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John Asker
Alexander Ljungqvist

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John Asker
*Stern School of Business*
*New York University*

Alexander Ljungqvist
*Stern School of Business*
*New York University*
and *CEPR*

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[†] Address for correspondence: Stern School of Business, New York University, 44 West Fourth Street, New York NY 10012-1126. Asker: Phone 212-998-0062; fax 212-995-4218; e-mail jasker@stern.nyu.edu. Ljungqvist: Phone 212-998-0304; fax 212-995-4220; e-mail aljungqv@stern.nyu.edu.

# Sharing Underwriters with Rivals: Implications for Competition in Investment Banking


## Abstract

We conjecture that issuing firms seek to avoid sharing underwriters with their product-market rivals in order to limit the risk that strategically sensitive information is leaked to a rival firm via the underwriter relationship. We investigate this conjecture in a sample of 5,272 equity deals and 12,453 debt deals by large U.S. firms between 1975 and 2003. Using several distinct sources of identification, we find that this phenomenon is at least as important in determining the choice of lead underwriter as the bank's reputation or the issuing firm's existing relationship with the underwriter. We argue that this finding has important implications for understanding the nature of competition among investment banks, the durability of underwriting relationships, the success of entrants, and the likely impact of investment bank mergers on market power.



Key words: Investment banking; Securities underwriting; Competition; Entry; Glass-Steagall Act; Commercial banks.

JEL classification: G24, G32, L11, L14, L84.

Informational frictions are at the heart of securities underwriting and influence how banks compete for deal flow. For instance, reputation enables an investment bank to certify the validity of information released when a company sells securities to less well-informed investors (Booth and Smith (1986), Chemmanur and Fulghieri (1994)). It has long been acknowledged that reputation can, as a result, present a barrier to entry . Other apparently important competitive tools are the provision of research analyst coverage (Ljungqvist, Marston, and Wilhelm (2005)) and, to a lesser extent, market-making (Ellis, Michaely, and O'Hara (2005)). Price competition, on the other hand, does not appear to play a large role in securities underwriting (Chen and Ritter (2000)).

In this paper, we investigate how informational frictions create a different constraint on competition in investment banking: The need to maintain exclusive client relationships to avoid information leakage. We contend that corporate issuers care about the risk that sensitive information revealed to their underwriters may be disclosed to one of their product-market competitors when underwriting services are provided by a common bank. This leads us to the following conjecture: All else equal, issuing firms will seek to avoid sharing underwriters with a rival firm to limit the risk that the rival may take advantage of sensitive information the bank became privy to.

Several models exist in the corporate finance and industrial organization literatures that formalize the concern expressed in the information disclosure conjecture (albeit not with our application in mind).[1] Intuitively, the story is as follows. Through due diligence and other activities designed to protect their reputations with investors, banks gain access to a great deal of commercially sensitive information about their clients. This information may include details of distribution channels, customer lists, new product launches, future cash flow projections, and the progress of research and development projects. Information about any of these areas of operations may give a competing firm a strategic advantage, and it is likely that verifiability problems will prevent banks from committing contractually

[1] See, for instance, Anand and Galetovic (2000, 2002), Baccara (2005), Baccara and Razin (2004), and Zabojnik (2002). An interesting empirical study of related issues in the pharmaceutical industry is Azoulay (2004).

to keeping information secret. Thus, if the underwriter is shared with a rival firm, issuing companies are likely to be concerned that contact between the rival and the bank increases the risk that sensitive information is leaked. If so, the structure of existing bank-firm relationships in its industry limits a firm's choice of investment bank. Our empirical results provide strong support for this conjecture.

Previous work by Ljungqvist, Marston, and Wilhelm (2005, 2006) has made it clear that prior bank-firm relationships (along with bank reputation and the provision of research analyst coverage) are first-order determinants of which bank an issuing firm will choose to underwrite its next debt or equity offer. That is, demand for underwriting services is sticky relative to other industries.[2] An important contribution of our paper is to explain why issuers typically maintain strong relationships with one investment bank. With a limited number of banks capable of executing large or complex deals, there may simply be too few banks to allow each company to have multiple relationship banks while at the same time avoiding sharing banks with a major rival. Entry by commercial banks appears to have played an important role in loosening this constraint since deregulation began in 1988, and as a result we document a stunning shift away from exclusive bank-firm relationships during the 1990s, especially in the debt markets where commercial banks have made the greatest inroads.[3] The fact that we observe no corresponding shift away from banks serving at most one large client per industry indicates that clients are indeed careful whom they choose to have relationships with.

A second, and potentially more insidious, reason for persistent underwriting relationships is that information disclosure concerns impose a cost on firms when terminating a bank relationship. Upon termination, the risk that the bank discloses information about its former client surely increases, and our empirical results show that banks that have recently lost clients become much more attractive to other large firms in the same industry. As a result, relationship banks enjoy a measure of hold-up

[2] This stylized fact likely applies to service industries generally, as compared to manufacturing or retail industries. Similarly, the results in this paper are likely to have more general applicability.
[3] See Gande, Puri, and Saunders (1999), Gande et al. (1997), and Yasuda (2005) for further evidence concerning the effects of commercial bank entry into debt underwriting.

power over their clients which would strengthen bank-firm relationships and may help explain the apparent absence of price competition.[4,5]

To examine the extent to which the information disclosure conjecture is empirically relevant, we take as a maintained assumption that underwriters gain access to sensitive information and examine the propensity for a bank's relationships with rivals to affect an issuer's choice of underwriter. Attributing the estimated impact of a rival relationship on underwriter choice to concerns about information disclosure presents a series of interesting identification challenges. The first problem is how to separate the attraction of a bank's accumulated industry expertise from information leakage concerns: A bank serving a rival will likely have more experience of the issuing firm's industry, and thus greater credibility with investors, than a bank that has no rival clients in the industry. Second, information leakage could work in both directions: While a firm may not wish for its own information to be disclosed, using a shared underwriter may enable it to glean useful information about a rival. Ideally, we would like to measure the relative impacts of the costs and benefits of such information leakage.

We approach these challenges with a series of identification strategies. Each provides evidence that is strongly consistent with our conjecture. Using a set of 5,272 equity and 12,453 debt deals completed by large (and therefore strategically relevant) firms between 1975 and 2003, we demonstrate that relationships with a large rival company have a negative effect on the choice of underwriter in a probit specification. The estimated marginal effects suggest that the desire to avoid sharing an underwriter is first-order economically, both in the equity and the debt markets.

The probit coefficients likely understate the effect of information disclosure concerns to the extent that they are contaminated by the positive impact of industry expertise. To separate out information disclosure concerns from industry expertise, we examine the behavior of rival firms when their relationship banks merge. Using exogenous variation from bank mergers enables us to hold industry

[4] For an analysis of hold-up in *lending* relationships, see Sharpe (1990), Rajan (1992) and Petersen and Rajan (1995).
[5] See Hansen (2001) on the recent Department of Justice investigation into fee competition on Wall Street.

expertise constant while increasing the probability of information leakage occurring. While there have been numerous mergers over the sample period, we find that banks have largely avoided merging with another bank that has large, rival clients. Where there has been overlap, we show that issuers intending to raise equity capital are more likely to switch away from their relationship bank than if the merger involves no overlap or if the bank has not been involved in a merger. Economically, the effect is extremely large, increasing a client's switching probability by more than thirty percentage points.

Finally, we tease apart the informational costs and benefits of information leakage concerns by looking at firms' responses to their rivals switching relationship banks. The key to identification here is the fact that when a rival client ends its relationship with a bank, the bank continues to benefit from superior knowledge of the rival's operations but no longer represents a danger that information might be leaked to the rival. Such a bank should thus be more attractive to an issuing company operating in the same industry, and our results strongly support this prediction. Moreover, under relatively weak assumptions, we can estimate the net effect of information disclosure concerns, which we find to be many times larger economically than any other effect, including bank reputation and the estimated benefit of prior relationships between the bank and the issuing company.

Our findings have important implications for how competition among investment banks is viewed. Previously, prior bank-firm relationships were seen as the key facet of demand influencing competition in underwriting (Anand and Galetovic (2001), Yafeh and Yosha (2001), Yasuda (2005)). This shaped a view in which entry was difficult, as the position of incumbents was protected by their long history of involvement with many issuers. The competitive advantage from relationships embedded in a bank's employees could hence be argued to be overwhelming. Our evidence suggests that this view of competition in investment banking is overly simplistic.

Instead, competition among underwriters is more subtle. The sensitivity of firms to the risk of

information leakage makes it unlikely that any one underwriter will ever dominate the provision of underwriting services for a given client industry. Rather, industry expertise will likely remain spread across several banks. Likewise, the possibility of mergers to create a dominant position for a bank is weakened in underwriting since client firms will be highly likely to switch to another bank if a merger leads to underwriting services being shared across rivals. Moreover, entry by sufficiently credible players, such as that by commercial banks during the 1990s, is not only possible but likely to be successful despite traditionally strong bank-firm relationships.

While the picture up to this point seems pro-competitive, it is balanced by the fact that, within the set of banks with expertise in a given industry, an issuing firm's choice of underwriter is significantly constrained by information leakage concerns. This means that information leakage limits the choice set of issuing firms, restricting their ability to substitute away from an existing relationship bank, should they choose to. This effect is likely to dampen competition in the investment banking industry and may help explain why there is little evidence of price competition in underwriting.

We have no "smoking gun" that proves issuers' apparent reluctance to share underwriters is due to information disclosure concerns. Other explanations are certainly possible, though we can think of none that are first-order and that fit all the facts we document. Regardless of the true explanation, the implications for the industrial organization of the investment banking industry derived above follow from the fact that issuers avoid sharing underwriters with their rivals, and not from our conjectured explanation.

The remainder of the paper is organized as follows. In the next section, we present a series of stylized facts about the underwriting industry and so set the stage for confronting our conjecture with empirical evidence. Section II sketches the empirical strategy and describes the data. Section III develops each empirical strategy in detail and discusses the results. Section IV concludes.

## I. Stylized Industry Facts

In this section we graph certain characteristics of the underwriting market in the U.S. over the period 1970 to 2003 to generate stylized facts about the industry. The data come from the U.S. New Issues database of Thomson Financial's Securities Data Corporation, excluding only financial and governmental issuers (i.e., SIC codes in the 6000s and 9000s) and non-underwritten issues. Applying these filters yields 54,659 transactions ranging from IPOs to seasoned debt and equity offerings, including both public and private offerings and firms. In constant 1996 dollars, the aggregate amount raised in these transactions exceeds $5 trillion. The distribution of different transaction types is reported in Table I. Public common stock and public nonconvertible debt offerings account for 35.5% and 26.9% of transactions, respectively, but public debt dominates in dollar terms.

Owing to differences in the amount and nature of information disclosed, equity and debt underwriting are best thought of as separate markets. The nature of debt securities implies that investors are mostly concerned with downside (repayment) risk, while equity investors are (relatively) more concerned about the upside. As a consequence, a bank's due diligence – and hence the information it learns about its corporate clients – may focus more on left-tail risk in debt issues and more on right-tail risk in equity issues. While it is hard to generalize, we expect industry rivals, in most situations, to be more interested in the latter, to the extent that corporate strategy, acquisition plans, investment policy etc. have a greater expected impact on equity than on debt returns.

### *A. Market Share Concentration*

We compute a bank's annual market share as the combined proceeds of all issues it lead managed (with equal credit given in the case of co-leads), divided by the total proceeds raised by issuers that year.[6] Figures 1a and 1b show annual concentration measures for the equity and debt underwriting markets over the period 1970 through 2003. Both appear somewhat concentrated. Historically, the four

[6] Throughout the paper, we focus attention on a firm's lead manager (rather than lower-tier members of its underwriting syndicates) as this is where the bank-firm relationship and thus any confidential information reside.

largest equity underwriters have had a combined market share of between 31% in 1971 and 71% in 1977, with a long-run average of 51%, while the C4 measure for debt underwriting has fluctuated between 45% in 1997 and 63% in 1984, with a mean of 53%. Thus, the main difference is that concentration is much more variable over time in equity underwriting than in debt underwriting. (The same basic pattern is true at the ten-bank level.) Its C4 places underwriting well within the set of industries that invite occasional (but not constant) regulatory supervision by the Federal Trade Commission and Department of Justice for potential competition law violations.[7]

Figures 1a and 1b also plot the C20, C30, C40, and C50 concentration measures. The fifty largest debt underwriters account for at least 98% of debt underwriting activity. The equity market accommodates slightly more players. C50 fluctuates between 86% and 100%, with an average of 96%. The remaining 4% is split among 82 banks in an average year.

*B. Entry*

The most notable force shaping the structure of the investment banking industry over the last two decades has been deregulation of Glass-Steagall separation of commercial and investment banking. In a series of steps beginning in 1988, commercial banks were allowed to underwrite securities offerings for the first time since 1933, culminating in the repeal of the Glass-Steagall Act in 1999. Commercial banks responded by either building capital markets operations in-house or acquiring investment banks (or, in some cases, both).

Figures 2a and 2b show the annual number of commercial banks active in equity and debt underwriting in the U.S., respectively, as well as their combined annual market share. While the number of commercial banks offering underwriting services is now fairly large, most do little business. A handful of commercial banks, including Citigroup, JP Morgan Chase, and Bank of America, have

[7] As a point of comparison, consider the following industries. In 1997 the beer industry had a C4 of 89.7%; motor vehicle manufacturing had a C4 of 82.4%; bookstores had a C4 of 54.1%; semiconductor manufacturing had a C4 of 52.5%; and pharmaceutical manufacturing had a C4 of 32.3%. (All numbers are by value of shipments. They are taken from Census (2001), Concentration Ratios in Manufacturing, 1997 Economic Census, Manufacturing, Subject Series, Table 2; and Census (2000), Concentration of Firms: Retail Trade, Economic Census, Retail Trade, Subject Series, Table 6.)

taken substantial business away from the investment banks, and as a group, commercial banks now have around 70% of the debt underwriting market and 38% of the equity underwriting market.

*C. Exclusivity of Client Relationships*

We code a bank as having an equity (debt) client in industry *i* in quarter *t* if it has lead managed one or more equity (debt) issues for a firm in that industry over the five years ending in quarter *t*-1. Since SDC does not provide underwriting data for the 1960s, observations before 1975 are based on less than five years of data.

Figure 3a plots the fraction of equity underwriters that have exactly one client among the top 3, 5, or 10 largest firms (ranked by annual Compustat net sales) in an industry (defined as a four-digit SIC code), conditional on having at least one such client. Prior to the mid 1990s, exclusivity in client relationships was evidently the norm in the equity market: Nearly every bank had at most one client among the three largest firms in an industry. Even among the ten largest firms in an industry, banks evidently maintained client exclusivity, given the around 95% frequency of having only one such client.[8] From the mid 1990s on, we see a modest decline in client exclusivity, especially in the fraction of underwriter-industry pairs that involve an exclusive relationship with a top 10 firm.

Debt underwriting relationships, shown in Figure 3b, display the same pattern of exclusivity though the level of exclusivity is consistently lower than in the equity market and the recent decline has been steeper, with the fraction of banks doing business with a single top 10 firm in an industry falling from 96% to 76% over the sample period.

[8] To provide a benchmark for this frequency, we compute the probability that a bank has exactly one large client per industry conditional on having any large clients in the industry, under the assumption that firms choose randomly with replacement from among *B* banks. The fewer firms are active issuers in an industry, the more likely it is that banks have no more than one large client per industry. On average, industries have between two and three active issuers ranked among the ten largest firms. The conditional probability of having one client given ten banks varies from 59.4% in industries with ten active issuers to 80.1% with five active issuers, 89.7% with three active issuers, and 94.7% with two. These benchmarks are illustrative only; unlike our subsequent econometric models, they do not condition on bank characteristics affecting how many banks can actually serve an issuer's particular requirements.

*D. Exclusivity of Bank Relationships*

Figures 4a and 4b show the extent to which issuing firms have tended to concentrate their underwriting business with a single bank. We measure this by calculating the total amount raised by each issuing firm in a given window and then looking at how this was shared among the one or more banks acting as lead manager. (For the purposes of the figures, we use one-, two-, and three-year windows.) From this we construct a Herfindahl index of the concentration of each issuer's bank relationships. A Herfindahl of one indicates an exclusive bank relationship. We then take a weighted average over firms in a quarter, weighting by the total proceeds raised in each firm's debt or equity issues over the relevant window. Weighting has the effect of reducing average exclusivity, indicating that larger issuers are more likely to have more than one relationship bank.

The patterns in Figures 4a and 4b are striking. Prior to the mid 1990s, bank relationships were nearly all exclusive. Debt relationships were historically less concentrated than equity relationships. From the mid 1990s on, bank relationships have become stunningly less exclusive in both markets. For the average equity issuer, concentration has fallen from around 0.95 to between 0.62 and 0.7 in 2003Q4, depending on the window used, suggesting that by the end of the sample period, the dominant model is no longer an exclusive bank relationship but a set of multiple relationships around a core bank that is awarded a disproportionate share of the average issuer's underwriting business. This may be the result of efforts to engender competition among banks in terms of either fees or some dimension of service. Alternatively, it is possible that commercial banks (which began entering the market around this time) leaned on their borrowers to share their underwriting business in return for preferential loan terms (Drucker and Puri (2005)). In the debt market, the decline in exclusivity has been even steeper. By the end of the sample period, average relationship concentration had fallen to between 0.39 and 0.47, depending on the window, a level consistent with a stable two- or three-bank relationship.

