61$). In columns 4 and 5, I use the Herfindahl index to measure the concentration of the syndicate and find that syndicate concentration has no effect on the loan's interest rate. With the above evidence, we cannot dismiss the risk-sharing argument altogether since there is a statistically significant, but economically small, effect of risk sharing on interest rates, at least as measured by $\text{Nu\_Lenders}_{i,l}$ and $\text{Pct\_Lead\_Lent}_{i,l}$.

To disentangle the risk-sharing hypothesis from the information-based rent-extraction hypothesis, I include these measures of risk sharing in the regression equation (3). If the variables that capture the lead lender's ability to hold up the

Table 7
The lead lender's risk sharing ability and the firm's cost of borrowing pre- and post-IPO

	Number of lenders		Percent lead lender lent		HHI	
	(1)	(2)	(3)	(4)	(5)	(6)
Risk sharing measures						
Number of lenders	−1.58**	−1.37*				
	(0.63)	(0.77)				
Number of lenders * After IPO		−0.47				
		(0.98)				
Percent lead lent			0.59**	0.61**		
			(0.29)	(0.30)		
Percent lead lent * After IPO				−0.05		
				(0.20)		
HHI					19.86	21.26
					(20.56)	(24.21)
HHI * After IPO						−2.88
						(26.18)
After IPO	−40.81***	−37.67***	−45.45***	−42.48***	−53.14***	−51.08*
	(10.58)	(12.43)	(11.95)	(16.01)	(18.56)	(26.46)
Firm and loan characteristics						
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of loans	660	660	553	553	308	308
Number of firms	159	159	134	134	108	108
R^2 within	0.07	0.07	0.06	0.06	0.10	0.10
F-statistic	4.89	4.36	3.51	3.13	2.67	2.36
Average nu of loans per firm	4.15	4.15	4.13	4.13	2.85	2.85

The reported results correspond to fixed effects estimates of regression equations of the type:

$$Spread_{i,l} = \beta_0 + \beta_{Risk\_Sharing} Risk\_Sharing_{i,l} + \beta_{Risk\_Sharing\_After} Risk\_Sharing\_After_{i,l} + \beta_{After\_IPO} After\_IPO_{i,l} + \varepsilon_i + \mu_{i,l},$$

where i indexes for firm and l for the loan number. $Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l; and where $Risk\_Sharing_{i,l}$ is one of the three risk-sharing measures: In columns 1 and 2 the risk-sharing variable is the number of lenders in the lending syndicate: $Nu\_Lenders_{i,l}$ equals the number of banks in the lending syndicate of loan l for firm i. In Columns 3 and 4 the risk-sharing variable is $Pct\_Lead\_Lent_{i,l}$, which for each firm i's loan l is the percentage of the loan amount contributed by the lead lender. In Columns 5 and 6 the risk-sharing measure is the Herfindahl index, equal to the sum of the squared percentage that each lender contributed to the loan. $Risk\_Sharing\_After_{i,l} = Risk\_Sharing_{i,l} * After\_IPO_{i,l}$. All regressions include firm fixed effects and relationship year fixed effects. Data for the risk-sharing measures have been collected from the Dealscan database. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

firm lose explanatory power while the variables that capture the lender's risk-sharing power remain significant, we can dismiss the rent-extraction hypothesis and attribute to the risk-sharing argument the observed pattern of interest rates. But if the former variables maintain their significance, we cannot dismiss the rent-extraction hypothesis.

The results are reported in Table 8. Column 1 includes $\text{Nu\_Lenders}_{i,l}$. As in Table 7, interest rates fall as the number of lending banks in the syndicate increases $\beta_{\text{Nu\_Lenders}} = -1.38$. Economically, this is marginally significant. The effect on relationship intensity measures is still statistically significant and economically large: the pattern of interest rates for pre-IPO loans is U-shaped, and the pattern for post-IPO loans is decreasing. Column 2 includes $\text{Nu\_Lenders}_{i,l}$

and Nu_Lenders_After_IPO$_{i,l}$, and reveals that the number of lenders has no differential effect on interest rates for post-IPO loans.

Columns 3–6 use as risk-sharing measures the percentage of the loan retained by the lead syndicate lender, Pct_Lead_Lent$_{i,l}$. Note that Pct_Lead_Lent$_{i,l}$ is not significant while the relationship intensity measures are both statistically and economically significant. Thus, the variables capturing how the firm is held up by its lender can significantly explain the interest rate pattern, while the risk-sharing measure appears to be insignificant. Next, in column 4, I reestimate the regression, now adding the interaction term Pct_Lead_Lent_After_IPO$_{i,l}$. This variable is insignificant, and the explanatory power of the hold-up variables still remains economically and statistically significant.

In some syndicated loans, the lead lender retains the full amount of the loan. I control for these "sole lender" loans in columns 5 and 6. Column 5 adds a categorical variable, PctLead100$_{i,l}$, equal to 1 if the lead lender in firm i's loan l retains 100% of the loan, and 0 otherwise. This variable does not significantly explain interest rates, and the information-based rent-extraction variables maintain their significance. Finally, in column 6, I exclude all sole lender loans and estimate the regression on the subsample of loans for which PctLead100$_{i,l} = 0$. This reduces the sample size and the number of firms in the firm fixed effects regressions to 295 loans for 65 firms. The rent-extraction variables retain their economic and statistical significance.

The results reported in Tables 7 and 8 reveal that while the risk-sharing measures appear to impact interest rates (Table 7), once I also control for the relationship intensity measures capturing how locked in the firm is to its lender, these risk-sharing measures lose explanatory power (Table 8). Thus, the rent-extraction hypothesis cannot be dismissed with this evidence. One reason why interest rates do not significantly depend on risk-sharing measures is that banks have well-diversified portfolios of borrowing firms and therefore do not need to diversify an individual borrower's risk.

