# ESSAYS ON THE ROLE OF PEER NETWORKS IN INVESTMENT BANKING

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# ESSAYS ON THE ROLE OF PEER NETWORKS IN INVESTMENT BANKING

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To my parents and my sister

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# SUMMARY

The following series of three essays examine the impact of peer networks of investment banks, including those commercial banks that recently entered security underwriting, on investment banking activities. Specifically, I focus on underwriter and financial advisor peer networks in security underwriting and mergers and acquisitions advisory services, and examine how the structure of these peer networks affects the performance of initial public offerings, the shareholders' wealth in mergers and acquisitions, and the market share of underwriters. The results indicate that the peer relations of underwriters and advisors have significant implications along various dimensions.

# CHAPTER 1

# INTRODUCTION

Investment banking is a knowledge- and information-based industry. Despite the changes in the industry and the recent switch towards the universal banking model, investment banking remains a relationship-intensive business. Two major functional roles of investment banks are underwriters in security issuance and financial advisors in mergers and acquisitions (M&A). Recently, commercial banks have joined the ranks of investments banks and entered security underwriting.

Investment banks, including those commercial banks that entered security underwriting, maintain relationships with each other from their cooperation in various investment banking activities. These peer relationships represent important channels of information and resources. Moreover, the structure of investment bank peer networks may vary along various dimensions, such as size and diversity, and the different characteristics of the networks should have implications for the quantity and quality of information and resources that flow through the networks. Hence, we expect significant consequences from investment bank peer networks. However, in the finance literature, we know very little about the effects of such networks. Thus, this dissertation research studies the effects of underwriter and financial advisor peer networks.

Specifically, Chapter 2 examines how the structure of underwriter peer network affects IPO performance. Network analysis methodology is applied to construct underwriter network measures in this chapter. Our results show that underwriter networks have significant effects on IPO pricing and placement. Specifically, we find that IPOs underwritten by book managers with larger or more centrally located networks

are more likely to experience bigger offer price revisions, suggesting greater informational role of such networks. This likelihood also increases when the book manager networks are more homogeneous or more cohesive. The book managers with above network characteristics are also associated with higher short-run stock returns. Furthermore, the effects of book manager peer networks on the IPO outcomes are greater under certain firm characteristics and market conditions. However, we find no significant difference between the informational role of networks of commercial banks and investment banks. Overall, our results from this chapter show that the underwriters use their peer networks to generate information and place securities, and the structure of the networks has implications for the security issuance process.

Chapter 3 explores the impact of the working relationship between acquirer and target advisors that result from various investment banking activities on M&A shareholder wealth, by examining domestic M&A deals that employ advisors on both buy and sell sides. In this chapter, we use measures of relative dependence between pairs of advisors. Our results show that when the relative bargaining power of the target advisor in the relationship is greater than that of the acquirer advisor, the target premium, announcement return and share of the total wealth gain are higher, while the acquirer firm's share is lower, and vice versa. We also find evidence that despite the additional conflict of interest that can result from the advisor peer relationship, target firms are more likely to hire advisors that have previously worked with the acquirer advisor.

In Chapter 4, we study how the structure of underwriter peer network affects market share by using measures from social network analysis. We find that underwriters with extensive ties and advantageous network positions are more likely to win book

manager and co-manager appointments in security underwriting and capture higher future market shares, especially in equity underwriting, and this effect is also more pronounced for commercial bank underwriters. Moreover, underwriters that are further away from the given book manager in terms of social distance are less likely to be selected as co-managers in both equity and debt underwriting, although the effect is somewhat mitigated for commercial banks. We also find that investment banks are more likely to experience increased deal flows from homogenous networks, while commercial banks benefit from diverse networks. Overall, our results in this chapter not only show that the various aspects of underwriter peer networks affect underwriter market share in the U.S., but also indicate differences in the effects of peer network between equity and debt underwriting and between commercial bank and investment bank underwriters. To summarize, these three essays add to our knowledge of the role of social networks in the security issuance process and M&As.

# CHAPTER 2

# THE ROLE OF UNDERWRITER PEER NETWORKS IN IPOS

## 2.1. Introduction

Information production is one of the key functions of underwriters in equity underwriting. Information that is needed to price an initial public offering (IPO) is neither standardized nor entirely public. To produce price relevant information, underwriters utilize different sources and rely on various relationships. One such relationship is the underwriter's peer network. This paper studies how the peer networks of underwriters affect the IPOs they underwrite by using measures from social network analysis. We find that IPOs underwritten by book managers with larger or more centrally located networks are associated with a higher likelihood of offer price revision and higher post-issue stock returns, suggesting a potential role of peer network in price discovery in the primary market and distribution of securities. The above effect is also observed if the networks are denser, more reciprocated, or more homogeneous.

Despite the changes in the industry and the recent switch towards the universal banking model, investment banking remains a relationship-intensive business. In the finance literature, from the various underwriter relationships, an underwriter's relationship with client firms has received the most attention. For example, Schenone (2004) studies whether the existence of a pre-IPO banking relationship with the firm

affects IPO underpricing, and Yasuda (2005) examines the effect of banking relationships on the underwriter choice in the corporate bond market.[1] Certain aspects of underwriter-investor relationship have also been examined. For instance, using brokerage commission data of mutual fund families, Reuter (2006) documents that business relationships with lead underwriters increase investor access to underpriced IPOs.[2]

Research on an underwriter's relationship with its peers is mostly limited to studies addressing underwriting syndicates such as Corwin and Schultz (2005) and Pichler and Wilhelm (2001). There is an interesting aspect to an underwriter's relationships with its peers, however. Through these relationships, an underwriter can tap other underwriters' client and investor networks indirectly, thus reaching out to additional information and distribution channels. Although such a relationship can have significant effects, specifically in an IPO setting, it remains rather unexplored in the literature. The goal of this paper is to develop a better understanding of the role and function of underwriter peer relationships in the security underwriting process.

Ties with other underwriters represent channels through which valuable information about the overall market condition, the issuer, and the institutional investor's reaction, flows. Networks can also serve a marketing purpose by generating greater investor demand for the issue. The structure of underwriter networks may vary, and the different characteristics of the networks should have implications for the volume,

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[1] See Ang and Zhang (2006), Burch, Nanda, and Warther (2005), Fernando, Gatchev, and Spindt (2005), and Ongena and Smith (2001) for more works on underwriter-firm relationship.

[2] See also Cornelli and Goldreich (2001), Sherman (2000), Binay, Gatchev, and Pirinsky (2007) for more studies on underwriter-investor relationship.

diversity, and richness of information that travel through the networks and subsequently affect the IPOs. For instance, underwriters that maintain ties to a large number of well-connected partners can receive greater information flow, or cohesive networks may be more conducive for information transmission.

Overall, underwriters with certain network capabilities should be able to produce more price relevant information and resolve most of the uncertainty surrounding an IPO earlier in the underwriting process. However, the role of a specific network characteristic can depend on the nature of information that is relevant to IPO underwriting. The impact of peer network on IPOs may also be contingent on certain factors such as the market condition and the firm-specific information asymmetry. With the entry of commercial banks into underwriting, it is also possible that commercial banks and investment banks utilize their peer networks differently to generate information. Finally, the networks formed in the equity underwriting market may be more informative than those formed in debt underwriting. These networks of peer relationships represent informal information markets for underwriters and to some extent, their social capital.

We explore the impact of underwriter peer networks by constructing network measures using the ties that underwriters form with each other when they work together in the syndicates of public equity and debt securities issued in the U.S. between 1970 and 2007. Network measures are constructed over moving four-year periods. To explore the informational role of peer network, we focus on equity IPOs because information asymmetry is likely to be higher in equity than debt issues, especially in the first public equity issuance. Specifically, we construct a set of network measures that capture the size (*degree*), position in the overall network (*closeness* and *betweenness*),

interconnectedness within individual underwriter networks *(reciprocity* and *density)* and heterogeneity (*tie, industry* and *geographical diversity*) of underwriter peer networks. Using these measures, we assess if the book manager's network characteristics affect offer price revision, underpricing, and post-issue stock return of IPOs.

Our results show that underwriter networks have significant effects on IPO pricing and placement. IPOs underwritten by book managers that are generally close to all other underwriters and occupy exclusive intermediary positions, maintain large, dense or homogenous peer networks are more likely to experience large offer price revisions. The book managers with such networks may receive more information. The results also show that dense and homogenous networks, rather than diverse networks, are more conducive to the flow of IPO relevant information. The book managers with large, more central and more homogenous networks are also associated with higher short-run stock returns, which can be due to both the marketing and informational role of the networks. However, after controlling for the offer price revision, the characteristics of the book manager network have no impact on IPO underpricing.

Furthermore, we find that book manager peer networks can have greater effect on the IPO outcomes contingent upon firm age or market condition. Networks and relationships formed among underwriters in the equity underwriting market are also somewhat more informative and significant than those formed in debt underwriting. However, we find no significant difference between the effects of the peer networks of commercial banks and investment banks. In general, the results indicate that the underwriters use their peer networks to produce information and place securities, and the structure of the networks has implications for these processes.

This study fits among the extensive literature on IPOs and the growing body of research on social networks in finance. Lately, interest in social networks has grown dramatically. For instance, Cohen, Frazzini, and Malloy (2007) focus on connections between fund managers and corporate board members via shared education networks.[3] Kirchmaier and Stathopoulos (2008) study the impact of CEO social networks on firm performance, while Hochberg, Ljungqvist, and Lu (2007a, 2007b) examine networks in venture capital industry. Other studies focus on the impact of informal networks on borrower terms (Garmaise and Moskowitz (2003)), mutual fund portfolio decisions (Gupta-Mukherjee (2007)), stock market participation (Hong, Kubik, and Stein (2004)), and portfolio choice (Massa and Simonov (2005)). Goldman, Rocholl, and So (2007) also examine political connections, and Kuhnen (2005) focuses on the relations between fund directors and advisory firms that manage the funds. Most of these studies use network measures based on geographical distance, shared educational or professional background.

Our contribution lies in illustrating the role of underwriter peer networks—another information channel—on issue outcomes. In doing so, we use network analysis methodology to capture underwriter networks and introduce these as additional underwriter characteristics. We also show that there are different aspects to peer networks and their effects differ. For example, the complex tacit information that is needed to price IPOs is shared among underwriters via homogenous networks. We also

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[3] An interested reader can consult Barnea and Guedj (2006), Wong and Gygax (2007), and Kramarz and Thesmar (2006) for more corporate board related studies.

show the contingent effects of these networks. To the best of our knowledge, no prior study in finance has examined the role of underwriter peer network as a determinant of issue outcomes. The results of this study add to our knowledge of how information is generated in IPO underwriting and how underwriters perform their intermediary function.

The remainder of the paper is organized as follows. Section 2.2 discusses the functions of underwriters and the role of their networks in IPOs in further detail. After introducing the network analysis methodology in Section 2.3, we describe the data and the descriptive statistics in Section 2.4. Section 2.5 presents the results of the impact of network on IPOs, and Section 2.6 concludes.

## 2.2. The role of networks in IPO underwriting

In equity underwriting, underwriters help firms raise equity capital. Particularly, underwriters perform a variety of duties: conduct due diligence research, prepare preliminary prospectus, file registration statements with the regulatory agency, organize road shows, value and distribute securities to investors, and provide aftermarket liquidity. Information production is at the heart of this process. Underwriters produce price relevant information and reduce information asymmetry between insiders and outsiders. As Chemmanur and Fulghieri (1994) show, underwriters care about information production and the securities they bring to market because their reputation depends on their deal history.

Previous research (e.g., Edelen and Kadlec (2005) and Lowry and Schwert (2004)) shows that both private and public information play a role in the underwriting

process. For example, Lowry and Schwert (2004) document that almost all public information is included in IPO pricing and it is the private information that drives IPO initial returns. According to Benveniste et al. (2002), IPO uncertainty has two main sources: (1) a factor common to all firms that share similar characteristics and (2) a firm specific factor. Therefore, generating firm information is not only useful in the subsequent deals with the same firm, but also in deals that involve other firms with similar characteristics.

Information, especially private information, flows via relationships. For instance, Cohen, Frazzini and Malloy (2007) find that information sharing occurs through the common educational ties between fund managers and board members. Asker and Ljungqvist (2008) also show that the major product market rival firms are not willing to share their underwriters for fear of information leakage.

For underwriters, who are information producers, information channels, therefore, should be of special interest. To produce price relevant information, underwriters rely on various relationships such as relationships with client firms, investors, and other underwriters. Pichler and Wilhelm (2001) consider an investment bank's information production capacity to be a function of investments in investor and client networks. Rajan and Petersen (1994) and James (1992) refer to durable bank-client relationships as "relationship specific capital" that can lower the cost of information production. The importance of building relationships with client firms and investors for underwriters has been emphasized in the finance literature. Research on peer relationships, on the other hand, is mostly limited to studies on underwriting syndicates.

Building and maintaining relationships, whether it is with firms or investors, is a time-consuming and costly process. Unless nurtured, relationships decay. Since it is costly to maintain relationships, Ang and Zhang (2006) document that firms maintain relationships with only 3-5 banks in the floating rate debt market. Institutional investors also value relationships with underwriters as evidenced by the survey of institutional investors' view on IPOs conducted by Jenkinson and Jones (2006). Given that investors are not likely to maintain long-term relationships with all the banks, to some extent, each bank's investor network is unique. Thus, through peer networks, underwriters can receive indirect feedback from valuable private information obtained by their peers through their various activities. Underwriters, in turn, share information with each other because they may need information in the future due to the repeated nature of the business.

Given that ties to other underwriters represent information and resource channels, the various characteristics of underwriter networks may have ramifications for the securities they underwrite. Networks, in general, display substantial heterogeneity in their structures. For example, some personal circles are denser and more close-knit than others. Similarly, underwriters' network characteristics are likely to vary. Different aspects of networks have implications for the volume, diversity, and richness of information that travel through these networks. For instance, all else being equal, those with large networks receive greater volume of information. Occupying a more central network location and maintaining ties to well-connected partners would also imply a greater access to a wide range of information. Cohesive networks characterized by extensive interconnections may be more conducive to information transmission, as

underwriters may be willing to cooperate and share substantial information only with whom they maintain close relationships.

As for the performance implications of network diversity and range, on one hand, having a diverse peer network can improve IPO performance because underwriters with heterogeneous peer networks can access information generated from different market segments, investor groups, and clienteles, which can greatly aid information production. On the other hand, network heterogeneity may also prove to be problematic since social and structural divisions may hinder effective cooperation. The relations based on similarity may be stronger than the relations that exist between dissimilar organizations. Strong relations, in turn, may affect the quality of the information and the amount of cooperative effort shared between underwriters. Despite the intuitive appeal of network heterogeneity, homogeneity in networks has been widely documented, especially in interpersonal networks. Homophily refers to the principle that contacts between similar people occur at a higher rate than among dissimilar people. Patterns of homophily are found to be remarkably robust across different types of relationships such as marriage, friendship, and acquaintance.[4]

Overall, underwriters with greater peer network capability should be able to produce more price relevant information. These underwriters may engage more actively in price discovery in the primary market and receive more information between the filing and offering dates resulting in a higher likelihood of price revision and a larger revision

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[4] See McPherson, Smith-Lovin, and Cook (2001) for a review of research on homophily.

when a revision occurs. In a related study, Wang and Yung (2008) find that more reputable underwriters reduce return variability in the secondary market. IPO underpricing, which is commonly considered to be a measure of information asymmetry and compensation to investors for revealing their demand information, may also be affected by underwriters' network capacity.

In addition to the function of uncovering information in security valuation, peer network can be used by underwriters to assist in the marketing of the securities. Underwriters market securities and provide price support in IPOs and SEOs. Cook et al. (2006) argue that the promotion of new securities is an important feature in security offerings and document a significant effect of issue publicity. An underwriter can contact its relationship investors to market a new equity offering. Underwriters can also spread the word about a security issue via their networks, which suggests that peer networks can serve marketing purposes by generating greater interest in the issue. Such indirect contacts are known to have significant economic consequences in many other areas, especially in the labor market. Effective promotion from underwriters that result in greater demand for the IPOs can explain some of the variation in the post-issue stock return, especially short-run return.

Furthermore, some aspects of peer network may have more impact on certain IPO outcomes than others. For instance, for information production, the interconnections among network members may matter as much as the size of the network. On the other hand, for marketing purposes, the network size may be more relevant in creating buzz surrounding issues. The role of certain network aspects can also depend on the type of information that is being transferred. For example, several previous studies (Hansen

(1999) and Reagans and McEvily (2003)) find that strong ties are more crucial in transferring tacit knowledge than codified knowledge.

The impact of peer network on IPOs may also be contingent upon certain firm specific and exogenous factors. For example, Pollock (2004) shows that an underwriter's ties to investors benefit the seller in a low demand and the buyer in a high demand environment. Gulati and Higgins (2003) document that the payoff from certain types of inter-organizational relationships for IPO firms depends on the market condition. Similarly, in our study, the role of network in IPOs may depend on the market condition. For instance, underwriters may need to utilize their networks more, when there is less information available in cold markets due to the low deal volume. The IPOs with higher information asymmetry, such as the IPOs in the so-called "soft information" industries that are heavily dependent on intangibles or the IPOs of relatively young firms, may also require underwriters to utilize their peer networks to greater extent.

The effects of peer networks of commercial banks and investment banks may differ as well. With the Section 20 exemption of Glass-Steagall Act and the subsequent repeal of the act, commercial banks have entered securities underwriting and managed to acquire significant market share. The consequences of commercial banks' entry into underwriting and the differences between these two types of underwriters have garnered substantial attention. Lack of established investor clientele and placement track record suggest that commercial banks may need to depend more heavily on peer networks for information production and distribution of IPOs. On the contrary, the role of peer network may be smaller for commercial banks if they can enhance their underwriter functions by information gathering from their commercial banking activities.

Finally, the information content of networks formed in equity and debt underwriting market may vary. For example, Burch, Nanda, and Warther (2005) document that the relationship capital is built through loyalty in equity underwriting, but it is not as valuable in debt underwriting. Asker and Ljungqvist (2008) also find that the debt underwriting relationships are less exclusive. Thus, it is possible that the ties that are forged in the equity underwriting market are more informative than those in debt underwriting.

Moreover, underwriter qualities such as the valuation skill are hard to measure, and the finance literature describes underwriter characteristics along limited dimensions, mainly in terms of reputation, which is commonly measured by market share and Carter-Manaster rank. An extensive literature focuses on reputation in investment banking, specifically on the effect of hiring reputable underwriters (e.g., Carter and Manaster (1990), Fang (2005), Livingston and Miller (2000)). Several previous studies suggest that more reputable underwriters produce more information, although how they actually do so remains less clear.

Recently, attempts have been made to capture other underwriter qualities. For example, Hoberg (2007) captures underwriter persistence in underpricing by using underwriter-specific initial returns (*UWpremium).* Lewellen (2006) finds that underwriters differ in their price support and the difference is not related to underwriter size or reputation, but mostly related to client base. We introduce another quality of an underwriter that captures the pattern of an underwriter's connections to its peers. Underwriters' network characteristics are likely to differ, but this cross-sectional

variation may not be fully captured by the commonly used measures of underwriter reputation, although the effects of reputation and network are not mutually exclusive.

### 2.3. Network measures

Network analysis describes the structure of networks by focusing on the relationships among a set of actors. The central idea is that social location and position matter, and some of the major themes are power, centrality, and similarity.[5] Many of the network analysis methodologies originate from graph theory. Network data are defined by actors and relations, which are represented by nodes and lines. Two actors are considered adjacent if they are connected, and the distance between two actors is measured by the number of relations along the path that connects them. Degree refers to the total number of ties an actor has, and thus, it is the size of the actor's ego or individual network. Ego network, therefore, refers to all the nodes to which a particular node is adjacent to. Numerous variables are utilized in network analysis, and for the purpose of this study, we focus on a set of network measures that capture the size (*degree*), position in the overall network (*closeness* and *betweenness*), interconnectedness within individual underwriter networks *(reciprocity* and *density)* and heterogeneity (*tie,*

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[5] For an entertaining history of network analysis, see Watts (2003). For introductions to economic sociology and new economic sociology, which relies heavily on network analysis, see Swedberg (2003) and Dobbin (2004).

*industry* and *geographical diversity*) of underwriter peer networks.[6] All the network measures are computed using undirected binary data with the exception of reciprocity, for which we use directed binary data. To better illustrate how the network measures are constructed, we present an example of a small simplified underwriter network in Figure 2.1.

**Panel A** **Panel B**

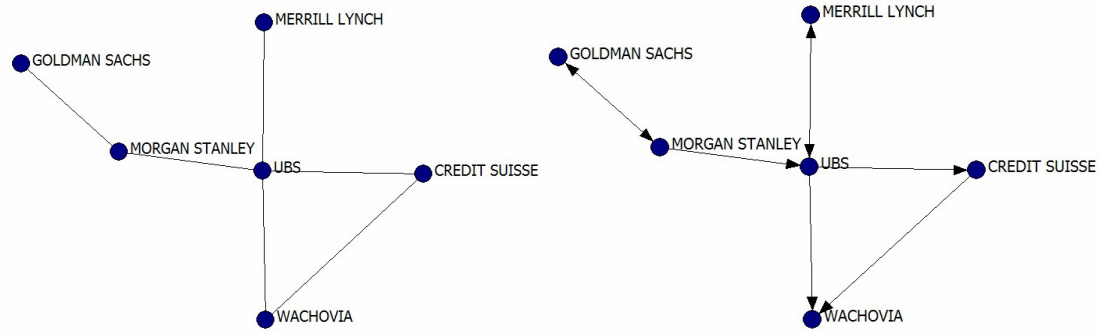


**Figure 2.1: An example of underwriter peer network**
For the purpose of illustrating the construction of different network measures, the following figures show an example of a small simplified network of underwriters. Panel A shows the undirected network graph. In the directed network graph in Panel B, an arrow indicates an invitation into a syndicate.

*Degree*

Degree refers to the number of relationships an underwriter has with other underwriters. The higher the number of relationships an underwriter has, the more access

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[6] Wasserman and Faust (1994) and Scott (2000) have detailed discussions of these measures. Hochberg et al. (2007a) also provide discussions on how the centrality measures are computed.

it has to price relevant information and distribution channels. In the undirected network in Panel A of Figure 2.1, UBS has four ties, and Morgan Stanley, Wachovia and Credit Suisse have two ties each while the other two underwriters have ties to only one other underwriter.

Since network size varies, it is difficult to meaningfully compare the degree, or the number of ties, across different networks. Instead, we use the normalized degree measure, which expresses degree as a percentage of the number of all actors in the network. Thus, in our set up, the normalized degree is the percentage of all other underwriters a specific underwriter maintains ties with. Formally, $Degree_i = \frac{\sum_j x_{ij}}{n-1}$, where $x_{ij}$ equals to one when there is a tie between underwriters $i$ and $j$, and $n$ equals to the number of all underwriters in the network.

In Panel A of Figure 2.1, the normalized degree of UBS is 80 percent since it maintains ties with four out of five other underwriters in the network. Similarly, Morgan Stanley, Wachovia and Credit Suisse have a normalized degree of 40 percent since they maintain ties with two out of five underwriters in the network. Merrill Lynch and Goldman Sachs have ties with just one underwriter, which means they have a normalized degree of 20 percent.

*Closeness*

The measure of closeness emphasizes the proximity of an underwriter to all other underwriters in the network. From a number of different closeness measures that are available in network analysis, we use an eigenvector centrality measure proposed by

Bonacich (1972) that attempts to find the most central actors in terms of the global network structure. Here, the centrality of each underwriter is determined by the centralities of the underwriters it is connected to. Thus, it is similar to an iterated degree measure. Now, not only how many relationships an underwriter has, but also to whom it is connected, matters.[7] If we denote the eigenvector centrality of $i$ by $ev_i$, formally, $ev_i = \frac{1}{\lambda}\sum_j A_{ij} ev_j$, where $\lambda$ is a constant that provides a nontrivial solution, and $A_{ij}$ is an adjacency matrix[8], and we normalize this measure by dividing it by the maximum possible eigenvector centrality in the network.

In Panel A of Figure 2.1, Merrill Lynch and Goldman Sachs both have relationships with just one underwriter, which means they have the same degree measure. However, a quick look at the figure reveals that Goldman Sachs is further away from the center of the overall network than Merrill Lynch. Computed eigenvector centrality measures confirm that as well. Merrill Lynch has a normalized eigenvector measure of 37.34 percent while Goldman Sachs has a normalized eigenvector centrality of 19.05. UBS naturally has the highest eigenvector measure of 88.85 percent followed by Credit Suisse and Wachovia with 64.39. Underwriters with higher closeness centrality measures occupy more central positions in the network and are closer to other underwriters, which suggest that they are sitting in the center of the information hub and enjoy more access to information.

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[7] Google's system of ranking web pages for a particular search is similar to eigenvector centrality measure.

[8] An adjacency matrix is a symmetric matrix, where $A_{ij}$=1 if node $i$ is adjacent to node $j$, and $A_{ij}$=0 otherwise.

*Betweenness*

We use betweenness measure proposed by Freeman (1979) that captures how often an underwriter happens to be located between pairs of other underwriters. An underwriter is between two underwriters if it lies on the shortest possible path (also called geodesic path) between them. For example, there is a single geodesic path between Goldman Sachs and UBS through Morgan Stanley in Panel A of Figure 2.1, and the geodesic distance is two. Betweenness, to some extent, reflects how often an underwriter sits on informational linkages between others. Specifically, $Betweenness_i = \sum_{jk} b_{jik}$, where $b_{jik}$ is the proportion of all paths linking distinct underwriters $j$ and $k$ that pass through underwriter $i$, and we divide it by the maximum possible betweenness in the network to obtain normalized betweenness.

In the Panel A of Figure 2.1, since Morgan Stanley happens to be on the shortest possible path between Goldman Sachs and all the other four underwriters, it happens to be "between" four times. The maximum possible betweenness any underwriter can have in an undirected network with five other underwriters is 10 (=(5x4)/2). This gives Morgan Stanley a normalized betweenness measure of 40 percent. Similarly, UBS sits on the shortest possible paths between eight different pairs of underwriters, which effectively gives it a betweenness measure of 80 percent. Furthermore, all the four underwriters that are situated at the edges do not lie between any other pair of underwriters that are not directly connected, so their betweenness measures are zero.

*Reciprocity*

Reciprocity refers to the proportion of all ties of an underwriter that are reciprocated, where a tie between two underwriters is considered reciprocated if the underwriters invite each other into their respective syndicates. Underwriters may be more likely to share information and cooperate with those with whom they maintain reciprocated ties. Therefore, reciprocity may reflect the strength of relationships and consequently, the quality of information. We compute reciprocity using directed ties. However, identifying who initiates a relationship in a syndicate is problematic, except for book managers. For example, it is hard to determine the direction of relationships between co-managers or between co-managers and syndicate members. Therefore, we establish the direction of relationships only between those who are book managers and those who are not, and reciprocity is measured only for underwriters that serve as book managers. Formally, $Reciprocity_i = \frac{\sum_j (x_{ij} > 0 \text{ and } x_{ji} > 0)}{\sum_j (x_{ij} > 0 \text{ or } x_{ji} > 0)}$, where $x_{ij}$ indicates that book manager $i$ invited underwriter $j$ into its syndicate. In the case of Morgan Stanley in Panel B of Figure 2.1, when serving as a book manager, Morgan Stanley invited both Goldman Sachs and UBS into its syndicates. However, in return, Morgan Stanley was invited only in the syndicates of Goldman Sachs when Goldman Sachs was the book manager. Therefore, out of two ties Morgan Stanley maintains, only one is reciprocated. Thus, the reciprocity measure for Morgan Stanley is 50 percent.

*Density*

Density of individual underwriters' ego networks can be another way of measuring the interconnectedness within an underwriter's network. Density is measured by dividing the number of ties that exist among underwriter's all partners (excluding the ties from the partners to the underwriter itself) by the number of all ties that can exist among the partners. Specifically, $Density_i = \frac{\sum_{jk} x_{jk}}{n_i(n_i - 1)}$, where $x_{jk}$ equals to one when there is a tie between underwriters $j$ and $k$ with whom underwriter $i$ maintains ties with, and $n_i$ equals to the number of all partners of underwriter $i$ (i.e., degree of underwriter $i$).

Dense network means that an underwriter's partners, in turn, have many ties to each another, which may indicate more trust or coordination in the network. In Panel A of Figure 2.1, for instance, UBS has ties to four other underwriters. Potentially, 12 ties (=4x3) can exist between 4 different underwriters in the ego network of UBS, and of those 12 potential ties, only one tie exists between Wachovia and Credit Suisse, which produces network density of 8.33 percent for UBS. Ego network density cannot be computed when an underwriter has no ties or only one tie.

*Tie diversity*

We attempt to capture the heterogeneity of individual underwriter networks first by the extent of non-redundant ties. The specific measure used is called reach efficiency in social network analysis. Reach efficiency measures how many non-redundant underwriters an underwriter can reach within two degrees of separation per each partner. If underwriters work with similar underwriters, who, in turn, work with the same type of

underwriters, the network may not be highly heterogeneous and the reach efficiency measure will be low.