Figures 1 through 4 present a picture of an industry in flux. Banks have traditionally found it hard to work for competing firms in an industry, which suggests the presence of concerns among issuing firms about conflicts of interest. While it has become more common to see banks providing underwriting services for more than one of the largest firms in a given industry, this is still a relatively rare event. On the issuer side, the data suggest two regimes. Prior to the mid 1990s, firms typically maintained relationships with just one bank. More recently, firms have started fostering relationships with multiple banks, perhaps in response to entry by commercial banks. This pattern is very sharp in the firm-level data shown in Figures 4a and 4b, with no corresponding break in the bank-level data shown in Figures 3a and 3b. This suggests that firms are being selective in how they choose their underwriters and pay attention to who their underwriters' other clients are.

In the remainder of the paper, we seek to unravel the interplay of the relationships between issuing firms and underwriters on the one hand and an issuing firm's choice of underwriter on the other. Specifically, we investigate how concerns that sharing underwriters may lead to information being leaked to competitors impact the demand for underwriting services.

## II. Data and Methodology

### *A. Empirical Strategy*

Our empirical strategy is to look for sources of exogenous variation that allow us to mimic the following experiment. Take an issuing firm, operating in an oligopoly setting, and two banks. One bank has a relationship with one of the firm's major product-market rivals, while the other bank has no client in the industry. In all other respects the banks are equal. If the issuing firm prefers the bank with no rival relationship, we will view this as consistent with the firm having concerns about information leaking to its rival via the underwriting relationship. As in all empirical work, the challenge is to find sources of exogenous variation that allow us to draw meaningful conclusions about the impact of

information disclosure on the demand for underwriting services.

There are, potentially, many tradeoffs in a firm's decision about whether to share an underwriter with a competitor. Perhaps most importantly, the firm may trade off the underwriter's industry expertise garnered from dealing with rivals against the chance that the underwriter may leak sensitive information to a competitor. Controlling for this effect will be an ongoing challenge in our treatment of the data. We confront this issue in a number of different ways. The firm may also consider sharing an underwriter in the hope that it will learn some information about its competitors in the process. This will often prove to be observationally equivalent to benefiting from an underwriter's accumulated industry expertise (at least in our data).[9]

Before discussing the sources of exogenous variation that we exploit to identify the impact of information disclosure concerns, we describe our sample and data.

*B. Sample and Data*

The estimation sample is a subset of the transactions used to construct Figures 1 through 4. In addition to excluding financial and governmental issuers[10] and non-underwritten deals, we impose three more filters. First, certain variables are constructed using five years of pre-deal data, which limits us to transactions completed from 1975 onwards. Second, we require that each deal was lead-managed by one of the 50 largest underwriters ranked by market share in the year of the offering. Third, we restrict attention to the ten largest firms (by Compustat net sales) in each four-digit SIC industry. We do so because leaked information has the most strategic value to large firms as these can affect the market equilibrium. We thus implicitly assume that firms below the top 10 are typically price-takers and so are unlikely to be strategically affected by information spilling over from or to the largest firms

[9] A related issue is that firms may wish to share underwriters to share information and facilitate collusion in the product market. While this may be conceivable, we find it difficult to envisage an investment bank having a sufficiently strong incentive to be party to such an arrangement and thus leave this issue undeveloped.

[10] Our results are qualitatively unchanged if we also exclude regulated industries (SIC 4000-4999).

in their markets.[11] To the extent that this assumption is incorrect, we bias our tests against finding support for the information disclosure conjecture.

Applying these filters yields 17,725 transactions by 3,406 distinct companies in 418 different four-digit SIC industries raising $2.4 trillion in constant 1996 dollars. These transactions account for 35.4% of the deals completed and 51.5% of the amount raised by U.S. non-financial companies in underwritten offerings over the period 1975-2003. As Table I shows, public nonconvertible debt and common stock offerings account for the majority of deals and proceeds.[12]

In some specifications, we split the sample period in 1990. Table I shows that the pace of capital market issuance by the ten largest firms in an industry has increased since 1990. There were 55% more transactions raising 119% more capital in 1990-2003 compared to 1975-1989.

*C. Sample of Competing Banks*

Estimating a bank's probability of being selected to lead manage a particular offering requires data for both the successful bank and its competitors. In the case of an equity (debt) transaction in year *t*, we treat as lead manager candidates the 50 banks with the largest equity (debt) underwriting market share during that year.[13] This follows the approach taken in Ljungqvist, Marston, and Wilhelm (2005). As we saw in Figure 1, the combined market shares of the top 50 banks is very high, averaging 96.5% in the equity market and 99.5% in the debt market over the 1970-2003 period.

*D. Bank-firm and Bank-rival Relationships*

Our measure of the strength of bank-firm relationships follows the procedure in Ljungqvist, Marston, and Wilhelm (2006). Let $P^{d}_{jkt}$ denote the aggregate proceeds company *k* raised in deals lead-managed by bank *j* over the four quarters preceding quarter *t* in deals of type $d = \{equity, debt\}$.[14,15] The

[11] The product market share of the tenth largest Compustat firm in the average industry between 1970 and 2003 is 1.5%, with a range from nearly zero to 6.1%. This puts an upper bound on the market shares of excluded firms.
[12] Results are unchanged if we restrict estimation to public nonconvertible debt and common stock offerings.
[13] By construction, a commercial bank is treated as competing for a lead-management mandate prior to the repeal of the Glass-Steagall Act only if it had a so called Section 20 subsidiary with the relevant securities underwriting authority.
[14] Results remain significant using longer windows, though they become progressively weaker.

strength of company *k*'s type-*d* relationship with bank *j* then is $R^d_{jkt} = P^d_{jkt} \Big/ \sum_j P^d_{jkt}$. $R^d_{jkt}$ ranges from zero (no relationship) to 100% (when the company maintained an exclusive bank relationship).

Ljungqvist, Marston, and Wilhelm (2005) present evidence that some banks, and especially new entrants, accept lower syndicate positions (specifically, "co-manager") as a way to establish relationships with an issuing company with a view to becoming its preferred lead manager in future. To capture this, we compute $R^{d-co}_{jkt}$ using the prior four quarters of co-management data.

Table II reports summary statistics for $R^d_{jkt}$ and $R^{d-co}_{jkt}$, broken down by whether or not the candidate bank was chosen as lead manager for the deal in question. Ahead of equity transactions, the average successful candidate bank had lead-managed 13% and 6.5% of the issuing company's equity and debt transactions by value over the prior four quarters, respectively. By comparison, unsuccessful candidate banks had significantly weaker relationships with the issuing company. The same pattern holds for co-management relationships as well as ahead of debt transactions.

Our primary focus is on the effect of a bank's relationships with an issuer's principal product-market competitors. To this end, we set a dummy variable equal to one if, during the five years before company *k*'s equity (debt) transaction in quarter *t*, candidate bank *j* lead-managed one or more equity (debt) transactions for one or more firms (other than *k* itself) ranked among the three largest companies (based on annual Compustat net sales) in *k*'s four-digit SIC industry. We similarly code a dummy variable capturing relationships with firms ranked fourth through tenth in *k*'s industry. Using a five-year window is conservative, since there is no guarantee that every rival is *still* one of the bank's clients toward the end of the window. To the extent that the rival has since switched banks, concerns about information being disclosed are eliminated, biasing us against finding support for the information disclosure conjecture. In Section III.D, we will exploit variation in the duration of rival relationships to construct a more powerful test of the conjecture.

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[15] Ljungqvist, Marston, and Wilhelm (2006) also control for lending relationships. However, systematic data on bank loans are not available for the 1970s and 1980s.

As shown in Table II, a greater fraction of winning banks than of losing banks had relationships with an issuer's top 3 or top 4-10 rivals, ahead of either equity or debt transactions. This univariate result runs counter to our conjecture that concerns over information leaking to rivals influence underwriter choice. But as mentioned in the introduction, a bank's relationships with an issuer's main rivals is likely to have two additional effects besides the risk of information leakage, in the form of the bank having greater industry expertise and disclosing information about its other clients to the issuer. Clearly, finer tests are required to disentangle these effects in the data. Furthermore, the possibility that the rival client has in fact switched banks could easily account for this univariate result.

*E. Bank Reputation*

Bank reputation is a key determinant of the demand for underwriting services. We use two types of proxies for a bank's reputation capital. The first type, following Megginson and Weiss (1991), uses a bank's prior-year shares of the equity and debt underwriting markets. Table II shows that successful candidate banks have, on average, significantly larger equity and debt market shares than other banks.

The second type measures a candidate bank's standing in the industry in a way similar to Carter and Manaster's (1990) analysis of banks' tombstone rankings. Rather than tombstone advertisements, which are not readily available, we analyze syndication relationships at the lead manager and co-manager levels using social network analysis. We expect better networked banks to have an advantage in the competition for lead management mandates. We view banks as better networked the more frequently they are chosen as syndication partners by other banks, and construct a measure called *indegree* which varies from zero (for a bank that has syndicated with no other banks) to one (for a bank that has syndicated with every bank).[16] Table II shows that the average successful candidate bank has syndicated equity deals with 4.6% of all banks, which is significantly greater than the average *indegree* of 2.8% among unsuccessful candidates. The difference is even greater in the debt sample.

While *indegree* captures whether a bank is popular, it does not allow for reputation differences

[16] Bank $j$'s $indegree^{d}_{j,t} = \sum_i I(S^{d}_{l,j,t-1} > 0)/(N-1)$, where $I(\,)$ is an indicator function evaluating whether bank $j$ served as co-manager in deals lead-managed by bank $l$ in year $t$-1, and $N$ is the number of distinct lead managers that year.

among its syndication partners. Assuming that status and influence derive, in part, from being networked to others who themselves are well-networked, we construct a second measure of network position called eigenvector centrality (Bonacich (1972, 1987)). This weights a bank's ties to others by the importance of the banks it is tied to.[17] As Table II illustrates, successful candidate banks have relationships with significantly better-networked banks than do the losing candidate banks.

*F. Bank Characteristics*

A recurring empirical challenge is how to disentangle the effects of information disclosure concerns and a bank's industry expertise garnered from dealing with the issuer's rivals. As a first pass, we measure a bank's industry expertise as the combined concurrent product market share of its clients in the issuer's four-digit SIC industry. Product market shares are computed from annual Compustat net sales data. Successful candidate banks have vastly greater industry expertise. The combined market share of their clients averages 12% ahead of equity deals and 22.3% ahead of debt deals, compared to the average combined market share of the unsuccessful banks' clients of 1.6% and 3.3%, respectively.

We also construct a "loyalty index" measuring how often a bank retains its clients in consecutive deals.[18] The index varies between zero and 100%. It is intended to control for unobserved factors such as execution capability etc. that affect an issuer's choice. Banks whose clients are typically generally loyal likely have more desirable characteristics. As Table II shows, companies are relatively loyal: The average successful candidate bank has a loyalty index of 61.4% ahead of equity transactions and 49.1% ahead of debt transactions. By comparison, unsuccessful candidate banks retain their clients only 44% and 33.2% of the time on average ahead of equity and debt transactions, respectively.

In some specifications, we control for whether a candidate bank was involved in a merger around the time of the sample transaction, given prior evidence that mergers can help expand a bank's client

[17] The weights are the reciprocal of the principal eigenvector $p_t^d$ of a symmetric matrix recording whether banks *l* and *j* syndicated one or more transactions of type $d = \{equity, debt\}$ in year *t*-1. Formally, $eigenvector^d_{j,t} \equiv E^d_{jt} = \sum_l p^d_{ljt} E^d_{lt}$ .

[18] Let $I_{ck}$ and $I_{rk} = 1$ if bank *j* lead-managed company *k*'s penultimate and most recent equity deals, respectively, in the five years to quarter *t*, and 0 otherwise. Then bank *j*'s loyalty index = $\Sigma_k I_{ck} I_{rk} / \Sigma_k I_{ck}$ (the number of retained clients over the total number of clients).

base. In a separate test reported in Section III.C, we will design an experiment around bank mergers in an attempt to identify the effect of information disclosure concerns on company behavior.

Our final control compares the size of the deal at hand to the bank's average deal size in the prior calendar year. This is intended to capture the fact that a bank is unlikely to lead manage a deal that is either unusually large or unusually small given its normal deal size. The comparison of means reported in Table II shows relatively little difference between winning and losing banks on this dimension.

## III. Information Disclosure and Demand for Underwriting Services

### *A. Lead Manager Choice Models*

Our first model takes as the unit of observation an issuing firm seeking external finance at a given date. The firm, having decided on the form of financing (i.e., debt or equity), chooses a bank to act as lead manager. Recall that we treat the 50 largest banks as competing to become lead manager. To investigate the determinants of the issuer's choice of lead manager we estimate a standard multivariate probit specification. Each company $k$ is modeled as having a utility $u_{kjt} = \alpha R_{jt} + x_{kjt}\beta + \varepsilon_{kjt}$ associated with each of the 50 competing banks $j$, where $R_{jt} = 1$ if bank $j$ has a rival client in the issuer's four-digit SIC industry, the $x_{kj}$ are other determinants of lead manager choice, and the $\varepsilon_{kj}$ is an observation-specific idiosyncratic shock that is assumed to have a normal distribution. Faced with these utilities over choices, each firm chooses the candidate bank that maximizes its utility.

To identify the effect of a candidate bank's relationship with a rival on a firm's decision to choose the bank as lead manager, we need to control for other factors bearing on the choice. Perhaps most importantly, we control for bank reputation and for prior bank-firm relationships established through the candidate bank having served as lead or co-manager on the issuer's prior deals, which Ljungqvist, Marston, and Wilhelm (2005, 2006) have shown to affect lead manager choice positively. In addition, we include our proxy for the bank's industry expertise alongside the bank loyalty variable, a dummy

variable identifying recent mergers involving the bank, and the log absolute difference between the size of the firm's deal at hand and the candidate bank's average deal size in the previous year.[19,20] Note that we need only include firm characteristics to the extent that they interact with bank characteristics. All other firm characteristics are common to all choices and thus cancel out in the probit specification.

We refrain from pooling equity and debt deals to allow firms to have specialized relationship banks. For the 5,272 equity deals completed between 1975 and 2003, col. (1) of Table III shows that a candidate bank's chances of becoming lead manager improve significantly, the stronger its prior underwriting relationship with the issuer; the greater its reputational standing; the greater its industry expertise; the more loyal its clients; following a merger; and if the deal is similar in size to the bank's typical deal. The pseudo $R^2$ of 21.6% suggests the specification has good fit.

Controlling for these effects, we find that firms are loath to share a lead manager with one of the three largest firms in their industry. This effect, which is strongly statistically significant, is consistent with the information disclosure conjecture. Its economic significance is about as large as that of prior bank-issuer relationships and of bank reputation. Specifically, having a relationship with an issuer's top 3 rival reduces a bank's likelihood of becoming lead manager by 16% (i.e., by 35 basis points from the 2.2% unconditional likelihood), holding all other covariates at their sample means.[21]

The negative sign of this rival-client effect contrasts with the univariate results shown in Table II. The control responsible for switching the sign on the top 3-rival variable in the multivariate model is our measure of industry expertise. Given that the industry expertise variable contains no information about the identity of the bank's clients, we can rule out mechanical reasons for the sign switch. Instead, it appears that the trade-off between the risk of information disclosure and the benefits of industry

[19] Because we cannot observe the fees *quoted* by banks that subsequently fail to win an underwriting mandate, we do not attempt to control for price competition. However, as pointed out in the introduction, cross-sectional variation in percentage fees *paid* is minimal, at least for equity deals.

[20] Unlike Ljungqvist, Marston, and Wilhelm (2005, 2006), we do not control for research coverage provided by a candidate bank as coverage data is not available for the first half of our sample period. Including research coverage in the second half of our sample period strengthens our conclusions concerning the effect of relationships with rivals on lead manager choice.

[21] The unconditional likelihood is greater than 2% (one in 50) because some issuers hire more than one lead manager.

expertise is a first-order identification problem, as conjectured.

In contrast to the negative effect of relationships with a top 3 rival, firms appear eager to share a lead manager with one of the smaller firms in their industry (those ranked fourth through tenth by sales). This suggests that industry expertise is still tainting the estimates of the negative impact of information disclosure, despite our attempts at controlling for industry expertise directly. Since the benefits of industry expertise introduce a positive bias to the estimates of relationships with an issuer's rivals, the likely impact of information disclosure concerns are actually stronger than indicated by the estimated coefficients in Table III. We will attempt to remove this bias in subsequent sections.