6.2.2 Concurrent lending and underwriting. The Financial Modernization Act, passed by the U.S. Congress on November 12, 1999, allows commercial banks to underwrite their client's initial public offer. Since then, commercial banks have become actively involved in underwriting securities, and investment banks have moved into commercial lending activities. The economic rationale for this overlap of services is based on information economies of scope that allow banks to provide the firm with one-stop shopping at a lower cost than what could be achieved if the firm had to go to different banks for each specific service.[24]

[24] For more on the effects of the 1999 Financial Modernization Act on an issuing firm's IPO, see Benzoni and Schenone (2009); Drucker and Puri (2005); and Schenone (2004). Benzoni and Schenone (2009) focus on whether commercial banks underwriting their client's IPO fall prey to conflicts of interest. Drucker and Puri (2005) study the pricing effect on underwriting services in the presence of concurrent lending and underwriting. Schenone (2004) studies whether having a pre-IPO lending relationship with a prospective IPO underwriter can

Table 8
Alternative hypothesis: The lead lender's risk sharing ability, relationship intensity, and the firm's cost of borrowing pre- and post-IPO

	Nu lenders			Pct lead lent		
	(1)	* After IPO (2)	(3)	* After IPO (4)	Lead = 100 (5)	No lead = 100 (6)
Relationship intensity						
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * After_IPO	−73.58***	−72.27**	−99.47***	−100.02***	−99.45***	−103.05**
	(28.17)	(28.87)	(34.16)	(34.55)	(34.21)	(40.86)
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * Before_IPO	246.52**	246.06**	−317.17**	−316.07**	−317.55**	−352.22**
	(105.11)	(105.23)	(130.27)	(130.80)	(130.67)	(157.75)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}\right)^2$	207.02*	206.32*	255.57*	254.26	255.84*	324.13*
	(118.68)	(118.84)	(154.38)	(155.02)	(154.69)	(174.72)
Switched lenders	−49.99***	−49.63***	−65.03***	−65.01***	−65.05***	−66.02**
	(17.53)	(17.63)	(21.00)	(21.03)	(21.03)	(26.39)
Loan characteristics						
First loan	−62.52**	−61.96**	−78.09**	−78.23**	−78.21**	−80.22**
	(25.78)	(25.94)	(30.45)	(30.52)	(30.58)	(39.10)
After IPO	−61.67***	−60.58***	−64.41***	−62.47**	−64.57***	−61.92*
	(20.18)	(20.84)	(23.81)	(29.23)	(24.04)	(32.23)
Loan characteristics and risk-sharing measures						
Number of lenders	−1.38**	−1.28				
	(0.64)	(0.78)				
Number of lenders * After IPO		−0.22				
		(1.04)				
Percent lead lent			0.47	0.48	0.49	0.64
			(0.33)	(0.35)	(0.50)	(0.52)
Percent lead lent * After IPO				−0.03		
				(0.25)		
Percent lead lent = 100					−1.72	
					(33.97)	

(*continued overleaf*)

Table 8
(Continued.)

	Nu lenders			Pct lead lent		
		* After IPO		* After IPO	Lead = 100	No lead = 100
	(1)	(2)	(3)	(4)	(5)	(6)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of loans	660	660	491	491	491	297
Number of firms	159	159	126	126	126	65
R^2 within	0.09	0.09	0.08	0.08	0.08	0.11
F-statistic	3.73	3.46	2.68	2.47	2.47	2.28
Average number of loans per firm	4.15	4.15	3.90	3.90	3.90	4.57
Min. number of loans per firm	2	2	2	2	2	2
Max. number of loans per firm	14	14	14	14	14	12

The reported results correspond to fixed effects estimates of regression equations of the type:

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{Intensity\_After}(Intensity_{i,l} * After\_IPO_{i,l}) + \beta_{Intensity\_Before}(Intensity_{i,l} * Before\_IPO_{i,l})_{i,l} \\ & + \beta_{Intensity\_Before\_Sqrd}(Intensity_{i,l} * Before\_IPO_{i,l})^2 + \beta_{Risk\_Sharing} Risk\_Sharing_{i,l} + \beta_{Risk\_Sharing\_After} * (Risk\_Sharing_{i,l} * After\_IPO_{i,l}) \\ & + \beta_{Switched} Switched_{i,l} + \beta_{Loan\_Characteristics} Loan\_Characteristics_{i,l} + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} \\ & + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} + \beta_{Loan\_Yrs} Loan\_years\_FE_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for the loan number.

$$\text{Intensity}_{i,l} = \frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$$

$Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. All regressions include firm fixed effects and relationship year fixed effects. In columns 1 and 2 the risk-sharing variable is $Nu\_Lenders_{i,l}$ equal to the number of banks in the lending syndicate of firm i's loan l. In columns 3 through 6, the risk-sharing variable is $Pct\_Lead\_Lent_{i,l}$, which is the percentage of firm i's loan l amount contributed by the lead lender. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Banks that bundle their services might offer an interest rate discount on loans, in exchange for the firm's underwriting business. Consistent with this, I find that the mean interest rate on loans in which the lead syndicate lender was also an IPO manager or co-manager is 216.35 basis points, and it is 246.08 basis points when the lead lender was not involved in the IPO in such a capacity. Similar results ensue when considering the lender's role as an IPO book runner: the mean interest rate on loans in which the lead syndicate lender is the IPO's book runner is 253.00 basis points, and it is 16.66 basis points lower than the mean rate when the lead lender is not involved as the IPO's book runner. These summary statistics reveal a significant correlation between the lead lender's role in the firm's IPO and the firm's borrowing cost. Consequently, I ask whether the pattern of interest rates reported in this article is driven by this alternative hypothesis: Are the lower rates on post-IPO loans explained by banks committing to a post-IPO loan-pricing discount when the firm employs the bank in its IPO? Can concurrent lending and underwriting explain the pre-IPO pattern of interest rates? To formally address this, I estimate the following regression:

$$\begin{aligned}\text{Spread}_{i,l} = {} & \beta_0 + \beta_{\text{After\_IPO}} \textit{After\_IPO}_{i,l} \\ & + \beta_{\text{Lead\_Lender\_IPO\_Mgr}} \text{Lead\_Lender\_IPO\_Mgr}_{i,l} \\ & + \beta_{\text{Lead\_Lender\_IPO\_Mgr}} (\text{Lead\_Lender\_IPO\_Mgr}_{i,l} * \textit{After\_IPO}_{i,l}) \\ & + \varepsilon_i + \eta_{i,l}, \end{aligned} \tag{5}$$

where $\text{Lead\_Lender\_IPO\_Mgr}_{i,l}$ is a categorical variable equal to 1 if firm i's lead lender for loan l is also the IPO manager or co-manager, and 0 otherwise. Here the coefficient on $\textit{After\_IPO}_{i,l}$ captures the difference in loan pricing between pre- and post-IPO loans, the coefficient on $\text{Lead\_Lender\_IPO\_Mgr}_{i,l}$ captures the effect on the cost of pre-IPO loans of employing the lead lender as the IPO manager or co-manager, and finally, the coefficient on the interaction term of $\textit{After\_IPO}_{i,l}$ and $\text{Lead\_Lender\_IPO\_Mgr}_{i,l}$ captures the incremental effect of employing the lead lender as the IPO manager on the cost of the post-IPO loans. I also estimate a similar specification in which I replace $\text{Lead\_Lender\_IPO\_Mgr}_{i,l}$ with $\text{Lead\_Lender\_Book}_{i,l}$, a categorical variable equal to 1 when firm i's lead lender for loan l is one of firm i's IPO book runners, and 0 otherwise. Both these regressions are estimated using firm fixed effects as well as controls for the year in which the loan originated. Table 9 reports the results. Column 1 presents the estimates for the regressor $\text{Lead\_Lender\_Book}_{i,l}$, and column 2 for $\text{Lead\_Lender\_IPO\_Mgr}_{i,l}$. The results do not support the hypothesis that the lead lender offers an interest rates discount on loans in exchange of the firm's future (or past) IPO business.

To explore further whether concurrent lending and underwriting mitigates the explanatory power of the information-based rent extraction hypothesis, I

help to ameliorate the asymmetric information problem faced by firms going public, and consequently lower IPO underpricing.

Table 9
Alternative hypothesis: Concurrent lending and underwriting

	Lead lender is also the	
	IPO book runner (1)	IPO mgr or co-mgr (2)
Lead lender is IPO book runner	12.57	
	(17.05)	
Lead lender is IPO book runner * After IPO	−9.52	
	(20.95)	
Lead lender is IPO Mgr		15.34
		(12.69)
Lead lender is IPO mgr * After IPO		−2.16
		(14.33)
After IPO	−40.45***	−40.84***
	(11.08)	(11.96)
Firm fixed effects	Yes	Yes
Loan year fixed effects	Yes	Yes
R^2 within	0.06	0.07
F-statistic	3.73	3.89
Average number of loans per firm	4.12	4.12
Number of loans	659	659
Number of firms	160	160

The reported results correspond to fixed effects estimates of regression equations of the type:

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{Lender\_IPO\_Underwriter} Lender\_IPO\_Underwriter_{i,l} \\ & + \beta_{Lender\_IPO\_Underwriter\_After}(Lender\_IPO\_Underwriter_{i,l} * After\_IPO_{i,l}) \\ & + \beta_{After\_IPO} After\_IPO_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for loan number. $Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. In column 1, $Lender\_IPO\_Underwriter_{i,l}$ is a categorical variable equal to 1 if firm i's lead lender for loan l is also the IPO manager or co-manager, and 0 otherwise. In column 2, $Lender\_IPO\_Underwriter_{i,l}$ is a categorical variable equal to 1 when firm i's lead lender for loan l is one of firm i's IPO book runners, and 0 otherwise. All regressions include firm fixed effects and relationship year fixed effects. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

reestimate Equation (3), now including the variables capturing the link between the IPO manager and the IPO book runner, $Lead\_Lender\_IPO\_Mgr_{i,l}$ and $Lead\_Lender\_Book_{i,l}$. Results are reported in Table 10, panel A. Neither variable significantly affects the firm's cost of borrowing prior to, or after, the IPO. Most important, including these two variables in the regression equation does not diminish the explanatory power of the variables related to the rent-extraction hypothesis.

Finally, I estimate the baseline regression for two subsamples: The first excludes all loans for which the lead lender also serves as the IPO manager (or co-manager) *or* the IPO bookrunner, and the second excludes all loans for which the lead lender serves the IPO manager (or co-manager) *and also* the IPO bookrunner. Results are reported in Table 10, panel B. Columns 1–3 report results using the first subsample, and columns 4–6 for the second subsample. For both subsamples, and for the different specifications, I find support for the rent-extraction hypothesis and confirm the main result of this article. I conclude that there is not enough evidence to support the hypothesis

Table 10
Alternative hypotheses: Concurrent lending and underwriting

Panel A: Loan spread, the intensity of the lending relationship, and the lender's role in the borrower's IPO