Formally, $Tie.diversity_i = \frac{k_i}{\sum_j (n_j - 1) + n_i}$, where $k_i$ equals to the number of all distinct underwriters within two degrees of separation from underwriter $i$, $n_j$ the degree or the size of the network of each underwriter $j$ that underwriter $i$ is connected to, and $n_i$ is the degree measure of underwriter $i$ itself. If the tie diversity measure is high, then the underwriter $i$ is essentially indirectly connected to a large number of non-redundant partners suggesting that the partners it works with, in turn, work with different underwriters. For example, in Figure 2.1, Wachovia has two primary partners (UBS and Credit Suisse) and the primary partners, UBS and Credit Suisse, themselves have four and two ties, respectively. Thus, the cumulative sum of their network size is 8 (=2+4+2). Once we ignore redundant ties, Wachovia can reach four distinct underwriters (Credit Suisse, UBS, Merrill Lynch, and Morgan Stanley) within two degrees of separation. Thus, the tie diversity measure is 0.5 or 50 percent (=4/8).

*Industry and geographical diversity*

Here, we attempt to measure the heterogeneity of an individual underwriter's network by the diversity of industry and geographical specialization of its partners, rather than by the identity of the partners as in tie diversity. These diversity measures are not traditional social network measures, but ones that we develop to capture additional aspects of underwriter networks. For each underwriter, we identify five major states and industries it specializes in, using the total volume of deals underwritten in different

industries and states over four-year periods. Next, we compute the number of different industries and states an underwriter *i* can reach through the expertise of its partners and normalize it by the number of partners. Again, if underwriter *i* works with underwriters that operate in various industries and states, this measure should be higher reflecting heterogeneity in the business line of the network partners.

The network measures—degree, closeness, betweenness, reciprocity, density, tie, industry and geographical diversity—capture different aspects of underwriter network structure. Degree measures the size of the network, while reciprocity and density consider the strength and interconnections of the individual underwriters' networks. Closeness and betweenness describe the position of an underwriter in the overall network, albeit in different ways. Borgatti, Carley, and Krackhardt (2006) explore the robustness of the centrality measures to various measurement errors and find that the centrality measures are quite robust and the accuracy of the centrality measures declines as measurement error increases, but in a monotonic fashion. Tie, industry and geographical diversity measures attempt to capture the heterogeneity of the underwriter networks.

### 2.4. Data and descriptive statistics

We use Thomson Financial's Security Data Corporation's (SDC) New Issues database to create underwriter network measures. The network measures are constructed using inter-organizational relationships that underwriters establish with other underwriters when they are involved in the same underwriting syndicates of public equity

and debt issues. Initially, we obtain all 23,084 public equity and 24,818 public debt securities issued between 1970 and 2007 in the U.S. excluding the securities offered by financial firms, as shown in Table 2.1. Of these equity and debt issues, 29,911 employ two or more underwriters. Since the emphasis in network construction is the ties between underwriters, we do not impose sample criteria on the security issues and utilize all of them to compute the network measures.

**Table 2.1: Sample of security issues**
The following sample includes all public securities issued in the U.S. between 1970 and 2007 excluding the securities of financial firms. We use these security issues to construct underwriter networks.

| | Number of issues | Number of issues that employ two or more underwriters | |
|---|---|---|---|
| Equity | 23,084 | 14,344 | |
| Initial public offerings | 10,073 | | 6,054 |
| Seasoned equity offerings | 13,011 | | 8,290 |
| Debt | 24,818 | 15,567 | |
| Non-convertible debt | 20,899 | | 13,030 |
| Convertible debt | 1,575 | | 801 |
| Non-convertible preferred | 1,704 | | 1,349 |
| Convertible preferred | 640 | | 387 |
| All deals | 47,902 | 29,911 | |

Underwriters may interact with each other before or after the deal syndication. There is no reason to believe that underwriters stop communicating with each other and the relationships die out as soon as a deal is over. Therefore, to capture the impact of relationships, we use a four-year moving period approach. Consequently, there are 35 rolling four-year periods from 1970 to 2007. Three- to five-year periods are commonly used in other studies (i.e., Hochberg et al. (2007a)).

We consider only the managing underwriters (book managers and co-managers) in syndicates and exclude syndicate members, because non-managing syndicate members typically only serve distributional purposes and have minimal role in the deal. We use reported underwriter names, but multiple variations of the same underwriter names appear in the SDC data due to inconsistent abbreviation, punctuation or spelling such as Goldman Sachs & Co and Goldman, Sachs & Co. We check all the underwriter names and manually correct the names when necessary. Cooney et al. (2004) perform a similar hand correction when working with underwriter data. In the case of bank mergers, we treat the post-merger bank as a new entity because a multitude of changes and restructuring occur around bank mergers. After all, network, and to a greater extent, underwriting business itself, is mainly about tacit human capital. In fact, Bradley, Choi, and Clarke (2008)) show that deal flow changes when investment bankers change employers. We also identify commercial banks in the sample using Gande et al. (1999), Federal Reserve data on large commercial banks, and hand check. By limiting syndicates only to those who serve as managing underwriters and following the above corrections, we obtain 1,936 underwriters in the original sample of all public issues. However, all 1,936 underwriters do not appear in our final sample, since we focus on the impact of network only on IPOs.

Using binary network data created from syndication in the public issues, we compute various network measures such as degree, closeness, and betweenness by employing the social network analysis software UCINET 6 (Borgatti, Everett, and Freeman (2002)). The network measures are constructed using all equity and debt deals together and also using only equity and debt deals separately. As an illustration, the

network measures of top twenty equity underwriters according to market share during 2004-07 are provided in Table 2.2. As Table 2.2 shows, for instance, Goldman Sachs, who ranked first in terms of equity market, has a degree measure of 55.73, which means that it maintained ties with 55.73 percent of all other underwriters that served at least once as a co-manager or book-manager during this period. Density measure of 28.39 shows that of all possible ties that could exist among the partners of Goldman Sachs, 28.39 percent exists.

**Table 2.2: Network measures of top twenty equity underwriters**

The table shows the network measures of the top twenty underwriters ranked by equity market share during 2004-07. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners.

| Underwriter | Degree | Closeness | Betweenness | Density | Reciprocity | Tie diversity | Industry diversity | Geographical diversity |
|---|---|---|---|---|---|---|---|---|
| Goldman Sachs | 55.73 | 17.08 | 2.32 | 28.39 | 0.00 | 2.27 | 0.18 | 0.16 |
| Morgan Stanley | 60.81 | 18.25 | 3.82 | 26.51 | 28.57 | 2.21 | 0.17 | 0.15 |
| Citi | 69.97 | 19.11 | 6.46 | 21.62 | 0.00 | 2.12 | 0.16 | 0.13 |
| JP Morgan | 66.67 | 18.34 | 6.39 | 22.27 | 0.00 | 2.17 | 0.17 | 0.14 |
| Merrill Lynch | 62.85 | 18.44 | 4.50 | 25.32 | 0.00 | 2.18 | 0.17 | 0.14 |
| Lehman Brothers | 58.78 | 17.80 | 2.99 | 27.28 | 0.00 | 2.22 | 0.19 | 0.15 |
| Credit Suisse | 65.14 | 18.54 | 4.85 | 23.81 | 0.00 | 2.15 | 0.16 | 0.13 |
| UBS | 72.52 | 19.31 | 9.49 | 20.50 | 0.00 | 2.11 | 0.15 | 0.13 |
| Deutsche Bank | 62.34 | 18.17 | 3.79 | 25.09 | 0.00 | 2.18 | 0.18 | 0.14 |
| Bank of America | 55.73 | 17.87 | 2.29 | 30.64 | 11.11 | 2.24 | 0.17 | 0.16 |
| Bear Stearns | 47.33 | 16.56 | 1.19 | 37.30 | 6.67 | 2.36 | 0.21 | 0.16 |
| Wachovia | 51.65 | 17.47 | 1.86 | 34.37 | 4.17 | 2.28 | 0.20 | 0.18 |
| RBC Capital Markets | 54.71 | 17.57 | 3.00 | 31.05 | 0.00 | 2.26 | 0.20 | 0.15 |
| CIBC World Markets | 38.93 | 12.97 | 1.83 | 36.21 | 18.18 | 2.84 | 0.25 | 0.20 |
| Jefferies | 41.22 | 15.21 | 0.94 | 42.72 | 18.75 | 2.53 | 0.25 | 0.20 |
| Société Générale | 34.35 | 12.35 | 0.84 | 42.96 | 0.00 | 2.97 | 0.26 | 0.21 |
| ABN Amro | 44.02 | 14.76 | 1.62 | 35.18 | 34.78 | 2.55 | 0.17 | 0.14 |
| Piper Jaffray | 45.80 | 16.25 | 1.90 | 38.83 | 20.51 | 2.39 | 0.22 | 0.18 |
| Raymond James Financial | 41.73 | 15.48 | 0.95 | 43.03 | 0.00 | 2.52 | 0.24 | 0.20 |
| Thomas Weisel Partners | 22.39 | 8.76 | 0.36 | 54.55 | 6.66 | 4.02 | 0.35 | 0.30 |

In addition to underwriter network features, we consider underwriter reputation, as measured by market share and Carter-Manaster rank. Carter-Manaster rank data is obtained from Jay Ritter's website. We also compute underwriter specific average post-issue three-month abnormal return and average residual underpricing, using all IPOs underwritten by an underwriter in a managing underwriter role over four-year periods. An underwriter's average three-month abnormal return is the mean of the three-month abnormal returns (computed by subtracting value-weighted market return) of all non-financial, common share IPOs an underwriter is involved in as a managing underwriter. The average residual underpricing is the average of the regression residuals of underpricing of all non-financial, common share IPOs an underwriter is involved in as a managing underwriter.

To investigate the effect of underwriter networks on issue performance, we focus on non-financial, common share IPOs with offer price above five dollars in line with previous research. We match the initial sample of 12,841 IPOs from SDC to the Center for Research in Security Prices (CRSP) database by cusip. Of those issues with matched cusips, we exclude investment funds, REITS and units etc., which results in 9,148 common share IPOs. After excluding issues of financial firms, those with offer price below five dollars in line with previous research, and those during 1970-73 because we relate the IPOs to the characteristics of their book managers in the preceding four-year period, our final IPO sample consists of 6,657 IPOs issued between 1974 and 2007.

In this final sample of IPOs, 490 underwriters serve as book managers. Of these, 22 are commercial bank underwriters. Of 4,808 IPOs issued since 1989 in our sample, about 13.7 percent employed a commercial bank as the book manager or the joint book

manager. However, this number has increased dramatically over time. For example, during the last four-year period, commercial banks served as the book manager or joint book manager in 48 percent of all the IPOs.

In 334 out of 6,657 IPOs, the syndicates include multiple book managers, and we take the average of the book managers' characteristics in these cases. Return and price data is retrieved from CRSP. Out of 6,657 issues, 2,735 issues have venture capital back-up, and 1,067 issues are listed on NYSE, and the rest on Nasdaq. Finally, proceeds are adjusted for inflation.

*2.4.1. Descriptive statistics*

Panel A of Table 2.3 is based on underwriter-period observations and presents the characteristics of 490 underwriters that serve as book managers in the sample. Mean degree centrality over all periods is 9.93 percent; closeness centrality is 9.31; and betweenness centrality is 0.95 using all public deals. On average, 9.08 percent of underwriter relationships are reciprocated and the mean density of underwriter relationships is 44.72 percent. As for the measures of network heterogeneity, on average, an underwriter can reach 0.64 and 0.60 unique industry and state per each partner. The mean tie diversity of 27.19 percent or 0.2719 indicates that for each tie within two degrees of separation, an underwriter gets access to 0.2719 unique underwriters.

**Table 2.3: Descriptive statistics**

The sample consists of 6,657 non-financial, common share IPOs issued in the U.S. between 1974 and 2007 with offer price above five dollars and 490 underwriters that serve as book managers in underwriting of these IPOs. Panel A presents the descriptive statistics of the book manager characteristics measured over moving four-year periods. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Market share is computed as the sum of the proceeds of the equity offerings lead by a specific underwriter, divided by the total deal volume of all the equity offerings during a period. Average abnormal underpricing is the mean of the residual underpricing of all non-financial, common share IPOs that an underwriter is involved in as a managing underwriter during the period. Average abnormal three-month IPO return is the mean of the market (value-weighted) adjusted post-issue three-month returns of all non-financial, common share IPOs that an underwriter is involved in as a managing underwriter during the period.

Panel B presents the descriptive statistics of the IPOs. Proceeds are adjusted for inflation. Secondary shares refers to the percentage of all shares offered by the insiders. Completion speed counts the number of days between the filing date and the offer date. Underpricing refers to the percentage change from the offer price to the closing price of the first trading day. Price adjustment measures the percentage change from the filing range mid point to the offer price. Firm age is computed using the firm founding date data available from Jay Ritter's website (http://bear.cba.ufl.edu/ritter/). Number of book managers refers to the number of underwriters in the syndicate that serve as book managers. Number of managing underwriters refers to the number of underwriters who are either book- or co-managers. Market (industry) adjusted post-issue return is the firm stock return minus the value-weighted market index return (average industry return).

| | Mean | Median | Min | Max | Std. Dev | *N* |
|---|---|---|---|---|---|---|
| **Panel A: Book manager characteristics** | | | | | | |
| Network measures constructed using all public deals | | | | | | |
| *Degree* | 9.93 | 5.77 | 0 | 63.80 | 11.71 | 1,884 |
| *Closeness* | 9.31 | 7.42 | 0 | 31.50 | 8.93 | 1,884 |
| *Betweenness* | 0.95 | 0.33 | 0 | 12.54 | 1.45 | 1,884 |
| *Reciprocity* | 9.08 | 0 | 0 | 100.00 | 16.12 | 1,663 |
| *Density* | 44.72 | 44.00 | 0 | 100.00 | 24.88 | 1,604 |
| *Tie diversity* | 27.19 | 11.58 | 0 | 99.71 | 29.11 | 1,884 |
| *Industry diversity* | 0.64 | 0.52 | 0 | 5.00 | 0.56 | 1,884 |
| *Geographical diversity* | 0.60 | 0.48 | 0 | 5.00 | 0.52 | 1,884 |
| Network measures constructed using all equity deals | | | | | | |
| *Degree* | 9.83 | 5.51 | 0 | 64.44 | 11.46 | 1,866 |
| *Closeness* | 9.80 | 7.81 | 0 | 32.60 | 9.32 | 1,866 |
| *Betweenness* | 0.90 | 0.35 | 0 | 18.00 | 1.40 | 1,866 |
| *Reciprocity* | 7.32 | 0 | 0 | 100.00 | 14.41 | 1,621 |
| *Density* | 45.53 | 44.96 | 0 | 100.00 | 24.07 | 1,564 |
| *Tie diversity* | 27.79 | 13.17 | 0 | 99.54 | 28.71 | 1,866 |
| *Industry diversity* | 0.69 | 0.59 | 0 | 5.00 | 0.57 | 1,866 |
| *Geographical diversity* | 0.64 | 0.53 | 0 | 5.00 | 0.54 | 1,866 |
| Network measures constructed using all debt deals | | | | | | |
| *Degree* | 14.89 | 9.03 | 0 | 68.57 | 15.85 | 1,342 |
| *Closeness* | 11.10 | 8.46 | 0 | 35.14 | 10.21 | 1,342 |
| *Betweenness* | 1.29 | 0.23 | 0 | 14.22 | 2.11 | 1,342 |
| *Reciprocity* | 11.64 | 0 | 0 | 76.00 | 18.01 | 1,203 |
| *Density* | 57.94 | 56.95 | 0 | 100.00 | 26.45 | 1,118 |
| *Tie diversity* | 25.03 | 11.93 | 0 | 99.30 | 27.27 | 1,342 |
| *Industry diversity* | 0.53 | 0.49 | 0 | 3.00 | 0.35 | 1,342 |
| *Geographical diversity* | 0.55 | 0.50 | 0 | 3.00 | 0.34 | 1,342 |

**Table 2.3 (continued)**

| | Mean | Median | Min | Max | Std. Dev | *N* |
|---|---|---|---|---|---|---|
| Market share (%) | 1.62 | 0.08 | 0 | 28.50 | 4.04 | 1,884 |
| Average abnormal underpricing | -1.72 | -3.34 | -70.721 | 111.79 | 13.90 | 1,594 |
| Average three-month IPO abnormal return (%) | 2.96 | 1.90 | -50.10 | 199.96 | 19.59 | 1,637 |
| | | | | | | |
| **Panel B: Issue characteristics** | | | | | | |
| Deal proceeds- adjusted ($ mil) | 39.91 | 18.78 | 0.12 | 4,903.95 | 119.89 | 6,657 |
| Shares offered (mil) | 4.31 | 2.50 | 0.06 | 600.00 | 11.21 | 6,657 |
| Secondary shares (%) | 3.87 | 0 | 0 | 100.00 | 13.36 | 6,657 |
| Gross spread (%) | 7.38 | 7.00 | 1.33 | 20.25 | 1.16 | 6,641 |
| Completion speed (days) | 76.98 | 60.00 | 0 | 1,164.00 | 72.83 | 6,122 |
| Underpricing (%) | 18.78 | 6.63 | -70.45 | 697.50 | 41.37 | 6,435 |
| Price adjustment (%) | 3.02 | 0 | -98.44 | 344.44 | 28.87 | 6,617 |
| Firm age (years) | 15.10 | 8 | 0 | 165 | 20.35 | 5,280 |
| No. of book managers | 1.06 | 1 | 1 | 5 | 0.29 | 6,657 |
| No. of managing underwriters | 2.36 | 2 | 1 | 28 | 1.50 | 6,657 |
| No. of all underwriters | 5.29 | 2 | 1 | 69 | 7.23 | 6,657 |
| Market adj. three-month return (%) | 2.92 | -3.13 | -90.60 | 602.78 | 41.59 | 6,541 |
| Market adj. one-year return (%) | -22.10 | -32.19 | -99.11 | 757.90 | 56.82 | 4,853 |
| Market adj. two-year return (%) | -29.60 | -50.30 | -99.94 | 3,266.00 | 100.81 | 4,509 |
| Industry adj. three-month return (%) | -0.54 | -4.97 | -84.54 | 374.88 | 35.66 | 6,541 |
| Industry adj. one-year return (%) | -27.63 | -36.38 | -98.96 | 557.53 | 49.22 | 4,853 |
| Industry adj. two-year return (%) | -40.51 | -57.59 | -99.94 | 1,347.31 | 68.48 | 4,509 |

At maximum, an underwriter has ties to 63.80 percent of all other underwriters. Some underwriters have ties that are all reciprocated as evidenced by the maximum reciprocity of 100 percent. Network measures constructed using either equity or debt deals are also presented. The total number of debt underwriters is less than that of equity underwriters, which explains the lower number of debt underwriter network measures.

Panel B presents the descriptive statistics of IPOs. IPOs in the sample have a mean size of $39.91 million in constant dollars. Typically, the issues do not contain secondary shares, which are the shares offered by the insiders, as indicated by the median of zero. Median gross spread of 7 percent is consistent with the previously documented 7 percent solution in the IPO market. Mean underpricing, which is measured by the percentage change from the offer price to the closing price of the first trading day, is 18.78 percent even after the mean price adjustment of 3.02 percent. For valid underpricing data, we require the first closing price to be reported within a trading day of the offer date. For valid return data, we also require that missing returns constitute no more than 25 percent of all observations within the return horizon. Firm age is computed using the founding date reported from Jay Ritter's website, but it is not available for all firms. We do not include the firm age variable in the regressions because it drastically reduces the sample size, and in unreported regressions, this variable is insignificant in most estimations. The average syndicate size across all periods is 5.29. The negative average one- and two-year returns are consistent with the previously documented post-issue underperformance of IPOs.

In Table 2.4, we present the correlations among the network measures. In Panel A, the first three network measures – degree, closeness and betweenness – have positive

and significant correlations with each other as expected. Degree or network size has negative correlation with network density, meaning that as the network of an individual underwriter grows, less embedded or close-knit the network becomes. The degree measure is also negatively correlated with the network diversity measures, since the redundancy of network ties grows as the network becomes larger, as the additional members are less likely to be different from those that are already in the network. Network diversity measures have positive correlations with each other as expected. Panel B shows the correlation between the network measures constructed using equity and debt deals and they range from 0.075 to 0.836 reflecting the differences and the similarities between the ties formed in equity and debt underwriting.

**Table 2.4: Correlations of the network measures**

The table presents Pearson correlation coefficients among the network measures of 490 underwriters that serve as book managers in 6,657 IPOs. Network variables are normalized measures constructed using the ties that underwriters form with other underwriters when they are involved in the same underwriting syndicates of public equity and debt issues over moving four-year periods. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters, and it is normalized by dividing it by the maximum eigenvector in the network. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters, and it is normalized by dividing it by the maximum betweenness in the network. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Industry is defined according to two-digit SIC codes. Market share is computed as the sum of the proceeds of the equity offerings lead by a specific underwriter, divided by the total deal volume of all the equity offerings during a period. *p*-values are reported in the brackets, and 1,867 underwriter-period observations are used.

**Panel A: Correlation among the network measures constructed using all public issues**

| | *Degree* | *Closeness* | *Betweenness* | *Reciprocity* | *Density* | *Tie diversity* | *Industry diversity* |
|---|---|---|---|---|---|---|---|
| *Closeness* | 0.746 | | | | | | |
| | (0.00) | | | | | | |
| *Betweenness* | 0.669 | 0.535 | | | | | |
| | (0.00) | (0.00) | | | | | |
| *Reciprocity* | 0.119 | 0.201 | 0.096 | | | | |
| | (0.00) | (0.00) | (0.00) | | | | |
| *Density* | -0.162 | -0.023 | -0.388 | 0.024 | | | |
| | (0.00) | (0.36) | (0.00) | (0.36) | | | |
| *Tie diversity* | -0.536 | -0.626 | -0.244 | -0.127 | -0.285 | | |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | | |
| *Industry diversity* | -0.408 | -0.418 | -0.222 | -0.076 | -0.202 | 0.650 | |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | |
| *Geographical diversity* | -0.420 | -0.422 | -0.238 | -0.080 | -0.163 | 0.656 | 0.946 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |

**Panel B: Correlation between the network measures constructed using equity and debt issues**

| | Network measures constructed from debt deals | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Degree* | *Closeness* | *Betweenness* | *Reciprocity* | *Density* | *Tie diversity* | *Industry diversity* | *Geographical diversity* |
| Same measure constructed from equity deals | 0.836 | 0.789 | 0.542 | 0.075 | 0.452 | 0.344 | 0.226 | 0.220 |
| | (0.00) | (0.00) | (0.00) | (0.02) | (0.00) | (0.00) | (0.00) | (0.00) |

**Panel C: Correlation between the network measures constructed using all public issues and the bank reputation measures**

| | *Degree* | *Closeness* | *Betweenness* | *Reciprocity* | *Density* | *Tie diversity* | *Industry diversity* | *Geographical diversity* |
|---|---|---|---|---|---|---|---|---|
| Market share | 0.648 | 0.539 | 0.568 | 0.072 | -0.216 | -0.283 | -0.231 | -0.245 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Carter-Manaster rank | 0.664 | 0.777 | 0.417 | 0.027 | 0.185 | -0.474 | -0.296 | -0.302 |
| | (0.00) | (0.00) | (0.00) | (0.28) | (0.00) | (0.00) | (0.00) | (0.00) |

Panel C of Table 2.4 presents the correlation between underwriter reputation, which is measured by market share and Carter-Manaster rank, and the network variables. The correlations between the market share and the network measures range from -0.283 to 0.648, with the highest correlation corresponding to the network size. The correlations between Carter-Manaster rank and the network measures range from -0.474 to 0.777. However, it should be noted that Carter-Manaster rank does not display much variation, and thus, we use market share in the regression analysis. Overall, the correlation coefficients suggest that the network measures are capturing different aspects of underwriter networks. The correlation coefficients also confirm that reputation and network are different characteristics, although they are correlated to some extent.

## 2.5. Impact of underwriter networks on IPOs

### *2.5.1. Offer price revision*

We first investigate whether the characteristics of the book manager's network affect the information production in the primary market. Underwriters report a filing range for the offer price when they file an IPO with SEC. The actual offer price can differ from the filing range midpoint, which may reflect arrival of new information that the underwriters compound into the price. Therefore, we examine the likelihood of price revision to see if book managers with certain network capabilities engage more actively in price discovery in the primary market, leading to more frequent price revision. Table 5 presents the estimated coefficients of logistic regressions of the likelihood of price revision. All the regressions include industry and year fixed effects.

**Table 2.5: Book manager's network and the probability of offer price revision in IPOs**

The table presents the estimated coefficients of logistic regressions of the probability of offer price revision. The dependent variable, price revision, equals to one if the offer price differs from the filing range midpoint, and zero otherwise. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Industry is defined according to two-digit SIC codes. Market share is computed as the sum of the proceeds of the equity offerings lead by a specific underwriter, divided by the total deal volume of all the equity offerings during a period. Integer mid point dummy equals to one if the mid point of the filing range is an integer, and zero otherwise. Expected proceeds is defined as the filing range midpoint multiplied by the number of shares offered. Market return>20% dummy equals to one if the absolute (value-weighted) total market return between the filing and the offer date exceeds 20 percent, and zero otherwise. NYSE dummy equals to one if the firm is listed on NYSE, and zero otherwise. *p*-values reported in the brackets are estimated using robust standard errors clustered within underwriters.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | -2.599 | -1.095 | -2.225 | -1.818 | -2.208 | -2.251 | -2.398 | -1.885 | 0.219 |
| | (0.01) | (0.25) | (0.02) | (0.06) | (0.02) | (0.02) | (0.02) | (0.05) | (0.83) |
| Network measures | | | | | | | | | |
| *Degree* | 0.035 | | | | | | | | -0.008 |
| | (0.00) | | | | | | | | (0.44) |
| *Closeness* | | 0.058 | | | | | | | 0.025 |
| | | (0.00) | | | | | | | (0.08) |
| *Betweenness* | | | 0.103 | | | | | | 0.503 |
| | | | (0.00) | | | | | | (0.20) |
| *Reciprocity* | | | | 0.007 | | | | | 0.002 |
| | | | | (0.02) | | | | | (0.55) |
| *Density* | | | | | 0.014 | | | | 0.009 |
| | | | | | (0.00) | | | | (0.02) |
| *Tie diversity* | | | | | | -0.006 | | | -0.005 |
| | | | | | | (0.02) | | | (0.34) |

**Table 2.5 (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Industry diversity* | | | | | | | -0.252 | | -0.653 |
| | | | | | | | (0.02) | | (0.00) |
| *Geographical diversity* | | | | | | | | -0.275 | |
| | | | | | | | | (0.02) | |
| … x Commercial bank | -0.014 | -0.005 | -0.053 | 0.005 | 0.001 | 0.014 | 0.400 | 0.297 | |
| dummy | (0.01) | (0.62) | (0.39) | (0.69) | (0.84) | (0.30) | (0.40) | (0.45) | |
| Market share | -0.050 | -0.046 | -0.029 | -0.016 | 0.014 | -0.014 | -0.014 | -0.015 | -0.011 |
| | (0.01) | (0.00) | (0.03) | (0.33) | (0.22) | (0.19) | (0.20) | (0.17) | (0.43) |
| Integer mid point | -0.832 | -0.860 | -0.786 | -0.722 | -0.651 | -0.809 | -0.782 | -0.782 | -0.721 |
| dummy | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Expected | 0.863 | 0.656 | 1.008 | 0.916 | 0.692 | 0.957 | 0.992 | 0.993 | 0.299 |
| proceeds) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Absolute market | 0.678 | 0.649 | 0.697 | 0.489 | 0.579 | 0.686 | 0.688 | 0.691 | 0.463 |
| return>20% dummy | (0.04) | (0.04) | (0.04) | (0.15) | (0.15) | (0.04) | (0.04) | (0.04) | (0.24) |
| Venture capital | 0.422 | 0.369 | 0.493 | 0.515 | 0.415 | 0.467 | 0.471 | 0.475 | 0.261 |
| dummy | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.01) |
| NYSE dummy | -0.483 | -0.461 | -0.513 | -0.404 | -0.345 | -0.485 | -0.492 | -0.494 | -0.221 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.08) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo $R^2$ | 15.40 | 16.40 | 15.04 | 12.38 | 10.32 | 15.13 | 15.06 | 15.06 | 11.22 |
| *N* | 6,091 | 6,091 | 6,091 | 5,450 | 5,438 | 6,091 | 6,091 | 6,091 | 5,142 |

Since several previous studies document an increasing tendency of the offer price being set at an integer or being rounded (i.e., Mola and Loughran (2004), Corwin (2003)), we include a dummy variable that denotes whether the filing range midpoint is an integer or not. If it is not an integer, it is more likely to be revised to an integer offer price. We also control for the expected deal size, the existence of venture capital back-up, and the listing venue choice. In addition, to reflect changes in market condition, we include a dummy variable that indicates whether the absolute market return between the filing date and the offer date is more than 20 percent.

In all the models in Table 2.5, the estimated coefficients on the network variables are significant. As the coefficients in models 1-3 show, the larger and more centrally located the book managers' networks are, the higher the likelihood of price revision, which is consistent with more information being received by these book managers. As evidenced by the results of models 4 and 5, the book managers with more reciprocated relationships and dense networks are also more likely to revise price implying that more or richer information is shared through such relationships. Measures of network diversity have negative significant coefficients in models 6-8, which suggests that the more diverse the network is, the less likely the book manager is to revise price. These negative effects of network diversity are consistent with the previous findings from interpersonal and inter-organizational relationships that homogenous ties tend to be stronger and more appropriate in transmitting complex information and knowledge. In model 9, we estimate the regression of the price revision with all the network variables, except geographical diversity due to its high correlation of 0.946 with industry diversity. Given the correlation among the network variables, some of the variables do become insignificant

in the estimation of this model. However, the significant coefficients on closeness, density and industry diversity still show that book managers with more central, more interconnected and more homogenous networks are more actively engaged in price discovery.