In columns (2) and (3) of Table III we split the sample period in 1990 – roughly the time when commercial banks began entering the market. While the control variables behave similarly in the two sub-periods, the negative effect of a candidate bank having relationships with one of the issuer's three largest rivals is larger and more significant in the 1975-1989 sample. This finding tallies with the evidence shown in Figures 3a and 4a that relationships have become both less exclusive (in the sense of banks increasingly having more than one large client in an industry) and much less concentrated (in the sense of firms increasingly using more than one bank for their investment banking needs).

The results for the debt sample, reported in Table IV, are very similar. Notably, relationships with the largest rivals significantly reduce the likelihood that the bank wins the lead management mandate (col. (1)), and unlike in the equity sample, this effect is present and significant in both sub-periods (columns (2) and (3)). Economically, the effect is similar in magnitude, at 36 basis points or a 15.7% decrease in the selection likelihood, to that in the equity sample.

It is conceivable that firms have no problem sharing underwriters with their rivals but banks face capacity constraints that prevent them from working for more than one large issuer at a time. To investigate this alternative explanation further, we distinguish between situations where the bank has a

rival relationship and the rival is in the process of issuing securities with the bank's help and situations where the bank has a rival relationship but the rival is not raising capital in the same quarter as the issuer. We find no difference between these situations (results available on request), so capacity constraints do not appear to account for our findings.

*B. Issuer and Issue Characteristics*

Table V explores whether the aversion to sharing banks is stronger among particular types of issuers or in certain types of deals.[22] First, we expect frequent issuers to be particularly sensitive to information disclosure concerns assuming they disclose more information to their lead managers than do infrequent issuers. We include in the probit specification an interaction term crossing the indicator variable identifying banks that have one or more clients among the three largest firms in the industry with the issuer's log cumulative amount raised in equity (col. (1)) or debt (col. (2)) securities offerings in the prior five years. In both the equity and debt samples, we find that the effect of relationships with rivals becomes significantly more negative the greater the firm's issue activity, as expected.[23]

Second, information disclosure concerns might be greater in oligopolistic industries than in perfectly competitive markets. When we interact the rival relationship dummy with a Herfindahl index of industry concentration, we find support for this conjecture among both equity and debt issuers in Table V. Firms in relatively unconcentrated industries such as apparel manufacturing (1997 Herfindahl = 100.6) appear relatively unconcerned about sharing underwriters: For them, the existence of a rival relationship at the top 3 level reduces a bank's chances of becoming lead manager by six basis points in equity deals and 16 basis points in debt deals, all else equal. In concentrated industries, the effect is much greater. For copper smelters, for instance (1997 Herfindahl = 2,392.3), the likelihood decreases

[22] Arguably, information disclosure concerns should be stronger in opaque industries. However, while there are generally accepted proxies for opacity at the firm level (e.g., R&D intensity, the use of intangible assets, asset volatility), there are no corresponding proxies at the industry level. In our experience, the within-industry variation of the firm-level proxies dwarfs the across-industry variation, making it extremely hard to classify industries into opaque or transparent.

[23] Note that we do not include issue activity itself in the model, as this is common to all choices and thus cancels out in the probit specification. It is trivial to show that our specification is not subject to the usual criticism that interaction terms in non-linear models (such as probit) do not capture the difference in marginal effects (see, for instance, Powers (2005)).

by 40 and 56 basis points in equity and debt deals, respectively.

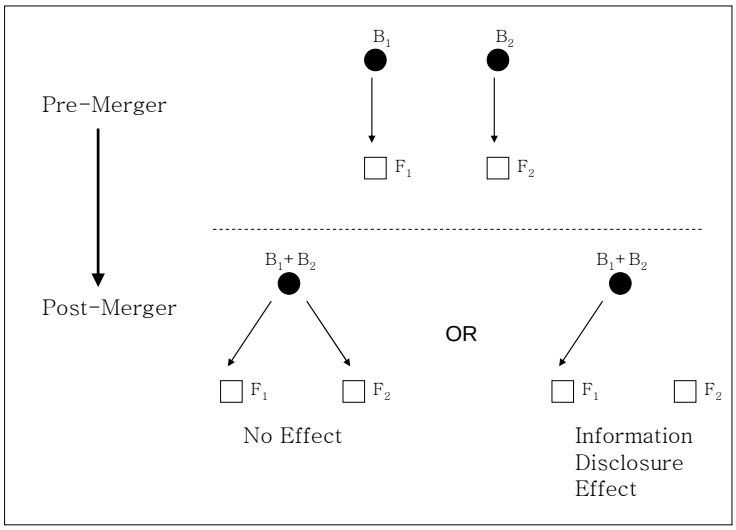
Third, we explore whether issuers of investment grade bonds are less averse to sharing underwriters than issuers of high-yield bonds, which are closer to equity and require more extensive due diligence. The insignificant interaction term shown in Table V suggests this is not the case. But its positive sign raises the possibility that junk bond issuers have higher demand for industry expertise, perhaps because this enables the bank to more credibly certify the issue. Interacting the dummy variable for high-yield bonds with both the top 3 rival indicator and our proxy for industry expertise supports this argument: Industry expertise has a greater beneficial effect on selection in high-yield issues than in investment-grade ones, and controlling for this effect, high-yield issuers are roughly twice as prone to avoiding sharing an underwriter with their three largest competitors.

*C. Exploiting Variation due to Bank Merger Activity*

A potential concern is that the probit coefficients on rival relationships reported in Tables III-V imperfectly identify the impact of information disclosure concerns on lead manager choice because an underwriter's industry expertise, skill in executing the transaction, or some other quality variable may be creating an endogeneity problem. Similar identification concerns arise if we consider the candidate banks themselves as having a say in whom they do business with (Fernando, Gatchev, and Spindt (2005)). For instance, a bank may not compete for an issuer's business if it feels this would generate concerns among its existing clients or concentrate sectoral exposure too much.

To address these concerns, we look for exogenous events that shock the bank-firm matching such that the risk of damaging information disclosure is increased for some firms, holding everything else constant. Under the information disclosure conjecture, we expect that the firms concerned will react to such a shock by minimizing the risk of damaging information disclosure, while other firms will take no action.

The consolidation of investment banking over the sample period, and especially during the 1990s, in anticipation of the repeal of the Glass-Steagall Act, gives a useful instance of an exogenous shock with which to isolate the effect of concerns about information disclosure on the matching of banks and firms. The following diagram presents our identification strategy:




The diagram shows two banks, $B_1$ and $B_2$, and their respective client firms, $F_1$ and $F_2$, assumed to be product-market competitors. At some point $B_1$ and $B_2$ merge. According to the information disclosure conjecture, the merger should lead to one of the two client firms switching banks (although we have no prediction as to which). The empirical analogue of Diagram 1 is that the probability of a firm ending its bank relationship should increase after a merger involving a bank that has a relationship with one of the firm's main product-market rivals.

This test provides an empirical measure of the propensity to change relationship banks given a change in the risk of information disclosure. It helps us distinguish information disclosure concerns from industry expertise effects, since the industry expertise of the population of banks other than the merging banks is unaffected by the merger and so is held constant. Likewise, it allows us to eliminate the effect of not controlling adequately for a bank's skill in executing the transaction or some other

quality variable. If these are driving a firm's lead manager choice, we should find no difference, following a given bank merger, in the switching behavior of firms in those industries where the banks have competing clients and those where they do not.

Formally, this is a difference-in-difference test using bank merger activity as the source of exogenous variation. We compare the switching behavior of a treatment group (those firms whose relationship bank has, since their last securities issue, merged with their chief rival's relationship bank) to the switching behavior of two control groups: Those whose relationship bank has merged with a bank lacking relationships with the largest firms in the industry (control group 1), and those whose relationship bank has not undergone a recent merger (control group 2). If firms have information disclosure concerns, we expect greater switching in the treatment group than in either of the two control groups, and we expect no difference in switching in control group 1 compared to control group 2, all else equal.

To implement the test, we estimate the probability that an issuer switches lead managers in consecutive equity or debt deals. A switch is defined as an equity (debt) issuer hiring as lead manager any bank other than the lead manager of its most recent equity (debt) deal (or, if that bank has since been acquired, its successor). In the case of multiple lead managers on a deal, we code as a switch any failure to retain every lead manager from the previous deal.[24] Excluding first-time deals, which cannot involve a switch, yields 3,177 equity deals and 9,939 debt deals over the 1975-2003 sample period.

Figures 5a and 5b graph the switching propensity and the quarterly number of transactions for the equity and debt samples, respectively. On average, large firms switch lead managers in 1,670 of the 3,177 equity deals (52.6%) and 5,977 of the 9,939 debt deals (63.7%). For comparison, Ljungqvist and Wilhelm (2005) report a 35.9% switching rate between a company's IPO and its first seasoned equity offering, over the period 1993-2003. Thus, firms appear to switch lead managers more frequently as

[24] This is the most logical way to code the data, but our results are not sensitive to this coding choice.

they mature. We are not aware of prior estimates of the switching rate for debt issuers, but it is clear that it is considerably higher than for equity issuers.

We identify 202 mergers involving sample banks over the 1970-2003 period. We distinguish three cases: Mergers between investment banks; mergers between commercial banks active in securities underwriting; and acquisitions of investment banks by commercial banks. Figure 6 shows three distinct merger waves, with the last one, beginning in 1994 and ending in 2001, the most active.

Our identification strategy requires a bank not just to merge, but to merge with a bank that has rival clients. As it turns out, this appears to be something banks have largely avoided doing. Among the 202 mergers, only 12 involve banks with rival equity clients and only 19 with rival debt clients ranked among the ten largest firms in a given industry. Conditional on there being overlap, the average merger involves 3.9 industries in which both banks have large equity clients (47 industries in total) and 6.3 industries in which both banks have large debt clients (119 industries in total).[25] Assuming conservatively that each bank involved in a merger has one client per industry gives a maximum number of treatment cases of 94 for equity and 238 for debt (fewer to the extent that some clients of the acquirer's or the target's have not raised capital in the remaining sample years since the merger).

Generally, even when a merger involved overlap, the extent of overlap is small. On average, only 6.7% (12%) of the combined number of industries in which the merging banks had large equity (debt) clients overlap. This pattern could signify a general reluctance to merge with a bank whose client relationships would upset the existing bank-firm matching. Alternatively, we cannot rule out that the large number of industries and banks in the sample leads to a small probability of two random banks having overlapping industry exposure. Either way, the small number of treatment cases will make it harder to find the predicted effect in the data, especially once we look for firms in the relevant industries completing securities transactions before *and* after a bank merger.

[25] The merger with the greatest degree of overlap was the November 2000 acquisition of Donaldson, Lufkin & Jenrette by CS First Boston, which overlapped in 23 industries for debt and 11 industries for equity.

Of the 3,177 equity deals, 630 follow a merger involving the bank lead-managing the issuer's previous deal. In 49 of these, the previous lead manager merged with a bank that had a relationship with one of the issuer's top 10 rivals; focusing on rivals in the top 3, there are 18 cases. These events are clearly associated with increased switching: 17 of the 18 issuers (94.4%) and 38 of the 49 issuers (77.6%) switch in response to their relationship bank merging with the relationship bank of one of their top 3 or top 10 rivals, respectively. For comparison, mergers with banks lacking relationships in the industry (control group 1) are followed by a 63.3% switching rate while issuers whose relationship bank has not undergone a recent merger (control group 2) switch 49.6% of the time. Statistically, the switching rates of the two control groups are significantly lower than those of the treatment groups.

The corresponding results for the debt sample are statistically and economically weaker. 848 deals follow a merger since the issuer's previous deal, with a switching rate of 67%. In the 63 (23) cases involving a target bank with relationships among the ten (three) largest firms in the issuer's industry, switching occurs 74.6% (73.9%) of the time. The switching rate in the absence of a merger is 63.3%.

These results, at least in the equity sample, provide preliminary support for the information disclosure conjecture. However, they make no attempt to control for other determinants of the switching decision. We therefore turn to multivariate probit specifications that include the control variables considered in Tables III and IV. In addition, we control for the log time since the firm's previous deal in view of prior evidence that the switching probability increases with time (Ljungqvist and Wilhelm (2005)). Figures 7a and 7b present kernel density estimates for the time between consecutive equity and debt deals, respectively. Most repeat equity issuers complete deals every one or two years; debt issuers typically do deals more frequently.[26]

The probit models in columns (1) and (3) of Table VI use all 3,177 equity and 9,393 debt deals,

[26] This might raise concerns that some consecutive debt deals may not, in fact, be independent of each other, leading to biased inferences if issuers pre-select their lead managers for a sequence of debt deals spaced a few weeks or months apart. To address this concerns, we have repeated every test excluding the 1% most active debt issuers (101 unique firms), which account for around a third of debt deals overall and two-thirds of the deals that complete within a short time (say 7, 30, or 60 days) of the most recent deal. All results are unaffected.

respectively. The base category is control group 2, so we test whether a) firms in the treatment group and b) firms in control group 1 are more likely to switch than are firms in control group 2. Columns (2) and (4) drop control group 2, focusing on the 630 equity and 848 debt deals that follow a bank merger, respectively. Here, we test for differences between the treatment group and control group 1.

Consider briefly the control variables. Issuers are less likely to switch the stronger their underwriting relationship with the bank. While a large equity market share does not insulate a bank from being dropped, a large debt market share does. Position in the network of banks has a similar effect. Banks whose clients are generally more loyal are less likely to be dropped in a given deal. Issuers switch when their deal is either unusually large or unusually small compared to the bank's typical deal size. Their switching propensity increases with time since their last deal.

Controlling for these factors, the positive and statistically significant coefficient estimated in col. (1) for firms in the treatment group (i.e., merger cases involving a bank whose clients include one of the issuer's top 3 rivals) supports the information disclosure conjecture: Issuers intending to raise equity capital are indeed likely to switch to another bank in response to a shock to the bank-firm equilibrium that increases their risk of damaging information disclosure. Compared to the two control groups, the switching probability is significantly greater in the treatment group, as predicted.[27] Economically, the effect is extremely large. The average switching rate is 33.2 *percentage points* greater in the treatment group than in control group 2, holding all other covariates in col. (1) at their sample means. (This difference is in line with that reported earlier for the bivariate comparison, indicating that the control variables included in Table VI have little effect on this result.) At the same time, we find no significant difference in switching between control groups 1 and 2, as predicted.

Interestingly, mergers involving a bank whose clients include the issuer's smaller (top 4-10) rivals

[27] The coefficient provides an estimate of the difference in switching propensity between the treatment group and the base category, control group 2. Comparing this coefficient to the one estimated for firms issuing equity following mergers by their previous lead managers that involve merger partners without rival relationships, we see that the switching propensity is also significantly different between the treatment group and control group 1 ($p = 0.048$).

are also associated with a greater likelihood of switching. Although the coefficient is imprecisely estimated, it is large economically (e.g., it is 42% larger than the effect of increasing the prior bank-issuer equity underwriting relationship by one standard deviation). The direction of this effect contrasts with our result in Table III that a bank having relationships with an issuer's top 4-10 rivals is *more* likely to be chosen as lead manager. Earlier, we conjectured that the coefficient for top 4-10 rivals may pick up both information disclosure concerns and the beneficial effects of industry expertise. The fact that we now find no less switching statistically, and more switching economically, when the bank maintains relationships with an issuer's smaller rivals validates our identification strategy.

The model shown in col. (2) focuses on firms whose previous equity lead manager has undergone a merger since the issuer's last deal by excluding control group 2. The positive and statistically significant coefficient estimated for firms in the treatment group confirms that it is a merger with a bank that has rival relationships, rather than a merger per se, that induces greater switching. This rules out the possibility that firms switch underwriters simply to avoid any upheaval accompanying mergers.

The fact that we find no corresponding results for the debt sample in columns (3) and (4) could be due to the small number of relevant merger cases, or it could indicate that information disclosure concerns play a substantially smaller role in the debt markets.

*D. Exploiting Variation due to Firm Switching*

The exogenous variation provided by bank mergers enables us to identify information disclosure effects free from contamination due to industry expertise or unobserved bank quality, at least in the equity sample. The data suggest that firms have considerable concerns about confidential information being leaked to competitors. However, recall that this may be partially offset by the chance of gleaning useful information about their rivals in return. That is, there are both negative and positive aspects to information leakage (an information benefit and an information cost, respectively).

To separately identify these aspects, we exploit instances of firms switching away from their relationship bank. Identification builds on the following insight. For other issuers in the industry, a rival's switch away from its former relationship bank presents a unique opportunity. This bank has both general industry expertise and specific knowledge of the rival, both of which are beneficial to an issuer, but there is no longer a risk of information leaking to the issuer's rivals. In contrast, banks that continue to serve the issuer's rivals have general industry expertise and offer both an information benefit (in the form of specific knowledge of the rival) and an information cost (in the form of possible information leakage). By comparing the propensity of firms to match with these two types of underwriters, we can isolate the cost of having information leak to a rival via a shared underwriter.

Using this source of variation raises concerns about the exogeneity of the client switch. The main concern is that firms switch underwriters when quality of service has deteriorated. Thus, we run the risk of our treated banks being poor quality relative to the untreated set. The direction of this potential bias is such that it can only weaken any support we find for the information disclosure conjecture.