	Lead lender is			
	IPO manager or co-manager		IPO bookrunner	
	(1)	(2)	(3)	(4)
Relationship intensity				
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * After_IPO	−72.92***	−73.17***	−70.67***	−70.39**
	(27.29)	(27.55)	(27.16)	(27.28)
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * Before_IPO	−252.66**	−252.44**	252.14**	−252.83**
	(101.34)	(101.49)	(101.57)	(101.81)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}\right)^2$	215.82*	215.48*	217.87*	218.86*
	(114.18)	(114.41)	(114.78)	(115.14)
Switched lenders	−53.53***	−53.58***	−54.08***	−54.05***
	(16.99)	(17.02)	(16.98)	(17.00)
Relation between lead lender and IPO underwriters				
Lead lender is IPO mgr	8.55	8.03		
	(10.09)	(12.54)		
Lead lender is IPO mgr * After IPO		1.01		
		(14.34)		
Lead lender is IPO book runner			4.75	5.88
			(14.27)	(16.69)
Lead lender is IPO book runner * After IPO				−2.66
				(20.31)
Loan characteristics				
After IPO	−64.86***	−65.20***	−65.41***	−65.16***
	(19.82)	(20.41)	(19.83)	(19.94)
First loan	−66.72***	−66.89***	−66.72***	−66.63***
	(25.07)	(25.21)	(25.09)	(25.12)
Number of lending bank	−1.58**	−1.58**	−1.61**	−1.61**
	(0.62)	(0.62)	(0.62)	(0.63)
Loan purpose:				
LBO_MBO	79.86***	79.97***	81.03***	80.92***
	(19.22)	(19.31)	(19.17)	(19.21)
Takeover * After IPO	44.28*	44.24*	43.77*	43.92*
	(23.19)	(23.22)	(23.32)	(23.37)
Loan type				
Term loan	1.98	2.00	1.50	1.58
	(11.91)	(11.93)	(11.91)	(11.94)
364-day facility	−23.53	−23.56	−24.61	−24.64
	(15.92)	(15.94)	(15.96)	(15.98)
Revolver	−21.15**	−21.12**	−21.66**	−21.60**
	(8.52)	(8.53)	(8.51)	(8.53)
Loan risk				
Above BBB	−58.56	−58.53	−58.00	−57.91
	(40.94)	(40.98)	(41.09)	(41.13)
Vulnerable	100.07***	100.11***	100.25***	100.13***
	(34.28)	(34.32)	(34.33)	(34.37)
Firm fixed effects	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes
R^2 within	0.18	0.18	0.18	0.18
F-statistic	5.04	4.80	5.01	4.77
Average number of loans per firm	4.13	4.13	4.13	4.13
Number of loans	657	657	657	657
Number of firms	159	159	159	159

Table 10
(Continued)

Panel B: Loan spread, the intensity of the lending relationship, and the lender's role in the borrower's IPO

	Exclude loans where the lead lender is					
	Also the IPO manager *or* bookrunner			Also the IPO manager *and* bookrunner		
	(1)	(2)	(3)	(4)	(5)	(6)
Relationship intensity						
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * After_IPO	−61.16**	−58.82**	−61.06**	−56.83**	−54.68**	−51.27**
	(28.28)	(27.96)	(27.59)	(25.18)	(25.03)	(24.90)
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * Before_IPO	−211.63**	−217.39**	−238.22***	−242.61***	−234.41***	218.64***
	(91.73)	(90.66)	(89.65)	(82.87)	(82.38)	(81.55)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}\right)^2$	180.16*	197.16*	219.92**	193.94**	187.88**	170.08*
	(109.42)	(108.24)	(106.91)	(96.60)	(96.00)	(95.02)
Switched lenders	−27.66*	−27.80*	−31.46**	−32.30**	−32.54**	−33.01**
	(16.12)	(15.93)	(15.74)	(14.61)	(14.51)	(14.37)
Loan characteristics						
After IPO	−44.65***	−42.16***	−44.61***	−51.78***	−49.08***	−49.26***
	(14.85)	(14.69)	(14.57)	(13.14)	(13.09)	(12.99)
First loan	−38.00*	−40.96**	−45.27**	−55.89***	−55.00***	−54.10***
	(20.75)	(20.53)	(20.31)	(18.65)	(18.53)	(18.32)
Number of lending banks	−0.33	−0.23	−0.04	−0.77	−0.84	−0.79
	(0.66)	(0.66)	(0.65)	(0.53)	(0.53)	(0.52)
Loan maturity	0.49***	0.42***	0.36**	0.36***	0.32**	0.28**
	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)	(0.13)
Loan purpose: LBO MBO		65.00***	59.71***		49.30***	51.16***
		(19.33)	(19.24)		(18.10)	(17.90)
S & P rating: Above BBB			−58.19*			−54.22*
			(34.79)			(32.85)
S & P rating: Vulnerable			74.91***			119.29***
			(27.81)			(41.54)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of loans	774	774	774	832	832	832
Number of firms	334	334	334	330	330	330
Average number of loans per firm	2.32	2.32	2.32	2.52	2.52	2.52
F-statistic	3.79	4.41	4.86	4.37	4.64	4.99
R^2 within	0.10	0.13	0.16	0.10	0.12	0.14

Only firms with pre- and post-IPO loans are considered. Each firm must have *at least* one loan before and one loan after the IPO. Results correspond to fixed effects estimates of

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{Intensity\_After}(Intensity_{i,l} * After\_IPO_{i,l}) + \beta_{Intensity\_Before}(Intensity_{i,l} * Before\_IPO_{i,l}) \\ & + \beta_{Intensity\_Before\_Sqrd}(Intensity_{i,l} * Before\_IPO_{i,l}) + \beta_{Lender\_IPO\_Underwriter} Lender\_IPO\_Underwriter_{i,l} \\ & + \beta_{Lender\_IPO\_Underwriter\_After}(Lender\_IPO\_Underwriter_{i,l} * After\_IPO_{i,l}) \\ & + \beta_{Switched} Switched_{i,l} + \beta_{Loan\_Characteristics} Loan\_Characteristics_{i,l} \\ & + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} + \beta_{Loan\_Yrs} Loan\_years\_FE_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for the loan number.

$$Intensity_{i,l} = \frac{Number\ of\ prior\ loans\ by\ lead}{Total\ number\ of\ loans\ to\ date}.$$

$Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. All regressions include firm fixed effects and relationship year fixed effects. Panel A: columns 1 and 2 control for loans in which the lead lender is also the IPO manager or co-manager; columns 3 and 4 control for loans where the lead lender is the IPO book runner. Panel B: columns 1–3 exclude loans where the lead lender is also an IPO book runner *or* an IPO manager; and columns 1–3 exclude those for which the lead lender is also an IPO book runner *and* an IPO manager. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

that concurrent lending and underwriting explains the pre- or post-IPO pattern of borrowing rates.