The interaction terms between the network variables and the commercial bank dummy are all insignificant, except in model 1. Thus, after controlling for market share and allowing for clustering in the observations of the same underwriter, there is no difference between the effects of investment bank and commercial bank networks on the likelihood of price revision. As for the control variables, the bank market share measure is either negative or insignificant. The coefficients on the integer dummy variable show that if the filing range midpoint is already set at an integer, it is less likely to be revised. Larger issues are also more likely to experience price revision, and when there are substantial stock market movements, the offer price is revised to reflect the changing market condition as evidenced by the positive coefficient on the market return dummy. The IPOs with venture capital back up are more likely to experience price revision, while firms that are listed on NYSE seem to experience price revision less frequently, consistent with the NYSE listed firms being more established with relatively lower information asymmetry and the venture capital backed firms displaying greater information asymmetry.

The results remain qualitatively the same when we run the regression analysis on the subsamples created based on the market condition and firm age. Based on the deal volume, years 1983, 1986-1987, and 1992-1997 are identified as hot markets. We also redefine the price revision variable using the filing range instead of the midpoint. The

price revision equals to one if the offer price falls outside the filing range and zero otherwise. Admittedly, underwriters may revise not only price, but also the number of shares, upon receiving new information. Thus, proceeds revision variable equals to one if either the offer price or the number of shares is revised. In unreported regressions, the results are robust to these alternative specifications of revision. In unreported regressions, we also consider the direction of the price revision and estimate the likelihood of an upward and downward revision separately. We find qualitatively similar results to those in Table 2.5, although the results from upward revision are more significant. We also find that the effects of the network measures constructed using equity deals are somewhat greater than those constructed using debt issues.

In Table 2.6, we focus on the absolute size of price revision. Similar to the previous findings, we document positive effects of network size, closeness and betweenness and negative effects of network diversity in Panel A of Table 2.6. Measures of reciprocity and density are insignificant in models 4 and 5. The interaction terms with commercial bank dummy are also insignificant. As for the economic significance, the estimated coefficient on degree in model 1 shows that when the size of the book manager's network increases by one standard deviation, the IPO experiences 1.77 percent larger price adjustment. Similarly, when the closeness centrality and the tie diversity in models 2 and 6 increase by one standard deviation, the absolute price revision is 2.31 percent higher and 1.02 percent lower, respectively.

**Table 2.6: Book manager's network and the size of offer price revision**

The table presents the estimated coefficients of linear regressions of the absolute price revision. The dependent variable, price adjustment, measures the absolute percentage change from the filing range mid point to the offer price. Panel A presents the results of the regressions estimated using the full sample. Panels B and C present the results of regressions estimated using the IPOs of issuers in the lowest and the highest age quintile, respectively. Firm age is computed using the firm founding date data available from Jay Ritter's website. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Industry is defined according to two-digit SIC codes. Market share is computed as the sum of the proceeds of the equity offerings lead by a specific underwriter, divided by the total deal volume of all the equity offerings during a period. Integer mid point dummy equals to one if the mid point of the filing range is an integer, and zero otherwise. Expected proceeds is defined as the filing range midpoint multiplied by the number of shares offered. Market return>20% dummy equals to one if the absolute (value-weighted) total market return between the filing and the offer date exceeds 20 percent, and zero otherwise. NYSE dummy equals to one if the firm is listed on NYSE, and zero otherwise. *p*-values reported in the brackets are estimated using robust standard errors that allow for clustered within underwriters.

**Panel A: Full sample**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | 3.992 | 7.984 | 5.127 | 6.566 | 8.358 | 6.309 | 5.277 | 5.576 | 18.05 |
| | (0.17) | (0.01) | (0.03) | (0.01) | (0.00) | (0.04) | (0.09) | (0.07) | (0.00) |
| Network measures | | | | | | | | | |
| *Degree* | 0.151 | | | | | | | | -0.103 |
| | (0.02) | | | | | | | | (0.36) |
| *Closeness* | | 0.259 | | | | | | | 0.082 |
| | | (0.00) | | | | | | | (0.30) |
| *Betweenness* | | | 0.553 | | | | | | 0.267 |
| | | | (0.07) | | | | | | (0.28) |
| *Reciprocity* | | | | -0.001 | | | | | -0.015 |
| | | | | (0.99) | | | | | (0.37) |

**Panel A (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Density* | | | | | 0.017 | | | | -0.003 |
| | | | | | (0.29) | | | | (0.86) |
| *Tie diversity* | | | | | | -0.035 | | | -0.065 |
| | | | | | | (0.01) | | | (0.03) |
| *Industry diversity* | | | | | | | -1.084 | | -2.756 |
| | | | | | | | (0.05) | | (0.00) |
| *Geographical diversity* | | | | | | | | -1.507 | |
| | | | | | | | | (0.01) | |
| … x Commercial bank | -0.049 | -0.026 | -0.264 | 0.035 | 0.024 | 0.129 | 4.147 | 4.254 | |
| dummy | (0.17 | (0.71) | (0.50) | (0.60) | (0.42) | (0.26) | (0.31) | (0.27) | |
| Market share | 0.034 | 0.046 | 0.098 | 0.193 | 0.238 | 0.187 | 0.193 | 0.189 | 0.185 |
| | (0.45) | (0.36) | (0.03) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Expected | 0.454 | -0.353 | 0.935 | 0.714 | 0.071 | 0.695 | 0.885 | 0.845 | -1.150 |
| proceeds) | (0.37) | (0.46) | (0.04) | (0.15) | (0.87) | (0.11) | (0.03) | (0.04) | (0.03) |
| Absolute market | 7.102 | 7.006 | 7.108 | 6.121 | 6.769 | 7.066 | 7.030 | 7.034 | 6.847 |
| return>20% dummy | (0.04) | (0.04) | (0.04) | (0.09) | (0.06) | (0.04) | (0.04) | (0.04) | (0.07) |
| Venture capital | 3.726 | 3.294 | 3.999 | 4.024 | 3.544 | 3.810 | 3.895 | 3.874 | 2.909 |
| dummy | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| NYSE dummy | -3.214 | -2.967 | -3.397 | -3.048 | -2.684 | -3.199 | -3.289 | -3.286 | -2.228 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 12.78 | 13.33 | 12.64 | 12.56 | 12.27 | 12.65 | 12.57 | 12.62 | 13.41 |
| *N* | 6,124 | 6,124 | 6,124 | 5,482 | 5,505 | 6,124 | 6,124 | 6,124 | 5,206 |

**Panel B: IPOs of the issuers in the lowest age quintile**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | 5.667 | 12.682 | 10.938 | 7.835 | 10.573 | 7.878 | 6.271 | 7.252 | 17.684 |
| | (0.40) | (0.07) | (0.15) | (0.29) | (0.06) | (0.28) | (0.39) | (0.32) | (0.10) |
| Network measures | | | | | | | | | |
| *Degree* | 0.334 | | | | | | | | -0.029 |
| | (0.00) | | | | | | | | (0.88) |
| *Closeness* | | 0.418 | | | | | | | 0.352 |
| | | (0.00) | | | | | | | (0.04) |
| *Betweenness* | | | 1.116 | | | | | | 0.105 |
| | | | (0.03) | | | | | | (0.83) |
| *Reciprocity* | | | | -0.006 | | | | | -0.045 |
| | | | | (0.89) | | | | | (0.29) |
| *Density* | | | | | 0.002 | | | | 0.010 |
| | | | | | (0.95) | | | | (0.78) |
| *Tie diversity* | | | | | | -0.037 | | | -0.014 |
| | | | | | | (0.07) | | | (0.80) |
| *Industry diversity* | | | | | | | -1.022 | | -2.125 |
| | | | | | | | (0.23) | | (0.15) |
| *Geographical diversity* | | | | | | | | -1.829 | |
| | | | | | | | | (0.02) | |
| … x Commercial bank | -0.069 | 0.022 | -0.043 | -0.080 | 0.013 | 0.024 | 3.182 | 1.847 | |
| dummy | (0.26) | (0.84) | (0.56) | (0.53) | (0.73) | (0.87) | (0.53) | (0.69) | |
| Market share | 0.001 | 0.147 | 0.165 | 0.344 | 0.379 | 0.345 | 0.358 | 0.343 | 0.210 |
| | (0.98) | (0.14) | (0.15) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.03) |
| Log (Expected | 0.513 | -0.741 | 1.866 | 1.816 | 0.719 | 1.627 | 1.884 | 1.782 | -2.101 |
| proceeds) | (0.53) | (0.42) | (0.01) | (0.02) | (0.38) | (0.03) | (0.01) | (0.02) | (0.04) |
| Absolute market | 3.675 | 3.541 | 3.783 | 4.329 | 4.065 | 3.929 | 3.769 | 3.916 | 4.838 |
| return>20% dummy | (0.47) | (0.49) | (0.45) | (0.44) | (0.46) | (0.44) | (0.46) | (0.44) | (0.40) |
| Venture capital | 2.664 | 2.217 | 3.261 | 2.986 | 2.463 | 3.168 | 3.203 | 3.178 | 1.400 |
| dummy | (0.02) | (0.04) | (0.01) | (0.02) | (0.05) | (0.01) | (0.01) | (0.01) | (0.25) |
| NYSE dummy | -3.714 | -3.221 | -4.038 | -3.549 | -3.272 | -3.774 | -3.853 | -3.861 | -2.642 |
| | (0.03) | (0.05) | (0.02) | (0.05) | (0.07) | (0.03) | (0.02) | (0.02) | (0.16) |

**Panel B (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 18.27 | 18.99 | 17.72 | 17.60 | 15.96 | 17.37 | 17.28 | 17.41 | 18.06 |
| *N* | 1,235 | 1,235 | 1,235 | 1,068 | 1,058 | 1,235 | 1,235 | 1,235 | 987 |

**Panel C: IPOs of the issuers in the highest age quintile**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | 14.954 | 15.734 | 15.186 | 15.828 | 10.245 | 16.117 | 15.362 | 14.985 | 28.264 |
| | (0.07) | (0.05) | (0.05) | (0.07) | (0.05) | (0.04) | (0.03) | (0.03) | (0.06) |
| Network measures | | | | | | | | | |
| *Degree* | 0.014 | | | | | | | | -0.229 |
| | (0.79) | | | | | | | | (0.18) |
| *Closeness* | | 0.101 | | | | | | | -0.003 |
| | | (0.03) | | | | | | | (0.98) |
| *Betweenness* | | | -0.021 | | | | | | 0.089 |
| | | | (0.90) | | | | | | (0.81) |
| *Reciprocity* | | | | -0.010 | | | | | -0.023 |
| | | | | (0.69) | | | | | (0.48) |
| *Density* | | | | | -0.002 | | | | -0.076 |
| | | | | | (0.92) | | | | (0.19) |
| *Tie diversity* | | | | | | -0.029 | | | -0.104 |
| | | | | | | (0.17) | | | (0.41) |
| *Industry diversity* | | | | | | | -0.194 | | -0.201 |
| | | | | | | | (0.93) | | (0.96) |
| *Geographical diversity* | | | | | | | | 0.476 | |
| | | | | | | | | (0.86) | |
| … x Commercial bank | 0.011 | -0.018 | 0.068 | -0.011 | -0.019 | 0.048 | -0.696 | -1.638 | |
| dummy | (0.76) | (0.87) | (0.87) | (0.92) | (0.67) | (0.66) | (0.90) | (0.74) | |

**Panel C (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Market share | 0.059 | 0.018 | 0.073 | 0.068 | 0.065 | 0.066 | 0.066 | 0.068 | 0.127 |
| | (0.31) | (0.70) | (0.14) | (0.19) | (0.24) | (0.18) | (0.18) | (0.20) | (0.21) |
| Log (Expected | -0.365 | -0.676 | -0.305 | -0.635 | -1.029 | -0.474 | -0.316 | -0.261 | -0.993 |
| proceeds) | (0.79) | (0.63) | (0.83) | (0.69) | (0.55) | (0.74) | (0.81) | (0.83) | (0.53) |
| Absolute market | 20.226 | 20.110 | 20.259 | 19.744 | 21.371 | 20.300 | 20.253 | 20.286 | 21.321 |
| return>20% dummy | (0.15) | (0.15) | (0.15) | (0.15) | (0.14) | (0.15) | (0.15) | (0.15) | (0.14) |
| Venture capital | 3.137 | 3.025 | 3.159 | 2.857 | 2.971 | 3.081 | 3.176 | 3.208 | 2.659 |
| dummy | (0.02) | (0.03) | (0.02) | (0.05) | (0.05) | (0.03) | (0.02) | (0.02) | (0.10) |
| NYSE dummy | -2.638 | -2.574 | -2.622 | -2.429 | -2.100 | -2.555 | -2.617 | -2.630 | -0.213 |
| | (0.06) | (0.07) | (0.07) | (0.13) | (0.19) | (0.07) | (0.06) | (0.06) | (0.20) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 13.32 | 13.48 | 13.31 | 13.59 | 14.58 | 13.39 | 13.32 | 13.33 | 14.64 |
| *N* | 1,206 | 1,206 | 1,206 | 1,136 | 1,148 | 1,206 | 1,206 | 1,206 | 1,110 |

Because younger firms may have higher information asymmetry and require greater use of underwriter networks, we focus on the firms that fall in the lowest age quintile in Panel B and compare the results to those of firms that fall in the highest age quintile in Panel C. Indeed, we find that the network variables are more significant and the estimated coefficients are larger for younger firms than older ones. In Panel C, we find that all the network variables, except for closeness, are insignificant.

Overall, the price revision results suggest that the book managers with certain network structure engage more actively in price discovery in the primary market. Large, dense and homogenous networks that are centrally located and characterized by reciprocated relationships enhance the information production of the book managers. These results indicate that underwriters do receive better information from their ties to a large number of partners, close connections to the rest of the network, and intermediary positions between other underwriters. The results also show that the information generated for IPO pricing is the type that flows better through dense and homogenous ties. There is some evidence that the role of network is greater for younger firms with greater information asymmetry and that the network measures constructed from equity deals have greater explanatory power, which suggests greater information content of these ties.

### *2.5.2. Underpricing*

An aspect of IPO that receives a tremendous attention in the finance literature is underpricing (see Loughran and Ritter (2004), Ljungqvist and Wilhelm (2003)). Underpricing is measured by the percentage change from the offer price to the closing

price on the first trading day. Some previous studies explain IPO underpricing in terms of information asymmetry, while others maintain that underwriters underprice issues to avoid being sued.

We examine if a book manager's peer network has an impact on underpricing after controlling for price revision in the primary market in Table 2.7. In all the models, we control for the factors that are known to affect underpricing in the literature. For instance, Hoberg (2007) documents underwriter persistence phenomenon with an implication that market share may not be the only measure of underwriter capability. We consider the book manager's average residual underpricing on all IPOs, in which the book manager participated as a managing underwriter during the previous four-year period. We find that the underwriters, who underprice more, continue to do so as evidenced by the positive coefficients on the average abnormal underpricing of the book manager. Consistent with several previous studies that document an association between prestigious underwriters and underpricing, we also observe significant positive coefficients on the market share variable. The average underpricing of all IPOs issued during the previous 30 days is included to reflect the overall IPO market sentiment as in Bradley and Jordan (2002), and it has a positive effect on underpricing as well.

**Table 2.7: Book manager's network and IPO underpricing**

The table presents the estimated coefficients of regressions of issue underpricing. The dependent variable, underpricing, is measured by the percentage change from the offer price to the closing price of the first trading day. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters, and it is normalized by dividing it by the maximum eigenvector in the network. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters, and it is normalized by dividing it by the maximum betweenness in the network. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Market share is computed as the sum of the proceeds of the equity offerings lead by a specific underwriter, divided by the total deal volume of all the equity offerings during a period. Book manager average abnormal underpricing refers to the average residual underpricing of all IPOs the book manager is involved in as a managing underwriter. The IPO market sentiment is the average underpricing of all IPOs in the 30 days preceding the offer date. Price adjustment is the percentage difference from the filing range mid point to the offer price. Expected proceeds is defined as the filing range midpoint multiplied by the number of shares offered. Secondary shares refer to the percentage of total shares offered by insiders. Venture capital dummy equals to one if there is a venture capital back-up on the issue, and zero otherwise. NYSE dummy equals to one if the firm is listed on NYSE, and zero otherwise. Industry is defined according to two-digit SIC codes. *p*-values reported in the brackets are estimated using robust standard errors clustered within underwriters.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | -42.161 | -42.118 | -42.211 | -46.236 | -44.717 | -41.947 | -41.683 | -41.121 | -51.749 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Network measures | | | | | | | | | |
| *Degree* | 0.024 | | | | | | | | 0.191 |
| | (0.82) | | | | | | | | (0.36) |
| *Closeness* | | -0.033 | | | | | | | -0.233 |
| | | (0.60) | | | | | | | (0.15) |
| *Betweenness* | | | -0.134 | | | | | | -0.414 |
| | | | (0.79) | | | | | | (0.29) |
| *Reciprocity* | | | | -0.010 | | | | | -0.012 |
| | | | | (0.63) | | | | | (0.59) |

**Table 2.7 (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Density* | | | | | 0.000 | | | | 0.003 |
| | | | | | (0.98) | | | | (0.91) |
| *Tie diversity* | | | | | | -0.000 | | | -0.031 |
| | | | | | | (0.99) | | | (0.37) |
| *Industry diversity* | | | | | | | -0.202 | | -1.060 |
| | | | | | | | (0.78) | | (0.47) |
| *Geographical diversity* | | | | | | | | -0.768 | |
| | | | | | | | | (0.31) | |
| … x Commercial bank dummy | 0.007 | 0.049 | -0.209 | 0.108 | 0.127 | 0.429 | 15.631 | 16.167 | |
| | (0.92) | (0.76) | (0.66) | (0.58) | (0.10) | (0.20) | (0.14) | (0.12) | |
| Market share | 0.478 | 0.527 | 0.519 | 0.517 | 0.570 | 0.539 | 0.563 | 0.564 | 0.524 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.12) | (0.00) |
| BM average abnormal underpricing | 0.111 | 0.108 | 0.110 | 0.116 | 0.120 | 0.117 | 0.117 | 0.120 | 0.078 |
| | (0.08) | (0.09) | (0.09) | (0.10) | (0.10) | (0.06) | (0.06) | (0.06) | (0.30) |
| IPO market sentiment | 0.149 | 0.148 | 0.148 | 0.135 | 0.133 | 0.145 | 0.146 | 0.145 | 0.130 |
| | (0.01) | (0.02) | (0.02) | (0.03) | (0.03) | (0.02) | (0.02) | (0.02) | (0.03) |
| Price adjustment | 0.564 | 0.564 | 0.564 | 0.587 | 0.574 | 0.562 | 0.561 | 0.561 | 0.594 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Expected proceeds) | -2.227 | -1.967 | -2.064 | -2.426 | -2.749 | -2.212 | -2.314 | -2.383 | -2.787 |
| | (0.01) | (0.01) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Secondary shares | -0.070 | -0.070 | -0.069 | -0.067 | -0.068 | -0.070 | -0.070 | -0.070 | -0.068 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.20) | (0.00) | (0.00) | (0.00) | (0.01) |
| Venture capital dummy | 3.656 | 3.767 | 3.718 | 3.747 | 3.541 | 3.596 | 3.481 | 3.437 | 3.852 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| NYSE dummy | -2.640 | -2.677 | -2.596 | -2.464 | -2.277 | -2.661 | -2.668 | -2.662 | -2.067 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 44.72 | 44.72 | 44.72 | 46.23 | 45.32 | 44.80 | 44.85 | 44.90 | 46.99 |
| *N* | 5,865 | 5,865 | 5,865 | 5,247 | 5,289 | 5,865 | 5,865 | 5,865 | 5,004 |

The issues with revised offer price display higher underpricing in our results, which has been previously documented by Corwin and Schultz (2005) and Hanley (1993). The positive coefficient on price adjustment is consistent with the partial adjustment hypothesis proposed by Benveniste and Spindt (1989), which states that underwriters adjust price only partially to compensate their institutional investors. According to Habib and Ljungqvist (2001), insiders may care about underpricing to the extent that they may lose from it. The proportion of shares sold by the insiders may be a proxy of the amount of insider wealth at stake, and consistent with Habib and Ljungqvist (2001), the secondary shares have significant and negative coefficients in most of our regression results. We also control for venture capital back-up and NYSE listing. Indeed, the NYSE listed issues are underpriced less in line with their lower information asymmetry, while the issues with venture capital back-up are underpriced more. After controlling for these variables, the characteristics of book manager network have no impact on IPO underpricing.

*2.5.3. Post-IPO stock return*

Underwriters market securities and provide price support in IPOs and SEOs. In this analysis, we examine whether the characteristics of the book manager's network affect post-issue performance of IPOs. We regress the three-month post-IPO market-adjusted return, which is computed by subtracting the value-weighted market return from the stock return, on the book manager's network characteristics in Table 2.8. The regression results in Panel A show that the network size, closeness and betweenness matter as well as the diversity. The measures of network embeddedness, density and

reciprocity, are insignificant. The interaction terms with commercial bank dummy are also insignificant.

**Table 2.8: Book manager's network and post-IPO three-month return**
The table presents the estimated coefficients of regressions of post-IPO three-month return. The dependent variable is three-month percentage stock return adjusted by the value-weighted market return. Panel A presents the results of the regressions estimated using the full sample. Panel B presents the results of regressions estimated using the IPOs issued during hot markets, and Panel C presents the results using all other IPOs, excluding those issued during hot markets. Years 1983, 1986-1987, and 1992-1997 are identified as hot markets based on the issue volume. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters, and it is normalized by dividing it by the maximum eigenvector in the network. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters, and it is normalized by dividing it by the maximum betweenness in the network. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Market share is computed as the sum of the proceeds of the equity offerings lead by a specific underwriter, divided by the total deal volume of all the equity offerings during a period. Book manager average three-month abnormal return refers to the average market-adjusted return of all IPOs the book manager is involved in as a managing underwriter. Expected proceeds is defined as the filing range midpoint multiplied by the number of shares offered. Secondary shares refer to the percentage of total shares offered by insiders. Venture capital dummy equals to one if there is a venture capital back-up for the issue, and zero otherwise. NYSE dummy equals to one if the firm is listed on NYSE, and zero otherwise. Industry is defined according to two-digit SIC codes. *p*-values reported in the brackets are estimated using robust standard errors clustered within underwriters.

**Panel A: Full sample**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | 5.449 | 5.243 | 4.859 | -10.335 | 6.342 | 7.877 | 6.563 | 6.657 | 17.029 |
| | (0.02) | (0.03) | (0.08) | (0.01) | (0.11) | (0.01) | (0.03) | (0.03) | (0.01) |
| Network measures | | | | | | | | | |
| *Degree* | 0.461 | | | | | | | | 0.371 |
| | (0.00) | | | | | | | | (0.04) |
| *Closeness* | | 0.374 | | | | | | | -0.178 |
| | | (0.00) | | | | | | | (0.19) |
| *Betweenness* | | | 1.139 | | | | | | -0.261 |
| | | | (0.04) | | | | | | (0.76) |
| *Reciprocity* | | | | 0.019 | | | | | -0.005 |
| | | | | (0.56) | | | | | (0.89) |
| *Density* | | | | | 0.009 | | | | -0.019 |
| | | | | | (0.73) | | | | (0.62) |
| *Tie diversity* | | | | | | -0.078 | | | -0.200 |
| | | | | | | (0.00) | | | (0.00) |
| *Industry diversity* | | | | | | | -2.305 | | 1.950 |
| | | | | | | | (0.03) | | (0.33) |
| *Geographical diversity* | | | | | | | | -2.689 | |
| | | | | | | | | (0.03) | |
| … x Commercial | -0.102 | -0.059 | -0.532 | 0.075 | -0.103 | -0.540 | -10.106 | -12.849 | |
| bank dummy | (0.10) | (0.74) | (0.40) | (0.76) | (0.12) | (0.01) | (0.30) | (0.08) | |
| Market share | -0.247 | -0.010 | 0.018 | 0.227 | 0.150 | 0.130 | 0.141 | 0.126 | -0.034 |
| | (0.02) | (0.90) | (0.85) | (0.01) | (0.10) | (0.12) | (0.10) | (0.14) | (0.72) |
| BM average 3-month | 0.041 | 0.040 | 0.037 | 0.033 | 0.031 | 0.036 | 0.039 | 0.045 | 0.024 |
| abnormal return | (0.29) | (0.32) | (0.34) | (0.52) | (0.45) | (0.36) | (0.32) | (0.25) | (0.57) |
| Log (Expected | -2.433 | -2.589 | -0.829 | -1.174 | -1.171 | -1.164 | -0.700 | -0.700 | -4.003 |
| proceeds) | (0.00) | (0.00) | (0.18) | (0.08) | (0.09) | (0.09) | (0.28) | (0.28) | (0.00) |
| Secondary shares | 0.070 | 0.082 | 0.077 | 0.076 | 0.069 | 0.075 | 0.076 | 0.076 | 0.067 |
| | (0.03) | (0.01) | (0.01) | (0.02) | (0.04) | (0.02) | (0.02) | (0.02) | (0.04) |
| VC backup dummy | 0.562 | 0.454 | 1.380 | 1.482 | 1.399 | 1.153 | 1.386 | 1.417 | 0.165 |
| | (0.58) | (0.66) | (0.18) | (0.15) | (0.17) | (0.25) | (0.17) | (0.16) | (0.88) |

**Panel A (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| NYSE dummy | 5.605 | 5.886 | 5.278 | 5.875 | 6.159 | 5.724 | 5.574 | 5.588 | 6.499 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 5.94 | 5.78 | 5.56 | 5.85 | 6.03 | 5.68 | 5.53 | 5.58 | 6.59 |
| *N* | 6,502 | 6,502 | 6,502 | 5,789 | 5,797 | 6,502 | 6,502 | 6,502 | 5,476 |

**Panel B: IPOs issued during hot markets**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | -0.166 | -0.619 | -1.507 | -1.476 | -2.890 | 2.291 | -0.844 | -0.822 | 13.730 |
| | (0.94) | (0.77) | (0.48) | (0.50) | (0.24) | (0.41) | (0.74) | (0.75) | (0.01) |
| Network measures | | | | | | | | | |
| *Degree* | 0.323 | | | | | | | | 0.325 |
| | (0.00) | | | | | | | | (0.20) |
| *Closeness* | | 0.274 | | | | | | | -0.332 |
| | | (0.00) | | | | | | | (0.11) |
| *Betweenness* | | | -0.067 | | | | | | -0.665 |
| | | | (0.85) | | | | | | (0.25) |
| *Reciprocity* | | | | -0.003 | | | | | -0.024 |
| | | | | (0.94) | | | | | (0.43) |
| *Density* | | | | | 0.089 | | | | 0.019 |
| | | | | | (0.00) | | | | (0.60) |
| *Tie diversity* | | | | | | -0.060 | | | -0.216 |
| | | | | | | (0.04) | | | (0.00) |
| *Industry diversity* | | | | | | | -0.405 | | 0.881 |
| | | | | | | | (0.71) | | (0.68) |
| *Geographical diversity* | | | | | | | | -0.458 | |
| | | | | | | | | (0.71) | |

**Panel B (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| … x Commercial | -0.301 | -0.222 | -3.038 | -0.322 | 0.086 | 0.231 | 8.600 | 8.436 | |
| bank dummy | (0.17) | (0.33) | (0.06) | (0.00) | (0.50) | (0.78) | (0.62) | (0.72) | |
| Market share | -0.428 | -0.290 | -0.034 | -0.013 | 0.195 | -0.062 | -0.029 | -0.32 | 0.083 |
| | (0.03) | (0.04) | (0.84) | (0.93) | (0.21) | (0.64) | (0.84) | (0.82) | (0.66) |
| BM average 3-month | -0.030 | -0.028 | -0.028 | 0.006 | 0.041 | -0.032 | -0.028 | -0.028 | 0.047 |
| abnormal return | (0.43) | (0.46) | (0.46) | (0.89) | (0.38) | (0.41) | (0.47) | (0.47) | (0.38) |
| Log (Expected | -0.818 | -1.073 | 0.497 | 0.097 | -1.394 | -0.282 | 0.314 | 0.319 | -3.247 |
| proceeds) | (0.26) | (0.19) | (0.42) | (0.88) | (0.03) | (0.70) | (0.64) | (0.63) | (0.00) |
| Secondary shares | 0.118 | 0.122 | 0.118 | 0.113 | 0.113 | 0.120 | 0.122 | 0.122 | 0.110 |
| | (0.01) | (0.00) | (0.01) | (0.01) | (0.01) | (0.01) | (0.00) | (0.00) | (0.02) |
| VC backup dummy | 2.226 | 2.023 | 2.720 | 2.880 | 2.154 | 2.310 | 2.581 | 2.588 | 1.499 |
| | (0.06) | (0.07) | (0.02) | (0.01) | (0.05) | (0.04) | (0.02) | (0.02) | (0.17) |
| NYSE dummy | 7.376 | 7.704 | 7.281 | 6.722 | 8.246 | 7.532 | 7.282 | 7.278 | 8.456 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 4.27 | 4.25 | 4.01 | 4.12 | 4.17 | 4.14 | 3.99 | 3.98 | 5.03 |
| *N* | 3,645 | 3,645 | 3,645 | 3206 | 3,205 | 3,645 | 3,645 | 3,645 | 3006 |

**Panel C: All other IPOs, excluding those issued during hot markets**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | 8.452 | 7.926 | 7.341 | 9.010 | 16.379 | 12.033 | 12.577 | 12.862 | 10.872 |
| | (0.01) | (0.01) | (0.04) | (0.06) | (0.01) | (0.00) | (0.00) | (0.00) | (0.38) |
| Network measures | | | | | | | | | |
| *Degree* | 0.566 | | | | | | | | 0.196 |
| | (0.00) | | | | | | | | (0.50) |
| *Closeness* | | 0.516 | | | | | | | 0.274 |
| | | (0.00) | | | | | | | (0.28) |

**Panel C (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Betweenness* | | | 2.717 | | | | | | 0.548 |
| | | | (0.01) | | | | | | (0.76) |
| *Reciprocity* | | | | 0.069 | | | | | 0.036 |
| | | | | (0.23) | | | | | (0.62) |
| *Density* | | | | | -0.112 | | | | -0.064 |
| | | | | | (0.03) | | | | (0.41) |
| *Tie diversity* | | | | | | -0.113 | | | -0.124 |
| | | | | | | (0.00) | | | (0.30) |
| *Industry diversity* | | | | | | | -7.349 | | 7.117 |
| | | | | | | | (0.00) | | (0.30) |
| *Geographical diversity* | | | | | | | | -8.735 | |
| | | | | | | | | (0.00) | |
| … x Commercial | -0.093 | -0.018 | -0.943 | 0.102 | -0.092 | -0.574 | -13.283 | -13.301 | |
| bank dummy | (0.14) | (0.93) | (0.26) | (0.72) | (0.16) | (0.00) | (0.16) | (0.04) | |
| Market share | -0.137 | 0.149 | 0.031 | 0.388 | 0.118 | 0.271 | 0.246 | 0.224 | -0.033 |
| | (0.31) | (0.18) | (0.82) | (0.00) | (0.28) | (0.03) | (0.04) | (0.05) | (0.80) |
| BM average 3-month | 0.087 | 0.084 | 0.085 | 0.036 | 0.019 | 0.075 | 0.087 | 0.095 | 0.013 |
| abnormal return | (0.15) | (0.20) | (0.16) | (0.67) | (0.73) | (0.22) | (0.16) | (0.10) | (0.81) |
| Log (Expected | -3.956 | -4.179 | -2.331 | -2.688 | -1.735 | -2.309 | -2.039 | -2.091 | -4.531 |
| proceeds) | (0.00) | (0.00) | (0.04) | (0.03) | (0.16) | (0.04) | (0.08) | (0.07) | (0.00) |
| Secondary shares | 0.043 | 0.068 | 0.059 | 0.067 | 0.053 | 0.061 | 0.059 | 0.059 | 0.054 |
| | (0.40) | (0.16) | (0.24) | (0.17) | (0.29) | (0.22) | (0.22) | (0.22) | (0.30) |
| VC backup dummy | -1.633 | -1.724 | -0.668 | -0.702 | -0.093 | -0.721 | -0.535 | -0.515 | -1.518 |
| | (0.36) | (0.36) | (0.72) | (0.72) | (0.96) | (0.70) | (0.77) | (0.78) | (0.42) |
| NYSE dummy | 3.749 | 3.863 | 3.303 | 5.114 | 4.122 | 3.667 | 3.692 | 3.675 | 4.365 |
| | (0.15) | (0.13) | (0.20) | (0.08) | (0.13) | (0.16) | (0.15) | (0.16) | (0.14) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 7.67 | 7.43 | 7.42 | 7.60 | 7.99 | 7.30 | 7.28 | 7.38 | 8.20 |
| *N* | 2,857 | 2,857 | 2,857 | 2,583 | 2,592 | 2,857 | 2,857 | 2,857 | 2,470 |

These results show that when book managers have many partners (degree), are generally close to all other underwriters (closeness), occupy exclusive network positions (betweenness), they are associated with higher short-run IPO returns. Finally, book managers that work with similar partners and thus, have more homogenous networks are also associated with higher IPO returns. These results can be driven by the fact that the book managers with above network characteristics can both market the security better and initially produce more information leading to less negative surprises. The median three-month market-adjusted IPO return is -3.13 percent. In model 9, when we regress all the network variables together, the network size and tie diversity measures are still significant with a positive and negative coefficient, respectively. As for the economic significance of these variables, when the closeness centrality of the book manager's network increases by one standard deviation, for instance, the three-month stock return increases by 3.34 percent. Similarly, when the tie diversity falls by one standard deviation, the three-month stock return increases by 2.27 percent.