We focus on two types of switches. The first can reasonably be thought of as exogenous. We consider a candidate bank's rival client to have switched if it has been acquired by another firm at some point in the five years preceding the deal for which an issuing company is selecting a lead manager. We use CRSP delisting codes 200 and 300 to identify acquisitions. Our maintained assumption is that the merged firm's CFO will most likely use the bank with which he has an existing relationship, leaving the target's relationship bank in the position of having lost an important client.

The second type of switch exploits variation in the duration of rival relationships. We consider a candidate bank's rival client to have switched if the firm has awarded no underwriting business to the bank for T years, and report results for T=3 and T=5. Within T years of its most recent deal, a rival firm is coded as an active client of the bank's. After T years, it is coded as a former or inactive client.

We assume the bank's information about the rival client to decay following a switch, and so code the bank as having an inactive rival client for only one year following the switch (i.e., in year T+1). Beyond that, the bank is coded as no longer having a rival client in the industry.

We implement the client switching identification strategy by adapting the probit models shown in Tables III and IV. Specifically, we adjust the reduced-form utility of a company *k* choosing bank *j*, $u_{kjt} = \alpha R_{jt} + x_{kjt}\beta + \varepsilon_{kjt}$ (where $R_{jt} = 1$ if the bank has a rival client in *k*'s industry) so that

$$u_{kjt} = \hat{\alpha} R_{jt}^{ns} + \hat{\gamma} R_{jt}^{s} + x_{kjt}\beta + \varepsilon_{kjt}$$

where $R_{jt}^{ns} = 1$ if bank *j* has a large rival client in the issuer's industry and that client has not switched (i.e., it remains an active rival client), $R_{jt}^{s} = 1$ if the bank had a large rival client that has recently switched (i.e., an inactive rival client), $x_{kjt}\beta$ is the impact of the other covariates in the model, and $\varepsilon_{kjt}$ is the idiosyncratic i.i.d. taste parameter (distributed normally in the probit specification).

To see where identification is coming from, we decompose $\hat{\alpha}$ and $\hat{\gamma}$. Let

$\hat{\alpha}$ = industry expertise + information cost + information benefit

$\hat{\gamma}$ = industry expertise + information benefit

so that $\hat{\alpha} - \hat{\gamma}$ = information cost

The function $\hat{\alpha} - \hat{\gamma}$ can easily be constructed from estimated parameters. Standard errors are computed using the delta method (see Greene (2003, p. 916), theorem D.22).

This identification strategy makes three assumptions: 1) An underwriter's industry expertise is not affected by the switch, at least within the timeframe after the switch we consider; 2) the information benefit is similarly unaffected; and 3) the switch is orthogonal to any unobserved bank quality (though recall that failure of this assumption biases us against identifying the size of the information cost).

Panel A of Table VII reports the three specifications, using firm mergers and client switches with

T=3 and T=5, respectively, to identify active and inactive rival clients, separately for equity and debt transactions. To conserve space, we report only the coefficients estimated for the active and inactive rival relationship dummies and the difference between the two. As per the above decomposition, this difference measures the net effect of concerns about information disclosure.

The results provide strong support for the conjecture that information disclosure concerns have a first-order effect on firms' choice of lead manager. The function $\hat{\alpha} - \hat{\gamma}$ is consistently negative and significant in five of the six specifications for the case of top 3 rivals and four of the six specifications for the case of top 4-10 rivals. The economic magnitude of the information cost, shown in the columns labelled dF/dx, is very large. An equity issuer, for instance, is 1.3 to 4.8 percentage points less likely to choose a bank that presents a risk of information leakage than one that does not, which is enormous relative to the unconditional likelihood of 2.2%. Comparing these estimated economic magnitudes to the much smaller ones of around 35 basis points in Tables III and IV, and recalling that relationships with top 4-10 rivals previously appeared to *help* a bank become lead manager, supports our view that our earlier estimates were contaminated by the beneficial effects of industry expertise. Compared to the bank merger identification strategy in the previous section, we here appear to have sufficient power to establish that debt issuers too are concerned about information leakage.

When we split the sample period in 1990, we find evidence of a weakening over time in the negative effect of information disclosure concerns, especially when the bank has rival relationships with one of the three largest firms in the issuer's industry; see Panels B and C of Table VII.

Finally, note that $\hat{\gamma}$ is not only almost invariably positive and significant but also frequently large economically. Depending on the specification, a bank is several percentage points more likely to be chosen if it *used to* have relationships with one of the issuer's main rivals. This suggests that industry expertise and intimate knowledge of key rivals do, in fact, play a key role in underwriter selection.

## IV. Conclusions

Collectively, our tests suggest that an issuing firm's concerns about information leakage are at least as important as its existing underwriting relationships and bank reputation in determining the identity of the lead manager in a given debt or equity deal. A less conservative view, based on our final test, suggests that this is a lower bound and that concerns about information leakage may be many times more important than any other previously documented effect.

We argue that these results help explain why firms typically maintain long-lasting relationships with one investment bank. With a limited number of banks capable of executing large or complex deals, there simply may not be enough banks to allow each company to have multiple relationship banks while at the same time avoiding sharing banks with its major rivals. Moreover, firms may be hesitant to terminate a relationship out of concern the bank may then leak information to future clients.

Our results have important implications for how competition among investment banks is viewed. They suggest that the position of incumbent banks is not as strong as was previously thought: Relationships are not everything and given a choice, issuers appear keen to maintain relationships with multiple banks so long as there is little risk sensitive information is disclosed to a rival. This is good news for entrants that have the capacity to handle complex deals, and the stunning shift away from exclusive bank-firm relationships during the 1990s suggests that entry by commercial banks has played an important role in loosening the constraint on firms' choice set imposed by information leakage concerns since deregulation began in 1988. Similarly, banks that merge are unlikely to retain clients in industries where the merger results in rivals sharing an underwriter. We find that the probability of losing at least one such client is over 80% following such mergers.

On the other hand, our evidence suggests that firms' underwriter choice is more constrained than was previously thought. Concerns about information leakage appear to reduce the effective choice set

of lead managers enjoyed by an issuing firm. This would dampen the pressure of competition among banks, in the absence of a competitive shock such as a merger or entry. We conjecture that this may be a part of the reason so little price competition is observed in the underwriting market.

Our study has examined demand for underwriting services and drawn implications for the nature of competition from the estimated structure of demand. To better understand the competitive nature of investment banking, and hence the way capital markets are accessed, it is also necessary to consider the supply side of the industry. In particular, a rigorous empirical understanding of the production function underlying investment banking would go a long way to fleshing out the appropriate competitive model of investment banking. This is no small task since the capital and labor used in production in this industry are meshed together in the minds of banks' employees. Unraveling the returns to bankers at different stages of their careers would be a good place to start. Needless to say, this requires investment in datasets of a quite different nature than those used in this study.

## References

Anand, Bharat, and Alexander Galetovic, 2000, Information, non-excludability and financial market structure, Journal of Business 73, 357-402.

Anand, Bharat, and Alexander Galetovic, 2001, Relationships, competition, and the structure of the investment banking market, Unpublished working paper, Harvard Business School.

Anand, Bharat, and Alexander Galetovic, 2002, Does competition kill relationships? Inside investment banking, Unpublished working paper, Harvard Business School.

Azoulay, Pierre, 2004, Capturing knowledge across and within firm boundaries: Evidence from clinical development, American Economic Review 94, 1591-1612.

Baccara, Mariagiovanna, 2005, Outsourcing, information leakage, and consulting firms, Unpublished working paper, New York University.

Baccara, Mariagiovanna, and Ronny Razin, 2004, From thought to practice: Appropriation and endogenous market structure with imperfect intellectual property rights, Unpublished working paper, New York University.

Bonacich, Philip, 1972, Factoring and weighting approaches to status scores and clique identification, Journal of Mathematical Sociology 2, 113-120.

Bonacich, Philip, 1987, Power and centrality: A family of measures, American Journal of Sociology 92, 1170-1182.

Booth, J.R., and R. Smith, 1986, Capital raising, underwriting, and the certification hypothesis, Journal of Financial Economics 15, 261-281.

Carter, Richard B., and Steven Manaster, 1990, Initial public offerings and underwriter reputation, Journal of Finance 45, 1045–1067.

Chemmanur, Thomas J., and Paolo Fulghieri, 1994, Investment bank reputation, information production, and financial intermediation, Journal of Finance 49, 57-79.

Chen, Hsuan-Chi, and Jay R. Ritter, 2000, The seven percent solution, Journal of Finance 55, 1105-1131.

Drucker, Steven, and Manju Puri, 2005, On the benefits of concurrent lending and underwriting, Journal of Finance, forthcoming.

Ellis, Katrina, Roni Michaely, and Maureen O'Hara, 2005, Competition in investment banking: Proactive, reactive, or retaliatory?, Unpublished working paper, Cornell University.

Fernando, Chitru S., Vladimir A. Gatchev, and Paul A. Spindt, 2005, Wanna dance? How firms and

underwriters choose each other, Journal of Finance 60, 2437-2470.

Gande, Amar, Manju Puri, and Anthony Saunders, 1999, Bank entry, competition and the market for corporate securities underwriting, Journal of Financial Economics 54, 165-195.

Gande, Amar, Manju Puri, Anthony Saunders, and Ingo Walter, 1997, Bank underwriting of debt securities: Modern evidence, Review of Financial Studies 10, 1175-1202.

Greene, William H., 2003, Econometric Analysis, Prentice Hall.

Hansen, Robert S., 2001, Do investment banks compete in IPOs? The advent of the '7% plus contract', Journal of Financial Economics 59, 313-346.

Ljungqvist, Alexander, Felicia Marston, and William J. Wilhelm, 2005, Scaling the hierarchy: How and why investment banks compete for syndicate co-management appointments, Unpublished working paper, New York University.

Ljungqvist, Alexander, Felicia Marston, and William J. Wilhelm, 2006, Competing for securities underwriting mandates: Banking relationships and analyst recommendations, Journal of Finance, forthcoming.

Ljungqvist, Alexander, and William J. Wilhelm, 2005, Does prospect theory explain IPO market behavior?, Journal of Finance 60, 1759-1790.

Megginson, William L., and Kathleen A. Weiss, 1991, Venture capitalist certification in initial public offerings, Journal of Finance 46, 879-903.

Petersen, Mitchell A., and Raghuram G. Rajan, 1995, The effect of credit market competition on lending relationships, Quarterly Journal of Economics 110, 407–443.

Powers, Eric A., 2005, Interpreting logit regressions with interaction terms: An application to the management turnover literature, Journal of Corporate Finance 11, 504-522.

Rajan, Raghuram G., 1992, Insiders and outsiders: The choice between informed and arm's-length debt, Journal of Finance 47, 1367-1400.

Sharpe, Steven A., 1990, Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships, Journal of Finance 45, 1069-1087.

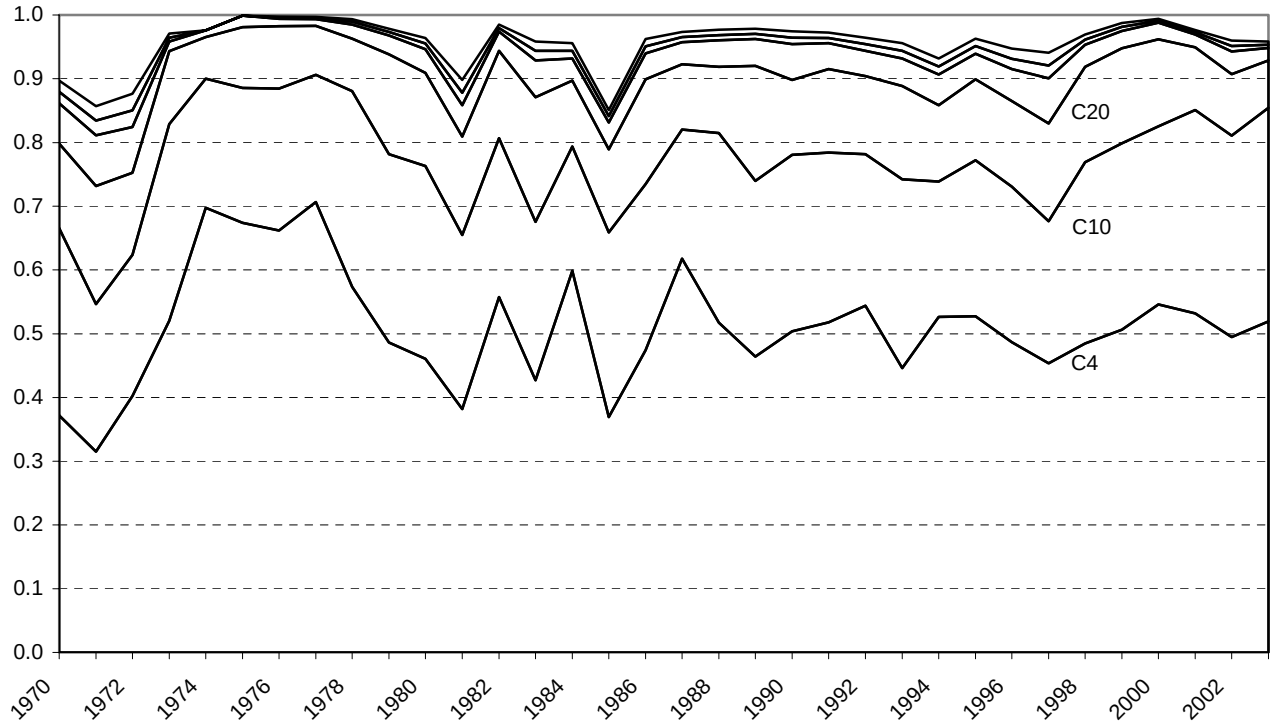
Yafeh, Yishay, and Oved Yosha, 2001, Industrial organization of financial systems and strategic use of relationship banking, European Finance Review 5, 63-78.

Yasuda, Ayako, 2005, Do bank relationships affect the firm's underwriter choice in the corporate-bond underwriting market?, Journal of Finance 60, 1259-1292.

Zabojnik, Jan, 2002, A theory of trade secrets in firms, International Economic Review 43, 831-855.

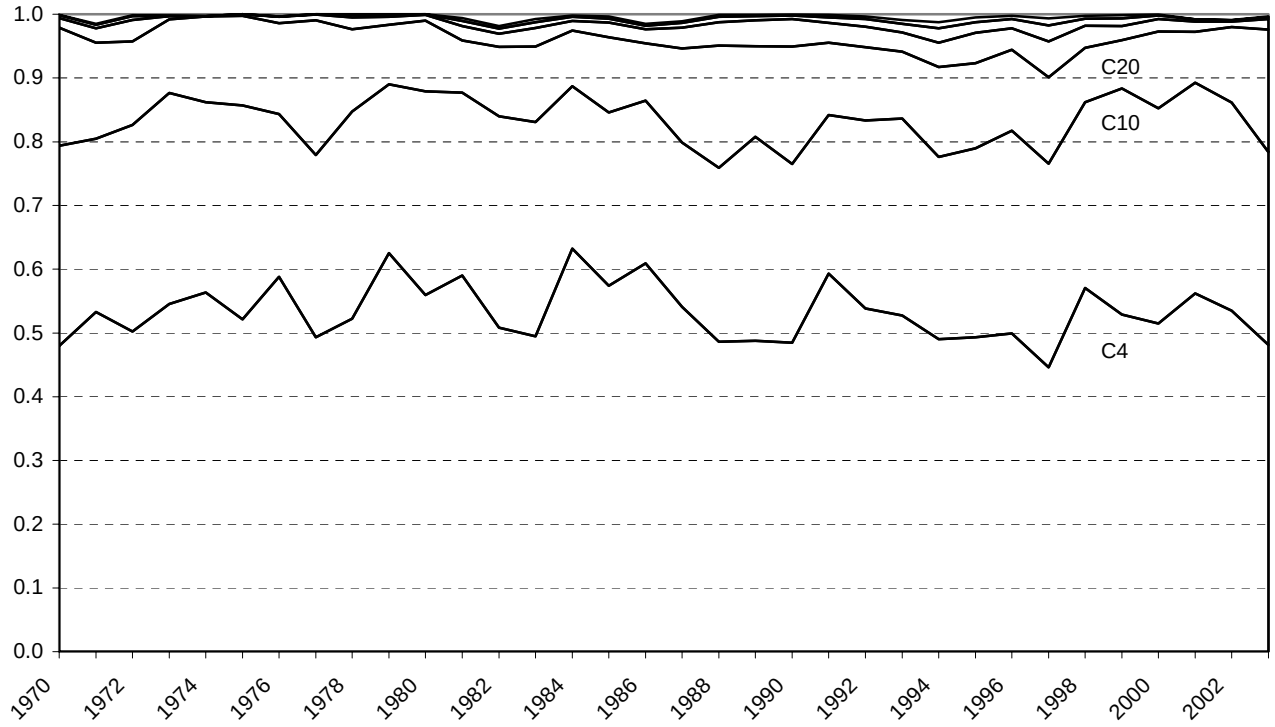
## Figure 1a. Equity Underwriting Market Shares of Top 50 Banks

The graphs show, from bottom to top, the combined equity underwriting market shares of the four, 10, 20, 30, 40, and 50 largest equity underwriters each year, the first three of which are labeled C4, C10, and C20.