6.3 The IPO bubble period: Tech and internet stocks

The sample period considered includes the Internet and tech IPO bubble years, 1998–2000. Loughran and Ritter (2004) and Ljungqvist and Wilhelm (2003) show that IPOs in these years were different from traditional IPOs. In fact, Internet and tech stocks might be subject to greater asymmetric information problems than more traditional firms. Thus, they might be more susceptible to be held up by their relationship bank. To ensure that the results of this article are not driven by these nontraditional IPOs, I control for the IPO bubble firms.[25]

First, I create two categorical variables that flag the Internet and tech stocks in my sample: Tech_Stock_i equal to 1 if firm i is identified by Loughran and Ritter (2004) as a tech stock IPO, and 0 otherwise; and Internet_Stock_i equal to 1 if Ritter identifies firm i as an Internet stock in data provided in his IPO-research Web site, and 0 otherwise.[26] I include these variables in the baseline regression equation, and report results in Table 11. Column 1 includes Tech_Stock_i and column 2 includes Internet_Stock_i. The estimates show that on average, tech-stock IPOs and Internet-stock IPOs pay higher interest rates than non-tech and non-Internet IPOs, $\beta_{\text{Tech\_Stock}} = 63.32$ and $\beta_{\text{Internet\_Stock}} = 68.06$, a result that is consistent with the notion that the tech and Internet stocks were riskier than the more traditional IPOs. In both these specifications, the economic and statistical significance of the relationship lock-in variables remains unaffected. Thus, controlling for the Internet bubble period does not alter the main result of this article.

Next, I exclude the Internet and tech stocks from the estimation sample. Eliminating tech and Internet stocks eliminates issuing firms that might be more prone to be held up by their banks. If the hold-up results reported are driven by these firms, once I eliminate them from the sample the effect of *Intensity* on interest rates should vanish. I estimate the baseline regression model on the subsample of firms for which $\textit{Internet\_Stock}_i = 0$ and then for the subsample for which $\textit{Tech\_Stock}_i = 0$, and report the results in columns 3 and 4 of Table 11, respectively. The main results of the article hold: the pattern of interest rates for pre-IPO loans is U-shaped and for post-IPO loans it is decreasing. Only in the subsample that excludes tech stocks, the coefficient

[25] I thank an anonymous referee for encouraging me to delve into this.

[26] Loughran and Ritter (2004) identify tech stocks as those with SIC codes 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3674, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7370, 7371, 7372, 7373, 7375, 7378, and 7379. The following tickers were not classified as tech stocks, although their business description seems to indicate they are indeed tech stocks. I therefore recode them as tech stocks: ECLG, Internet Service Provider (ISP); ASDS, Provider of Web service solutions; VCLK, Provider of Internet advertising services; ATON, Provider of Internet solutions; OPUS, Provider of Internet-based services; JFAX, Provider of communication services via Internet; BNBN, Provider of online book retail market; HHNT Provider of Web-based employment services. Internet stocks were classified as in: http://bear.cba.ufl.edu/ritter/List%20of%20Internet%20IPOs.xls.

Table 11
Further robustness analysis: Internet stocks, tech stocks, and the IPO bubble years

	Include		Exclude	
	Tech stocks (1)	Internet stocks (2)	Internet stocks (3)	Tech stocks (4)
Relationship intensity				
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * After_IPO	−80.28***	−79.57***	−91.06*	−119.56*
	(27.05)	(26.99)	(52.14)	(68.13)
$\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}}$ * Before_IPO	−267.06***	−268.88***	−693.76***	−598.89***
	(101.06)	(100.78)	(210.88)	(283.66)
$\left(\frac{\text{Number of prior loans by lead}}{\text{Total number of loans to date}} * \text{Before\_IPO}\right)^2$	218.62*	219.75*	898.75***	800.54**
	(114.61)	(114.30)	(280.27)	(358.02)
Switched lenders	−53.73***	−53.93***	−89.28***	−108.85**
	(16.87)	(16.82)	(30.92)	(42.85)
Loan characteristics				
First loan	−69.42***	−72.50***	−117.79***	−90.77
	(24.75)	(24.75)	(43.42)	(63.33)
After IPO	−64.33***	−65.49***	−55.53*	7.05
	(19.24)	(19.17)	(33.80)	(54.49)
Tech and Internet stocks				
Technology stock	63.32*		No	No
	(37.80)			
Internet stock		68.06**	No	No
		(29.73)		
Firm fixed effects	Yes	Yes	Yes	Yes
Loan year fixed effects	Yes	Yes	Yes	Yes
R-squared	0.09	0.09	0.10	0.13
F-statistic	3.91	4.11	1.69	1.33
R^2 within	0.09	0.09	0.10	0.13
Number of firms	701	701	221	149
Number of loans	160	160	50	41
Average number of loans per firm	4.38	4.38	4.42	3.63
Max. number of loans per firm	701	701	221	149
Min. number of loans per firm	160	160	50	41