The estimated positive and significant coefficients on the market share in some of the models are consistent with the previously documented association of more prestigious underwriters and better performing IPOs. Bao and Edmans (2007) find that the past return of advisors has explanatory power in M&A acquirer returns, but the past return of IPOs of the book managers is insignificant in our results. The firms listed on NYSE and issues with a larger number of secondary shares tend to perform better within a three-month horizon as well.

Underwriters may need to utilize their networks more, when there is less information available during periods with low deal volume. Thus, we estimate the

regressions using IPOs issued during hot markets and also using all IPOs, excluding those issued during hot markets, in Panels B and C, respectively. We find that the results from the sample of IPOs issued during normal and cold market conditions in Panel C are more significant and the coefficients of the network variables are larger than those estimated using the IPOs issued during hot markets in Panel B.

The results also remain qualitatively the same with the use of industry adjusted returns and one-month returns. In unreported regressions, we repeat the analysis using the network measures constructed from equity and debt deals separately. When we conduct similar analysis on one- and two-year post-issue returns, we find no effect of book manager peer network, which is consistent with the underwriter services exerting the most impact in the short run.

All the previous results presented in Section 5 remain robust to alternative specifications. We repeat the previous analyses using network measures constructed in a variety of ways. Specifically, the network measures are computed over moving two-year periods. Additionally, we focus on all the managing underwriters in an IPO instead of just the book managers and compute the average network measures of managing underwriters for each issue. All the results remain robust to the implementations of these various measures.

## 2.6. Conclusions

In this paper, we assess the impact of underwriter peer networks on IPO pricing and performance, using measures from social network analysis and a sample of U.S. IPOs

issued between 1974 and 2007. The network measures are constructed using underwriter ties that result from underwriting syndicates of public issues between 1970 and 2007. A unique aspect of an underwriter's relationships with others is that through these relationships, an underwriter can access information generated from other underwriters' client and investor networks. Particularly, in a knowledge- and information-based industry like investment banking, such networks could be pivotal. Hence, we expect significant consequences from underwriter peer networks.

Our analysis reveals that underwriter networks have a significant impact on the price discovery and marketing of IPOs. When book managers have many partners, are generally close to all other underwriters, occupy exclusive network positions, and have dense and homogenous networks, the IPOs are associated with a higher likelihood of an offer price revision. Beyond the impact on price revision, book manager peer network has no additional effect on underpricing, but it has a significant impact on the post-issue short-run stock returns. Book managers with larger, more central and more homogenous networks are associated with higher three-month stock returns. Moreover, the impact of book manager peer network is greater in the price discovery of relatively younger firms and in the placement of deals during certain market conditions, further highlighting the informational role of peer network. We find no significant difference between the effects of the peer networks of commercial banks and investment banks. In general, the results show that the underwriters use their peer networks to generate information and place securities, and the structure of the networks has implications for the volume and the quality of information shared between the underwriters.

The main contribution of this study is to illustrate the impact of underwriter peer networks on IPOs and propose that the peer relationship is another information channel in addition to the previously discussed client and investor networks of underwriters. The results indicate that the network effect is different from that of a bank's reputation. Overall, our study sheds light on the role of social networks in securities issuance.

# CHAPTER 3

# M&A ADVISOR RELATIONSHIPS: THE IMPACT ON SHAREHOLDER WEALTH

## 3.1. Introduction

Mergers and acquisitions (M&A) are among the most critical events that firms encounter. In these colossal deals, financial advisors play a crucial role. Financial advisors, in turn, maintain relationships with each other through their cooperation in various investment banking activities. Given that an advisor serves not only as an expert in M&As, but also as an intermediary in deal negotiation, its relationship with the advisors on the opposite side of the deal may have significant implications. This paper attempts to shed light on advisor peer relationships and their role in M&A deals. More specifically, we study how the relative bargaining power, inherent in the business relationships between the acquirer and target advisors, affects the shareholder wealth of the acquirer and target firms by examining target premium, announcement returns, and division of shareholder wealth gain.

An M&A deal involves a negotiation process, and therefore, advisors' bargaining power can play a significant role in it. Bargaining power can result from the interdependence in inter-organizational relationships. In other words, one's power stems from another's dependence. If two advisors maintain a working relationship and one advisor is more dependent than the other on this relationship for future business generation and information production, the other advisor may possess a greater bargaining power. As a result, in order not to jeopardize its relationship with an important partner, the advisor with the less bargaining power may find its actions in an

M&A deal constrained to certain extent, whereas the advisor with the greater bargaining power may be able to negotiate more favorable deal terms for its client. Overall, power relations that exist among advisors in various investment banking segments may cause an incentive misalignment between firms and advisors and influence how the wealth gain is shared between target and acquirer firms.

We examine the consequences of power in advisor peer relationships on 2,938 domestic M&A deals of public firms between 1984 and 2007. To measure the existence and the strength of advisor peer relationships, we use all public security issues and M&As during 1980-2007 that employ multiple underwriters or advisors, and create a measure of relative dependence for each pair of advisors. Two advisors are considered to have a relationship if they serve together as underwriters in the same syndicate or advise the same firm on an M&A deal. The importance of a relationship with a certain advisor is measured by the percent of all co-managed deals completed with that advisor.

Our results show that the dynamics of the relationship between acquirer and target advisors exerts a significant impact on the acquirer and target shareholder wealth. The regression results indicate that when the relative bargaining power of the acquirer (target) advisor in the relationship is greater than that of the target (acquirer) advisor, the announcement return and the share of the wealth gain pertaining to the acquirer (target) firm is higher possibly because of more favorable deal terms negotiated by the acquirer (target) advisor. The results also show that when the target advisor has more power in the acquirer-target advisor relationship, target shareholders obtain higher premium. However, the results are generally weaker on the sell side compared to the ones on the buy side, reflecting the asymmetry in the target and acquirer advisor functions in M&As.

In addition, it is possible that the familiarity between acquirer and target advisors stemming from past working relationships fosters more effective information transmission and deal negotiation. Yet, we find no significant effect of the past familiarity between the target and acquirer advisors on the likelihood of deal completion, completion speed and total wealth gain. We also find evidence that despite the additional conflict of interest that may result from the relationship between the target and acquirer advisor, target firms are more likely to hire advisors that previously worked with the acquirer advisor.

Consequently, our main contribution lies in highlighting the role and importance of advisor peer relationships and showing how a potential conflict of interest can arise from them in the context of an M&A deal. Investment banking is considered a relationship-intensive industry with substantial built-in conflicts of interest that need to be managed, but to the best of our knowledge, the impact of relationship between the acquirer and target advisors has not been addressed in the prior literature.

Our study is also relevant to several research areas in finance. First, the study is related to the discussion of the broad role of financial advisors in M&As and the extent to which they add value. Our findings clearly illustrate how advisor peer relationship can affect shareholder wealth in M&As. Furthermore, this paper is indirectly related to the function of boutique investment banks. Despite the increasing importance of financial capital relative to human capital in many investment banking activities, advisory service still remains largely dependent on tacit human capital, and the market for small and focused boutique banks has grown lately. The boutique banks typically do not participate in security underwriting, and therefore, have no underwriting ties to the advisors on the

other side of the deal table. Finally, this paper fits among the growing body of research on social networks. Our work shows that the existence of relationships between acquirer and target advisors, especially close working relationships, can affect how the advisors advise on these strategically sensitive deals.

The remainder of the paper is organized as follows. Section 3.2 discusses M&A advisors and their peer relationships in further detail. Section 3.3 introduces the data and the descriptive statistics. Section 3.4 presents the regression results, and Section 3.5 concludes.

### 3.2. The role of advisor peer relationships in M&As

Mergers and acquisitions are one of the most prominent events in a firm's lifecycle. Given their strategic significance and the large deal size, extensive research examines various aspects of mergers and acquisitions, including the role of the financial advisors that advise on these deals. In M&As, the role of such advisors extends into a number of areas. Experienced advisors provide knowledge on market dynamics, consult on regulatory matters, offer networks of contacts, identify potential acquirer or target firms, and help resolve potentially difficult situations. Overall, the main functions of M&A advisors can be considered as providing expertise in various areas and serving as an intermediary in deal negotiation.

Bowers and Miller (1990) were among the first to examine whether investment banks add value in acquisitions, and since then, substantial literature exists on the role of M&A advisors. Particularly popular topics have been the choice of an advisor (e.g., Da

Silva Rosa et al. (2004), Forte, Iannotta, and Navone (2007), Hunter and Jagtiani (2003), Serveas and Zenner (1996), Thomas (1995)) and the impact of advisor reputation (e.g., Ma (2007), Michel, Shaked, and Lee (1991), Rau and Rodgers (2002)). For instance, Servaes and Zenner (1996) investigate the factors that determine whether an acquirer hires an advisor and how that hiring decision affects announcement returns, and Ma (2007) studies whether target shareholders benefit from hiring top tier banks.

Most of the previous research, however, focuses on acquirer rather than target advisors. In general, studies that focus on both acquirer and target advisors are rather rare. Exceptions to this include the study by Kale, Kini, and Ryan (2003), which examines the effect of the relative reputation of advisors on the share of wealth gain in corporate takeovers, and that by Allen et al. (2004), which studies commercial banks that serve as merger advisors and focuses on their previous lending relations with acquirer and target firms. These studies, however, do not explore the role of the relationships among advisors. In fact, most research on advisor relationships focuses on advisor-firm relationship. For instance, Saunders and Srinivasan (2001) study the effect of prior bank-firm relationship on advisory fees, and Allen and Peristiani (2007) explore the effect on the pricing of syndicated loans when the acquirer's advisor serves as the lender.

M&A advisors may maintain relationships with each other because of their previous cooperation in investment banking activities such as security underwriting and M&A advisory services. With syndication becoming increasingly frequent in underwriting, the network of ties that exist among banks is becoming denser. Given the fierce competition in the underwriting industry, having strong ties to other prominent underwriters is very important as underwriters can be invited as co-managers on the deals

that are lead by others. Ljungqvist et al. (2007) also show that becoming a co-manager in a security underwriting increases the likelihood of an investment bank being selected as a book runner in the future deals of the firm. In a reputation- and knowledge-intensive industry like investment banking, thus, peer relationships are crucial as they represent deal flow and information channels.

The existence of relationships between acquirer and target advisors, especially close working relationships, may influence their function on these strategically sensitive deals, because advisors need to manage the relationships with their partners as well. Particularly, relationship between target and acquirer advisors can introduce an additional conflict of interest that may result in deal terms that are more favorable to one firm than the other. An important aspect of investment banking is the built-in conflicts of interest that must be managed. Some dimensions of conflict of interest in investment banking have already been examined. For example, using U.K. data, Stouraitis (2003) examines how the announcement return and premium differ when advisors invest their own money and provide financing in the deal. Bodnaruk, Massa, and Simonov (2007) examine if banks advising the bidders use their privileged information to their benefit by investing in the target firms. The conflict of interest inherent in the provision of fairness opinions has also attracted academic interest lately, as evidenced by the studies of Calomiris and Hitscherich (2005), Kisgen, Qian, and Song (2007), and Makhija and Narayanan (2007). However, to the best of our knowledge, a potential conflict of interest that arises from the relationship between advisors has not been examined in the extant literature. In general, relationships and networks can produce both positive and negative outcomes, and the ties that bind can easily become the ties that blind (Smith-Doerr and Powell (2005)).

M&A deal negotiation is a bargaining process and thus, the advisors' bargaining power can play a significant role. Such power stems from the interdependence of the advisors in peer relationships. More specifically, according to the resource dependence theory (Emerson (1962)), one's power essentially derives from another's dependence. If a certain relationship between two parties is more important to one party because this party generates a larger portion of its revenues from the relationship, and thus, it is more dependent on the relationship, the other party may hold greater bargaining power. In our setting, if the target and acquirer advisors have a close working relationship in various investment banking segments, they rely on this relationship for future business generation and information production. However, the extent of their dependence on the relationship can be different. This difference in their relative dependence, in turn, can indicate who has more power. For example, in order not to jeopardize its relationship with an important partner, the advisor with less bargaining power may find its actions constrained to some extent and not advocate for the interest of its client firm as much as it would have otherwise. On the other hand, the advisor with the greater bargaining power can use this to its advantage and negotiate better deal terms for its client. A number of prior studies in finance have established that the deal design and the terms of transactions do matter in M&As. For instance, previous research has examined the role of lockup options (Burch (2001)), method of payment (Chang (1998)), termination fee (Officer (2003)), and markup pricing (Schwert (1996)).

More specifically, for the acquirer firms, advisors can help to make sure that the acquirer is not overpaying. For the target firms, advisors can assist firms to better estimate their values and obtain higher premium for their shareholders. Therefore, when

the target (acquirer) advisor has more power in the acquirer-target advisor relationship, it may be able to obtain higher (lower) premium for target shareholders and negotiate more favorable deal terms for the target (acquirer) firm resulting in higher announcement returns and larger share of wealth gains for the target (acquirer) firm. Overall, power dynamics in the relations between advisors may cause an incentive misalignment between firms and advisors and influence how the wealth gain is shared between target and acquirer firms.

On the other hand, it is possible that advisors that worked together previously, especially in M&A deals, have better communication and information sharing skills due to their familiarity with each other. According to Bruner (2004), negotiation is a learning process in which new information must be produced and analyzed in real time. Effective communication, therefore, is critical. Past shared experience and repeated interactions between advisors can improve the quantity and quality of information shared during the M&A process. This informational advantage can help advisors negotiate deal terms more effectively and efficiently, and thus, positively affect deal outcomes.

The impact of familiarity and trust on performance has been examined previously in other fields, especially in the context of team and alliance performance in strategy and organizational literature. For example, Huckman, Staats, and Upton (2009) document that team familiarity and team performance are positively related. Espinosa et al. (2007) also find that team familiarity is beneficial, especially when team coordination is more difficult.

The familiarity, thus, implies that employing target and acquirer advisors that have previously worked together can have positive effect on the deal at hand because of

the improved information transmission. Specifically, this informational advantage can help advisors identify deals that create higher value to shareholders. Effective and efficient negotiation can also lead to a higher likelihood of deal completion or faster deal completion.

### 3.3. Data

To measure the existence and the strength of pairwise relationships among financial advisors in M&As, we obtain data on public security issues and M&A deals between 1980 and 2007 from Securities Data Corporation (SDC). Specifically, we use all U.S. public issues that employ two or more underwriters and all M&A deals involving a U.S. firm and at least fifteen percent stake that also employ two or more advisors on either acquirer or target side. In total, we obtain 57,617 public issues of various types and 6,471 M&As between 1980 and 2007 as shown in Table 3.1. Two investment banks are considered to have a relationship if they serve together as underwriters in the same syndicate or as advisors for the same firm on a merger deal. As we want to examine power in relationships, we focus on syndicate roles with potential to build significant relationships. Thus, we consider managing underwriters in equity syndicates and joint lead underwriters in debt syndicates to construct ties among underwriters.

**Table 3.1: Sample of security issues and M&A deals that employ multiple underwriters and advisors**

The following sample includes all public securities issued in the U.S. between 1980 and 2007 that employ two or more underwriters and all M&A deals involving a U.S. firm and at least fifteen percent stake that employ two or more advisors on either acquirer or target side. We use these deals to construct pairwise advisor relationship variables.

| | | | Number of deals |
|---|---|---|---|
| All public issues | 57,617 | | |
| Equity | | 16,613 | |
| Initial public offerings | | | 7,629 |
| Seasoned equity offerings | | | 8,984 |
| Debt | | 41,004 | |
| Non-convertible debt | | | 36,825 |
| Convertible debt | | | 869 |
| Non-convertible preferred | | | 2,755 |
| Convertible preferred | | | 555 |
| Mergers and acquisitions | 6,471 | | |
| All deals | 64,088 | | |

Based on these public securities and M&A deals, we identify all pairwise relationships between investment banks over moving four-year periods. Relationships are not likely to vanish as soon as a deal is over. Underwriters and advisors may interact with each other before or after the deal. Therefore, to account for the continuous nature of relationships, we use four-year moving period approach. In total, there are 25 four-year periods between 1980 and 2007. We use reported underwriter and advisor names, but multiple variations of the same name appear in the SDC data due to inconsistent abbreviation, punctuation or spelling such as Goldman Sachs & Co and Goldman, Sachs & Co. We check all the names and manually correct the names when necessary. In the case of investment bank mergers, we treat the post-merger bank as a new entity because a multitude of changes and restructuring occur around bank mergers.

For each pair of investment banks, we compute the number and dollar volume of deals they worked on together. Table 3.2 describes these pairwise relationships among all investment banks across different investment banking segments. As presented in Table 3.2, an investment bank maintains relationships with 13.86 banks on average, when we consider all types of deals. The average strength of these pairwise relationships is 7.09 deals or $3,070.31 million in deal volume.

**Table 3.2: Characteristics of the relationships among investment banks**
The table presents the characteristics of the pairwise relationships among all investment banks that serve as underwriters and financial advisors between 1980 and 2007. We identify pairwise relationships among investment banks using the deals in Table 1. Two investment banks are considered to be related if they serve together as managing underwriters in the same equity syndicate or as joint book managers in the same debt syndicate or as advisors for the same firm on a M&A deal over moving four-year periods. The strength of a pairwise relationship between two investment banks refers to the total number (dollar volume) of deals these two investment banks worked on together during a given four-year period.

| | **Mean** | **Median** | **Min** | **Max** | ***N*** |
|---|---|---|---|---|---|
| Number of relationships a bank maintains in | | | | | |
| M&A deals | 4.91 | 1 | 1 | 97 | 5,916 |
| Public issues | 23.40 | 15 | 1 | 109 | 2,684 |
| Equity issues | 24.16 | 16 | 1 | 109 | 2,489 |
| Debt issues | 3.96 | 1 | 1 | 41 | 753 |
| All deals | 13.86 | 2 | 1 | 167 | 8,501 |
| | | | | | |
| Strength of a pairwise relationship based on | | | | | |
| *Number of deals in* | | | | | |
| M&A deals | 2.05 | 1 | 1 | 56 | 36,582 |
| Public issues | 7.99 | 2 | 1 | 808 | 108,930 |
| Equity issues | 6.74 | 2 | 1 | 238 | 105,716 |
| Debt issues | 11.97 | 2 | 1 | 783 | 13,180 |
| All deals | 7.09 | 2 | 1 | 808 | 133,358 |
| *Dollar volume of deals ($ mil) in* | | | | | |
| M&A deals | 3,891.64 | 383.84 | 0.28 | 310,695 | 33,706 |
| Public issues | 2,487.69 | 214.03 | 0.11 | 281,043 | 108,930 |
| Equity issues | 1,849.26 | 207.73 | 0.11 | 141,506 | 105,716 |
| Debt issues | 5,727.37 | 374.54 | 3.05 | 220,643 | 13,180 |
| All deals | 3,070.31 | 234.93 | 0.11 | 507,929 | 130,982 |

A relationship between two investment banks, however, may be of differing importance to each bank. Thus, to measure the importance of a specific relationship to an investment bank, we compute a dependence ratio by dividing the number (dollar volume) of deals completed with a certain bank by the number (dollar volume) of deals completed with all partner banks. Specifically,

Dependence of advisor *i* on advisor *j* =

= (∑ deals advisor *i* worked w/ advisor *j*) /(∑ deals advisor *i* worked w/ others) (1)

Consequently, the importance of a relationship is expressed as a percent of all co-managed deals completed with a certain bank. For example, during the period of 2004-07, Merrill Lynch and Lazard worked together on 28 deals of various types according to our criteria. During the same period, in total, Merrill Lynch and Lazard cooperated with others on 1,816 and 214 deals, respectively. Therefore, 28 deals on which they worked together represent 1.54 percent of all co-managed deals for Merrill Lynch, while it represents 13.08 percent for Lazard. Clearly, this cooperative relationship is of much more significance to Lazard than Merrill Lynch.

Furthermore, for a given pair of banks, the difference between their respective relationship dependence ratios may indicate to whom this relationship is more important and indicate relative bargaining power. Formally,

Relative dependence of advisor *i* on advisor *j* =

= Dependence of advisor *i* on advisor *j* – Dependence of advisor *j* on advisor *i* (2)

In the above example of Merrill Lynch and Lazard, the relative dependence ratio of Lazard on Merrill Lynch is 11.54 (= 13.08 – 1.54). A positive measure means Lazard is relatively more dependent on this relationship than Merrill Lynch. If the difference

equals to zero, it indicates equal dependence and thus neither party has greater bargaining power over the other.

Moreover, the importance of a relationship between advisors *i* and *j* for advisor *i* can be high or low, and at the same time, the relative importance of this relationship for advisor *i* can be greater or less than the importance of this relationship for advisor *j*. Thus, the bargaining power of advisor *j* that stems from the greater relative dependence of advisor *i* may be magnified if this relationship is an important relationship to advisor *i* to start with (i.e. the importance for advisor *i* is high). Hence, the interaction between the relative and absolute dependence measures can further highlight the power dynamics in relationship.

To analyze the impact of advisor relationships in M&As, next we obtain all domestic M&A deals between 1984 and 2007 that employ both acquirer and target advisors. We require that the acquirer holds less than 50 percent of the target firm at the announcement with plans to acquire more than 50 percent, and the acquirer and target are public firms with price information available from Center for Research on Security Price (CRSP) database. In line with previous research, the minimum deal value is set at $1 million. We also include only the first bid for the same target within two years to avoid double-counting target firms that receive multiple bids.

After applying the above criteria, we obtain a final sample of 2,938 domestic M&As between 1984 and 2007, of which 2,659 are completed. In total, 4,568 firms and 423 advisors are involved in these deals. About 869 deals involve financial acquirers in our sample. When we repeat the analysis excluding these firms, we obtain qualitatively the same results. There are 159 hostile and 178 challenged deals in the sample, as well as

1,786 deals that utilize termination fees. Of all acquisitions, 1,113 are also considered horizontal acquisitions as the primary SIC codes of the acquirer and target firms are the same. The takeover history of both acquirer and target firms are obtained from SDC. Since Bao and Edmans (2007) find performance persistence in acquirer advisors, we also compute the average announcement return of the previous client firms of the advisors, in addition to the advisors' market shares.

Table 3.3 presents the descriptive statistics of the final sample of 2,938 M&As. When presenting advisor characteristics in Table 3.3, we collapse the sample to advisor-period observations. Similarly, when presenting advisor pairwise relationship characteristics, we collapse the observations to unique acquirer-target advisor pairs across different periods. For each pair of acquirer and target advisor, we compute the relative dependence ratio between the advisors. When two advisors have no prior relationship, this ratio equals to zero to indicate that neither advisor has greater bargaining power over the other. In a small number of deals with multiple advisors advising the same firm, we take the average of the advisor characteristics. Table 3.3 shows that the computed dependence ratio of the financial advisors that advise on these 2,938 M&As range from 0 to 100. The average market share of the acquirer advisor is 4.28 percent while that of the target advisor is 3.70 percent. The relationship measures based on the number of deals are used in the regression analysis, because the dollar values of some M&A deals are missing during the early sample periods. The results, however, remain qualitatively the same when the dollar based measures are used.