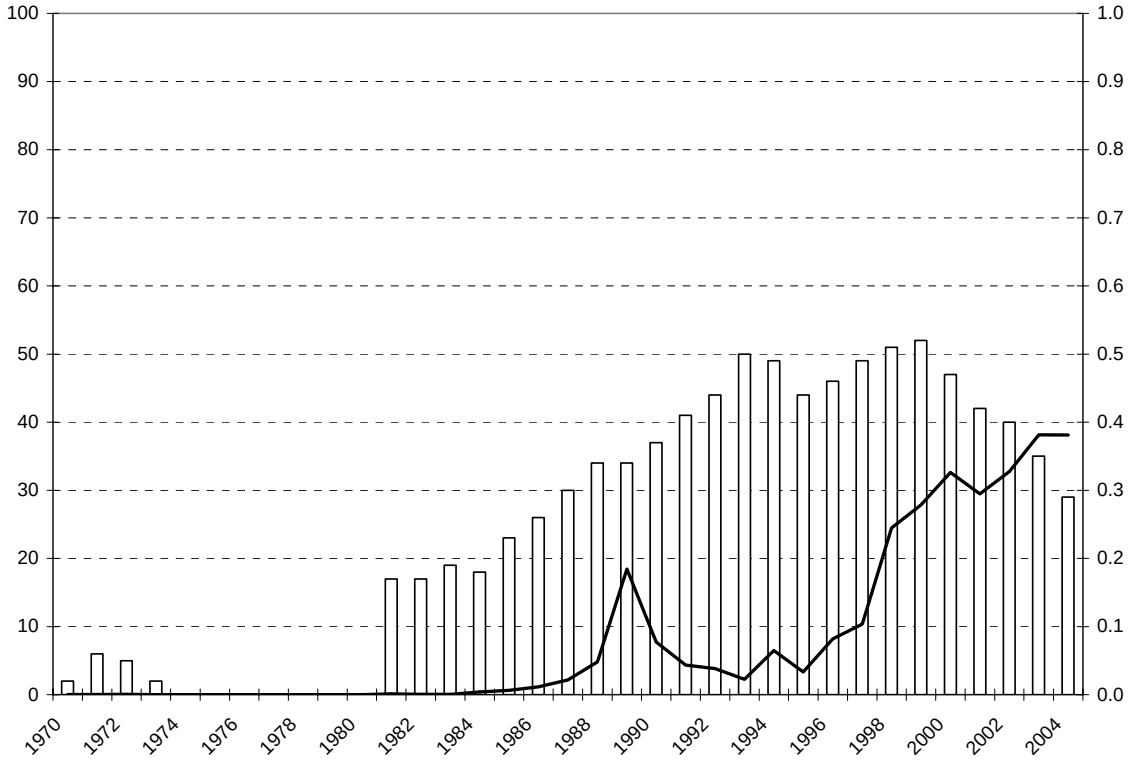

## Figure 1b. Debt Underwriting Market Shares of Top 50 Banks

The graphs show, from bottom to top, the combined debt underwriting market shares of the four, 10, 20, 30, 40, and 50 largest debt underwriters each year, the first three of which are labeled C4, C10, and C20.

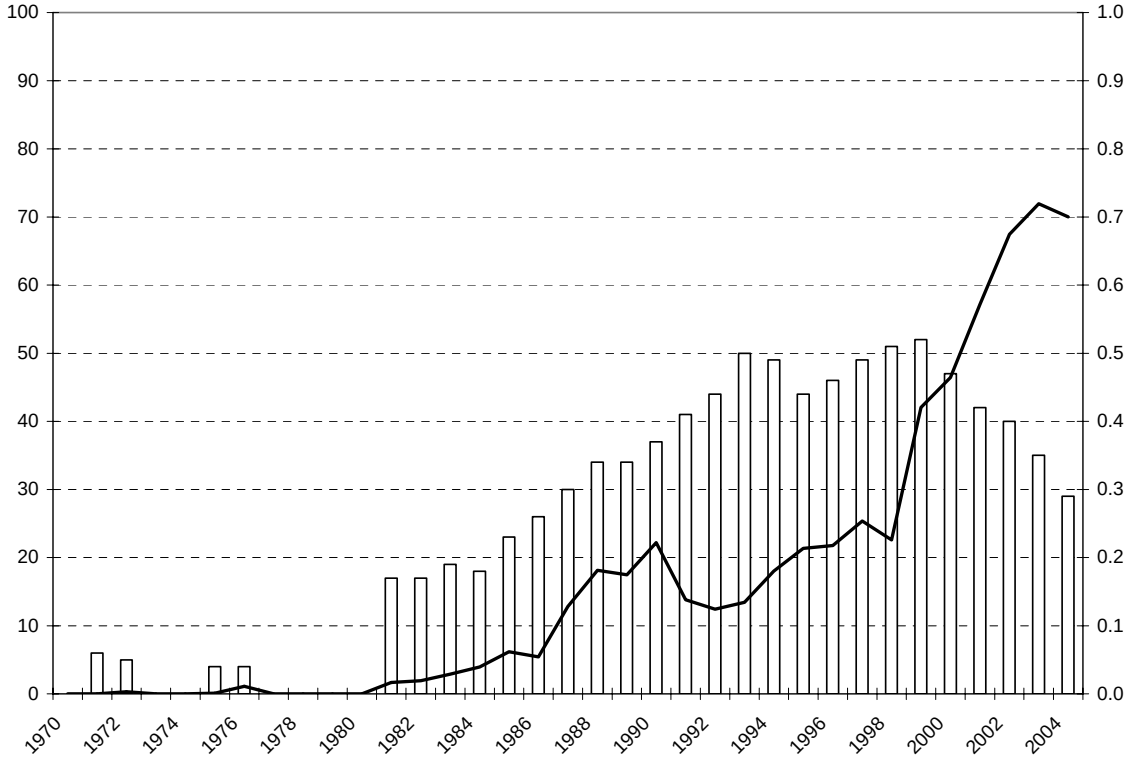


## Figure 2a. Number and Combined Equity Market Share of Commercial Banks

The graphs show the combined equity (in 2a) and debt (in 2b) market share of commercial banks (on the right-hand axis) and the number of commercial banks that have positive market share in each year (on the left-hand axis). Deregulation began in 1988 and the Glass-Steagall Act was repealed in 1999. There is underwriting by commercial banks prior to 1988 as some banks had grandfathered underwriting rights; due to the inclusion of foreign banks active in the U.S. capital markets; and because we include private placements, which fell outside the Glass-Steagall restrictions.

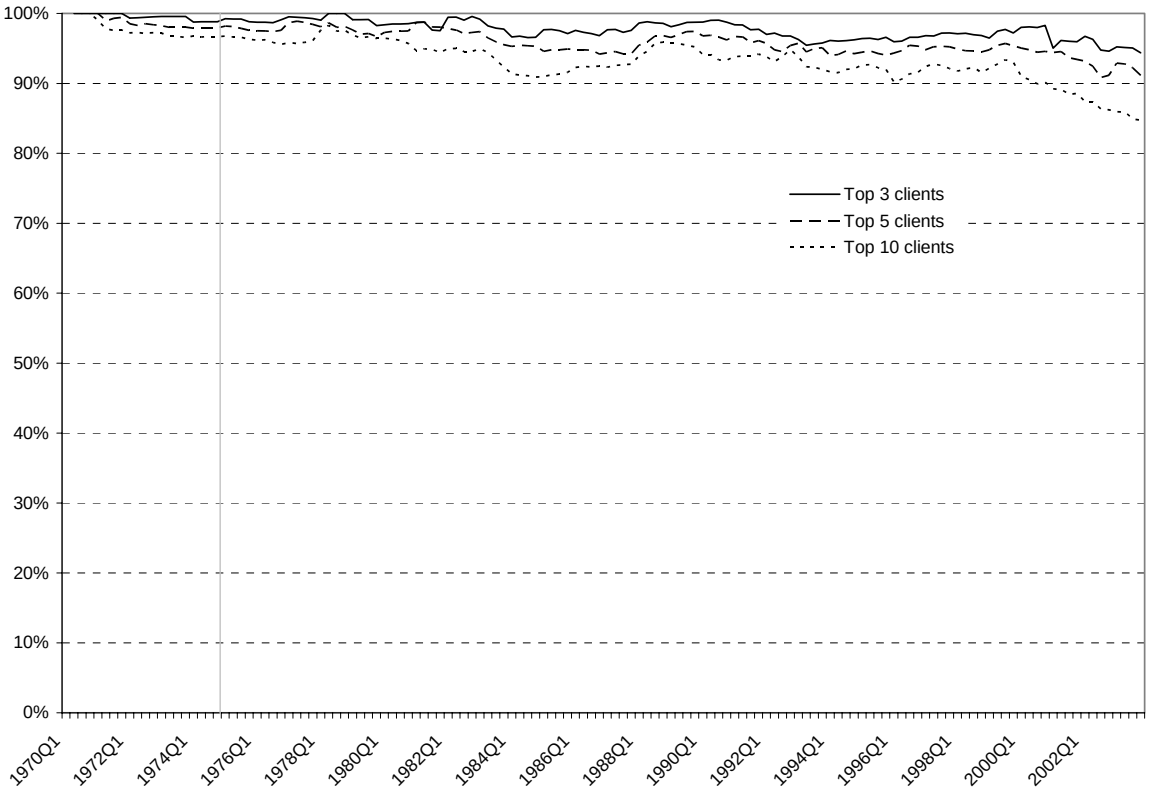



## Figure 2b. Number and Combined Debt Market Share of Commercial Banks

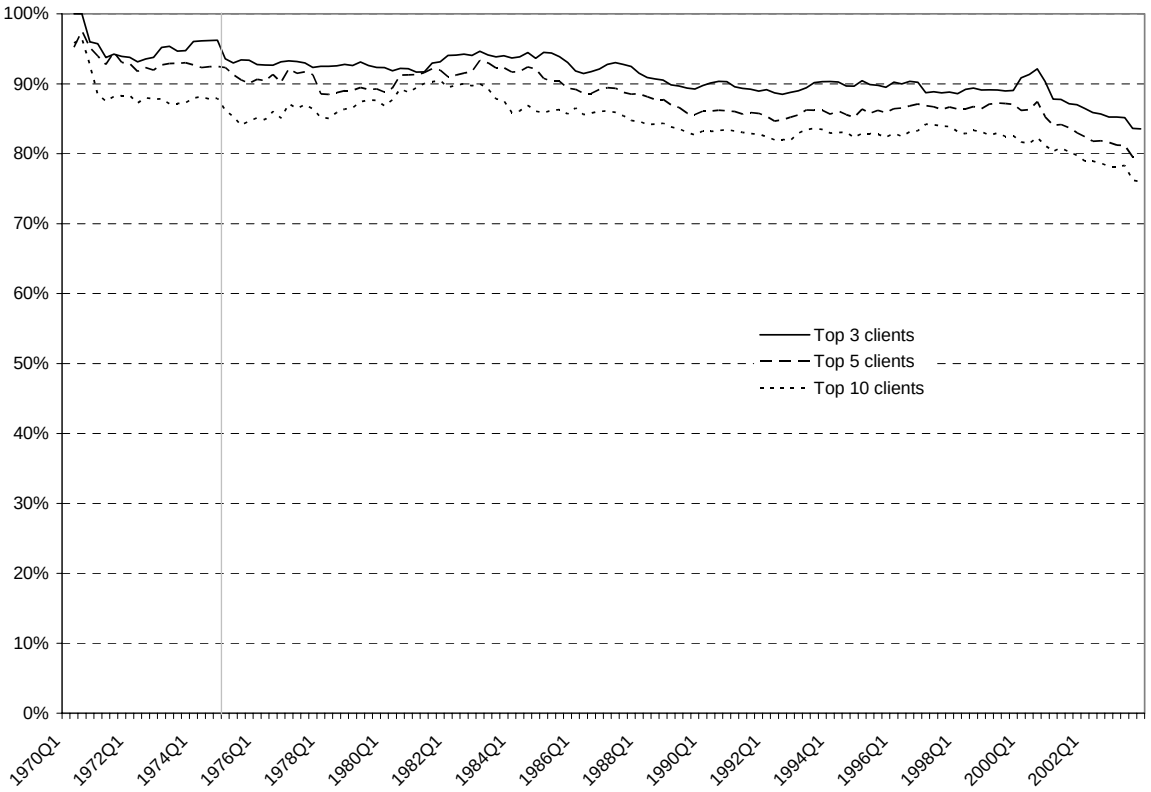


## Figure 3a. Exclusivity of Bank-firm Equity Relationships

The graphs show the fraction of time that a given bank with at least one equity or debt relationship client among the three, five, or ten largest firms (by Compustat net sales) in a given four-digit SIC code in a given quarter has exactly one such relationship client.

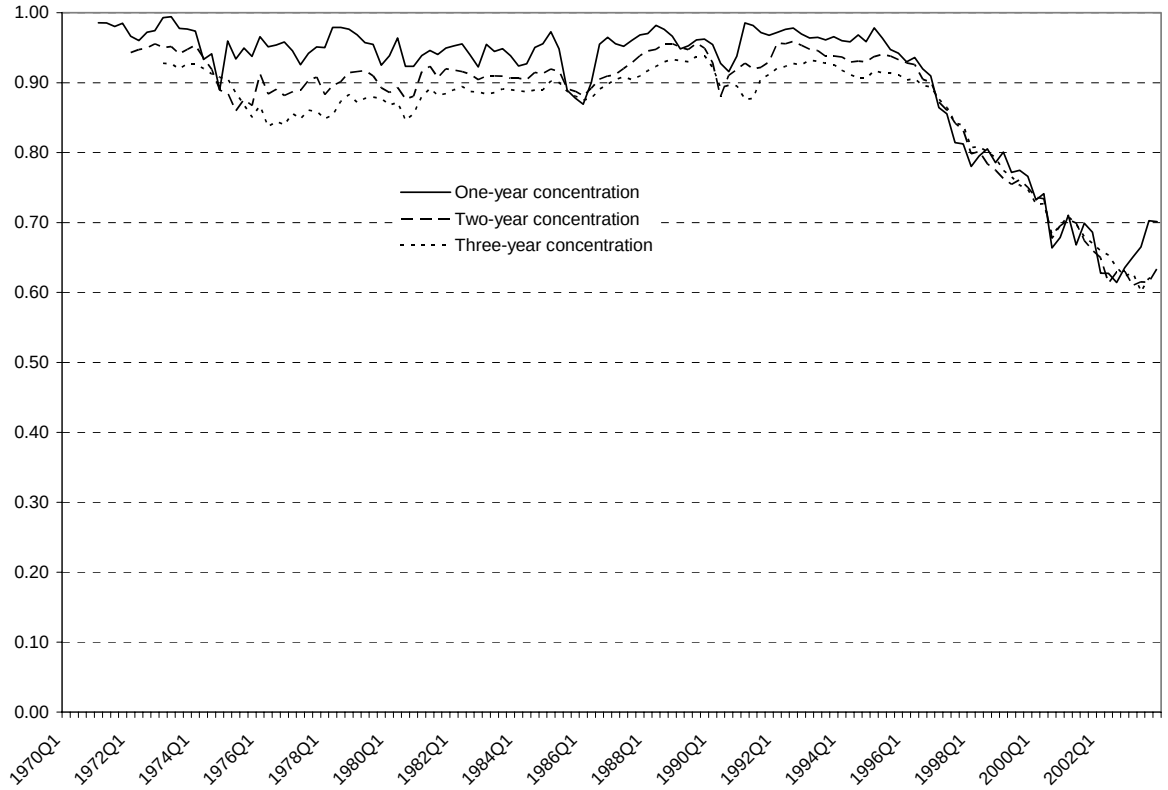



## Figure 3b. Exclusivity of Bank-firm Debt Relationships

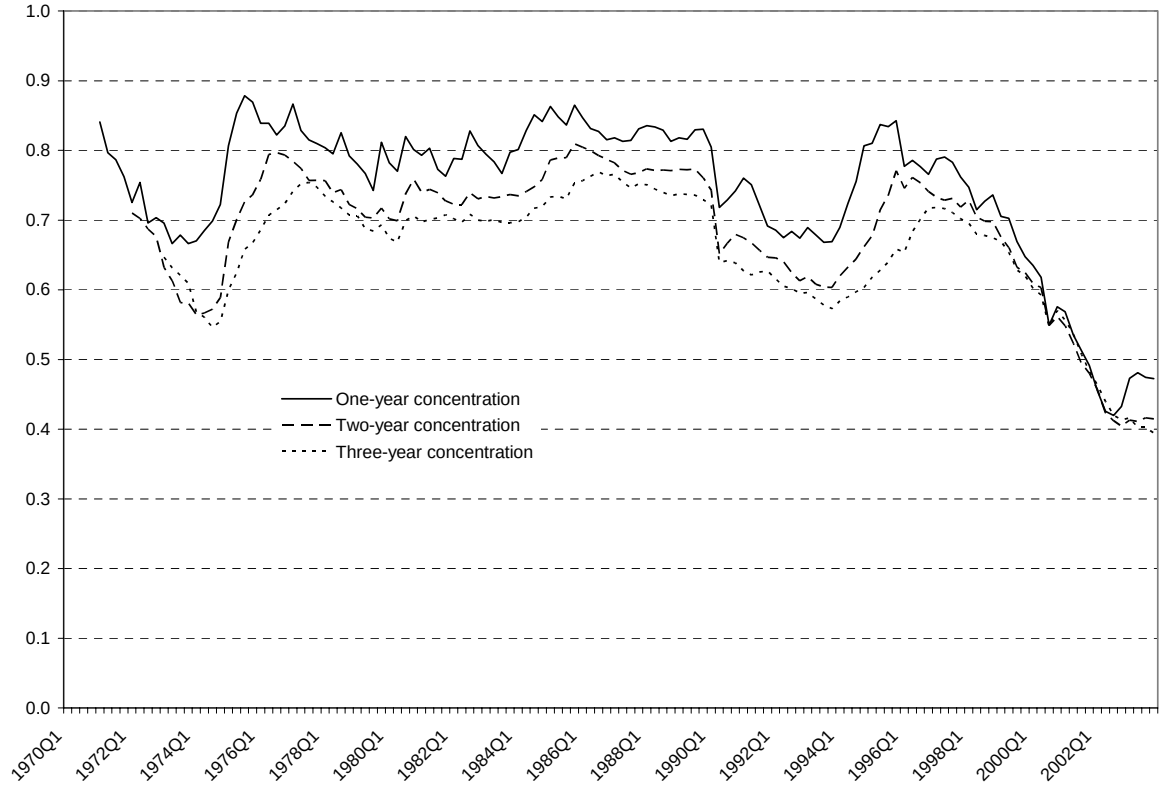


## Figure 4a. Concentration of Bank-firm Equity Relationships

The graphs show the Herfindahl concentration index of bank-firm relationships, measured over the prior one, two, or three years, of the average U.S. issuer (weighted by each issuer's cumulative proceeds over the relevant window).