For the purpose of this estimation, *only those firms with pre- and post-IPO loans* are considered. Each firm must have *at least* one loan before and one loan after the IPO. The reported results correspond to fixed effects estimates of

$$\begin{aligned} Spread_{i,l} = {} & \beta_0 + \beta_{Intensity\_After}(Intensity_{i,l} * After\_IPO_{i,l}) + \beta_{Intensity\_Before}(Intensity_{i,l} * Before\_IPO_{i,l}) \\ & + \beta_{Intensity\_Before\_Sqrd}(Intensity_{i,l} * Before\_IPO_{i,l}) + \beta_{Switched} Switched_{i,l} \\ & + \beta_{Loan\_Characteristics} Loan\_Characteristics_{i,l} \\ & + \beta_{Firm\_Characteristics} Firm\_Characteristics_{i,l} + \beta_{Loan\_Yrs} Laon\_years_{i,l} + \varepsilon_i + \mu_{i,l}, \end{aligned}$$

where i indexes for firm and l for the loan number.

$$Intensity_{i,l} = \frac{Number\ of\ prior\ loans\ by\ Lead}{Total\ number\ of\ loans\ to\ date}.$$

$Spread_{i,l}$ is the all-in-spread drawn for firm i's loan l. All regressions include firm fixed effects and relationship year fixed effects. Columns 1 and 2 control for whether the lead IPO firm is a technology stock or an Internet stock, respectively; columns 3 and 4 exclude technology and Internet stocks, respectively. Standard errors are reported in parentheses, below the coefficient. I use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

on $After\_IPO_{i,l}$ is not precisely estimated, but this could simply be due to the reduced sample, which now includes only 41 firms and 149 loans.

6.4 How much information is released to the market participants *prior* to the firm's IPO?

Firms that issue public or private debt prior to the IPO have to disclose information to the public markets in compliance with the SEC rules pertaining to debt issues. This can mitigate the relationship bank's information monopoly. Therefore, for these firms, the event that destroys the relationship bank's information monopoly is not the IPO but the pre-IPO public or private debt issue. The results reported below reveal that very few firms issue debt prior to their IPO and therefore, for most firms, the IPO is indeed the event that eliminates the relationship bank's information monopoly.

First, I identify *public debt issues* between January 1, 1990, and December 31, 2004, using the SDC database. I merge this data with the sample of firms considered thus far. The number of firms with pre- and post-IPO public debt issues is reported in Table 12. Panel A shows that only 18 firms in the sample of 378 firms considered have issued public debt during the 3–13 years prior to the IPO, or at any point within 1–6 years after going public. Of these, three firms have only pre-IPO public issues, and one firm has both pre- and post-IPO public debt issues. The remaining 14 firms have only post-IPO public debt issues. Results from estimating Equation (3) for the subsample of firms that have no pre-IPO public debt issues show that excluding these firms has little, if any, effect on the pattern of interest rates that firms face prior to, and following, the firm's IPO. This is to be expected given that there are so few firms with pre-IPO debt issues.

Next, I use SDC to identify private firms that issue *private debt*, or arrange private debt placements according to Rule 144 Private Placements between January 1, 1990, and December 31, 2004. I merge these data with the sample considered thus far. Table 12, panel B, shows that 84 firms out of the sample of 378 firms considered have private debt placements. Of these, only 19 firms have pre-IPO private debt issues: 13 firms have only pre-IPO private debt distributions, and 6 firms have both pre- and post-IPO private debt placements. Results from estimating regression equation (3) for the subsample of firms that have no pre-IPO private debt placements show that the exclusion of these firms has little, if any, effect on the pattern of interest rates that the firms face.

Finally, I estimate regression equation (3) for the subsample of firms that have no pre-IPO private or public debt issues. Excluding these firms has no significant effect on the pattern of interest rates that the firms face.[27]

[27] Tables reporting results from all the subsample regression estimates are available from the author upon request.

Table 12
Public and private debt issues

Panel A: Public debt issues

	Total	*No* public debt issues	Public debt issues	Firms with public debt issues		
				Only Pre- IPO	Only Post-IPO	Pre-and post-IPO
Number of firms	378	360	18	3	14	1

Panel B: Private debt issues

	Total	*No* private debt issues	Private debt issues	Firms with private debt issues		
				Only Pre- IPO	Only Post-IPO	Pre-and post-IPO
Number of firms	378	294	84	13	65	6

Panel C: Public *and* private debt issues

		No private *or* public issues	Private *and* public debt issues					
			11					
			Classified by pre- and post-IPO					
			Pre-IPO (3 firms)			Post-IPO (11 firms)		
			Public *and* private	Public *but not* private	Private *but not* public	Public *and* private	Public *but not* private	Private *but not* public
Number of firms	378	367	1	0	1	10	1	0

From the SDC database, I obtain all public and private debt issues between January 1, 1990, and December 31, 2004. I merge this data with the sample of firms with bank loans for which all loan characteristics are available (the sample of firms used in Tables 2–4). Panel A shows that only 19 of the sample firms have issued public debt. Of these, only three firms have pre-IPO public issues and one firm has both pre-and post-IPO public debt issues. The remaining 14 firms have post-IPO public debt issues. Panel B shows that 84 of the sample firms have issued public debt. Of these, only 13 firms have pre-IPO public issues and six firms have both pre- and post-IPO public debt issues. The remaining 65 firms have both pre- and post-IPO public debt issues. Panel C reports that only 11 firms have both private and public debt issues. Of these only one has pre-IPO issues.

7. Discussion and Conclusions

The question of whether relationship lending grants the lender an information monopoly, which the lender exploits to extract rents from its locked-in customer, has captured the interest of many academics and practitioners. The extant empirical and theoretical works provide diverse predictions and findings regarding the pattern of interest rates that relationship borrowers face.