**Table 3.3: Descriptive statistics**

The table presents the descriptive statistics of 2,938 U.S. domestic M&As involving public target and acquirer firms between 1984 and 2007. The advisor characteristics are measured over moving four-year periods from 1980 to 2007. The dependence of advisor *i* on advisor *j* is measured by the number of all deals advisors *i* and *j* worked together divided by the number of all co-managed deals completed by advisor *i*. An advisor's market share refers to the percent of the total deal volume of all M&A deals advised by the financial advisor. Acquirer (target) advisor's average ACAR (TCAR) refers to the average cumulative three-day abnormal return of all acquirer (target) firms the acquirer (target) advisor advised during the previous four-year period. The strategic complexity measure is a sum of five dummy variables that capture the difficulties of completing a deal such as two-tier structure or pending litigations. Target premium is measured by the percentage difference between the offer price and the target firm's share price 21 days prior to the announcement. The previous M&As of the acquirer and target firms refer to the number of all previous M&A transactions completed by these firms. The relative size is the ratio of acquirer market value to target market value, where market value is measured at 21 days prior to the deal announcement. Industry fixed effects are based on the acquirer two-digit SIC codes.

| | **Mean** | **Median** | **Min** | **Max** | **Std dev** | ***N*** |
|---|---|---|---|---|---|---|
| *Acquirer advisor characteristics (%)* | | | | | | |
| Dependence of the acquirer adv on target adv in | | | | | | |
| M&A deals | 2.75 | 0 | 0 | 100 | 7.55 | 1,123 |
| Public issues | 3.92 | 0 | 0 | 100 | 7.91 | 1,123 |
| Equity issues | 5.39 | 0 | 0 | 100 | 10.11 | 1,123 |
| Debt issues | 0.72 | 0 | 0 | 50 | 3.52 | 1,123 |
| All deals | 4.21 | 0 | 0 | 100 | 7.80 | 1,123 |
| Acquirer advisor market share | 4.28 | 0.38 | 0 | 70.76 | 8.48 | 1,123 |
| Acquirer advisor's past ACAR | 0.40 | 0.35 | -39.53 | 57.81 | 5.33 | 848 |
| | | | | | | |
| *Target advisor characteristics (%)* | | | | | | |
| Dependence of the target adv on acquirer adv in | | | | | | |
| M&A deals | 3.15 | 0 | 0 | 100 | 10.16 | 1,280 |
| Public issues | 3.99 | 0 | 0 | 100 | 8.17 | 1,280 |
| Equity issues | 5.35 | 0 | 0 | 100 | 10.08 | 1,280 |
| Debt issues | 0.81 | 0 | 0 | 66.67 | 3.99 | 1,280 |
| All deals | 4.76 | 0 | 0 | 100 | 10.36 | 1,280 |
| Target advisor market share | 3.70 | 0.20 | 0 | 70.76 | 8.03 | 1,280 |
| Target advisor's past TCAR | 19.49 | 18.33 | -17.64 | 187.73 | 13.58 | 985 |

**Table 3.3 (continued)**

| | Mean | Median | Min | Max | Std dev | *N* |
|---|---|---|---|---|---|---|
| *Acquirer and target advisor characteristics (%)* | | | | | | |
| Relative dependence of the acquirer adv on target adv in | | | | | | |
| (= -Relative dependence of the target adv on acquirer adv) | | | | | | |
| M&A deals | -0.31 | 0 | -99.45 | 99.45 | 8.73 | 3,881 |
| Public issues | -0.56 | 0 | -99.86 | 99.12 | 9.69 | 3,881 |
| Equity issues | -0.44 | 0 | -99.64 | 99.72 | 11.66 | 3,881 |
| Debt issues | -0.17 | 0 | -66.41 | 49.65 | 4.50 | 3,881 |
| All deals | -0.66 | 0 | -99.94 | 97.87 | 9.75 | 3,881 |
| | | | | | | |
| *Deal and firm characteristics* | | | | | | |
| Deal value ($ mil) | 1,724.70 | 317.17 | 1.31 | 164,746.9 | 6,346.00 | 2,938 |
| Percent cash (%) | 32.01 | 0 | 0 | 100 | 42.10 | 3,109 |
| Complexity | 0.84 | 1 | 0 | 4 | 0.58 | 3,109 |
| Acquirer three-day ab. return (%) | -2.28 | -1.87 | -69.30 | 51.33 | 10.13 | 2,933 |
| Target three-day ab. return (%) | 20.30 | 16.94 | -69.38 | 244.51 | 23.70 | 2,934 |
| Combined wealth gain ($ mil) | -27.72 | 6.12 | -29,743.98 | 17,276.19 | 1,653.25 | 2,929 |
| Combined wealth gain (%) | 6.95 | 3.88 | -3,321.20 | 5,836.55 | 271.05 | 3,099 |
| Target premium (%) | 40.68 | 33.43 | -92.94 | 1,533.33 | 51.47 | 2,845 |
| Toehold ownership (%) | 0.84 | 0 | 0 | 49 | 4.67 | 2,938 |
| No. of acquirer SIC codes | 4.32 | 3 | 1 | 26 | 3.42 | 2,938 |
| No. of target SIC codes | 2.83 | 2 | 1 | 25 | 2.15 | 2,938 |
| No. of previous M&A deals of acquirer | 8.20 | 4 | 0 | 114 | 11.33 | 2,938 |
| No. of previous M&A deals of target | 3.46 | 1 | 0 | 72 | 5.55 | 2,938 |
| Acquirer market value ($ mil) | 8,296.21 | 1,204.55 | 1.17 | 567,484.2 | 26,368.72 | 2,933 |
| Target market value ($ mil) | 1,140.20 | 208.50 | 1.67 | 78,204.26 | 4,185.11 | 2,934 |
| Relative size (%) | 47.47 | 21.77 | 0.04 | 11,447.92 | 245.00 | 2,934 |

As for the 2,938 deals, the average deal value is $1,724.70 million, and 32.01 percent of the deal financing comes from cash payments. The strategic complexity measure is a sum of five dummy variables that capture the difficulties of completing a deal such as two-tier structure or pending litigations. The average complexity measure is 0.84 in the sample. The average acquirer and target three-day announcement returns are -2.28 and 20.30 percent, respectively, which are consistent with the target firms usually experiencing much higher announcement returns than the acquirer firms. The median target premium, which is measured as the percentage difference between the offer price and the target firm's share price 21 days prior to the announcement, is 33.43 percent in our sample. This is consistent with the previously reported average premium of 38 percent between 1973 and 1998 (Andrade, Mitchell and Stafford (2001)).

As evidenced by the median toehold ownership of zero, most acquirers do not have previous toehold ownership in the target firms. On average, the acquirer and target firm operate in 4.32 and 2.83 different industries, which suggest that acquirer firms tend to be more diversified than target firms. The median acquirer firm is also about five times larger than the median target firm, and acquirer firms are involved in 8.20 M&A deals before the deal at hand. In the next section, we investigate how the acquirer-target advisor relationship affects the shareholder wealth of M&A deals.

### 3.4. The effect of advisor peer relationships on shareholder wealth

*Target premium*

Substantial attention has been paid to the premium that the target shareholders receive over the target firm's premerger price in M&As. Target advisors typically work to negotiate favorable deal terms for the target shareholders and to obtain high premium for them. We examine whether the relative dependence of the target advisor on the acquirer advisor affects the size of the target premium in Table 3.4. Table 3.4 presents the OLS regression results, and the dependent variable, target premium, is winsorized below at the 10 percent and above at the 90 percent level.

**Table 3.4: Relative dependence between advisors and target premium**
The table presents the results of OLS regressions of target premium. Target premium is measured by the percentage difference between the offer price and the target firm's share price 21 days prior to the announcement. The dependent variable is winsorized at 10% and 90% levels. The dependence of advisor *i* on advisor *j* is measured by the number of all deals advisors *i* and *j* worked together divided by the number of all co-managed deals completed by advisor *i*. An advisor's market share refers to the percent of the total deal volume of all M&A deals advised by the financial advisor. Acquirer (target) advisor's average ACAR (TCAR) refers to the average cumulative three-day abnormal return of all acquirer (target) firms the acquirer (target) advisor advised during the previous four-year period. The relative size is the ratio of acquirer market value to target market value, where market value is measured at 21 days prior to the deal announcement. Pure cash deal, hostile deal, challenged deal, termination fee, and previous toehold are dummy variables that equal to one if the payment method is 100% cash, deal attitude is hostile, deal is challenged, termination fee is used, and acquirer holds target shares prior to announcement, respectively. Complexity is the sum of dummy variables that indicate whether the deal requires regulatory agency approval, target has defense mechanisms, target has significant family ownership, deal involves a pending litigation, and deal is two-tier. Same industry dummy equals to one if the acquirer and target share the same primary two-digit SIC code. The previous M&As of the acquirer and target firms refer to the number of all previous M&A transactions completed by these firms. The relative size is the ratio of acquirer market value to target market value, where market value is measured at 21 days prior to the announcement. Industry fixed effects are based on two-digit SIC codes. *p*-values are reported in brackets.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Advisor relationships from | | | | |
| | M&A deals | Public issues | Equity issues | Debt issues | All deals |
| Intercept | 44.749 | 44.449 | 44.463 | 44.220 | 44.577 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| *Advisors' characteristics* | | | | | |
| Relative dependence of target adv on acquirer adv | 0.095 | 0.032 | 0.045 | 0.293 | 0.050 |
| | (0.29) | (0.65) | (0.44) | (0.13) | (0.51) |
| … x Absolute dependence of target adv on acquirer adv | -0.004 | -0.001 | -0.002 | -0.016 | -0.002 |
| | (0.05) | (0.45) | (0.14) | (0.01) | (0.32) |
| Target advisor's market share | -0.063 | -0.069 | -0.070 | -0.064 | -0.065 |
| | (0.20) | (0.17) | (0.15) | (0.19) | (0.20) |
| *Deal characteristics* | | | | | |
| Tender offer | 6.078 | 6.140 | 6.117 | 6.037 | 6.121 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Pure cash deal | 2.373 | 2.340 | 2.369 | 2.359 | 2.327 |
| | (0.10) | (0.10) | (0.10) | (0.10) | (0.10) |
| Log (Deal value) | -0.089 | -0.042 | -0.037 | -0.013 | -0.073 |
| | (0.83) | (0.92) | (0.93) | (0.98) | (0.86) |
| Hostile deal | 8.258 | 8.240 | 8.218 | 8.317 | 8.231 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Challenged deal | 2.142 | 2.080 | 2.066 | 2.109 | 2.114 |
| | (0.33) | (0.34) | (0.35) | (0.34) | (0.34) |
| Termination fee | 3.943 | 3.975 | 3.975 | 4.004 | 3.969 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Complexity | 0.937 | 0.910 | 0.904 | 0.847 | 0.912 |
| | (0.32) | (0.34) | (0.34) | (0.37) | (0.34) |
| *Firm characteristics* | | | | | |
| Previous toehold ownership | -2.776 | -2.667 | -2.585 | -2.802 | -2.639 |
| | (0.21) | (0.23) | (0.24) | (0.21) | (0.23) |
| Log (No. of acquirer SIC codes) | 1.980 | 1.942 | 1.937 | 1.965 | 1.959 |
| | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) |
| Log (No. of target SIC codes) | -0.664 | -0.677 | -0.689 | -0.639 | -0.682 |
| | (0.45) | (0.44) | (0.43) | (0.46) | (0.43) |
| Same industry | 1.366 | 1.364 | 1.370 | 1.318 | 1.363 |
| | (0.19) | (0.20) | (0.19) | (0.21) | (0.20) |
| Log (1 + No. of prev. acq M&As) | 0.786 | 0.772 | 0.760 | 0.775 | 0.775 |
| | (0.14) | (0.15) | (0.16) | (0.15) | (0.15) |
| Log (1 + No. of prev. tar M&As) | -1.934 | -1.984 | -1.985 | -1.998 | -1.964 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Relative size | -0.007 | -0.007 | -0.007 | -0.007 | -0.007 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| *N* | 2,583 | 2,583 | 2,583 | 2,583 | 2,583 |
| Adjusted *R*-square | 10.47 | 10.36 | 10.42 | 10.62 | 10.37 |

The regression results in Table 3.4 show that the interaction terms between the relative and absolute dependence measures of target advisor are significant in models 1 and 4. The relative dependence ratio indicates whether the advisor relationship is relatively more important to target than acquirer advisor, whereas the absolute dependence ratio shows how important the advisor relationship is for the target advisor. The significant coefficients on the interaction terms in models 1 and 4 indicate that the relative dependence of the target advisor on the acquirer advisor, a proxy for bargaining power, is significant only when the relationship is important for the target advisor. When the target advisor is the more dependent party in a significant relationship, the acquirer advisor retains greater power in the bargaining process. A consequence of such power dynamics from previous cooperation is lower premium for target shareholders, given the negative significant coefficients. However, this effect is documented only in the advisor relationships that exist in M&A advisory market and debt underwriting. The results also show that the target advisor's market share has no significant effect on the target premium. Tender offers, hostile deals and those with termination fee are associated with higher premiums. Diversified acquirers are also associated with higher target premium.

*Acquirer announcement return*

The relationship between the acquirer and target advisors may affect how the advisors structure the deal and negotiate the terms, which, in turn, can affect market reactions to deal announcements. Table 3.5 presents the estimated coefficients from the OLS regressions of acquirer three-day cumulative abnormal return (CAR) around the announcement date on the relative bargaining power between acquirer and target

advisors. Acquirer announcement return is winsorized below at the 5 percent and above at the 95 percent level.

**Table 3.5: Relative dependence between advisors and acquirer three-day abnormal return**

The table presents the results of OLS regressions of acquirer three-day abnormal return around the announcement date. The dependent variable is winsorized at 5% and 95% levels. The dependence of advisor *i* on advisor *j* is measured by the number of all deals advisors *i* and *j* worked together divided by the number of all co-managed deals completed by advisor *i*. The acquirer advisor's market share is measured by all the completed M&A deals of the advisor over the previous four-year period as a percent of total M&A deal volume. Acquirer advisor's average ACAR refers to the average cumulative three-day abnormal return of all acquirers the advisor advised during the previous four-year period. Pure cash deal, hostile deal, challenged deal, termination fee, and previous toehold are dummy variables that equal to one if the payment method is 100% cash, deal attitude is hostile, deal is challenged, termination fee is used, and acquirer holds target shares prior to announcement, respectively. Log (Deal value) refers to the natural logarithm of the reported deal value in inflation-adjusted dollars. Complexity is the sum of dummy variables that indicate whether the deal requires regulatory agency approval, target has defense mechanisms, target has significant family ownership, deal involves a pending litigation, and deal is two-tier. Same industry dummy equals to one if the acquirer and target share the same primary two-digit SIC code. The previous M&As of the acquirer and target firms refer to the number of all previous M&A transactions completed by these firms. The relative size is the ratio of acquirer market value to target market value, where market value is measured at 21 days prior to the announcement. Industry fixed effects are based on the acquirer two-digit SIC codes. *p*-values are reported in brackets.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Advisor relationships from | | | | |
| | M&A deals | Public issues | Equity issues | Debt issues | All deals |
| Intercept | -4.780 | -4.789 | -4.767 | -4.726 | -5.006 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| *Advisors' characteristics* | | | | | |
| Relative dependence of acquirer adv on target adv | -0.029 | -0.036 | -0.026 | -0.042 | -0.032 |
| | (0.19) | (0.04) | (0.08) | (0.25) | (0.07) |
| … x Absolute dependence of acquirer adv on target adv | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | (0.12) | (0.24) | (0.68) | (0.85) | (0.26) |
| Acquirer advisor's market share | 0.010 | 0.007 | 0.008 | 0.011 | 0.008 |
| | (0.41) | (0.59) | (0.52) | (0.34) | (0.55) |

**Table 3.5 (continued)**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Acquirer advisor's past ACAR | 0.002 | 0.004 | 0.005 | 0.002 | 0.004 |
| | (0.97) | (0.92) | (0.90) | (0.97) | (0.93) |
| *Deal characteristics* | | | | | |
| Pure cash deal | 2.182 | 2.192 | 2.189 | 2.189 | 2.188 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Deal value) | -0.315 | -0.306 | -0.309 | -0.323 | -0.308 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Hostile deal | -0.759 | -0.758 | -0.779 | -0.774 | -0.763 |
| | (0.24) | (0.24) | (0.23) | (0.23) | (0.24) |
| Challenged deal | -0.266 | -0.238 | -0.235 | -0.254 | -0.251 |
| | (0.64) | (0.68) | (0.68) | (0.66) | (0.66) |
| Termination fee | 0.405 | 0.411 | 0.422 | 0.393 | 0.409 |
| | (0.21) | (0.20) | (0.19) | (0.22) | (0.20) |
| Complexity | -0.389 | -0.391 | -0.399 | -0.384 | -0.384 |
| | (0.11) | (0.11) | (0.10) | (0.12) | (0.12) |
| *Firm characteristics* | | | | | |
| Previous toehold ownership | 1.148 | 1.115 | 1.137 | 1.133 | 1.130 |
| | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) |
| Log (No. of acquirer SIC codes) | 0.478 | 0.493 | 0.502 | 0.485 | 0.495 |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Log (No. of target SIC codes) | 0.405 | 0.414 | 0.404 | 0.411 | 0.408 |
| | (0.07) | (0.07) | (0.07) | (0.07) | (0.07) |
| Same industry | 0.148 | 0.139 | 0.142 | 0.155 | 0.156 |
| | (0.59) | (0.61) | (0.60) | (0.57) | (0.57) |
| Log (1 + No. of prev. acq M&As) | 0.064 | 0.066 | 0.066 | 0.061 | 0.066 |
| | (0.65) | (0.64) | (0.64) | (0.66) | (0.64) |
| Log (1 + No. of prev. tar M&As) | -0.208 | -0.210 | -0.213 | -0.204 | -0.210 |
| | (0.21) | (0.20) | (0.20) | (0.22) | (0.20) |
| Relative size | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.14) | (0.66) | (0.67) | (0.66) | (0.65) |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| *N* | 2,666 | 2,666 | 2,666 | 2,666 | 2,666 |
| Adjusted *R*-square | 4.77 | 4.83 | 4.82 | 4.73 | 4.80 |

The results in Table 3.5 show that the relative bargaining power of acquirer advisor stemming from the advisor relationships in equity underwriting, public security underwriting and all deals has statistically significant effect on the acquirer announcement returns, after controlling for other variables. The estimated coefficients on

the relative dependence ratios in models 2, 3 and 4 are significant and negative, which suggests that when the acquirer advisor is more dependent on the target advisor (i.e., the bargaining power of the target advisor is greater), the acquirer firm's announcement return is lower. In fact, an increase of a one standard deviation in the relative dependence ratio is associated with a CAR that is about 1.30 percent lower, holding all else the same. The advisor peer relationship, therefore, has an economically significant impact on acquirer returns. When an acquirer advisor is facing a target advisor with whom it maintains an important cooperative relationship, it may not want to jeopardize its valuable relationship because it affects its revenues in other areas and thus, its actions as an acquirer advisor may be constrained to some extent. However, interacting the relative dependence ratio with the absolute dependence measure is not significant, which suggests that regardless of the level of the relationship importance to the acquirer advisor, the relative power dynamics between the advisors is significant.

The acquirer advisor reputation, as measured by market share, and the past average return of acquirers advised by the same advisor do not have statistically significant effects on the acquirer announcement return. The results also show that pure cash deals experience significantly higher market reaction, while larger deals are associated with less positive market reaction. The market views acquirers with previous ownership in the target firms more favorably as indicated by the positive and significant coefficients on the previous toehold ownership variable.

*Target announcement return*

In the previous analysis, we established a significant impact of advisor relationship on acquirer announcement return. Some research studies suggest that the incentive alignment between advisors and firms are not symmetrical on M&A buy and sell sides and the roles of advisors are somewhat different as well, perhaps due to the fee structure on buy and sell sides. For instance, Allen et al. (2004) document a net certification effect of commercial banks for target firms, but not for acquirer firms. Thus, it is possible that the relationship between advisors affects target outcomes differently than the way it affects acquirers.

Next, we examine whether the advisor relationship stemming from the past cooperation affects target three-day CAR and present the results in Table 3.6. As evidenced by the estimated coefficients, only the relative dependence between advisors in the advisory market is significant when interacted with the importance of the relationship for the target advisor. The target advisor's market share and the past average return of the target firms that it advised have no significant effect on the announcement return. Similar to the results of target premium in Table 3.4, tender offers are associated with higher announcement returns as well. Hostile deals, pure cash deals and deals that are pursued by diversified acquirers are also associated with higher target announcement returns. After controlling for these variables, there is evidence that the relationship between advisors in the advisory market affects target announcement returns. Employing target advisors with greater bargaining power relative to acquirer advisors (i.e., target advisors with lower relative dependence measure) is associated with higher CARs for target firms. However, this effect is only significant when the relative dependence

measure is interacted with the absolute measure, and also this effect is not observed in advisor relationships based on the previous cooperation in public security underwriting of any type. Thus, the overall announcement effect of the power dynamics in the advisor relationship is smaller for target firms than acquirer firms. In other words, the potential conflict of interest between the client firm and the advisor due the advisor's peer relationship may be lower on the sell side.

**Table 3.6: Relative dependence between advisors and target three-day abnormal return**

The table presents the results of OLS regressions of target three-day abnormal return around the announcement date. The dependent variable is winsorized at 5% and 95% levels. The dependence of advisor *i* on advisor *j* is measured by the number of all deals advisors *i* and *j* worked together divided by the number of all co-managed deals completed by advisor *i*. The target advisor's market share is computed based on all the completed M&A deals of the advisor over the previous four-year period. Target advisor's average TCAR refers to the average cumulative three-day abnormal return of all acquirers the advisor advised during the previous four-year period. Pure cash deal, hostile deal, challenged deal, termination fee, and previous toehold are dummy variables that equal to one if the payment method is 100% cash, deal attitude is hostile, deal is challenged, termination fee is used, and acquirer holds target shares prior to announcement, respectively. Log (Deal value) refers to the natural logarithm of the reported deal value in inflation-adjusted dollars. Complexity is the sum of dummy variables that indicate whether the deal requires regulatory agency approval, target has defense mechanisms, target has significant family ownership, deal involves a pending litigation, and deal is two-tier. Same industry dummy equals to one if the acquirer and target share the same primary two-digit SIC code. The previous M&As of the acquirer and target firms refer to the number of all previous M&A transactions completed by these firms. The relative size is the ratio of acquirer market value to target market value, where market value is measured at 21 days prior to the announcement. Industry fixed effects are based on the target two-digit SIC codes. *p*-values are reported in brackets.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Advisor relationships from | | | | |
| | M&A deals | Public issues | Equity issues | Debt issues | All deals |
| Intercept | 17.025 | 16.961 | 16.943 | 16.917 | 16.957 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| *Advisors' characteristics* | | | | | |
| Relative dependence of target adv on acquirer adv | 0.021 | -0.010 | 0.005 | 0.005 | 0.004 |
| | (0.66) | (0.80) | (0.87) | (0.96) | (0.92) |

**Table 3.6 (continued)**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| … x Absolute dependence of target adv on acquirer adv | -0.002 (0.05) | 0.001 (0.62) | 0.000 (0.88) | -0.002 (0.65) | -0.001 (0.80) |
| Target advisor's market share | -0.032 (0.24) | -0.031 (0.26) | -0.028 (0.29) | -0.030 (0.26) | -0.029 (0.29) |
| Target advisor's past TCAR | 0.030 (0.36) | 0.030 (0.35) | 0.031 (0.34) | 0.031 (0.35) | 0.031 (0.34) |
| *Deal characteristics* | | | | | |
| Tender offer | 3.845 (0.00) | 3.893 (0.00) | 3.894 (0.00) | 3.888 (0.00) | 3.887 (0.00) |
| Pure cash deal | 2.501 (0.00) | 2.466 (0.00) | 2.464 (0.00) | 2.473 (0.00) | 2.474 (0.00) |
| Log (Deal value) | -0.201 (0.37) | -0.187 (0.41) | -0.191 (0.39) | -0.180 (0.42) | -0.189 (0.40) |
| Hostile deal | 5.903 (0.00) | 5.937 (0.00) | 5.924 (0.00) | 5.941 (0.00) | 5.928 (0.00) |
| Challenged deal | -3.301 (0.00) | -3.319 (0.00) | -3.306 (0.00) | -3.323 (0.00) | -3.313 (0.00) |
| Termination fee | 0.207 (0.75) | 0.233 (0.72) | 0.233 (0.72) | 0.247 (0.71) | 0.229 (0.73) |
| Complexity | 0.851 (0.09) | 0.843 (0.09) | 0.842 (0.09) | 0.835 (0.10) | 0.844 (0.09) |
| *Firm characteristics* | | | | | |
| Previous toehold ownership | -2.002 (0.09) | -1.986 (0.09) | -1.969 (0.09) | -1.977 (0.09) | -1.974 (0.09) |
| Log (No. of acquirer SIC codes) | 1.397 (0.00) | 1.385 (0.00) | 1.381 (0.00) | 1.382 (0.00) | 1.379 (0.00) |
| Log (No. of target SIC codes) | 0.248 (0.60) | 0.254 (0.59) | 0.251 (0.60) | 0.252 (0.59) | 0.253 (0.59) |
| Same industry | -0.071 (0.90) | -0.077 (0.89) | -0.079 (0.89) | -0.077 (0.89) | -0.068 (0.90) |
| Log (1 + No. of prev. acq M&As) | 0.359 (0.21) | 0.360 (0.21) | 0.355 (0.22) | 0.358 (0.22) | 0.355 (0.22) |
| Log (1 + No. of prev. tar M&As) | -0.363 (0.29) | -0.391 (0.26) | -0.392 (0.26) | -0.397 (0.25) | -0.389 (0.26) |
| Relative size | -0.002 (0.04) | -0.002 (0.04) | -0.002 (0.04) | -0.002 (0.04) | -0.002 (0.04) |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| *N* | 2,371 | 2,371 | 2,371 | 2,371 | 2,371 |
| Adjusted *R*-square | 8.14 | 7.95 | 7.94 | 7.96 | 7.94 |

*Share of announcement wealth gain*

Another important matter in M&As is how the total wealth gain is divided between the target and acquirer firms. Focusing on the share of wealth gain is also a good setting to examine the power dynamics between the advisors. The share of wealth gain refers to the percent of total wealth effect that the acquirer or the target firm receives. The total wealth effect is the sum of announcement wealth effects of target and acquirer firms. Announcement wealth effect of target (acquirer) firm is computed by multiplying the target (acquirer) firm's three-day abnormal return by the target's (acquirer) market value at 21 days prior to the announcement. We study whether the advisor relationship affects the acquirer share of wealth gain in Table 3.7. We do not present the results on the target share of the wealth gain as they are merely the mirror opposite of the acquirer share. Since the share of wealth gain is well defined only when the total wealth gain is positive, we focus only on the deals that have positive wealth gain.

**Table 3.7: Relative dependence between advisors and acquirer share of wealth gain**
The table presents the results of OLS regressions of acquirer share of positive combined wealth gain. Combined dollar wealth is the sum of target three-day abnormal return times the target market value and acquirer three-day abnormal return times the acquirer market value. The dependent variable is winsorized at 5% and 95% levels. The dependence of advisor *i* on advisor *j* is measured by the number of all deals advisors *i* and *j* worked together divided by the number of all co-managed deals completed by advisor *i*. The relative market share is the acquirer advisor's M&A market share relative to the target advisor's M&A market share in the previous four-year period. Pure cash deal, hostile deal, challenged deal, termination fee, and previous toehold are dummy variables that equal to one if the payment method is 100% cash, deal attitude is hostile, deal is challenged, termination fee is used, and acquirer holds target shares prior to announcement, respectively. Log (Deal value) refers to the natural logarithm of the reported deal value in inflation-adjusted dollars. Complexity is the sum of dummy variables that indicate whether the deal requires regulatory agency approval, target has defense mechanisms, target has significant family ownership, deal involves a pending litigation, and deal is two-tier. Same industry dummy equals to one if the acquirer and target share the same primary two-digit SIC code. The previous M&As of the acquirer and target firms refer to the number of all previous M&A transactions completed by these firms. The relative size is the ratio of acquirer market value to target market value, where market value is measured at 21 days prior to the announcement. Industry fixed effects are based on the acquirer two-digit SIC codes. *p*-values are reported in brackets.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Advisor relationships from | | | | |
| | M&A deals | Public issues | Equity issues | Debt issues | All deals |
| Intercept | 33.696 | 31.753 | 32.618 | 33.115 | 32.618 |
| | (0.61) | (0.63 | (0.62) | (0.62) | (0.62) |
| *Advisors' characteristics* | | | | | |
| Relative dependence of | -0.969 | -1.096 | -0.842 | -0.351 | -1.111 |
| acquirer adv on target adv | (0.04) | (0.00) | (0.02) | (0.69) | (0.01) |
| … x Absolute dependence of | 0.021 | 0.011 | 0.010 | -0.161 | 0.022 |
| acquirer adv on target adv | (0.08) | (0.29) | (0.34) | (0.15) | (0.47) |
| Relative market share | 0.077 | 0.071 | 0.074 | 0.084 | 0.063 |
| | (0.29) | (0.32) | (0.30) | (0.24) | (0.39) |
| *Deal characteristics* | | | | | |
| Pure cash deal | 20.869 | 20.348 | 20.323 | 20.936 | 20.215 |
| | (0.00) | (0.00) | (0.01) | (0.00) | (0.00) |
| Log (Deal value) | -11.224 | -11.226 | -11.234 | -11.167 | -11.293 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Hostile deal | -9.148 | -9.448 | -9.808 | -9.941 | -9.845 |
| | (0.50) | (0.48) | (0.46) | (0.46) | (0.46) |
| Challenged deal | 0.602 | 1.128 | 1.463 | -0.064 | 1.059 |
| | (0.96) | (0.92) | (0.90) | (0.99) | (0.93) |
| Termination fee | -5.719 | -5.579 | -5.569 | -5.522 | -5.659 |
| | (0.45) | (0.47) | (0.47) | (0.47) | (0.46) |

**Table 3.7 (continued)**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Complexity | -3.563 | -3.734 | -4.132 | -3.756 | -3.473 |
| | (0.51) | (0.49) | (0.45) | (0.49) | (0.52) |
| *Firm characteristics* | | | | | |
| Previous toehold ownership | 11.287 | 11.129 | 11.367 | 10.514 | 11.836 |
| | (0.35) | (0.36) | (0.35) | (0.39) | (0.33) |
| Log (No. of acquirer SIC codes) | 5.470 | 5.714 | 6.060 | 5.538 | 5.747 |
| | (0.25) | (0.23) | (0.20) | (0.25) | (0.23) |
| Log (No. of target SIC codes) | -2.407 | -1.857 | -2.129 | -1.799 | -2.309 |
| | (0.64) | (0.71) | (0.68) | (0.72) | (0.65) |
| Same industry | 2.636 | 2.518 | 2.779 | 2.975 | 3.036 |
| | (0.68) | (0.69) | (0.66) | (0.64) | (0.63) |
| Log (1 + No. of prev. acq M&As) | 5.388 | 5.178 | 5.103 | 5.229 | 5.222 |
| | (0.09) | (0.11) | (0.11) | (0.10) | (0.10) |
| Log (1 + No. of prev. tar M&As) | -3.586 | -3.981 | -3.969 | -3.701 | -3.722 |
| | (0.35) | (0.30) | (0.30) | (0.34) | (0.33) |
| Relative size | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 |
| | (0.84) | (0.83) | (0.82) | (0.81) | (0.86) |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| *N* | 1,443 | 1,443 | 1,443 | 1,443 | 1,443 |
| Adjusted *R*-square | 4.82 | 5.11 | 4.96 | 4.79 | 5.04 |

In the analysis of the acquirer share of wealth gain in Table 3.7, the bargaining power between advisors stemming from relationships in all investment banking segments, except debt, is significant, as evidenced by the statistically significant negative coefficients on all the relative dependence measures. Hence, the negative coefficients on the relative dependence ratio show that the greater the bargaining power of the target advisor, the lower the share of the total wealth gain the acquirer firm receives and thus, the higher the share of the total wealth gain the target firm receives. For instance, an increase of a one standard deviation in the relative dependence ratio of the acquirer advisor from all deals is associated with an acquirer share of total wealth gain that is about 8.67 percent lower, holding all else the same. This suggests that holding all else

equal, when the target advisor becomes more important to the acquirer advisor, the acquirer advisor is more likely to accept deal terms that are more favorable for the target firm. We also control for other variables including the relative market share measure in line with Kale, Kini, and Ryan (2003). Similar to the previous analyses that focus on acquirer advisor relationship, the interaction terms are insignificant here as well.