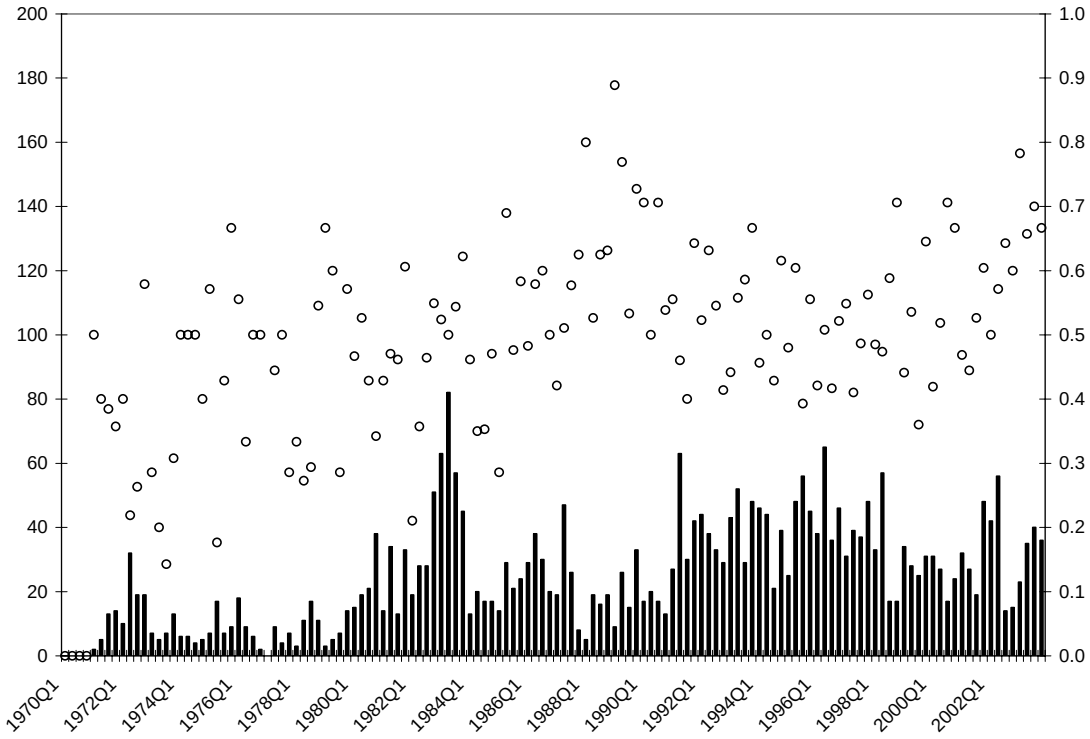



## Figure 4b. Concentration of Bank-firm Debt Relationships

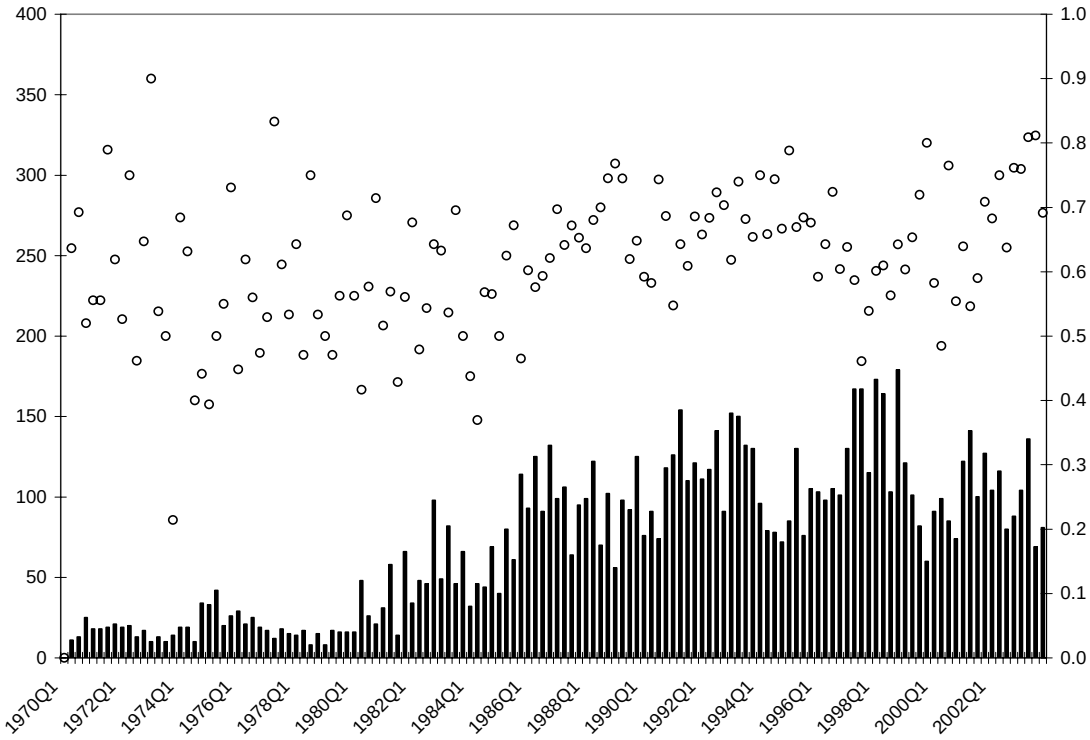


## Figure 5a. Switching Propensity in Consecutive Equity Transactions

The bars represent the quarterly number of equity or debt transactions by issuers ranked among the ten largest firms in their industry by sales, excluding an issuer's first recorded deal in 1970-2003 (as we focus on lead manager switches compared to the most recent deal). A switch is defined as the issuer hiring as lead manager any bank other than the lead manager of its most recent deal (or, if that bank has since been acquired, its successor). In the case of multiple lead managers on a deal, we code as a switch any failure to retain every lead manager from the previous deal. The quarterly fraction of switchers is indicated by "o" and measured on the right-hand axis. Note that we do not condition on the time between deals.




## Figure 5b. Switching Propensity in Consecutive Debt Transactions



## Figure 6. Annual Number of Bank Mergers

The figure shows the annual number of bank mergers. We distinguish three cases: Mergers between two investment banks (IB-IB); mergers between two commercial banks (CB-CB); and acquisitions of investment banks by commercial banks (CB-IB). We continue to call a commercial bank a commercial bank after it has acquired an investment bank. We include all mergers (and in two cases, joint ventures of the two banks' capital markets divisions) by any bank involved in securities underwriting, according to Securities Data Corporation, between 1970 and 2003. As a consequence, the figure includes mergers between foreign banks, such as the 1984 merger between two Canadian commercial banks, Harris Bankcorp and Bank of Montreal. The total number of mergers included in the figure is 202.

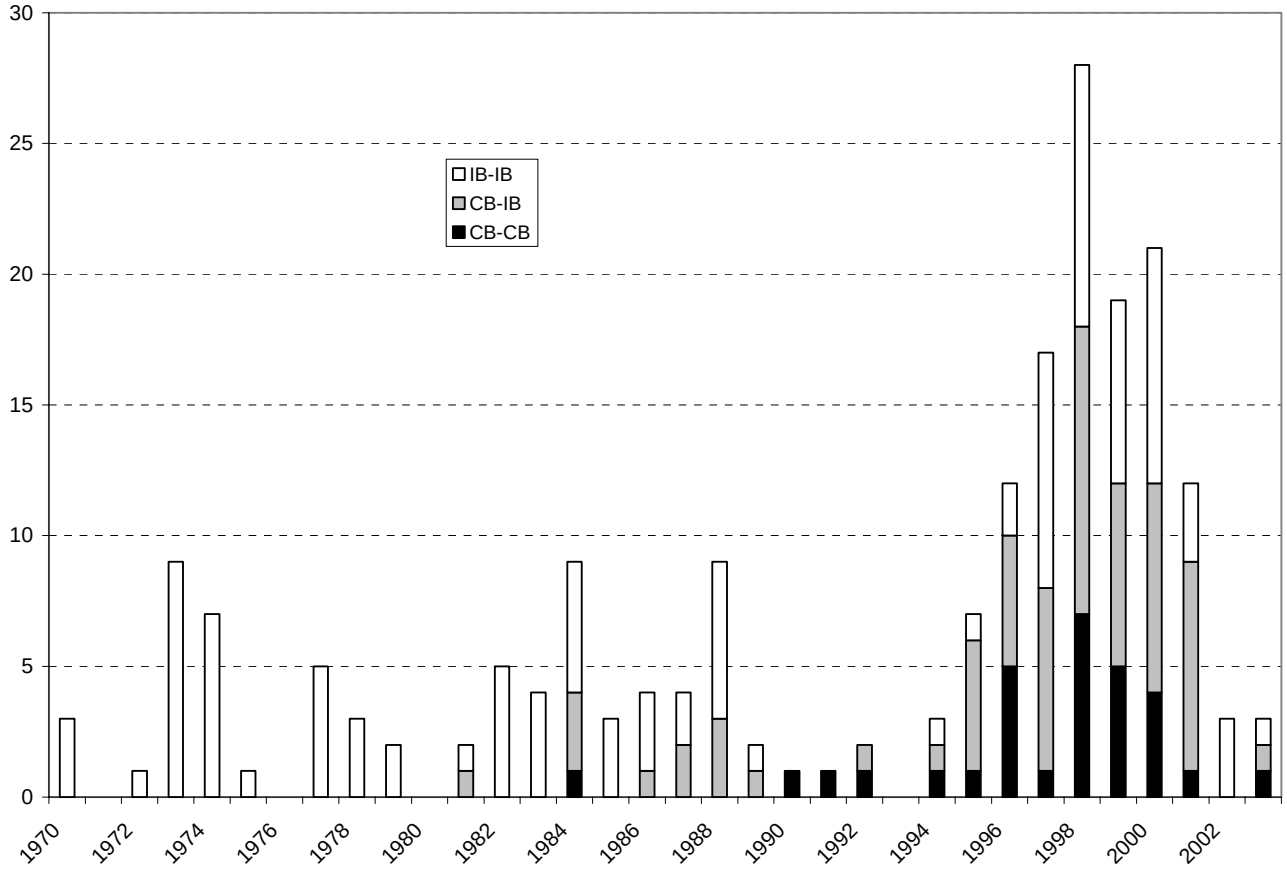


**Figure 7a. Kernel Density Estimate for Time between Consecutive Equity Deals**

The graph plots a kernel density estimate using an Epanechnikov kernel with bandwidth = 0.2 and $N$ = 3,000, of the time in years between any two equity deals that a U.S. issuing firm ranked among the ten largest in its four-digit industry completes between 1970 and 2003. For the purpose of the graph (but not the kernel estimation), times longer than 20 years are not shown.

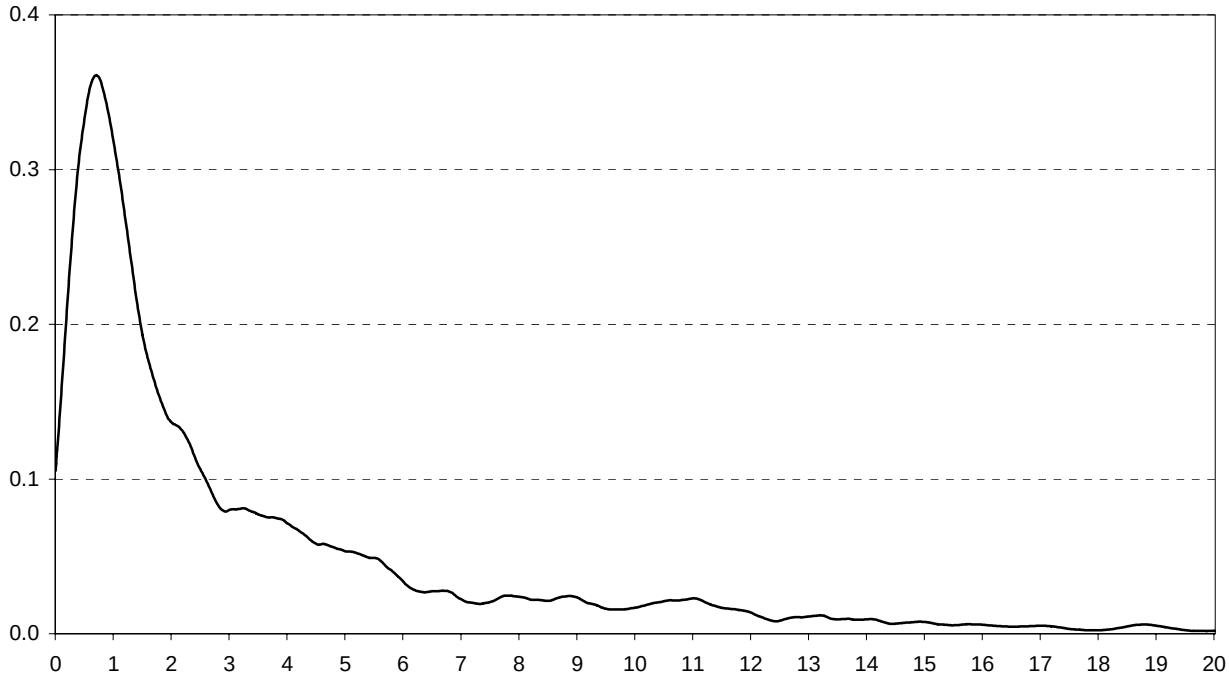
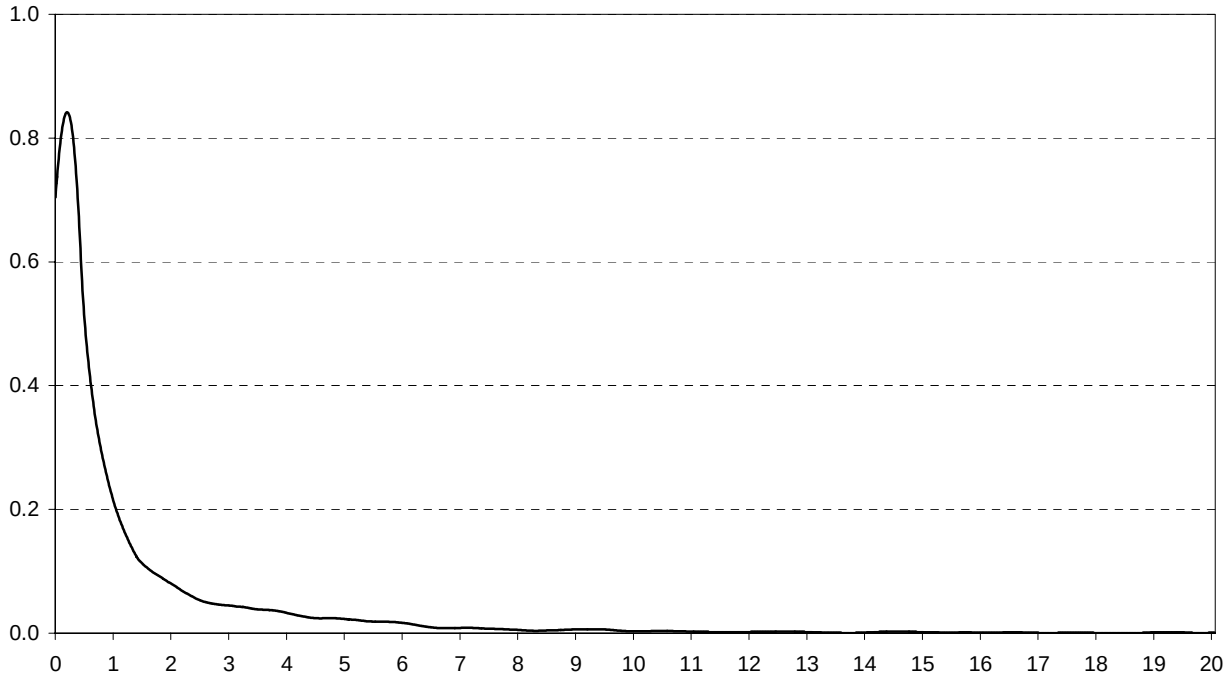



**Figure 7b. Kernel Density Estimate for Time between Consecutive Debt Deals**

The graph plots a kernel density estimate using an Epanechnikov kernel with bandwidth = 0.2 and $N$ = 3,000, of the time in years between any two debt deals that a U.S. issuing firm ranked among the ten largest in its four-digit industry completes between 1970 and 2003. For the purpose of the graph (but not the kernel estimation), times longer than 20 years are not shown.