In this article, I take a different approach to address whether relationship banks exploit their privileged information. I focus on bank loan pricing around a significant information-releasing event in the life of a borrower, an event that changes the information structure among lenders and alters the relationship

bank's ability to extract rents from the relationship firm: the initial public offerings of equity. Prior to going public, firms are not required to broadly and systematically disclose information. In the course of the public offering, a substantial amount of information about the firm is revealed and the firm is held accountable by the SEC for its reporting. Following the IPO, the firm must comply with the ongoing disclosure requirements mandated by the SEC and the stock exchange where its shares trade. The firm's public share price yields another piece of the informational puzzle facing outsiders. I use this as a natural experiment in the firm's life to test for the presence of information monopolies: I predict that evidence of informational rent extraction will be concentrated in the period before the firm's IPO. As the IPO leads to wider dissemination of information, competition from outside lenders for the lending relationship increases. As a result, I predict that the firm's cost of borrowing declines in relationship intensity.

Using a new and unique dataset that tracks a firm's lending relationships across the IPO year, this article reports differences in the pattern of interest rates that are charged by the relationship bank during these two informationally different periods, which reveal that banks exploit their information advantage and extract rents while the firm faces high switching costs and is locked into the relationship. However, once switching costs drop, then relationship banks lower the interest rate that they charge their clients.

With this evidence, one is tempted to conclude that firms should rush to go public. This would be a hasty conclusion, since there are many costs involved in going public, not the least of which are complying with all required disclosures, revealing information to competitors, etc. In fact, there is an array of factors influencing the firm's decision to go public, as described, for example, in Chemmanur and Fulghieri (1999); Pagano, Paneta, and Zingales (1998); Benveniste, Busaba, and Wilhelm (2002); and Maksimovic and Pichler (1996). The point that this article makes is that the pre-IPO lender appears to exploit its information-based monopoly, extracting rents from its locked-in client firm. Consequently, the information monopoly that pre-IPO lenders have on their borrowers is a likely contributor to the borrowing firm's IPO decision.

This article is also related to a recent strand of literature that explores how physical proximity between lender and borrower impacts the lender's acquisition of private information, the borrower's ability to switch lenders, and the borrower's cost of borrowing. For instance, Agarwal and Hauswald (2007) find that borrower proximity facilitates the bank's collection of soft private information, which the lender uses to create an adverse selection problem for competitors, allowing the lender to carve out a local captive market. Degryse and Ongena (2005) show that loan rates decrease with the distance between the firm and the lending bank, and increase with the distance between the firm and competing banks.[28] Whether the relation between the interest rates that a

[28] See also Petersen and Rajan (2004) and Berger et al. (2005).

borrower pays and the intensity of the lending relationship differs depending on the physical proximity between the borrower and its lender is an open question for further research.[29]

References

Agarwal, S., and R. Hauswald. 2008. Distance and Information Asymmetries in Lending. Working Paper, Federal Reserve Bank of Chicago, and American University.

Alti, A. 2006. How Persistent Is the Impact of Market Timing on Capital Structure? *Journal of Finance* 61:1681–710.

Benveniste, L., W. Busaba, and W. Wilhelm. 2002. Information Externalities and the Role of Underwriters in Primary Equity Markets. *Journal of Financial Intermediation* 11:61–86.

Benzoni, L., and C. Schenone. Forthcoming. Conflict of Interest and Certification: Long-Term Performance and Valuation of U.S. IPOs Underwritten by Relationship Banks. *Journal of Financial Intermediation*

Berger, A. N., N. H. Miller, M. A. Petersen, R. G. Rajan, and J. Stein. 2005. Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks. *Journal of Financial Economics* 76:237–69.

Berger, A. N., and G. F. Udell. 1995. Relationship Lending and Lines of Credit in Small Firm Finance. *Journal of Business* 68:351–81.

Bharath, S., S. Dahiya, A. Saunders, and A. Srinivasan. 2007. So What Do I Get? The Bank's View of Lending Relationships. *Journal of Financial Economics* 85:368–419.

Bolton, P., and D. S. Scharfstein. 1996. Optimal Debt Structure and the Number of Creditors. *Journal of Political Economy* 104:1–25.

Boot, A. W. 2000. Relationship Banking: What Do We Know? *Journal of Financial Intermediation* 9:7–25.

Boot, A. W., and A. V. Thakor. 1994. Moral Hazard and Secured Lending in an Infinitely Repeated Credit Market Game. *International Economic Review* 35:899–920.

Chemmanur, T., and P. Fulghieri. 1999. A Theory of the Going Public Decision. *Review of Financial Studies* 12:249–79.

Degryse, H., and S. Ongena. 2005. Distance, Lending Relationships, and Competition. *Journal of Finance* 40:231–66.

Degryse, H., and P. Van Cayseele. 2000. Relationship Lending within a Bank-Based System: Evidence from European Small Business Data. *Journal of Financial Intermediation* 9:90–109.

Dennise, S. A., and D. J. Mullineaux. 2000. Syndicated Loans. *Journal of Financial Intermediation* 9:404–26.

Detragiache, E., P. Garella, and L. Guiso. 2000. Multiple versus Single Banking Relationships: Theory and Evidence. *Journal of Finance* 55:1133–61.

Diamond, D. 1991. Monitoring and Reputation, the Choice between Bank Loans and Directly Placed Debt. *Journal of Political Economy* 99:688–721.

Drucker, S., and M. Puri. 2005. On the Benefits of Concurrent Lending and Underwriting. *Journal of Finance* 60:2763–800.