Consequently, these results of the relative bargaining power between advisors highlights a potential advantage of hiring boutique investment banks as M&A advisors. The boutique investment banks typically do not participate in security underwriting, and therefore, have no underwriting ties to the advisors on the other side of the deal table. The market for small and focused boutique firms has grown lately, and they are starting to receive attention from the academic community, as Song and Wei (2008) are among the first to focus on the performance of M&As that are advised by boutique banks.

*Familiarity effect of advisor peer relationship*

Advisor peer relationships may also have a positive impact on M&A deals due to the familiarity between the financial advisors. Due to their close working relationships in the past, advisors may be able to negotiate the deal terms more effectively, resulting in a higher likelihood of deal completion or faster deal completion. We examine whether advisor relationships affect the likelihood of deal completion in unreported logistic regressions. To study the efficiency implications of advisor relationships, we focus on the strength of the advisor relationship, as measured by the number of deals two advisors worked on together, rather than the bargaining power. We find no significant effect of the relationship between the buy and sell side advisors on the likelihood of deal

completion, after controlling for other variables. Therefore, the strength of the relationship between the advisors has no statistically significant impact on deal completion. In unreported regressions, we also find that the extent of the previous cooperation between the advisors has no effect on the speed of deal completion. The above findings are consistent with the limited impact of financial advisors' on deal success suggested by several prior studies. For instance, Song and Wei (2008) find that employing boutique advisors do not affect the likelihood of deal completion. Ma (2007) also documents no significant association between target firms hiring top-tier investment banks and deal completion.

As a possible consequence of familiarity, we also examine whether the relationships between advisors, especially close cooperative relationships, help advisors identify deals that create higher value to shareholders, because of the improved information transmission between the advisors. We examine the combined shareholder wealth effect in unreported regression, where the dependent variable is the total announcement wealth effect as a percent of the deal value. Again, the results were insignificant. Overall, we do not observe significant effects of familiarity from advisor peer relationships.

*Choice of target advisor*

In the previous tables, we see evidence that the power inherent in the advisor relationships affect deal outcomes. Thus, it would be insightful to examine whether firms take such advisor peer relationships into account when they hire advisors. The choice of an advisor has been a particularly popular topic in the extant literature (e.g., Da Silva

Rosa et al. (2004), Forte, Iannotta, and Navone (2007), Hunter and Jagtiani (2003), Serveas and Zenner (1996), Thomas (1995)). The role of firm-advisor relationship in advisor selection has also been examined. In fact, some practitioners attempt to build positive personal relationships with the counterparties or hire advisors who already possess such relationships (Bruner (2004)).

We focus on whether firms take peer relationships into account, by examining whether a potential advisor's relationship with the acquirer advisor affects its likelihood of being selected as a target advisor. In Table 3.8, we focus on M&A deals, where a target firm hires advisor(s) after the acquirer advisor(s) are selected and consequently model the target firm's choice of advisor. Since we do not have detailed and complete information on when the acquirer and target advisors are hired, we use the date acquirer and target advisors are added as reported by SDC. However, out of 2,938 deals, only 1,422 have reported dates for both the acquirer and target advisors and of these 496 deals have target advisors added after the acquirer advisors. We assume that the target firms are able to observe the identities of the acquirer advisors in these 496 deals and use them in the regression analysis.

**Table 3.8: Advisor peer relationships and choice of target advisor**

The table presents the estimated coefficients of logistic regressions of the probability of becoming a target advisor. The sample consists of 496 U.S. domestic M&As involving public target and acquirer firms between 1984 and 2007, where the target advisors were chosen after the acquirer advisors. The models include one observation for each eligible advisor for each deal, and the dependent variable equals to one if an advisor is identified as the target advisor in a deal, and zero otherwise. The set of eligible advisors include those that serve as M&A advisors during the year. The advisor characteristics are measured over the four-year period prior to the announcement year. Intensity of the advisor-target firm relationship is measured by the percent of all previous deals of the target firm that employed the advisor.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Advisor relationships from | | | | |
| | M&A deals | Public issues | Equity issues | Debt issues | All deals |
| Intercept | -3.006 | -3.014 | -3.016 | -3.007 | -3.012 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| *Advisor characteristics* | | | | | |
| Advisor's number of past deals with the acquirer advisor | 0.094 | 0.008 | 0.011 | 0.015 | 0.008 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Advisor's number of past deals with the acquirer advisor$^2$ | -0.002 | -0.001 | -0.001 | -0.001 | -0.001 |
| | (0.00) | (0.01) | (0.02) | (0.04) | (0.01) |
| Difference between market shares of advisors | -0.013 | -0.012 | -0.012 | -0.012 | -0.012 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Advisor's market share x No. of prev. M&As of target firm | 0.004 | 0.007 | 0.007 | 0.009 | 0.007 |
| | (0.23) | (0.02) | (0.03) | (0.00) | (0.03) |
| Intensity of advisor-target firm relationship | 0.032 | 0.032 | 0.031 | 0.033 | 0.032 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| *N* | 55,885 | 55,885 | 55,885 | 55,885 | 55,885 |
| Pseudo *R*-square | 7.86 | 7.46 | 7.50 | 7.26 | 7.50 |

Table 3.8 presents the estimated coefficients of the logistic regressions of the probability of an advisor being selected as the target advisor. The models in Table 3.8 include one observation for each eligible advisor for each deal. The eligible advisors include those who serve as either acquirer or target advisor during the year. If an advisor is identified as the target advisor, the dependent variable equals to one and zero otherwise. We are relating the advisor characteristics over four-year periods to the probability of becoming the target advisor in the next year. To allow for deal specific effects, we adjust standard errors for clustering within issues. The explanatory variable of interest is the extent of the past relationship between the acquirer advisor and the eligible advisor, as measured by the number of deals they worked on together. Since extensive literature documents that firm relationships matter in advisor selection, we also include firm-advisor relationship measures. We also control for the difference between the market share measures of the eligible advisor and the acquirer advisor.

The logistic regression results of Table 3.8 show that target firms are more likely to pick advisors that had past relationship with the acquirer, although this effect is not linear as evidenced by the negative significant coefficient on the squared term. We also find that firms are more likely to choose advisors that are close to the acquirer advisor in terms of market share, which means that once a reputable acquirer advisors is hired, the target firm is also likely to employ a reputable advisor. The significant positive coefficient on the interaction term shows that the target firms with extensive prior M&A experience are likely to pick advisors with greater market share. The results indicate that the previous relationship with the target firm matters as well. The results show that even though there is no significant positive effect of familiarity between advisors and an

evidence of potential of conflict of interest, firms choose target advisors that have relationships with the acquirer advisors in the past. In a similar strand of literature, Bao and Edmans (2007) also report that despite the persistence in the announcement returns of acquirer advisors that clients should consider when selecting M&A advisors, in practice, these measures are overlooked by the firms.

### 3.5. Conclusions

In M&A deals, financial advisors play a crucial role. Financial advisors maintain relationships with each other from various investment banking activities. From these close working relationships among advisors, a potential conflict of interest can arise. In this paper, we explore how the dynamics in the relationship between acquirer and target advisors affect shareholder wealth. Specifically, we study whether an advisor's relative bargaining power over its peer advisor that works for the opposite side affects the target premium, the announcement returns, and the share of the wealth gain of the acquirer and target firms.

To capture the advisor pairwise relationships, we use all public security issues and M&As during 1980-2007 that employ multiple underwriters or advisors and create measures of relative dependence for each pair of advisors. Using these measures, we examine the impact of advisor relationships on 2,938 domestic M&A deals between 1984 and 2007.

Our results suggest that the announcement return and the share of the total wealth gain of the acquirer and target firms depend on the relative bargaining power between the

acquirer and target advisors. When the relative bargaining power of the target advisor is greater than that of the acquirer advisor, the target firm's announcement return and share of the total wealth gain are higher and the acquirer firm's share is lower, and vice versa. The results also show that when the target advisor has more power in the acquirer-target advisor relationship, it is more likely to obtain higher premium for target shareholders. However, the results involving target advisors are generally weaker than those involving acquirer advisors.

In addition, we find no significant evidence that the familiarity between acquirer and target advisors, stemming from past working relationships, fosters more effective information transmission and deal negotiation and affects the likelihood of deal completion, completion speed and total wealth gain. However, we find evidence that despite the additional conflict of interest that may result from the relationship between the target and acquirer advisor, target firms are more likely to hire advisors that previously worked with the acquirer advisor.

The main contribution of this research lies in the investigation of the previously unexplored relationship dynamics between the acquirer and target advisors. This study is also relevant to a number of topics in finance, such as the role of financial advisors in M&As, the role of social networks, and to some extent, the effectiveness of boutique financial advisors, since they usually have no underwriting ties to other advisors.

# CHAPTER 4

# REACHING OUT TO YOUR PEERS: PERFORMANCE CONSEQUENCES OF UNDERWRITER PEER NETWORKS

## 4.1. Introduction

It is widely accepted in a number of literature streams that the structure of a firm's ties with its partners has a strong impact on the firm's performance. For instance, embeddedness, the idea that social structure shapes economic behavior and outcomes, has emerged as a core concept in new economic sociology. In the security underwriting process, despite the critical role of the relationships among underwriters, we know very little about the effect of such relationships on underwriters' performance.

The goal of this paper is to examine how the underwriter peer network structure affects market share by using measures from social network analysis. We find that underwriters with certain network characteristics capture higher future market shares, as they are more likely to win underwriting mandates and be selected as co-managers.

A key objective for underwriters is to maximize their market share. With gross spreads usually around seven percent in IPOs (Chen and Ritter (2000)), five percent in seasoned equity offerings (Mola and Loughran (2004)), and less than one percent in high-quality, long-term corporate bonds (Matthews (1994)), market share dominance leads to superior profits. Building networks with others can increase an underwriter's market share. Selecting syndicate partners involves a fair amount of uncertainty, and therefore, banks may prefer to work with their previous partners. Consequently, well-networked underwriters with extensive ties can be included in the syndicates of their partners and

enjoy increased deal flow. Certain network characteristics may further improve an underwriter's likelihood of winning mandates or being invited into syndicates. Underwriter networks differ along various dimensions, such as size and diversity, and these various characteristics have different implications for an underwriter's ability to increase its market share.

Moreover, the role of the peer network may be different for commercial bank and investment bank underwriters. The entrance of commercial banks into security underwriting has attracted substantial attention in the literature and a number of studies examine commercial bank underwriters. Commercial banks build relationships with firms early on and enjoy spillovers from the information production in their traditional banking activities. Flexibility in financing is another advantage as well. On the other hand, commercial banks face a conflict of interest from their dual role as a lender and underwriter. In addition, commercial banks may lack strong investor clientele and reputation that are critical in underwriting. Because of these inherent differences, commercial banks and investment banks can bring different sets of skills, and these differences can also affect the role of their peer networks.

We explore the impact of underwriter peer networks by constructing network measures using the ties that underwriters form with each other when they are involved in the same underwriting syndicates. Network measures are constructed over moving four-year periods using equity and debt securities issued in the U.S. between 1970 and 2007. Specifically, we construct a set of network measures that capture the size (*degree*), position (*closeness* and *betweenness*), interconnectedness *(reciprocity* and *density)* and heterogeneity (*tie, industry* and *geographical diversity*) of underwriter peer networks.

Using these measures, we assess the impact of the network structure on the overall future market share, and specifically on the likelihood of winning the book manager and co-manager positions in equity and debt underwriting.

Our results show that underwriters with extensive ties and advantageous network positions capture higher market shares in equity underwriting in the following year, and this relationship is more pronounced for commercial banks. For instance, a one standard deviation increase in the degree is associated with an increase of about 15.2 basis points in the equity market share in the following year for investment banks and an increase of 46.4 basis points in the market share of commercial banks, holding all else the same. These are economically significant effects given that the mean equity underwriter market share is 0.46 percent. We also find that investment banks are more likely to gain deal flow from networks with more homogenous partners, whereas commercial banks benefit from more diverse peer networks. This result is consistent with the greater role of specialization in investment banking than commercial banking. Commercial banks typically engage in a larger set of financial activities than investment banks. In debt underwriting, some of the aspects of peer network remain significant, but, in general, the effect of network on the market share is smaller. The regression results of the likelihood of winning the book manager position in equity and debt deals support these findings.

Regarding the likelihood of being invited as a co-manager, not only the network size and structure, but also the proximity to the specific book manager helps underwriters in both equity and debt underwriting. Underwriters that are further away from the book manager are less likely to be selected as a co-manager, although the effect is somewhat mitigated for commercial banks. The evidence shows that underwriters prefer to work

with their previous partners, as eighty and ninety percent of the hired co-managers in equity and debt deals have previously worked with the book managers.

This study fits among the extensive literature on underwriters and the growing body of research on social networks in finance. Our contribution lies in illustrating the role of peer network for underwriters and documenting its impact on market share. In doing so, we use network analysis methodology to characterize networks, and show how the different aspects of networks of peer relationships affect market share. To the best of our knowledge, no prior study has explicitly examined how the various aspects of underwriter peer networks affect market share in the U.S. We also focus on both equity and debt underwriting in this paper, and show how the overall network of equity and debt underwriters in the U.S. has changed over time. Highlighting the differences between the effects of peer network for commercial banks and investment banks is also another contribution of this paper. Our results show that, in general, commercial bank underwriters derive larger increases in their market shares from their networks.

The remainder of this paper is organized as follows. Section 4.2 discusses the role of underwriter peer networks in further detail. After introducing the network analysis methodology in Section 4.3, we describe the data and the summary statistics in Section 4.4. Section 4.5 presents the results regarding the impact of network on bank performance, and Section 4.6 summarizes by presenting our conclusions.

### 4.2. Underwriter peer network and market share

For investment banks and investment banking arms of commercial banks, a key objective in security underwriting is to maximize market share, given that underwriting fees are relatively fixed. Underwriter market share is periodically ranked and published in league tables, which are closely followed by the market participants. Naturally, there is fierce competition among underwriters for the top ranks in league tables. Gaining presence in certain market segments is even cited as a motive for bank mergers (Davis (2003)).

A number of studies have examined investment bank market share. For example, Dunbar (2000) studies the impact of several factors such as IPO return and abnormal compensation on investment bank IPO market share. Ang and Zhang (2004) examine both price and non-price competition for market share in the floating rate debt market. Rau (2000) investigates the determinants of investment bank market share in the mergers and acquisitions (M&A) advisory market.

An underwriter's strategy of building a network with other underwriters can improve its market share. Relationships have always been important in investment banking, where non-price competition is dominant. In the finance literature, an underwriter's relationship with client firms has received the most attention. Research on an underwriter's relationship with its peers includes several works on underwriting syndicates. For instance, Corwin and Schultz (2005) examine the composition of IPO syndicates. Ljungqvist, Marston and Wilhelm (2007) document that optimistic analyst research attracts co-management appointments. Sufi (2007) studies the syndicate structure in the syndicated loan market. In a theoretical analysis, Pichler and Wilhelm

(2001) relate the syndicate form to moral hazard problem in team production. Syndicates are generally formed to facilitate a single offering and thus, short-lived, but they represent stable informal relationships that exist among underwriters.

Underwriters are also competitors, and thus, these peer networks are co-opetitive networks. When underwriters collaborate with competitors, they face certain risks and benefits. On one hand, these peer relationships are beneficial if the underwriters have complementary skills, and especially since the majority of the corporate securities are underwritten by syndicates nowadays, relationships with other underwriters matter more than ever. On the other hand, underwriters can lose their client firms to their partners as Ljungqvist et al. (2007) show that becoming a co-manager in a deal increases the likelihood of an investment bank becoming a book manager in the future deals.

An extensive literature examines this delicate balance between cooperation and competition in various industries. In finance, a number of studies examine competition in investment banking. For instance, Ellis, Michaely and O'Hara (2005) study how investment banks compete for follow-on equity offerings using different strategies. Hansen (2001) examines whether the seven percent solution in the IPO market is consistent with competition rather than collusion. Anand and Galetovic (2006) introduce a model that explains how the tension between competition and relationships can be resolved in investment banking.

We expect that an underwriter's network qualities reflect potential co-management opportunities. To reduce costs and the risk of opportunism, underwriters may cooperate with a select group of peers and create stable relationships. In this regard, well networked underwriters can be included in a large number of future deals as co-

managers or joint book managers, because they have ties to many underwriters. In addition to size, underwriter networks can differ in terms of their position, reciprocity, interconnectedness, and diversity, and underwriters with certain network characteristics may be able to further increase their likelihood of being included in deals. For example, underwriters with more central network positions may be more visible. Moreover having ties to partners, who themselves are well-connected, can help increase deal flow. Ties may also be interpreted as a signal of quality and status. Thus, underwriters may want to enhance their status by partnering with other underwriters with greater network capabilities.

As for the performance consequences of network diversity, having a diverse peer network with partners that specialize in different industry sectors and geographical regions can improve underwriter performance because diversity implies expanded opportunity set. Diverse ties can be especially beneficial when underwriters enter new market sectors. Underwriters with heterogeneous peer networks can access information generated from different market segments, investor groups, and clienteles, which can greatly aid information production. Moreover, a bridging position that connects different underwriters can enhance an underwriter's status and increase its appeal as a syndicate partner. On the contrary, network heterogeneity may also prove to be problematic since social and structural divisions can hinder effective cooperation. In fact, homogeneity within networks has been widely documented, especially in interpersonal networks. Homophily refers to the principle that a contact between similar people or organizations

occurs at a higher rate than among dissimilar people.[9] Consequently, relations based on similarity may be stronger than the relations that exist between dissimilar organizations. Strong relations, in turn, have implications for the amount of cooperative effort the underwriter receives from its peers. Thus, network homogeneity may positively influence an underwriter's performance due to the strength of the relations and the partners' willingness to cooperate.

Previous findings on the subject of network heterogeneity present mixed results and usually focus on heterogeneity in the relationship type: arm's-length versus embedded ties. Embedded ties mean frequent and close interactions, as opposed to less-frequent and distant arm's-length ties. Some studies document that firms benefit from a balance of strong and weak ties (Uzzi (1997) and Baum et al. (2006)). In contrast, Shipilov (2005) shows that maintaining a mix of arm's length and embedded relationships is a disadvantageous strategy. Beckman and Haunschild (2002) find that firms, whose boards are interlocked to other firms with heterogeneous prior premium experience, tend to pay less for acquisitions.

From cooperating with other underwriters and serving in their syndicates, an underwriter not only earns fees, but also establishes relationships with firms that can be a stepping stone for winning the lead position in the firm's deals in the future. It is also plausible that general network capabilities, in addition to direct relationships with firms, help underwriters win the book manager position. Issuing firms might prefer

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[9] See McPherson, Smith-Lovin, and Cook (2001) for a review of research on homophily.

underwriters with more ties, as such underwriters can provide valuable services via their networks. As a result, a peer network can be considered an underwriter's social capital as it can help the underwriter win deals as either a co-manager or a book manager. Several studies in strategic management focus on documenting a link between an investment bank's network and market share in Canadian investment banking industry (Shipilov (2005, 2006), and Shipilov, Li and Baum (2007)).

Moreover, it is possible that not all aspects of a network enhance the market share equally. In addition, how underwriter peer network affects market share may be different in equity and debt underwriting. Specifically, peer network may be more important in equity than debt underwriting due to the higher information asymmetry involved and the more lucrative nature of equity underwriting. The differences between the relationships formed in equity and debt underwriting have been previously noted. For example, Asker and Ljungqvist (2008) find that the debt underwriting relationships are less exclusive.

Furthermore, can the effect of network be different for commercial bank and investment bank underwriters? The entrance of commercial banks into underwriting has attracted substantial attention in the literature (e.g., Gande et al. (1997), Gande, Puri and Saunders (1999), Puri (1996), and Shivdasani and Song (2007)). Because of the inherent differences between commercial banks and investment banks, the role of peer network may be different for them. Commercial banks build relationships with firms early on. Commercial banks also enjoy economies of scope in information production, as information spills over from their lending activities. As a result, they may possess superior information regarding client firms. However, commercial banks also face a conflict of interest, as they can misrepresent the information they possess to the market

and try to issue securities of low quality firms to repay loans. The market participants are aware that this potential conflict of interest can affect commercial banks' function as underwriters. In addition, commercial banks lack the established investor clientele and reputation of investment banks that are crucial in the underwriting process.

Hence, on one hand, commercial banks may largely focus on their firm relationships and financing capacities to win deals and depend less on peer relationships. On the other hand, commercial banks may rely more heavily on peer networks because they lack established investor networks and placement track record. For this purpose, commercial banks can play up their advantages such as their enhanced information production to increase their appeal as syndicate partners. Commercial banks and investment banks may bring different sets of skills to the market and have complementary skills. In fact, Song (2004) finds some evidence of such complementary skills in corporate bond underwriting and shows that during the period from 1991 to 1996, pure investment bank, pure commercial bank, and mixed syndicates served different types of bond issuers.

### 4.3. Network measures

Network analysis describes the structure of networks by focusing on the relationships among a set of actors. Network data are defined by actors and relations, which are represented by nodes and lines. For the purpose of this study, we focus on a set of network measures that capture the size (*degree*), position (*closeness* and *betweenness*), interconnectedness *(reciprocity* and *density)* and heterogeneity (*tie,*

*industry* and *geographical diversity*) of underwriter peer networks. All the network measures are computed using undirected binary data with the exception of reciprocity, for which we use directed data. Detailed discussions of these measures and network analysis are provided in Chapter 2, which uses a small simplified network of underwriters as an example to better illustrate the construction of these network measures.

*Degree*

The normalized degree measures the percentage of all other underwriters a specific underwriter maintains ties with. Formally, $Degree_i = \frac{\sum_j x_{ij}}{n-1}$, where $x_{ij}$ equals to one when there is a tie between underwriters *i* and *j,* and *n* equals to the number of all underwriters in the network. The higher the number of relationships an underwriter has, the more access it has to deal flow as it can be included in the syndicates of its partners.

*Closeness*

The measure of closeness emphasizes the proximity of an underwriter to all other underwriters in the network, and we specifically use an eigenvector centrality measure proposed by Bonacich (1972). Here, the centrality of each underwriter is determined by the centralities of the partners it is connected to.[10] If we denote the eigenvector centrality of *i* by $ev_i$, formally, $ev_i = \frac{1}{\lambda}\sum_j A_{ij} ev_j$, where $\lambda$ is a constant that provides a nontrivial

[10] Google's system of ranking web pages for a particular search is similar to eigenvector centrality measure.

solution, and $A_{ij}$ is an adjacency matrix[11], and we normalize this measure by dividing it by the maximum possible eigenvector centrality in the network. Underwriters with higher closeness measures occupy more central positions in the network and are closer to other underwriters, which suggest that they are sitting in the center of the industry network and enjoy more access to information and deal flows.

*Betweenness*

We use betweenness measure proposed by Freeman (1979) that captures how often an underwriter happens to be located between pairs of other underwriters. An underwriter is between two underwriters if it lies on the shortest possible path (also called geodesic path) between them. Betweenness, to some extent, reflects an underwriter's capacity to serve as an intermediary between others. An underwriter with higher betweenness can make connections between other underwriters and may have more power to isolate others or prevent contact. Specifically, $Betweenness_i = \sum_{jk} b_{jik}$ , where $b_{jik}$ is the proportion of all paths linking distinct underwriters $j$ and $k$ that pass through underwriter $i$, and we divide it by the maximum possible betweenness in the network to obtain normalized betweenness. Closeness and betweenness are core network position measures, and they capture how advantageous an underwriter's network position is.

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[11] An adjacency matrix is a symmetric matrix, where $A_{ij}$=1 if node $i$ is adjacent to node $j$, and $A_{ij}$=0 otherwise.

*Reciprocity*

Reciprocity refers to the proportion of all ties of an underwriter that are reciprocated, where a tie is considered reciprocated if the two underwriters invite each other into their respective syndicates. Underwriters may be more likely to cooperate with those with whom they maintain reciprocated ties. We compute reciprocity using directed ties. We establish the direction of relationships only between those who are book managers and those who are not, and reciprocity is measured only for those who serve as book managers. Formally, $Reciprocity_i = \frac{\sum_j (x_{ij} > 0 \text{ and } x_{ji} > 0)}{\sum_j (x_{ij} > 0 \text{ or } x_{ji} > 0)}$, where $x_{ij}$ indicates that book manager $i$ invited underwriter $j$ into its syndicate.

*Density*

Density of an underwriter's ego (i.e., individual) network can be another way of measuring the so-called embeddedness or interconnectedness within a network. Density refers to the percent of all ties that can exist among an underwriter's partners that are actually present. Specifically, $Density_i = \frac{\sum_{jk} x_{jk}}{n_i(n_i - 1)}$, where $x_{jk}$ equals to one when there is a tie between underwriters $j$ and $k$ with whom underwriter $i$ maintains ties with, and $n_i$ equals to the number of all partners of underwriter $i$ (i.e., degree of underwriter $i$). Network density cannot be computed when an underwriter has no ties or only one tie. Dense network means that an underwriter's partners, in turn, have many ties with each another, which may indicate more trust or coordination in the network. Reciprocity and

density capture the structure of relationships around the underwriter and thus, attempt to indirectly measure the tendency to cooperate with each other.

*Tie diversity*

We first capture the heterogeneity of an individual underwriter's network by the extent of non-redundant ties. The specific measure used is called reach efficiency. Reach efficiency measures how many non-redundant partners an underwriter can reach within two degrees of separation per each partner. If underwriters work with similar underwriters, who, in turn, work with the same type of underwriters, the network may not be highly heterogeneous and the reach efficiency measure will be low. Formally, $Tie.diversity_i = \frac{k_i}{\sum_j (n_j - 1) + n_i}$, where $k_i$ equals to the number of all unique underwriters within two degrees of separation from underwriter $i$, $n_j$ the degree or the size of the network of each partner $j$ of underwriter $i$, and $n_i$ is the degree of underwriter $i$ itself.

*Industry and geographical diversity*

Here, we attempt to measure the heterogeneity of an individual underwriter's network by the diversity of the industrial and geographical specialization of its partners. These measures are not traditional social network measures, but ones that we develop to capture additional aspects of underwriter networks. For each underwriter, we identify five major states and industries it specialized in over four-year periods. Next, we compute the number of different industries and states underwriter $i$ can reach indirectly through the experience of its partners and normalize it by the number of partners. If an underwriter maintains ties with heterogeneous partners that operate in different industries

and states, the diversity measures will be high. Network diversity has implications for the underwriter's access to heterogeneous information and different market segments, but it also reflects differentiation and segmentation and thus, may reveal information about the likelihood and efficiency of cooperation within a network.

### 4.4. Data and descriptive statistics

We use Thomson Financial's Security Data Corporation's (SDC) New Issues database to create underwriter network measures. The network measures are constructed using inter-organizational relationships that underwriters establish with each other when they are involved in the same underwriting syndicate. We obtain all 23,084 public equity and 24,818 public debt securities issued between 1970 and 2007 in the U.S. excluding the securities offered by financial firms as shown in Table 4.1. Of these equity and debt issues, 29,911 employ two or more underwriters.

**Table 4.1: Sample of security issues**
The following sample includes all public securities issued in the U.S. between 1970 and 2007 excluding the securities of financial firms. We use these security issues to construct underwriter networks.

| | Number of issues | Number of issues that employ two or more underwriters |
|---|---|---|
| Equity | 23,084 | 14,344 |
| Initial public offerings | 10,073 | 6,054 |
| Seasoned equity offerings | 13,011 | 8,290 |
| Debt | 24,818 | 15,567 |
| Non-convertible debt | 20,899 | 13,030 |
| Convertible debt | 1,575 | 801 |
| Non-convertible preferred | 1,704 | 1,349 |
| Convertible preferred | 640 | 387 |
| All deals | 47,902 | 29,911 |

Underwriters may interact with each other before or after the deal syndication, and their relationships probably do not die out as soon as a deal is over. Therefore, to capture the lasting nature of relationships, we use a four-year moving period approach. Consequently, there are 35 rolling four-year periods from 1970 to 2007.

We consider only the managing underwriters (book managers and co-managers) in syndicates and exclude syndicate members, because non-managing syndicate members typically only serve distributional purposes and have minimal role in deals. We use reported underwriter names, but multiple variations of the same underwriter names appear in the SDC data due to inconsistent abbreviation, punctuation or spelling such as Goldman Sachs & Co and Goldman, Sachs & Co. We check all the underwriter names and manually correct the names when necessary. Cooney et al. (2004) perform a similar hand correction when working with underwriter data. In the case of bank mergers, we treat the post-merger bank as a new entity because a multitude of changes and restructuring occur around bank mergers. We also identify commercial banks in the sample using Gande et al. (1999), Federal Reserve data on large commercial banks, and hand check.