## Table I. The Sample of Capital-raising Transactions

Thompson Financial's Securities Data Corporation reports 54,659 capital-raising transactions completed between January 1970 and December 2003, after excluding non-underwritten issues; transactions by firms classified as SIC 6000-6999 (financial institutions, etc.) and SIC 9000-9999 (government agencies, etc.); and offerings by non-U.S. corporations. The sample used in the econometric analyses imposes three additional filters. First, because we require five years of data to establish prior relationships with rivals, the econometric models use data from 1975 onwards. Second, we require that each deal was lead-managed by one of the 50 largest underwriters active that year. Third, we focus on the ten largest firms (by Compustat net sales) in each four-digit SIC industry and ignore transactions involving smaller firms. In some specifications, we split the sample in 1990. All currency amounts are in 1996 constant dollars, deflated using the quarterly GNP deflator.

| | 1970 - 2003 | | | | Estimation sample (ten largest firms per industry) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1975 - 2003 | | 1975 - 1989 | | 1990 - 2003 | |
| | No. of deals | % of deals | Aggregate amount raised ($m, real) | % of amt. | No. of deals | Aggregate amount raised ($m, real) | No. of deals | Aggregate amount raised ($m, real) | No. of deals | Aggregate amount raised ($m, real) |
| **Equity** | | | | | | | | | | |
| Common stock | 19,388 | 35.5 | 1,244,409 | 24.4 | 5,012 | 570,972 | 2,240 | 126,844 | 2,772 | 444,128 |
| Private common | 2,579 | 4.7 | 63,488 | 1.2 | 260 | 11,199 | 87 | 4,220 | 173 | 6,979 |
| **Debt** | | | | | | | | | | |
| Non-convertible debt | 14,706 | 26.9 | 2,566,572 | 50.4 | 7,307 | 1,386,102 | 1,927 | 400,829 | 5,380 | 985,273 |
| Convertible debt | 1,458 | 2.7 | 177,474 | 3.5 | 609 | 97,286 | 396 | 39,772 | 213 | 57,514 |
| Private non-convertible debt | 12,248 | 22.4 | 764,347 | 15.0 | 3,741 | 261,637 | 1,877 | 148,959 | 1,864 | 112,678 |
| Private convertible debt | 481 | 0.9 | 11,162 | 0.2 | 77 | 3,397 | 46 | 1,432 | 31 | 1,965 |
| Non-convertible preferred | 1,288 | 2.4 | 123,761 | 2.4 | 311 | 36,983 | 165 | 18,389 | 146 | 18,594 |
| Convertible preferred | 561 | 1.0 | 79,596 | 1.6 | 229 | 46,916 | 119 | 13,848 | 110 | 33,069 |
| Private non-convertible preferred | 747 | 1.4 | 22,337 | 0.4 | 78 | 3,776 | 52 | 2,305 | 26 | 1,471 |
| Private convertible preferred | 1,203 | 2.2 | 40,739 | 0.8 | 101 | 9,777 | 45 | 5,400 | 56 | 4,376 |
| **All deals** | 54,659 | 100.0 | 5,093,886 | 100.0 | 17,725 | 2,428,044 | 6,954 | 761,998 | 10,771 | 1,666,045 |

## Table II. Descriptive Statistics

The unit of observation is a bank-deal pair. The estimation dataset consists of 5,272 equity deals and 12,453 debt deals completed by firms ranked among the ten largest in their four-digit SIC industries (based on Compustat net sales) between 1975 and 2003, for each of which the 50 largest banks are deemed to compete to become lead manager (except where fewer than 50 banks were active in the market at the time). This gives a sample of 262,580 bank-deal pairs for equity and 610,500 for debt. The columns headed 'winning banks' refer to the bank-deal pairs involving banks that were awarded lead-management assignments, while the columns headed 'losing banks' refer to the bank-deal pairs involving banks that were eligible to compete for but were not chosen as lead manager. Note that some deals have more than one lead manager, and so the number of winning banks exceeds the number of deals. For each bank-deal pair, we report the main explanatory variables used in the econometric models. A candidate bank's prior relationships with the issuing company and with the issuing company's product market rivals are based on their joint capital raising histories before the deal in question. The loyalty index measures how often a bank retains its underwriting clients in consecutive deals. To measure a candidate bank's position in the network of syndicate banks, we compute *indegree* (the number of unique banks it has syndicated with in the prior calendar year, normalized by the number of possible syndication partners) and *eigenvector* centrality (a recursive measure of indegree that weights syndication ties by how well networked each syndication partner is). A bank's industry expertise is proxied by the combined product market share of its clients in the same SIC4 industry as the issuer, at the time of the deal. The last column provides *t*-tests of differences in means/fractions comparing winning to losing banks.

**Continued over**

## Table II. Descriptive Statistics (Continued)

| | Winning banks | | Losing banks | | |
|---|---|---|---|---|---|
| | Mean or fraction | St.dev. | Mean or fraction | St.dev. | *t*-test |
| **Panel A: Equity Transactions** | N=5,694 | | N=256,886 | | |
| **Bank-firm relationships (lead)** | | | | | |
| bank's share of firm's debt deals as lead prior 4 quarters (%) | 6.5 | 22.9 | 0.2 | 3.6 | 95.6 |
| bank's share of firm's equity deals as lead prior 4 quarters (%) | 13.0 | 32.6 | 0.1 | 3.4 | 165.1 |
| **Bank-firm relationships (co-manager)** | | | | | |
| bank's share of firm's debt deals as co-manager prior 4 quarters (%) | 0.8 | 6.9 | 0.1 | 2.3 | 22.0 |
| bank's share of firm's eq. deals as co-manager prior 4 quarters (%) | 1.2 | 9.0 | 0.2 | 3.6 | 19.8 |
| **Bank-rival relationships** | | | | | |
| =1 if bank has ≥1 clients among 3 largest firms in industry (%) | 5.5 | | 1.6 | | 22.4 |
| =1 if bank has ≥1 clients among the 4-10 largest firms in ind. (%) | 8.8 | | 2.7 | | 27.5 |
| **Bank characteristics** | | | | | |
| bank's equity market share in prior calendar year (%) | 6.0 | 6.2 | 1.8 | 3.9 | 79.2 |
| bank's debt market share in prior calendar year (%) | 6.0 | 6.0 | 1.8 | 3.9 | 79.7 |
| bank's *indegree* centrality | 4.6 | 2.6 | 2.8 | 2.6 | 52.6 |
| bank's *eigenvector* centrality | 26.4 | 12.2 | 13.7 | 12.8 | 73.9 |
| bank's industry expertise (%) | 12.0 | 20.0 | 1.6 | 8.1 | 90.8 |
| bank's loyalty (%) | 61.4 | 21.8 | 44.0 | 35.1 | 37.2 |
| =1 if bank involved in merger (%) | 8.4 | | 5.3 | | 10.5 |
| abs(deal size – bank's mean deal size in prior calendar year) ($m) | 95.5 | 339.2 | 95.8 | 271.4 | -0.1 |
| **Panel B: Debt Transactions** | N=13,861 | | N=596,639 | | |
| **Bank-firm relationships (lead)** | | | | | |
| bank's share of firm's debt deals as lead prior 4 quarters (%) | 17.8 | 32.6 | 0.8 | 6.9 | 236.9 |
| bank's share of firm's equity deals as lead prior 4 quarters (%) | 4.2 | 19.3 | 0.2 | 4.5 | 86.9 |
| **Bank-firm relationships (co-manager)** | | | | | |
| bank's share of firm's debt deals as co-manager prior 4 quarters (%) | 3.0 | 11.6 | 0.4 | 3.7 | 77.1 |
| bank's share of firm's eq. deals as co-manager prior 4 quarters (%) | 1.0 | 8.3 | 0.2 | 2.8 | 34.4 |
| **Bank-rival relationships** | | | | | |
| =1 if bank has ≥1 clients among 3 largest firms in industry (%) | 23.6 | | 6.1 | | 82.4 |
| =1 if bank has ≥1 clients among the 4-10 largest firms in ind. (%) | 21.9 | | 5.7 | | 79.1 |
| **Bank characteristics** | | | | | |
| bank's equity market share in prior calendar year (%) | 6.7 | 6.7 | 1.7 | 3.9 | 143.0 |
| bank's debt market share in prior calendar year (%) | 7.9 | 5.9 | 1.9 | 3.8 | 182.4 |
| bank's *indegree* centrality | 8.7 | 4.0 | 4.2 | 4.3 | 122.5 |
| bank's *eigenvector* centrality | 30.2 | 13.0 | 12.7 | 13.8 | 147.9 |
| bank's industry expertise (%) | 22.3 | 24.6 | 3.3 | 11.2 | 190.7 |
| bank's loyalty (%) | 49.1 | 15.8 | 33.2 | 30.9 | 60.2 |
| =1 if bank involved in merger (%) | 9.6 | | 6.8 | | 13.1 |
| abs(deal size – bank's mean deal size in prior calendar year) ($m) | 128.3 | 253.2 | 121.6 | 210.7 | 3.7 |

## Table III. Lead Manager Choice – Equity

We estimate the probability that a given bank is chosen to lead-manage a particular securities transaction. We focus on deals involving a firm ranked among the ten largest by Compustat net sales in its four-digit SIC industry that year, and treat the 50 largest equity underwriters by market share that year as being in competition for each deal. (Note there were only 35 banks active in equity underwriting in 1975.) The dependent variable equals 1 if the bank won the lead-management mandate, and 0 otherwise. There are 15,475 equity deals during the sample period 1975-2003, of which 5,272 involve a top 10 firm in column (1). In columns (2) and (3) we split the sample period in 1990. The models are estimated using probit. Intercepts are not shown. Heteroskedasticity-consistent standard errors (which are clustered on deal id) are shown in italics. We use $^{***}$, $^{**}$, and $^{*}$ to denote significance at the 0.1%, 1%, and 5% level (two-sided), respectively.

| | Equity transactions | | |
|---|---|---|---|
| | 1975-2003 | 1975-1989 | 1990-2003 |
| | (1) | (2) | (3) |
| **Bank-rival relationships** | | | |
| =1 if bank has one or more clients among the three largest firms in industry | -0.139*** | -0.284*** | -0.097* |
| | *0.036* | *0.064* | *0.043* |
| =1 if bank has one or more clients among the 4-10 largest firms in industry | 0.142*** | 0.059 | 0.153*** |
| | *0.027* | *0.047* | *0.033* |
| **Bank-firm relationships (lead)** | | | |
| bank's share of firm's debt deals as lead in prior four quarters | 1.342*** | 1.567*** | 1.125*** |
| | *0.069* | *0.096* | *0.101* |
| bank's share of firm's equity deals as lead in prior four quarters | 2.206*** | 2.011*** | 2.298*** |
| | *0.053* | *0.088* | *0.066* |
| **Bank-firm relationships (co-manager)** | | | |
| bank's share of firm's debt deals as co-manager in prior four quarters | 0.604*** | 0.524* | 0.781*** |
| | *0.152* | *0.218* | *0.205* |
| bank's share of firm's equity deals as co-manager in prior four quarters | 0.646*** | 0.592*** | 0.663*** |
| | *0.095* | *0.164* | *0.115* |
| **Bank characteristics** | | | |
| bank's equity market share in prior calendar year | 2.015*** | 0.878*** | 3.409*** |
| | *0.166* | *0.248* | *0.338* |
| bank's debt market share in prior calendar year | 2.339*** | 1.998*** | 1.437*** |
| | *0.168* | *0.240* | *0.298* |
| bank's *indegree* centrality | 4.399*** | 0.027 | 3.989*** |
| | *0.278* | *1.593* | *0.384* |
| bank's *eigenvector* centrality | 1.470*** | 1.323*** | 1.984*** |
| | *0.062* | *0.083* | *0.107* |
| bank's industry expertise | 1.038*** | 1.313*** | 0.835*** |
| | *0.049* | *0.088* | *0.058* |
| bank's loyalty | 0.276*** | 0.203*** | 0.377*** |
| | *0.022* | *0.031* | *0.034* |
| =1 if bank involved in merger | 0.099* | -0.046 | 0.171*** |
| | *0.039* | *0.073* | *0.048* |
| *ln* abs(deal size – bank's mean deal size in prior calendar year) | -0.121*** | -0.169*** | -0.109*** |
| | *0.005* | *0.008* | *0.006* |
| **Diagnostics** | | | |
| Pseudo $R^2$ | 21.6 % | 19.3 % | 24.4 % |
| Wald test: all coefficients = 0 ($\chi^2$) | 9,878*** | 3,576*** | 6,320*** |
| No. of equity transactions | 5,272 | 2,327 | 2,945 |

## Table IV. Lead Manager Choice – Debt

We estimate the probability that a given bank is chosen to lead-manage a particular securities transaction. We focus on deals involving a firm ranked among the ten largest by Compustat net sales in its four-digit SIC industry that year, and treat the 50 largest debt underwriters by market share that year as being in competition for each deal. (Note there were fewer than 50 banks active in debt underwriting in 1975-1980 and in 2002.) The dependent variable equals 1 if the bank won the lead-management mandate, and 0 otherwise. There are 29,674 debt deals during the sample period 1975-2003, of which 12,453 involve a top 10 firm in column (1). In columns (2) and (3) we split the sample period in 1990. The models are estimated using probit. Intercepts are not shown. Heteroskedasticity-consistent standard errors (which are clustered on deal id) are shown in italics. We use $^{***}$, $^{**}$, and $^{*}$ to denote significance at the 0.1%, 1%, and 5% level (two-sided), respectively.

| | Debt transactions | | |
|---|---|---|---|
| | 1975-2003 | 1975-1989 | 1990-2003 |
| | (1) | (2) | (3) |
| **Bank-rival relationships** | | | |
| =1 if bank has one or more clients among the three largest firms in industry | -0.160$^{***}$ | -0.180$^{***}$ | -0.160$^{***}$ |
| | *0.013* | *0.023* | *0.017* |
| =1 if bank has one or more clients among the 4-10 largest firms in industry | 0.102$^{***}$ | 0.084$^{***}$ | 0.097$^{***}$ |
| | *0.012* | *0.021* | *0.014* |
| **Bank-firm relationships (lead)** | | | |
| bank's share of firm's debt deals as lead in prior four quarters | 1.419$^{***}$ | 1.450$^{***}$ | 1.371$^{***}$ |
| | *0.024* | *0.038* | *0.031* |
| bank's share of firm's equity deals as lead in prior four quarters | 0.697$^{***}$ | 0.770$^{***}$ | 0.649$^{***}$ |
| | *0.039* | *0.060* | *0.052* |
| **Bank-firm relationships (co-manager)** | | | |
| bank's share of firm's debt deals as co-manager in prior four quarters | 0.994$^{***}$ | 0.666$^{***}$ | 1.163$^{***}$ |
| | *0.049* | *0.090* | *0.060* |
| bank's share of firm's equity deals as co-manager in prior four quarters | 0.406$^{***}$ | 0.502$^{***}$ | 0.373$^{***}$ |
| | *0.083* | *0.125* | *0.111* |
| **Bank characteristics** | | | |
| bank's equity market share in prior calendar year | -0.264$^{*}$ | 0.101 | -1.069$^{***}$ |
| | *0.107* | *0.132* | *0.183* |
| bank's debt market share in prior calendar year | 4.120$^{***}$ | 3.303$^{***}$ | 4.899$^{***}$ |
| | *0.125* | *0.173* | *0.209* |
| bank's *indegree* centrality | 3.237$^{***}$ | 0.749$^{**}$ | 4.186$^{***}$ |
| | *0.138* | *0.266* | *0.157* |
| bank's *eigenvector* centrality | 1.343$^{***}$ | 0.998$^{***}$ | 1.683$^{***}$ |
| | *0.046* | *0.067* | *0.065* |
| bank's industry expertise | 1.117$^{***}$ | 1.502$^{***}$ | 0.973$^{***}$ |
| | *0.025* | *0.052* | *0.028* |
| bank's loyalty | 0.341$^{***}$ | 0.332$^{***}$ | 0.386$^{***}$ |
| | *0.015* | *0.025* | *0.019* |
| =1 if bank involved in merger | 0.066$^{**}$ | -0.137$^{*}$ | 0.104$^{***}$ |
| | *0.024* | *0.065* | *0.027* |
| *ln* abs(deal size – bank's mean deal size in prior calendar year) | -0.062$^{***}$ | -0.099$^{***}$ | -0.049$^{***}$ |
| | *0.003* | *0.005* | *0.004* |
| **Diagnostics** | | | |
| Pseudo $R^2$ | 24.9 % | 23.6 % | 26.1 % |
| Wald test: all coefficients = 0 ($\chi^2$) | 34,148$^{***}$ | 10,661$^{***}$ | 23,309$^{***}$ |
| No. of debt transactions | 12,453 | 4,627 | 7,826 |