---

[29] One way to interpret distance in this context is proximity in the space of bank services: a lender who becomes an IPO underwriter is "closer" to the firm than a lender who does not. If one could identify a bank to which the firm promised the underwriting mandate pre-IPO, or could identify a set of potential pre-IPO lenders who competed for the IPO underwriting mandate, one could build a measure such as "*Pre-IPO Lender and Expected Underwriter*" and use it to define proximity. The problem is that a firm's promise to grant the bank its prospective IPO mandate is unobservable. See Ljungqvist, Marston, and Wilhelm (2006) for more on how banks compete for underwriting mandates, and how to identify the set of prospective underwriters for the firm's IPO mandate.

Elsas, R. 2005. Empirical Determinants of Relationship Lending. *Journal of Financial Intermediation* 14:32–57.

Elsas, R., and J. P. Krahnen. 1998. Is Relationship Lending Special? Evidence from Credit-File Data in Germany. *Journal of Banking and Finance* 22:1283–316.

Fama, E. F. 1985. What's Different about Banks? *Journal of Monetary Economics* 15:29–39.

Goswami, G., T. Noe, and M. Rebello. 1995. Debt Financing under Asymmetric Information. *Journal of Finance* 50:633–59.

Greenbaum, S., G. Kanatas, and I. Venezia. 1989. Equilibrium Loan Pricing under the Bank-Client Relationship. *Journal of Banking and Finance* 13:221–35.

Hauswald, R., and R. Marquez. 2003. Information Technology and Financial Services Competition. *Review of Financial Studies* 16:921–48.

Hauswald, R., and R. Marquez. 2006. Competition and Strategic Information Acquisition in Credit Markets. *Review of Financial Studies* 19:967–1000.

Houston, J., and C. James. 1996. Bank Information Monopolies and the Mix of Private and Public Debt Claims. *Journal of Finance* 51:1863–89.

James, C. 1987. Some Evidence on the Uniqueness of Bank Loans. *Journal of Financial Economics* 19:217–35.

James, C. 1992. Relationship-Specific Assets and the Pricing of Underwriting Services. *Journal of Finance* 47:1865–85.

James, C., and P. Wier. 1990. Borrowing Relationships, Intermediation and the Cost of Issuing Public Securities. *Journal of Financial Economics* 28:149–71.

Kane, E., and B. Malkiel. 1965. Bank Portfolio Allocation, Deposit Variability and the Availability Doctrine. *Quarterly Journal of Economics* 79:113–34.

Karceski, J., S. Ongena, and D. Smith. 2005. The Impact of Bank Consolidation on Commercial Borrower Welfare. *Journal of Finance* 60:2043–82.

Ljungqvist, A., F. Marston, and W. Wilhelm. 2006. Competing for Securities Underwriting Mandates: Banking Relationships and Analyst Recommendations. *Journal of Finance* 61:301–40.

Loughran, T., and J. Ritter. 2004. Why Has IPO Underpricing Increased over Time? *Financial Management* 33:5–37.

Lummer, S. L., and J. J. McConnell. 1989. Further Evidence on the Bank Lending Process and the Capital Market Response to Bank Loan Agreements. *Journal of Financial Economics* 25:99–122.

Maksimovic, V., and P. Pichler. 2001. Technological Innovation and Initial Public Offerings. *Review of Financial Studies* 14:459–94.

Mikkelson, W. H., and M. M. Partch. 1986. Valuation Effects of Security Offerings and the Issuance Process. *Journal of Financial Economics* 15:31–60.

Ongena, S., and D. Smith. 2000. Bank Relationships: A Review. In Harper, K., and A. Zenios (eds.), *The Performance of Financial Institutions*, 221–58. Cambridge, UK: Cambridge University Press.

Ongena, S., and D. Smith. 2000. What Determines the Number of Bank Relationships? Cross-Country Evidence. *Journal of Financial Intermediation* 9:26–56.

Ongena, S., and D. Smith. 2001. The Duration of Bank Relationships. *Journal of Financial Economics* 61:449–75.

Padilla, A. J., and M. Pagano. 1997. Endogenous Communication among Lenders and Entrepreneurial Incentives. *Review of Financial Studies* 10:205–36.

Pagano, M., F. Paneta, and L. Zingales. 1998. Why Do Companies Go Public? An Empirical Analysis. *Journal of Finance* 53:24–64.

Petersen, M. A., and R. G. Rajan. 1994. The Benefits of Lending Relationships: Evidence from Small Business Data. *Journal of Finance* 49:3–37.

Petersen, M. A., and R. G. Rajan. 1995. The Effect of Credit Market Competition on Lending Relationships. *Quarterly Journal of Economics* 60:407–43.

Petersen, M. A., and R. G. Rajan. 2002. Does Distance Still Matter? The Information Revolution in Small Business Lending. *Journal of Finance* 57:2533–70.

Rajan, R. G. 1992. Insiders and Outsiders: The Choice between Informed and Arm's Length Debt. *Journal of Finance* 47:1367–400.

Santos, J. A. C., and A. Winton. 2008. Bank Loans, Bonds, and Information Monopolies Across the Business Cycle. *Journal of Finance* 63:1315–59.

Sapienza, P. 2002. The Effects of Bank Mergers on Loan Contracts. *Journal of Finance* 57:329–67.

Schenone, C. 2004. The Effect of Banking Relations on the Firm's IPO Underpricing. *Journal of Finance* 60:2903–58.

Sharpe, S. 1990. Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Customer Relationships. *Journal of Finance* 45:1069–87.

Sufi, A. 2007. Information Asymmetry and Financial Arrangements: Evidence from Syndicated Loans. *Journal of Finance* 62:629–68.

Sunder, J. 2002. Information Production in Stock Markets and Cost of Bank Debt. Working Paper, Northwestern University.

Veerbek, M., and T. Nijman. 1992. Testing for Selectivity Bias in Panel Data Models. *International Economic Review* 33:681–703.