By limiting syndicates only to those who serve as managing underwriters and following the above corrections, we obtain total of 1,653 and 840 underwriters in the equity and debt samples, respectively. Of these underwriters, 115 and 106 are commercial banks. Using binary network data created from the equity and debt syndicates, we compute various network measures by employing the social network analysis software UCINET 6 (Borgatti, Everett, and Freeman (2002)).

We examine the impact of peer network on underwriter performance. A major performance measure for an underwriter is fee income, but detailed fee information for individual underwriters is unavailable. However, fee income is closely related to market share since underwriting fees are stable. Market share is computed as the sum of the proceeds of the offerings lead by a specific underwriter, divided by the total deal volume of all the securities over a period, along the line of Megginson and Weiss (1991). In addition to market share, we compute underwriter loyalty index to reflect an underwriter's ability to retain its clients similar to Ljungqvist et al (2007). Loyalty index measures how often the lead underwriter is retained in the subsequent deals of the client firms during a four-year period. We also identify all firm-underwriter relationships in the sample and measure the strength of each firm-underwriter relationship by the percent of all deals of a specific firm that is underwritten by a certain underwriter during a four-year period. Finally, proceeds are adjusted for inflation.

*4.4.1. Overall network of underwriters*

The characteristics of the overall network of underwriters in the U.S. equity and debt underwriting market are presented in Table 4.2. The entire networks of underwriters during selected periods are also depicted in Figure 4.1. As we can see in Panel A of Figure 4.1, during 1970-73 there are many equity underwriters without syndicate ties appearing as isolate nodes on the left. The density measure of the overall equity underwriter network of this period in Panel A of Table 4.2 is 0.41 percent meaning that only 0.41 percent of all possible ties among 613 equity underwriters are actually present. However, some underwriters may have more dense individual networks than others. The

average geodesic distance between reachable pairs of underwriters is 3.096, which means that on average the degrees of separation between any connected pair of underwriters is 3.096.

**Table 4.2: Characteristics of the overall underwriter networks**
The following tables present the characteristics of the overall network of underwriters that serve as managing underwriters of public securities over rolling four-year periods. Networks are created using the ties that underwriters form with each other when they are involved in the same underwriting syndicate of equity or debt securities during a four-year period. Panel A focuses on underwriters that serve in equity issues, and Panel B focuses on underwriters that serve in debt issues. Density shows the percent of all possible ties that are actually present. The average geodesic distance is the average of the geodesic distances among all reachable pairs of underwriters. Geodesic distance refers to the number of relations along the shortest possible path between a pair of underwriters.

**Panel A: Network of equity underwriters**

| Period | Years | Number of underwriters | Density | Average geodesic distance |
|---|---|---|---|---|
| 1 | 1970-73 | 613 | 0.41 | 3.096 |
| 2 | 1971-74 | 519 | 0.57 | 2.768 |
| 3 | 1972-75 | 429 | 0.71 | 2.742 |
| 4 | 1973-76 | 187 | 2.73 | 2.551 |
| 5 | 1974-77 | 140 | 5.06 | 2.426 |
| 6 | 1975-78 | 147 | 5.58 | 2.361 |
| 7 | 1976-79 | 164 | 4.83 | 2.326 |
| 8 | 1977-80 | 178 | 3.98 | 2.373 |
| 9 | 1978-81 | 214 | 2.58 | 2.590 |
| 10 | 1979-82 | 230 | 2.35 | 2.863 |
| 11 | 1980-83 | 296 | 1.84 | 3.280 |
| 12 | 1981-84 | 315 | 1.79 | 3.368 |
| 13 | 1982-85 | 301 | 1.99 | 3.410 |
| 14 | 1983-86 | 345 | 1.80 | 3.596 |
| 15 | 1984-87 | 344 | 1.81 | 4.056 |
| 16 | 1985-88 | 330 | 2.08 | 3.732 |
| 17 | 1986-89 | 336 | 2.12 | 4.451 |
| 18 | 1987-90 | 289 | 2.63 | 3.684 |
| 19 | 1988-91 | 260 | 3.32 | 2.568 |
| 20 | 1989-92 | 300 | 3.43 | 3.164 |
| 21 | 1990-93 | 336 | 4.05 | 3.056 |
| 22 | 1991-94 | 360 | 3.87 | 3.196 |
| 23 | 1992-95 | 408 | 3.53 | 3.357 |
| 24 | 1993-96 | 440 | 3.41 | 3.464 |
| 25 | 1994-97 | 457 | 3.05 | 3.137 |
| 26 | 1995-98 | 442 | 3.38 | 3.505 |
| 27 | 1996-99 | 463 | 3.85 | 2.983 |
| 28 | 1997-00 | 427 | 4.66 | 2.905 |
| 29 | 1998-01 | 358 | 5.53 | 2.762 |
| 30 | 1999-02 | 342 | 7.18 | 2.489 |
| 31 | 2000-03 | 313 | 9.25 | 2.296 |
| 32 | 2001-04 | 293 | 10.94 | 2.158 |
| 33 | 2002-05 | 284 | 11.73 | 2.164 |
| 34 | 2003-06 | 276 | 12.13 | 2.104 |
| 35 | 2004-07 | 262 | 14.81 | 2.027 |

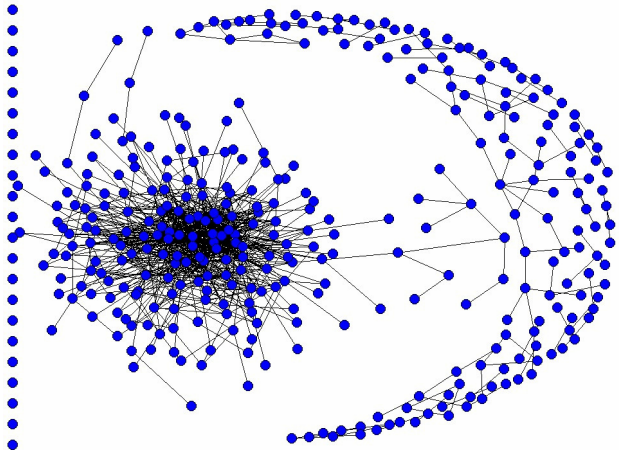
**Panel B: Network of debt underwriters**

| Period | Years | Number of underwriters | Density | Average geodesic distance |
|---|---|---|---|---|
| 1 | 1970-73 | 178 | 4.93 | 2.363 |
| 2 | 1971-74 | 169 | 5.80 | 2.198 |
| 3 | 1972-75 | 155 | 7.42 | 2.199 |
| 4 | 1973-76 | 132 | 9.51 | 2.230 |
| 5 | 1974-77 | 135 | 9.29 | 2.269 |
| 6 | 1975-78 | 143 | 8.77 | 2.243 |
| 7 | 1976-79 | 147 | 8.23 | 2.365 |
| 8 | 1977-80 | 140 | 8.58 | 2.388 |
| 9 | 1978-81 | 134 | 7.38 | 2.507 |
| 10 | 1979-82 | 130 | 7.49 | 2.226 |
| 11 | 1980-83 | 130 | 6.82 | 2.479 |
| 12 | 1981-84 | 136 | 6.63 | 2.415 |
| 13 | 1982-85 | 143 | 6.26 | 2.346 |
| 14 | 1983-86 | 156 | 5.81 | 2.379 |
| 15 | 1984-87 | 166 | 5.53 | 2.338 |
| 16 | 1985-88 | 162 | 5.88 | 2.348 |
| 17 | 1986-89 | 157 | 6.53 | 2.315 |
| 18 | 1987-90 | 149 | 7.71 | 2.240 |
| 19 | 1988-91 | 141 | 8.39 | 2.117 |
| 20 | 1989-92 | 154 | 9.29 | 2.088 |
| 21 | 1990-93 | 201 | 7.76 | 2.044 |
| 22 | 1991-94 | 221 | 7.53 | 2.090 |
| 23 | 1992-95 | 234 | 7.55 | 2.060 |
| 24 | 1993-96 | 234 | 7.95 | 2.068 |
| 25 | 1994-97 | 224 | 8.44 | 2.093 |
| 26 | 1995-98 | 220 | 9.84 | 2.106 |
| 27 | 1996-99 | 233 | 9.89 | 2.118 |
| 28 | 1997-00 | 239 | 10.47 | 2.117 |
| 29 | 1998-01 | 243 | 13.79 | 1.959 |
| 30 | 1999-02 | 245 | 15.25 | 1.940 |
| 31 | 2000-03 | 269 | 16.36 | 1.899 |
| 32 | 2001-04 | 268 | 17.16 | 1.896 |
| 33 | 2002-05 | 270 | 18.27 | 1.867 |
| 34 | 2003-06 | 263 | 20.28 | 1.838 |
| 35 | 2004-07 | 265 | 19.85 | 1.849 |

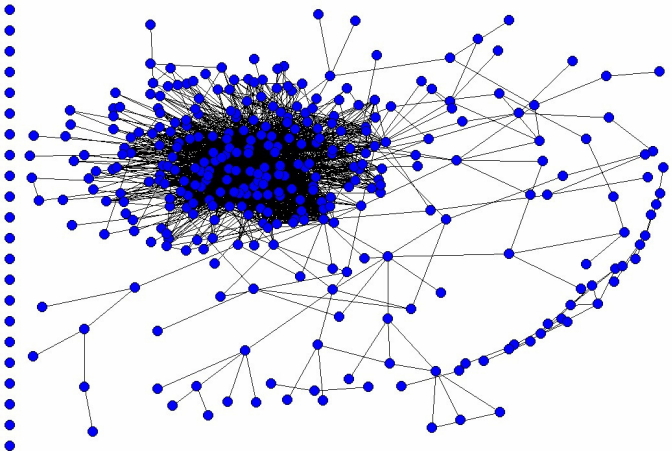
**Figure 4.1: Overall network of underwriters during selected periods**

The following figures show the overall network of underwriters that serve as managing underwriters in public securities during selected four-year periods. Networks are created using the ties that underwriters form with each other when they are involved in the same underwriting syndicates of equity or debt securities during a four-year period. Panels A-C display the overall network of underwriters that serve in equity issues, and Panels D-F display the overall network of underwriters that serve in debt issues.

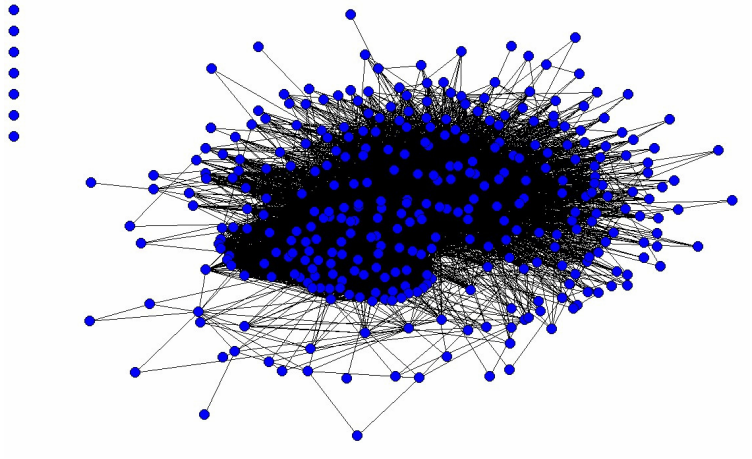
**Panel A: Network of equity underwriters during 1970-73**



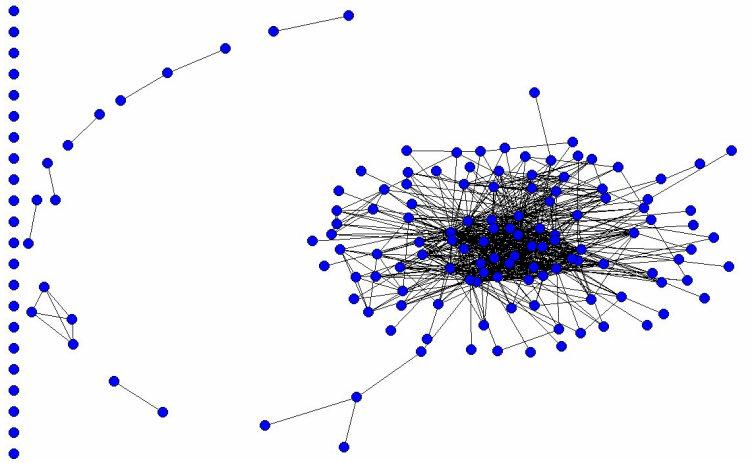
**Panel B: Network of equity underwriters during 1990-93**



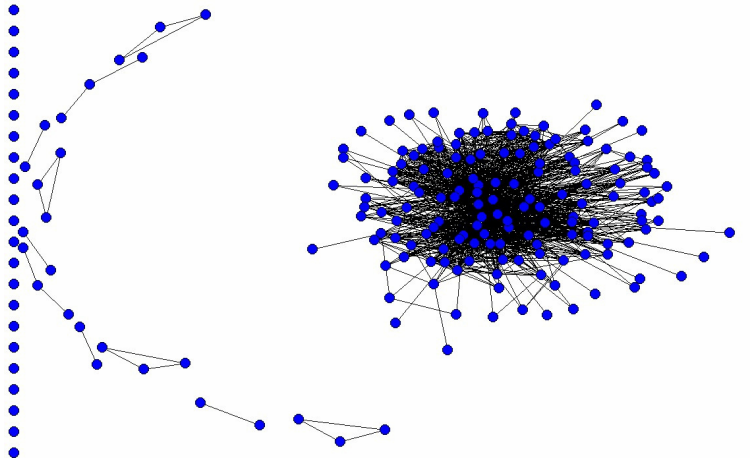
**Panel C: Network of equity underwriters during 2004-07**



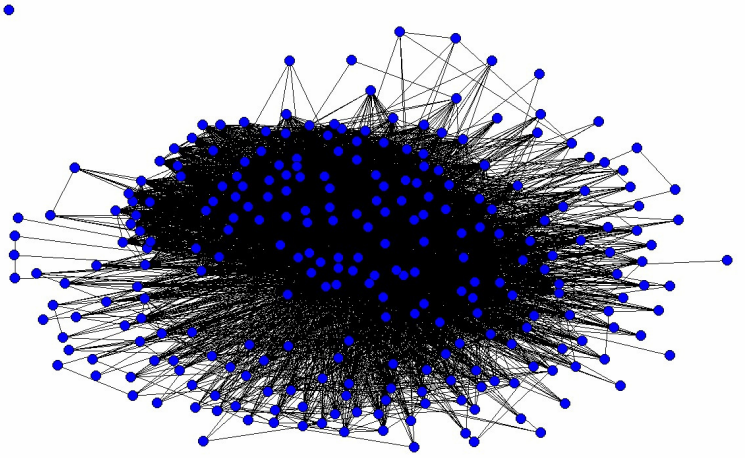
**Panel D: Network of debt underwriters during 1970-73**



**Panel E: Network of debt underwriters during 1990-93**



**Panel F: Network of debt underwriters during 2004-07**



In Panel B of Figure 4.1, more ties are visible among underwriters during 1990-93. The network density is 4.05 percent during this period. The average geodesic distance between reachable pairs is 3.056, similar to the first period. However, during the last period of 2004-07 in Panel C, almost all the underwriters maintain some relationships with other banks as evidenced by much less isolate nodes on the left. The overall network density has reached 14.81 percent meaning that, of all possible relationships that can exist among 262 equity underwriters, 14.81 percent are actually present. In large networks, density rarely reaches extremely high levels because it is impossible for every one to maintain ties with every one else. The average geodesic distance between reachable pairs has declined to 2.027. Therefore, on average, any equity underwriter is only 2.027 relationships away from any other equity underwriter that is reachable in 2004-07. Moreover, the underwriters seem to be globally connected to each other and do not display distinct cliques. The significant drop in the number of underwriters during the mid and late 1970s in Panel A of Table 4.2 is mainly due to the cold market during

those years. The upward trend in the overall network density from late 1990s naturally coincides with the increasing frequency of syndication.

As for the underwriters of debt securities, there has been a smaller number of debt underwriters compared to equity underwriters as shown in Panel B of Table 4.2. The same trend of increasing density is also observed here. The density of the overall debt network has increased from 4.93 in 1970-73 to 19.85 in 2004-07. In fact, the network of debt underwriters has consistently displayed higher density than the network of equity underwriters. For example, the density measure of debt underwriters' network during the first period is 4.93 percent while it is 0.41 percent for equity underwriters' network and 7.76 percent instead of 4.05 in 1990-93, respectively. Panels D through F in Figure 4.1 also display the increasing interconnectedness among debt underwriters.

During the last period of 2004-07 in Panel F, almost all the debt underwriters maintain some relationships with each other as evidenced by the general lack of isolate nodes on the left. The overall network density has reached 19.85 percent meaning that, of all possible relationships among 265 debt underwriters, 19.85 percent are actually present. The average geodesic distance between reachable pairs has come down to 1.849. Therefore, on average, a debt underwriter is only 1.849 relationships away from any other debt underwriter that is reachable. These figures and tables show that historically there have been a larger number of underwriters in equity than debt underwriting, although the numbers have become similar in recent years. However, the network of debt underwriters still remains more densely connected.

*4.2. Descriptive statistics*

In this section, we move from the overall network measures to the descriptive statistics of the networks of individual underwriters. Panel A of Table 4.3 is based on underwriter-period observations and presents the characteristics of the underwriters of equity and debt securities. For example, mean degree of equity underwriters across all periods is 4.15 percent; closeness is 3.79; and betweenness is 0.27. The mean density of the individual networks of equity underwriters is 65.39 percent. As for the measures of network diversity, the mean industry and geographical diversity are 0.72 and 0.65, which means that on average, equity underwriters can access 0.72 different industries and 0.65 states through each partner. At maximum, an equity underwriter has ties to 67.93 percent of all other underwriters. Some underwriters have ties that are all reciprocated as evidenced by the maximum reciprocity of 100 percent. The average market share of equity underwriters is smaller than that of debt underwriters, consistent with the fact that there are more equity underwriters. We can observe similar statistics for debt underwriters as well.

**Table 4.3: Descriptive statistics**

The following sample includes 23,084 equity and 24,818 debt securities issued in the U.S. between 1970 and 2007, excluding those issued by financial firms, and all the underwriters that serve as managing underwriters in these securities. There are 1,653 and 840 underwriters involved in the underwriting of these equity and debt securities, respectively. Panel A presents the descriptive statistics of the underwriters' characteristics measured over moving four-year periods. Panel B presents the characteristics of the securities. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters, and it is normalized by dividing it by the maximum eigenvector in the network. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters, and it is normalized by dividing it by the maximum betweenness in the network. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. *Geodesic distance* is the number of relationships along the shortest possible path between a pair of underwriters. Market share is computed as the sum of the proceeds of the offerings lead by a specific underwriter, divided by the total deal volume of all the offerings during a period. Loyalty index measures how often an underwriter is retained as the book manager in the subsequent deals of its clients. Firm-underwriter relationship strength denotes the percent of all deals of a firm that is underwritten by a specific underwriter over a four-year period. We present the strength of the issuing firms' relationships with their book managers in the table below.

| | Mean | Median | Min | Max | Std Dev | *N* |
|---|---|---|---|---|---|---|
| **Panel A: Underwriter characteristics** | | | | | | |
| **Equity underwriters** | | | | | | |
| Network measures | | | | | | |
| *Degree* | 4.15 | 0.83 | 0 | 67.93 | 7.60 | 12,981 |
| *Closeness* | 3.79 | 0.69 | 0 | 32.60 | 6.29 | 12,981 |
| *Betweenness* | 0.27 | 0 | 0 | 18.00 | 0.83 | 12,981 |
| *Reciprocity* | 4.80 | 0 | 0 | 100.00 | 13.12 | 10,259 |
| *Density* | 65.39 | 68.28 | 0 | 100.00 | 31.03 | 8,127 |
| *Tie diversity* | 34.04 | 24.51 | 0 | 99.57 | 31.75 | 12,981 |
| *Industry diversity* | 0.72 | 0.70 | 0 | 5.00 | 0.67 | 12,981 |
| *Geographical diversity* | 0.65 | 0.63 | 0 | 5.00 | 0.58 | 12,981 |
| *Geodesic distance* | 2.93 | 2 | 1 | 17 | 1.54 | 2702906 |
| Market share (%) | 0.46 | 0.01 | 0 | 29.47 | 2.15 | 8,768 |
| Loyalty index (%) | 44.01 | 50.00 | 0 | 100.00 | 39.66 | 2,772 |
| Firm-underwriter relationship strength (%) | 14.22 | 0 | 0 | 100.00 | 34.15 | 23,084 |

**Table 4.3 (continued)**

| | Mean | Median | Min | Max | Std Dev | *N* |
|---|---|---|---|---|---|---|
| **Debt underwriters** | | | | | | |
| Network measures | | | | | | |
| *Degree* | 10.51 | 5.00 | 0 | 82.16 | 13.41 | 6,431 |
| *Closeness* | 6.81 | 3.73 | 0 | 35.27 | 7.70 | 6,431 |
| *Betweenness* | 0.42 | 0 | 0 | 14.37 | 1.28 | 6,431 |
| *Reciprocity* | 6.09 | 0 | 0 | 100.00 | 13.90 | 5,929 |
| *Density* | 79.54 | 87.43 | 0 | 100.00 | 23.29 | 5,281 |
| *Tie diversity* | 26.98 | 14.96 | 0 | 99.55 | 27.31 | 6,586 |
| *Industry diversity* | 0.61 | 0.56 | 0 | 16.00 | 0.49 | 6,569 |
| *Geographical diversity* | 0.61 | 0.55 | 0 | 16.00 | 0.50 | 6,569 |
| *Geodesic distance* | 2.05 | 2 | 1 | 8 | 0.64 | 1000406 |
| Market share (%) | 1.53 | 0.02 | 0 | 40.04 | 4.52 | 3,013 |
| Loyalty index (%) | 42.41 | 46.04 | 0 | 100.00 | 33.29 | 1,455 |
| Firm-underwriter relationship strength (%) | 20.05 | 0 | 0 | 100.00 | 33.43 | 24,818 |
| | | | | | | |
| **Panel B: Issue characteristics** | | | | | | |
| **Equity issues** | | | | | | |
| Deal proceeds ($ mil) | 57.50 | 21.42 | 0.05 | 10674.3 | 224.69 | 23,084 |
| No. of book managers | 1.07 | 1 | 1 | 6 | 0.31 | 23,084 |
| No. of managing underwriters | 2.33 | 2 | 1 | 46 | 1.74 | 23,084 |
| No. of all underwriters | 3.71 | 2 | 1 | 105 | 5.19 | 23,084 |
| | | | | | | |
| **Debt issues** | | | | | | |
| Deal proceeds ($ mil) | 193.32 | 92.84 | 0.25 | 8446.11 | 387.12 | 24,818 |
| No. of book managers | 1.19 | 1 | 1 | 12 | 0.57 | 24,818 |
| No. of managing underwriters | 3.26 | 2 | 1 | 59 | 3.35 | 24,818 |
| No. of all underwriters | 3.47 | 2 | 1 | 82 | 4.41 | 24,818 |

Panel B presents the descriptive statistics of the securities. The average debt offering is more than three times larger than the average equity offering, as evidenced by the mean equity offering of $57.50 million versus the mean debt offering of $193.32 million. Mean syndicate size across all periods is 3.71 for equity deals and 3.47 for debt deals.

In Table 4.4, we present the mean network characteristics of investment banks and commercial banks using issues from 1989-2007, since Section 20 subsidiaries were

permitted to underwrite corporate securities in 1989. From the mean network characteristics in Panel A of Table 4.4, it seems that the commercial banks have less diverse, more reciprocated and larger networks than investment banks in both equity and debt underwriting. However, the commercial banks have larger market shares consistent with large commercial banks entering investment banking and fighting aggressively for market share, whereas there are a variety of investment banks that range from small boutique firms to large prestigious ones. In Panel B of Table 4.4, we randomly match a commercial bank to an investment bank based on the market share, which results in two samples of equal size. In these market share-matched samples, commercial banks and investment banks have similar network characteristics, but the commercial banks, on average, still have larger networks with more advantageous positions.

**Table 4.4: Characteristics of the networks of investment bank and commercial bank underwriters**

The following tables present the characteristics of the networks of investment banks and commercial banks that serve as managing underwriters of public securities between 1989 and 2007, since Section 20 subsidiaries of commercial banks were permitted to underwrite corporate bond and equity securities in 1989 and 1990, respectively. Panel A presents the mean network characteristics of investment banks and commercial banks. Panel B presents the mean network characteristics of commercial banks and those of investment banks that are matched by market share. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. *N* refers to the number of underwriter-period observations.

**Panel A: Mean network characteristics of commercial banks and investment banks**

| | **Equity underwriters** | | **Debt underwriters** | |
|---|---|---|---|---|
| | Investment banks ($N$ = 9,726) | Commercial banks ($N$ = 1,270) | Investment banks ($N$ = 3,302) | Commercial banks ($N$ = 927) |
| Market share | 0.20 | 0.31 | 0.62 | 0.85 |
| *Degree* | 3.36 | 5.38 | 9.25 | 18.64 |
| *Closeness* | 2.74 | 3.25 | 5.60 | 9.87 |
| *Betweenness* | 0.22 | 0.25 | 0.32 | 0.47 |
| *Reciprocity* | 4.83 | 5.53 | 5.67 | 6.02 |
| *Density* | 68.93 | 70.55 | 82.24 | 76.48 |
| *Tie diversity* | 26.29 | 8.65 | 25.24 | 13.51 |
| *Industry diversity* | 0.55 | 0.25 | 0.58 | 0.47 |
| *Geographical diversity* | 0.50 | 0.22 | 0.58 | 0.47 |

**Panel B: Mean network characteristics of commercial banks and market share-matched investment banks**

| | **Equity underwriters** | | **Debt underwriters** | |
|---|---|---|---|---|
| | Investment banks ($N$ = 295) | Commercial banks ($N$ = 295) | Investment banks ($N$ = 437) | Commercial banks ($N$ = 437) |
| *Degree* | 13.60 | 18.69 | 22.32 | 28.49 |
| *Closeness* | 8.46 | 10.83 | 11.49 | 14.15 |
| *Betweenness* | 0.72 | 0.98 | 0.78 | 0.95 |
| *Reciprocity* | 7.08 | 7.58 | 7.71 | 8.64 |
| *Density* | 58.27 | 53.91 | 62.92 | 60.74 |
| *Tie diversity* | 20.28 | 11.63 | 10.14 | 7.53 |
| *Industry diversity* | 0.55 | 0.43 | 0.41 | 0.36 |
| *Geographical diversity* | 0.49 | 0.36 | 0.42 | 0.36 |

## 4.5. Impact of underwriter network on market share

### *4.5.1. Future market share*

We examine whether peer network affects future market share of equity and debt underwriters in Table 4.5. The table presents the estimated coefficients of OLS regressions, where we regress the underwriter market share in a given year on the underwriter characteristics during the previous four-year period. All the regressions include year fixed effects and robust standard errors that allow for clustering in the observations of the same underwriter. Since lagged market share may have significant explanatory power due to persistence in market share, we include the market share from the previous four-year period in addition to our network measures. We also include loyalty index that captures how often an underwriter is retained by the client firms in their subsequent deals during a four-year period. This measure may indirectly proxy for some underwriter capability.

**Table 4.5: Impact of underwriter network on future market share**

The table presents the estimated coefficients of regressions of underwriter market share in equity (Panel A) and debt (Panel B) underwriting. The sample includes all underwriters that serve as either a book- or co-manager in U.S. equity and debt offerings in 1970- 2007. The dependent variable, market share, refers to the sum of the proceeds of the offerings lead by a specific underwriter during a year, divided by the total annual deal volume of all the offerings. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Loyalty index measures how often an underwriter is retained as the book manager in the subsequent deals of its client firms. *p*-values reported in brackets.