## Table V. Lead Manager Choice – Issuer and Issue Characteristics

As in Tables III and IV, we estimate the probability that a given bank is chosen to lead-manage a particular securities transaction. We include three separate interaction terms crossing the indicator variable identifying banks that have one or more clients among the three largest firms in the industry with: i) the issuer's log cumulative amount raised in equity (col. (1)) or debt (col. (2)) securities offerings over the five years preceding the transaction in question; ii) a Herfindahl measure of industry concentration computed from annual Compustat net sales data; or iii) an indicator identifying high-yield bond issues (those rated as high-yield at issue by at least one of the three rating agencies with NRSRO designation). To conserve space, we report only the coefficients of interest. The models are estimated using probit. Heteroskedasticity-consistent standard errors (which are clustered on deal id) are shown in italics. We use $^{***}$, $^{**}$, and $^{*}$ to denote significance at the 0.1%, 1%, and 5% level (two-sided), respectively.

| | Equity (1) | Debt (2) |
|---|---|---|
| **Frequent issuers** | | |
| =1 if bank has one or more clients among the three largest firms in industry | -0.028 | -0.062$^{*}$ |
| | *0.044* | *0.029* |
| x *ln* cumulative amount raised in prior five years | -0.055$^{***}$ | -0.015$^{***}$ |
| | *0.014* | *0.004* |
| **Industry concentration** | | |
| =1 if bank has one or more clients among the three largest firms in industry | -0.017 | -0.060$^{***}$ |
| | *0.057* | *0.015* |
| x annual Herfindahl index of industry concentration | -0.500$^{**}$ | -0.664$^{***}$ |
| | *0.188* | *0.069* |
| **High-yield vs. investment grade bonds** | | |
| =1 if bank has one or more clients among the three largest firms in industry | | -0.163$^{***}$ |
| | | *0.014* |
| x Dummy = 1 if the bond issue is rated high-yield | | 0.033 |
| | | *0.030* |
| **High-yield vs. investment grade bonds** | | |
| =1 if bank has one or more clients among the three largest firms in industry | | -0.145$^{***}$ |
| | | *0.014* |
| x Dummy = 1 if the bond issue is rated high-yield | | -0.166$^{***}$ |
| | | *0.047* |
| bank's industry expertise | | 1.069$^{***}$ |
| | | *0.025* |
| x Dummy = 1 if the bond issue is rated high-yield | | 0.493$^{***}$ |
| | | *0.075* |

## Table VI. Lead Manager Switches Following Bank Mergers

We estimate the probability that an issuing company switches lead managers in consecutive equity or debt deals. A switch is defined as an equity (debt) issuer hiring as lead manager any bank other than the lead manager of its most recent equity (debt) deal (or, if that bank has since been acquired, its successor). In the case of multiple lead managers on a deal, we code as a switch any failure to retain every lead manager from the previous deal. We focus on deals involving a firm ranked among the ten largest by Compustat net sales in its four-digit SIC industry that year. All bank variables refer to characteristics of the lead manager in the previous deal measured as of the time of the current deal. The models are estimated using probit. Intercepts are not shown. Heteroskedasticity-consistent standard errors are shown in italics. We use $^{***}$, $^{**}$, and $^{*}$ to denote significance at the 0.1%, 1%, and 5% level (two-sided), respectively.

| | Equity | | Debt | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Mergers and merger partner's rival relationships** | | | | |
| =1 if bank involved in merger since previous deal but merger partner has no rival relationships | 0.036 | | 0.026 | |
| | *0.068* | | *0.054* | |
| =1 if since previous deal, bank has merged with another bank that has one or more clients among 3 largest firms in issuer's industry | 1.026$^{*}$ | 0.983$^{*}$ | 0.201 | -0.006 |
| | *0.500* | *0.494* | *0.278* | *0.290* |
| =1 if since previous deal, bank has merged with another bank that has one or more clients among 4-10 largest firms in issuer's industry | 0.234 | 0.174 | 0.130 | 0.052 |
| | *0.269* | *0.285* | *0.265* | *0.246* |
| **Bank-firm relationships (lead)** | | | | |
| bank's share of firm's debt deals as lead in prior four quarters | -0.373$^{***}$ | -1.077$^{**}$ | -0.496$^{***}$ | 0.159 |
| | *0.103* | *0.345* | *0.035* | *0.164* |
| bank's share of firm's equity deals as lead in prior four quarters | -0.359$^{***}$ | -0.575$^{*}$ | -0.175$^{**}$ | 0.099 |
| | *0.071* | *0.252* | *0.068* | *0.399* |
| **Bank-firm relationships (co-manager)** | | | | |
| bank's share of firm's debt deals as co-manager in prior four quarters | 0.993$^{**}$ | -1.822 | -0.082 | 0.590 |
| | *0.385* | *0.980* | *0.154* | *1.670* |
| bank's share of firm's equity deals as co-manager in prior four quarters | 0.608 | -0.225 | 0.186 | -0.143 |
| | *0.560* | *1.523* | *0.157* | *1.202* |
| **Bank characteristics** | | | | |
| bank's equity market share in prior calendar year | -0.190 | -1.305 | -0.051 | 0.088 |
| | *0.640* | *1.658* | *0.253* | *1.174* |
| bank's debt market share in prior calendar year | -1.568$^{*}$ | -1.583 | -1.253$^{***}$ | -1.526 |
| | *0.662* | *1.596* | *0.355* | *1.334* |
| bank's *indegree* centrality | 0.782 | -2.468 | -1.235$^{*}$ | -0.650 |
| | *1.274* | *2.668* | *0.505* | *1.933* |
| bank's *eigenvector* centrality | -0.867$^{***}$ | -0.810 | 0.035 | -1.059 |
| | *0.251* | *0.619* | *0.188* | *0.766* |
| bank's industry expertise | 0.093 | -0.419 | 0.043 | 0.113 |
| | *0.119* | *0.254* | *0.055* | *0.186* |
| bank's loyalty | -1.026$^{***}$ | -0.850$^{**}$ | -0.797$^{***}$ | -1.182$^{***}$ |
| | *0.107* | *0.314* | *0.092* | *0.332* |
| *ln* abs(deal size – bank's mean deal size in prior calendar year) | 0.023 | 0.107$^{*}$ | 0.026$^{*}$ | 0.016 |
| | *0.018* | *0.043* | *0.010* | *0.033* |
| **Time since previous deal** | | | | |
| *ln* (1+ years since previous deal) | 0.399$^{***}$ | 0.396$^{***}$ | -0.057$^{*}$ | 0.431$^{***}$ |
| | *0.048* | *0.093* | *0.026* | *0.080* |
| **Diagnostics** | | | | |
| Pseudo $R^2$ | 15.4 % | 14.8 % | 3.4 % | 6.7 % |
| Wald test: all coefficients = 0 ($\chi^2$) | 591.9$^{***}$ | 121.7$^{***}$ | 393.9$^{***}$ | 72.1$^{***}$ |
| No. of observations | 3,177 | 630 | 9,393 | 848 |

## Table VII. Lead Manager Choice Following Rival Client Switches

The models shown here are identical in every respect to the specifications shown in Tables III and IV, except that we split the effect of rival relationships into those that are active as of the time of the deal in question and those that are inactive. We consider three definitions of active and inactive. The first (labeled "mergers" in the table) considers a candidate bank's rival client to be inactive if it has been acquired by another firm at some point in the five years preceding the deal in question (based on CRSP delisting codes 200 and 300). The second and third (labeled "switches" in the table) consider a candidate bank's rival client to be inactive if the firm has awarded no underwriting business to the bank for five or three years, respectively. We assume the bank's information about the rival client to decay following a switch, and so code the bank as having an inactive rival client for only one year following the switch (i.e., years 6 and 4, respectively). Beyond that, the bank is coded as no longer having a rival client (active or inactive). Choosing a bank that has an active rival client runs the risk of information disclosure to one of the issuer's product-market competitors, though there are two potential offsetting benefits in the form of the bank having greater industry expertise or disclosing information about the rival client to the issuer. Choosing a bank that has an inactive rival client runs no corresponding risk but still offers both potential benefits. Therefore, the difference between the coefficients estimated for active and inactive rival clients isolates the effect of concerns about information disclosure to rival firms on lead manager choice. The models are estimated using probit, separately for equity and debt transactions, and for the entire sample period (Panel A) as well as split in 1990 (Panels B and C). To conserve space, we report only the coefficients estimated for active and inactive rival relationships, and the difference between the two (as a measure of the net effect of concerns about information disclosure). Heteroskedasticity-consistent standard errors (which are clustered on deal id) are shown in italics. The standard errors for the difference between each pair of coefficients are calculated using the delta method. We also report marginal effects (denoted dF/dx); for comparison, the unconditional likelihood of a bank becoming lead manager is about 2.2%. For the number of observations used in each specification, see Tables III and IV. We use $^{***}$, $^{**}$, and $^{*}$ to denote significance at the 0.1%, 1%, and 5% level (two-sided), respectively.

| | **Equity Transactions** | | | | | | **Debt Transactions** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mergers | | Switches (T=5) | | Switches (T=3) | | Mergers | | Switches (T=5) | | Switches (T=3) | |
| | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx |
| **Panel A: 1975-2003** | | | | | | | | | | | | |
| = 1 if bank has active top 3 rival | -0.131$^{***}$ | -0.003 | -0.115$^{***}$ | -0.003 | -0.087$^{*}$ | -0.002 | -0.166$^{***}$ | -0.004 | -0.164$^{***}$ | -0.004 | -0.118$^{***}$ | -0.003 |
| | *0.036* | | *0.036* | | *0.040* | | *0.014* | | *0.014* | | *0.014* | |
| = 1 if bank has inactive top 3 rival | 0.255 | 0.010 | 0.295$^{**}$ | 0.012 | 0.273$^{***}$ | 0.011 | -0.148 | -0.003 | 0.729$^{***}$ | 0.044 | 0.368$^{***}$ | 0.015 |
| | *0.158* | | *0.098* | | *0.074* | | *0.112* | | *0.074* | | *0.052* | |
| Difference | -0.386$^{*}$ | -0.013 | -0.409$^{***}$ | -0.015 | -0.359$^{***}$ | -0.013 | -0.019 | 0.000 | -0.894$^{***}$ | -0.048 | -0.487$^{***}$ | -0.018 |
| | *0.162* | | *0.104* | | *0.082* | | *0.112* | | *0.076* | | *0.053* | |
| = 1 if bank has active top 4-10 rival | 0.176$^{***}$ | 0.006 | 0.174$^{***}$ | 0.006 | 0.166$^{***}$ | 0.006 | 0.111$^{***}$ | 0.003 | 0.119$^{***}$ | 0.004 | 0.113$^{***}$ | 0.003 |
| | *0.027* | | *0.027* | | *0.030* | | *0.012* | | *0.012* | | *0.012* | |
| = 1 if bank has inactive top 4-10 rival | 0.213$^{*}$ | 0.008 | 0.369$^{***}$ | 0.016 | 0.396$^{***}$ | 0.018 | 0.316$^{***}$ | 0.012 | 0.221$^{**}$ | 0.007 | 0.309$^{***}$ | 0.012 |
| | *0.109* | | *0.079* | | *0.059* | | *0.071* | | *0.079* | | *0.051* | |
| Difference | -0.036 | -0.002 | -0.195$^{*}$ | -0.010 | -0.230$^{***}$ | -0.012 | -0.205$^{**}$ | -0.009 | -0.103 | -0.004 | -0.196$^{***}$ | -0.008 |
| | *0.113* | | *0.085* | | *0.067* | | *0.071* | | *0.081* | | *0.053* | |

**Continued over**

## Table VII. Lead Manager Choice Following Rival Client Switches (Continued)

| | Equity Transactions | | | | | | Debt Transactions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mergers | | Switches (T=5) | | Switches (T=3) | | Mergers | | Switches (T=5) | | Switches (T=3) | |
| | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx | Coeff. *s.e.* | dF/dx |
| **Panel B: 1975-1989** | | | | | | | | | | | | |
| = 1 if bank has active top 3 rival | -0.234*** | -0.006 | -0.233*** | -0.006 | -0.188** | -0.005 | -0.171*** | -0.004 | -0.174*** | -0.004 | -0.089*** | -0.002 |
| | *0.064* | | *0.064* | | *0.070* | | *0.023* | | *0.023* | | *0.023* | |
| = 1 if bank has inactive top 3 rival | -0.220 | -0.005 | 0.250 | 0.010 | 0.389*** | 0.019 | -0.319 | -0.006 | 0.844*** | 0.060 | 0.555*** | 0.029 |
| | *0.469* | | *0.175* | | *0.115* | | *0.192* | | *0.131* | | *0.095* | |
| Difference | -0.014 | 0.000 | -0.483** | -0.016 | -0.578*** | -0.023 | 0.147 | 0.002 | -1.018*** | -0.064 | -0.644*** | -0.031 |
| | *0.473* | | *0.186* | | *0.129* | | *0.192* | | *0.132* | | *0.095* | |
| = 1 if bank has active top 4-10 rival | 0.079 | 0.003 | 0.096* | 0.003 | 0.122* | 0.004 | 0.074*** | 0.002 | 0.089*** | 0.003 | 0.057* | 0.002 |
| | *0.045* | | *0.045* | | *0.050* | | *0.021* | | *0.021* | | *0.023* | |
| = 1 if bank has inactive top 4-10 rival | 0.515** | 0.029 | 0.391** | 0.019 | 0.372*** | 0.018 | 0.274* | 0.010 | 0.224 | -0.008 | 0.579*** | -0.031 |
| | *0.178* | | *0.134* | | *0.089* | | *0.120* | | *0.153* | | *0.082* | |
| Difference | -0.436* | -0.026 | -0.295* | -0.016 | -0.250* | -0.013 | -0.200 | -0.008 | -0.134 | -0.005 | -0.523*** | -0.029 |
| | *0.184* | | *0.142* | | *0.104* | | *0.121* | | *0.154* | | *0.085* | |
| **Panel C: 1990-2003** | | | | | | | | | | | | |
| = 1 if bank has active top 3 rival | -0.105* | -0.002 | -0.085* | -0.002 | -0.058 | -0.001 | -0.177*** | -0.004 | -0.173*** | -0.004 | -0.143*** | -0.003 |
| | *0.044* | | *0.043* | | *0.048* | | *0.017* | | *0.017* | | *0.017* | |
| = 1 if bank has inactive top 3 rival | 0.289 | 0.010 | 0.271* | 0.009 | 0.152 | 0.005 | -0.129 | -0.003 | 0.640*** | 0.033 | 0.255*** | 0.008 |
| | *0.167* | | *0.118* | | *0.098* | | *0.139* | | *0.090* | | *0.064* | |
| Difference | -0.393* | -0.013 | -0.356** | -0.011 | -0.210* | -0.006 | -0.048 | -0.001 | -0.813*** | -0.037 | -0.398*** | -0.011 |
| | *0.173* | | *0.125* | | *0.107* | | *0.139* | | *0.092* | | *0.066* | |
| = 1 if bank has active top 4-10 rival | 0.207*** | 0.007 | 0.193*** | 0.006 | 0.168*** | 0.005 | 0.118*** | 0.003 | 0.122*** | 0.003 | 0.124*** | 0.003 |
| | *0.034* | | *0.033* | | *0.037* | | *0.014* | | *0.014* | | *0.015* | |
| = 1 if bank has inactive top 4-10 rival | 0.008 | 0.000 | 0.323*** | 0.012 | 0.390*** | 0.016 | 0.330*** | 0.012 | 0.222* | 0.007 | 0.177** | 0.005 |
| | *0.140* | | *0.099* | | *0.078* | | *0.087* | | *0.093* | | *0.066* | |
| Difference | 0.198 | 0.006 | -0.130 | -0.006 | -0.223* | -0.010 | -0.212* | -0.009 | -0.101 | -0.004 | -0.053 | -0.002 |
| | *0.146* | | *0.107* | | *0.088* | | *0.087* | | *0.095* | | *0.068* | |