**Panel A: The impact of network on the future market share of equity underwriters**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | 0.048 | 0.072 | 0.151 | 0.177 | 0.279 | 0.225 | 0.167 | 0.181 | -0.107 |
| | (0.07) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.57) |
| *Degree* | 0.020 | | | | | | | | 0.059 |
| | (0.01) | | | | | | | | (0.00) |
| *Closeness* | | 0.011 | | | | | | | -0.024 |
| | | (0.06) | | | | | | | (0.12) |
| *Betweenness* | | | 0.021 | | | | | | 0.001 |
| | | | (0.66) | | | | | | (0.98) |
| *Reciprocity* | | | | -0.001 | | | | | -0.001 |
| | | | | (0.86) | | | | | (0.75) |
| *Density* | | | | | -0.002 | | | | 0.001 |
| | | | | | (0.10) | | | | (0.31) |
| *Tie diversity* | | | | | | -0.002 | | | 0.001 |
| | | | | | | (0.01) | | | (0.90) |
| *Industry diversity* | | | | | | | -0.055 | | 0.053 |
| | | | | | | | (0.02) | | (0.42) |
| *Geographical diversity* | | | | | | | | -0.072 | |
| | | | | | | | | (0.02) | |
| … x Commercial | 0.041 | 0.094 | 0.466 | 0.038 | 0.015 | 0.039 | 2.015 | 2.137 | |
| bank dummy | (0.01) | (0.00) | (0.01) | (0.02) | (0.00) | (0.01) | (0.00) | (0.00) | |
| Market share | 0.955 | 0.973 | 0.974 | 0.984 | 0.984 | 0.955 | 0.987 | 0.987 | 0.938 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Loyalty index | -0.001 | -0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | -0.002 |
| | (0.19) | (0.30) | (0.66) | (0.34) | (0.50) | (0.50) | (0.37) | (0.39) | (0.10) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 75.64 | 75.56 | 75.33 | 76.37 | 74.54 | 75.07 | 75.21 | 75.17 | 76.16 |
| *N* | 3,341 | 3,341 | 3,341 | 2,753 | 2,562 | 3,341 | 3,341 | 3,341 | 2,260 |

**Panel B: The impact of network on the future market share of debt underwriters**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | -0.094 | 0.070 | 0.227 | 0.286 | 1.597 | 0.444 | 0.358 | 0.330 | -0.512 |
| | (0.43) | (0.46) | (0.00) | (0.01) | (0.00) | (0.00) | (0.00) | (0.00) | (0.36) |
| *Degree* | 0.024 | | | | | | | | 0.088 |
| | (0.11) | | | | | | | | (0.00) |
| *Closeness* | | 0.011 | | | | | | | -0.080 |
| | | (0.44) | | | | | | | (0.03) |
| *Betweenness* | | | 0.197 | | | | | | 0.134 |
| | | | (0.14) | | | | | | (0.38) |
| *Reciprocity* | | | | 0.002 | | | | | 0.004 |
| | | | | (0.78) | | | | | (0.44) |
| *Density* | | | | | -0.020 | | | | 0.005 |
| | | | | | (0.00) | | | | (0.29) |
| *Tie diversity* | | | | | | -0.006 | | | -0.002 |
| | | | | | | (0.00) | | | (0.80) |
| *Industry diversity* | | | | | | | -0.096 | | 0.068 |
| | | | | | | | (0.23) | | (0.61) |
| *Geographical diversity* | | | | | | | | -0.095 | |
| | | | | | | | | (0.21) | |
| … x Commercial | 0.041 | 0.079 | 0.686 | 0.032 | 0.008 | 0.020 | 0.836 | 1.179 | |
| bank dummy | (0.01) | (0.00) | (0.00) | (0.11) | (0.08) | (0.08) | (0.10) | (0.06) | |
| Market share | 0.951 | 0.990 | 0.918 | 0.995 | 0.962 | 0.991 | 0.995 | 0.996 | 0.883 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Loyalty index | 0.002 | 0.005 | 0.004 | 0.009 | 0.007 | 0.007 | 0.007 | 0.007 | 0.006 |
| | (0.35) | (0.08) | (0.12) | (0.01) | (0.06) | (0.03) | (0.03) | (0.02) | (0.13) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 74.40 | 73.98 | 74.42 | 72.91 | 72.89 | 73.51 | 73.51 | 73.54 | 72.89 |
| *N* | 1,510 | 1,510 | 1,510 | 1,190 | 1,178 | 1,510 | 1,510 | 1,510 | 1,117 |

Panel A of Table 4.5 presents the regression results of the impact of network on the future market share of equity underwriters. As the estimated coefficients show, network degree and closeness have significant positive effects on market share, and network diversity measures have significant and negative coefficients. In addition, all the interaction terms between the network variables and the commercial bank dummy are consistently significant and positive.

The results indicate that underwriters with larger networks and closer ties to other underwriters experience higher market share in the following year, which is consistent with equity underwriters using their contacts to generate greater deal flows and increase their market shares. Underwriters with well-connected partners generally display higher closeness, and such partners would be especially beneficial in increasing deal flow. These positive effects of degree and closeness are even more pronounced for commercial bank underwriters, as evidenced by the significant coefficients of 0.041 and 0.094 on the interaction terms in models 1 and 2.

Betweenness in model 3 is insignificant for investment banks, but it has a significant effect on the future market share of commercial banks. Betweenness centrality for underwriter *i* is essentially the proportion of all geodesic paths between pairs that utilize underwriter *i*, and according to Borgatti (2005), it captures the exclusivity of underwriter *i*'s position. Thus, it reflects an underwriter's capacity to serve as an intermediary between others. However, betweenness is insignificant for investment banks, but commercial banks are able to utilize their intermediary position and use it to control information and deal flows.

Measures of reciprocity and density of underwriter networks are both insignificant in models 4 and 5, which suggests that for investment banks, existence of more ties among its partners or greater reciprocity with its partners does not necessarily increase their market shares. However, commercial banks benefit from such dense and reciprocated networks.

Finally, measures of network diversity are negatively associated with future market share, but the effect is mitigated for commercial banks. Having a diverse peer network can improve performance because underwriters with such networks can indirectly access information and deal flow in different market segments, but heterogeneous networks with diverse partners may also hinder effective cooperation. The estimated coefficients show that investment banks generate deal flows from more specialized homogenous networks, whereas commercial banks benefit from heterogeneous networks. This result is consistent with the fact that specialization, in general, has played a greater role in investment banking than commercial banking. Commercial banks typically engage in a larger set of financial activities than investment banks and tend to be more diversified than investment banks along certain dimensions. Therefore, commercial banks can be better equipped to work with diverse partners. As for the control variables, the estimated coefficients on lagged market share shows the persistence in market share. Loyalty index, on the other hand, is insignificant. The adjusted *R*-squares that range from 74.54 to 76.37 percent support our conjecture that these underwriter characteristics explain variations in future market share.

In terms of the economic significance of the equity network measures, a one standard deviation increase in the degree is associated with an increase of about 15.2

basis points in the market share in the following year for investment banks and an increase of 46.4 basis points in the market share of commercial banks, after controlling for other variables. These are economically significant effects given that the mean equity underwriter market share is 0.46 percent. Similarly, all else being equal, a one standard deviation increase in the closeness centrality is associated with an increase of 6.9 basis points in the market share of investment banks and 66 basis points in that of commercial banks. When the tie diversity of a network increases by one standard deviation, the following year's market share is 6.35 basis points lower for investment banks and 117.47 basis points higher for commercial banks.

In Panel B of Table 4.5, we repeat the analysis for debt underwriters. Only the density and tie diversity measures are significant, although the interaction terms of some of the network variables with the commercial bank dummy are significant as well. Overall, the regression results show that the role of peer network in market share is less significant in debt underwriting than equity. Equity networks may be more advantageous and of greater strategic importance than debt networks because first, the fees generated from equity deals tend to be higher than those from debt deals even after controlling for the difference in the deal size. Second, there is higher information asymmetry surrounding equity deals. These may enhance the role of networks in equity underwriting.

Commercial banks that serve as debt underwriters are able to utilize the size, closeness and betweenness of their networks to increase deal flow of debt securities, as evidenced by the estimated coefficients of the interaction terms in models 1-3, but the benefits from other aspects of networks are not significant at five percent level. The fact

that the commercial banks are more familiar with debt than equity underwriting due to their lending activities, may have further lowered the potential benefit of peer network for them in debt underwriting. The regression results in Panel B also show persistence in market share. The loyalty index, which can control for some unobserved characteristics of debt underwriters, is significant and positive in some of the models.

Since many commercial banks have recently entered underwriting, we test whether the documented effect of network for commercial banks is simply due to underwriter age in unreported regressions. We obtain the date when underwriters first appear in the sample and use that as an underwriter age proxy. We find that the effect of commercial bank networks is not entirely driven by underwriter age, and thus, not unique to young underwriters. Overall, our results show that equity underwriters—both investment banks and commercial banks—with extensive ties and located in the center of the network capture higher market shares in the following year, and this relationship is stronger for commercial banks. Moreover, investment bank underwriters are more likely to gain equity deal flows from partners that are similar, while commercial bank underwriters gain from diverse peer networks. The evidence of a greater impact of peer network on commercial bank market share implies that commercial banks utilize their peer networks more aggressively possibly playing up their complementary skills. It, thus, supports the view that commercial banks and investment bank have complementary skills, which increases the appeal of commercial banks as partners, and as a result, commercial banks generate greater deal flow from networks. Finally, there is some evidence that peer network matters more for equity underwriters than debt underwriters.

*4.5.2. Probability of winning a book manager position*

In the previous section, we establish that underwriters with certain network capabilities tend to capture higher market shares in the next year. Naturally, underwriters with such network capabilities are more likely to be invited into the future syndicates of their partners as a co-manager or a syndicate member. In this section, we specifically examine whether peer network helps an underwriter win a book manager position in individual deals. Certain network characteristics may increase an underwriter's visibility and improve the likelihood of being selected by issuing firms.

Panel A of Table 4.6 presents the estimated coefficients of the logistic regressions of the probability of an underwriter winning a book manager position in an equity deal. The models in Table 6 include one observation for each eligible underwriter for each deal. The eligible underwriters are those who serve as managing underwriters in equity deals during the year of the offering. However, given the large sample size, for ease of estimation, we randomly select every fifth underwriter. If an underwriter is identified as the book manager, the dependent variable equals to one and zero otherwise. We are relating the underwriter characteristics over four-year periods to the probability of winning an equity mandate in the next year. To allow for deal specific effects, we adjust standard errors for clustering within issues. We also control for the underwriter's ability to retain client firms (loyalty index), previous experience in the same industry and state as the issuer, and relationship with the issuer, since extensive literature documents that firm relationships matter in underwriter selection.

**Table 4.6: Underwriter network and the probability of winning a book manager position**

The table presents the estimated coefficients of logistic regressions of the probability of winning a book manager position in an underwriting mandate. Panel A focuses on the probability of winning a book manager position in an equity deal, and Panel B focuses on debt deals. The models include one observation for each eligible underwriter for each deal, and the dependent variable equals to one if an underwriter is identified as the book manager in a deal, and zero otherwise. The set of eligible equity (debt) underwriters include those that serve as either a book or co-manager in an equity (debt) offering during the issue year. However, to make the sample more manageable, we randomly pick every fifth underwriter. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated, which occurs when two underwriters invite each other into their syndicates. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. Market share is computed as the sum of the proceeds of the offerings lead by a specific underwriter, divided by the total deal volume of all the offerings. Loyalty index measures the percent of the time that the underwriter is retained as a book manager in the subsequent issues of its client firms. Previous industry and state experience dummies equal to one if an underwriter had underwritten an equity deal in the same industry or state as the issuer during the previous four-year period, and zero otherwise. Firm-underwriter relationship strength measures the percent of the total volume of past equity deals of the issuer that is underwritten by the specific underwriter. Industry is defined based on two-digit SIC code. *p*-values reported in brackets are estimated using robust standard errors clustered by deals.

**Panel A: Probability of winning a book manager position in an equity deal**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | -8.373 | -8.818 | -8.488 | -9.054 | -7.728 | -8.316 | -8.256 | -8.250 | -6.985 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Network measures | | | | | | | | | |
| *Degree* | 0.051 | | | | | | | | 0.060 |
| | (0.00) | | | | | | | | (0.00) |
| *Closeness* | | 0.039 | | | | | | | -0.020 |
| | | (0.00) | | | | | | | (0.04) |
| *Betweenness* | | | 0.166 | | | | | | -0.119 |
| | | | (0.00) | | | | | | (0.10) |
| *Reciprocity* | | | | 0.002 | | | | | -0.002 |
| | | | | (0.20) | | | | | (0.26) |
| *Density* | | | | | -0.015 | | | | -0.020 |
| | | | | | (0.00) | | | | (0.00) |
| *Tie diversity* | | | | | | -0.007 | | | -0.011 |
| | | | | | | (0.00) | | | (0.00) |
| *Industry diversity* | | | | | | | -0.389 | | -0.151 |
| | | | | | | | (0.00) | | (0.28) |
| *Geographical diversity* | | | | | | | | -0.448 | |
| | | | | | | | | (0.00) | |
| … x Commercial bank dummy | 0.010 | 0.043 | 0.087 | 0.027 | 0.013 | 0.032 | 1.673 | 1.995 | |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | |
| Market share | 0.038 | 0.055 | 0.051 | 0.066 | 0.057 | 0.066 | 0.066 | 0.067 | 0.032 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Loyalty index | 0.010 | 0.010 | 0.013 | 0.013 | 0.014 | 0.013 | 0.013 | 0.013 | 0.009 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Industry experience | 0.917 | 0.928 | 1.078 | 1.126 | 1.073 | 1.105 | 1.109 | 1.108 | 0.844 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |

**Panel A (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| State experience | 1.313 | 1.278 | 1.453 | 1.514 | 1.374 | 1.472 | 1.481 | 1.480 | 1.224 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Firm-underwriter relationship strength | 0.037 | 0.037 | 0.037 | 0.037 | 0.036 | 0.037 | 0.037 | 0.037 | 0.035 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Expected proceeds) | 0.006 | 0.005 | 0.008 | 0.037 | 0.090 | 0.006 | 0.006 | 0.005 | 0.101 |
| | (0.62) | (0.71) | (0.51) | (0.02) | (0.00) | (0.65) | (0.66) | (0.67) | (0.00) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo $R^2$ | 26.40 | 26.09 | 25.86 | 25.23 | 24.51 | 25.59 | 25.72 | 25.73 | 25.01 |
| *N* | 970,894 | 970,894 | 970,894 | 794,516 | 601,809 | 970,894 | 970,894 | 970,894 | 531,138 |

**Panel B: Probability of winning a book manager position in a debt deal**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | -5.688 | -6.325 | -5.607 | -6.006 | -3.958 | -5.428 | -5.301 | -5.460 | -6.145 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Network measures | | | | | | | | | |
| *Degree* | 0.043 | | | | | | | | 0.017 |
| | (0.00) | | | | | | | | (0.02) |
| *Closeness* | | 0.069 | | | | | | | 0.053 |
| | | (0.00) | | | | | | | (0.00) |
| *Betweenness* | | | 0.100 | | | | | | -0.011 |
| | | | (0.00) | | | | | | (0.56) |
| *Reciprocity* | | | | 0.006 | | | | | 0.006 |
| | | | | (0.00) | | | | | (0.00) |
| *Density* | | | | | -0.024 | | | | -0.013 |
| | | | | | (0.00) | | | | (0.00) |
| *Tie diversity* | | | | | | -0.017 | | | 0.007 |
| | | | | | | (0.00) | | | (0.12) |
| *Industry diversity* | | | | | | | -0.901 | | 0.329 |
| | | | | | | | (0.00) | | (0.33) |
| *Geographical diversity* | | | | | | | | -0.565 | |
| | | | | | | | | (0.00) | |
| … x Commercial | 0.016 | 0.043 | 0.158 | 0.031 | 0.015 | 0.063 | 1.944 | 2.161 | |
| bank dummy | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | |
| Market share | 0.086 | 0.119 | 0.118 | 0.165 | 0.124 | 0.155 | 0.154 | 0.160 | 0.081 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Loyalty index | 0.007 | 0.007 | 0.008 | 0.009 | 0.008 | 0.009 | 0.009 | 0.009 | 0.007 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Industry experience | 1.281 | 1.181 | 1.499 | 1.435 | 1.332 | 1.535 | 1.567 | 1.555 | 1.082 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |

**Panel B (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| State experience | 1.143 | 1.011 | 1.460 | 1.382 | 1.242 | 1.473 | 1.519 | 1.513 | 0.837 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Firm-underwriter relationship strength | 0.029 | 0.029 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 | 0.028 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Expected proceeds) | -0.083 | -0.083 | -0.085 | -0.079 | -0.066 | -0.087 | -0.086 | -0.086 | -0.062 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo $R^2$ | 34.47 | 34.52 | 33.95 | 33.50 | 31.76 | 33.73 | 33.85 | 33.83 | 31.66 |
| *N* | 419,555 | 419,555 | 419,555 | 337,929 | 314887 | 419,555 | 419,555 | 419,555 | 297,480 |

The logistic regression results in Panel A of Table 4.6 suggest that large networks, close proximity to other underwriters and the exclusive network position of betweenness, help both investment banks and commercial banks win the book manager position. However, this relationship is even more pronounced for commercial banks. Reciprocity is insignificant for investment banks, but maintaining highly reciprocated relationships help commercial banks win the book manager position. The density has a negative coefficient, which means when an underwriter has a dense network with the partners working with each other, it is less likely to be selected as a book manager. This effect is somewhat mitigated for commercial banks though. It is possible that when the partners of an underwriter have extensive connections with each other, the likelihood of one of them selecting the underwriter as a joint book manager diminishes.

Similar to the results in Table 4.5, maintaining relationships with diverse partners also lowers the likelihood of winning the deal for investment banks, but this is mitigated for commercial banks. In unreported regressions, we repeat the analysis by limiting the eligible underwriters to those in the highest and lowest market share quintile and find qualitatively same results, although the effect of network on the likelihood of winning the equity book manager position is greater for large underwriters.

As for the control variables, market share has positive and significant estimated coefficients as expected. Underwriters with larger market shares are more likely to become book managers because they have more experience in placing deals, and thus may be better at pricing and distributing issues. Having underwritten an equity deal in the same industry or state as the issuer during the previous four-year period significantly increases a bank's chances of winning the deal as well. However, in a related study that

uses debt and equity offerings, Asker and Ljungqvist (2007) document that the large established firms that engage in product market competition are disinclined to share underwriters with other firms in the same industry.

When it comes to the likelihood of being selected as the book manager in a debt deal, the results in Panel B of Table 4.6 are similar to those of equity underwriting. The only difference is that reciprocity is significant here. Overall, the results in Table 4.6 show that the underwriters with large and more homogenous networks that display higher closeness and betweenness are more likely to become book managers in equity and debt deals, and many of these results are more significant for commercial banks. These results also largely confirm our findings on the overall market share from Table 4.5.

*4.5.3. Probability of winning a co-manager position*

Co-managers comprise the top tier in syndicates after book managers and receive a substantial portion of fees. Book managers have a significant discretion over the choice of co-managers, since co-managers are typically selected after the book managers. Therefore, we examine how not only the network characteristics, but also an underwriter's tie to the book manager, affect the probability of being chosen as a co-manager. Unlike previous studies that use a binary variable to indicate an existence of a relationship between two underwriters, we use geodesic distance, which measures the number of relationships along the shortest possible path between an underwriter and the IPO book manager. For instance, Corwin and Schultz (2004) have previously showed that if an underwriter served in the previous ten syndicates of the book manager, it is more likely to be included in the current syndicate as a member. By contrast, we use the

degrees of separation—geodesic distance—in this study. However, geodesic distance is only computed for connected pairs. Thus, whenever an underwriter has no ties to the IPO book manager, we use the sum of one and the maximum geodesic distance of that period.

In Table 4.7, the sample consists of 14,344 equity and 15,567 debt deals that employ co-managers. The models include one observation for each eligible underwriter for each deal, and the dependent variable equals to one if an underwriter is identified as the co-manager in a deal, and zero otherwise. The set of eligible underwriters include those that serve in an equity or debt deal in a managing underwriter role during the year of the offering. In order to make the sample more manageable, we further limit the eligible underwriters to those with previous experience in the same industry as the issuer.

**Table 4.7: Underwriter network and the probability of winning a co-manager position**

The table presents the estimated coefficients of logistic regressions of the probability of winning a co-manager position in an equity (Panel A) and debt (Panel B) deal. The sample includes 14,344 equity and 15,567 debt deals that employ co-managers. The models include one observation for each eligible underwriter for each deal, and the dependent variable equals to one if an underwriter is identified as the co- manager in a deal, and zero otherwise. The set of eligible equity (debt) underwriters include those that serve as either a book or co-manager in an equity (debt) offering during the issue year and have previous underwriting experience in the same industry as the issuer. *Degree* is the percent of all other underwriters a specific underwriter maintains ties with. *Closeness* is an eigenvector centrality measure that captures how close an underwriter is to all other underwriters. *Betweenness* measures how often an underwriter falls on the shortest possible paths between pairs of other underwriters. *Reciprocity* refers to the percent of all ties of an underwriter that are reciprocated. *Density* shows the percent of all possible ties that can exist among the partners of an underwriter that are actually present. *Tie diversity* measures how many other non-redundant underwriters an underwriter can reach within two degrees of separation for each partner. *Industry* and *geographical diversity* refer to the numbers of different industries and states that an underwriter's partners specialize in, divided by the number of partners. *Geodesic distance* measures the number relationships along the shortest path between the underwriter and the book manager of the deal. Loyalty index measures the percent of the time that the underwriter is retained as a book manager in the subsequent issues of its client firms. Previous state experience dummy equals to one if an underwriter had underwritten an equity (debt) deal in the same state as the issuer during the previous four-year period, and zero otherwise. Firm-underwriter relationship strength measures the percent of the total volume of past equity (debt) deals of the issuer that is underwritten by the specific underwriter. Industry is defined based on two-digit SIC code. *p*-values reported in brackets are estimated using robust standard errors clustered by each deal.

**Panel A: Probability of winning a co-manager position in an equity deal**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | -4.865 | -6.056 | -5.034 | -5.088 | -5.227 | -4.183 | -3.892 | -3.855 | -2.811 | -1.048 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.40) |
| Network measures | | | | | | | | | | |
| *Degree* | 0.042 | | | | | | | | | 0.018 |
| | (0.00) | | | | | | | | | (0.03) |
| *Closeness* | | 0.064 | | | | | | | | -0.011 |
| | | (0.00) | | | | | | | | (0.30) |
| *Betweenness* | | | 0.038 | | | | | | | -0.031 |
| | | | (0.00) | | | | | | | (0.20) |
| *Reciprocity* | | | | -0.001 | | | | | | -0.003 |
| | | | | (0.20) | | | | | | (0.10) |

**Panel A (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Density* | | | | | 0.004 | | | | | -0.003 |
| | | | | | (0.00) | | | | | (0.28) |
| *Tie diversity* | | | | | | -0.033 | | | | -0.006 |
| | | | | | | (0.00) | | | | (0.29) |
| *Industry diversity* | | | | | | | -1.414 | | | -0.229 |
| | | | | | | | (0.00) | | | (0.42) |
| *Geographical diversity* | | | | | | | | -1.577 | | |
| | | | | | | | | (0.00) | | |
| *Geodesic distance* | | | | | | | | | -1.193 | -0.930 |
| | | | | | | | | | (0.00) | (0.00) |
| … x Commercial bank dummy | -0.001 | 0.019 | 0.043 | 0.010 | 0.011 | 0.047 | 1.245 | 1.432 | 0.331 | |
| | (0.20) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | |
| Market share | -0.031 | -0.014 | -0.001 | 0.007 | 0.013 | 0.001 | 0.000 | -0.001 | 0.004 | -0.009 |
| | (0.00) | (0.00) | (0.64) | (0.00) | (0.00) | (0.61) | (0.96) | (0.57) | (0.02) | (0.11) |
| Loyalty index | 0.004 | 0.002 | 0.007 | 0.007 | 0.007 | 0.004 | 0.005 | 0.005 | 0.003 | 0.003 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| State experience | 1.215 | 1.081 | 1.369 | 1.361 | 1.335 | 1.227 | 1.264 | 1.261 | 1.131 | 1.212 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Firm-bank relationship strength | 0.010 | 0.011 | 0.010 | 0.010 | 0.010 | 0.010 | 0.011 | 0.011 | 0.019 | 0.017 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Proceeds) | 0.075 | 0.071 | 0.075 | 0.075 | 0.076 | 0.072 | 0.071 | 0.071 | 0.024 | 0.002 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.91) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo $R^2$ | 6.85 | 7.50 | 6.17 | 5.98 | 5.87 | 7.31 | 7.17 | 7.20 | 8.74 | 7.96 |
| *N* | 1385246 | 1385246 | 1385246 | 1281420 | 1306240 | 1385246 | 1385246 | 1385246 | 1385246 | 1187854 |

**Panel B: Probability of winning a co-manager position in a debt syndicate**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | -4.785 | -6.013 | -4.695 | -5.057 | -3.424 | -3.753 | -4.555 | -4.645 | -2.624 | -9.965 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Network measures | | | | | | | | | | |
| *Degree* | 0.031 | | | | | | | | | -0.018 |
| | (0.00) | | | | | | | | | (0.25) |
| *Closeness* | | 0.080 | | | | | | | | 0.089 |
| | | (0.00) | | | | | | | | (0.00) |
| *Betweenness* | | | 0.107 | | | | | | | 0.019 |
| | | | (0.61) | | | | | | | (0.05) |
| *Reciprocity* | | | | 0.004 | | | | | | 0.002 |
| | | | | (0.00) | | | | | | (0.01) |
| *Density* | | | | | -0.021 | | | | | -0.013 |
| | | | | | (0.00) | | | | | (0.00) |
| *Tie diversity* | | | | | | -0.058 | | | | 0.013 |
| | | | | | | (0.00) | | | | (0.10) |
| *Industry diversity* | | | | | | | -0.287 | | | -0.051 |
| | | | | | | | (0.01) | | | (0.43) |
| *Geographical diversity* | | | | | | | | -0.168 | | |
| | | | | | | | | (0.00) | | |
| *Geodesic distance* | | | | | | | | | -1.576 | -1.359 |
| | | | | | | | | | (0.00) | (0.00) |
| … x Commercial bank dummy | 0.004 | 0.139 | 0.033 | 0.006 | 0.008 | 0.031 | 0.698 | 0.807 | 0.394 | |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | |
| Market share | -0.010 | 0.002 | -0.002 | 0.022 | 0.008 | 0.022 | 0.036 | 0.027 | 0.027 | 0.003 |
| | (0.00) | (0.06) | (0.04) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.08) |
| Loyalty index | 0.001 | 0.001 | 0.002 | 0.003 | 0.001 | 0.002 | 0.002 | 0.003 | 0.002 | 0.001 |
| | (0.01) | (0.01) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |

**Panel B (continued)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| State experience | 1.040 | 0.877 | 1.208 | 1.265 | 1.099 | 1.104 | 1.282 | 1.291 | 1.154 | 0.839 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00 | (0.00) |
| Firm-bank relationship strength | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.009 | 0.010 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Log (Proceeds) | 0.025 | 0.025 | 0.026 | 0.024 | 0.025 | 0.025 | 0.024 | 0.024 | 0.003 | 0.001 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.58) | (0.95) |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo $R^2$ | 5.59 | 6.01 | 5.24 | 4.79 | 5.45 | 5.27 | 4.90 | 4.91 | 6.35 | 7.16 |
| *N* | 1201751 | 1201751 | 1201751 | 1143493 | 1195116 | 1201751 | 1201751 | 1201751 | 1201751 | 1002485 |

The estimated coefficients on all the network measures in Panel A of Table 4.7 are significant, except for reciprocity. These results indicate that peer network is crucial for underwriters for winning co-management appointments in equity deals. The underwriters with larger and denser networks that have central and between positions are more likely to be selected as a co-manager, and the effect is usually more pronounced for commercial banks. Having diverse partners lowers the likelihood of an investment bank being selected as a co-manager, but the effect is opposite for commercial banks. The negative sign on network diversity measures are consistent with the greater specialization in investment banking. It is possible that investment banks maintain close ties with other banks that are similar in terms of geographical or sector specialization and more likely to cooperate with them.

The estimated coefficients on geodesic distance are significant and negative, which means that the further away an underwriter is from the book manager, the less likely it is to be selected as a co-manager on the deal. As evidenced by the estimated coefficient of -1.193, an increase of one more relation along the geodesic path drastically lowers the probability of winning a co-manager position. However, this effect is somewhat mitigated for commercial banks, as the estimated coefficient on the interaction term between geodesic distance and commercial bank dummy in model 9 in Panel A is 0.331 and significant. This shows that social distance is less harmful for commercial banks perhaps because they have other advantages that can enhance their appeal as partners. Overall, not just large and central networks, but also direct ties to the book manager, helps an underwriter win the co-manager appointment.

In terms of control variables, there is mixed evidence regarding underwriter market share. Having previous underwriting experience in the same state as the issuer and maintaining a relationship with the issuer increase the likelihood of being selected as a co-manager. Since the number of co-managers increases with deal size, deal size has positive estimated coefficients as well.

Panel B of Table 4.7 presents the results of the likelihood of becoming a co-manager in a debt issue. All the network variables, except for betweenness, are significant and also all the interaction terms with commercial bank dummy are significant as well. Underwriters with larger networks and more central position are more likely to be selected as a co-manager in debt deals similar to equity deals, and the effect is more pronounced for commercial banks. Underwriters with more reciprocated ties are also more likely to be selected, consistent with the notion of reciprocity. However, those with dense networks do not seem to necessarily gain from it, contrary to the results from equity underwriting in Panel A. An underwriter is more likely to be chosen as a co-manager in an equity deal if its partners have extensive ties to each other, but the effect is opposite for debt deals. Having diverse partners lowers the likelihood of an investment bank being selected as a co-manager, but the effect is opposite for commercial banks. The results on geodesic distance are similar to those in equity underwriting. Underwriters that are further away from the book manager are less likely to be selected as a co-manager in debt deals, but this effect is again weaker for commercial banks.

In fact, Table 4.8 shows the geodesic distance between the book managers and the actual co-managers hired in all the issues that employ co-managers. In equity underwriting, almost 80 percent of all the co-managers are the previous partners of the

book managers as they fall within one degree from the book manager. The same ratio is even higher for debt underwriting. In debt securities that employ co-managers, 90 percent of the time the co-managers are the previous partners of the book managers. The evidence shows that underwriters dominantly work with their previous partners. As shown in the descriptive statistics in Table 4.3, on average, an equity underwriter maintains ties with 4.15 percent of all other equity underwriters and debt underwriter maintains ties with 10.51 percent of the entire network, but they choose their co-managers from their networks 80 and 90 percent of the time, respectively. This further highlights the importance of peer relationships.

**Table 4.8: Social distance between book managers and co-managers**
The following table displays the social distance between the book managers and the co-managers of all 14,344 equity and 15,567 debt offerings that employ co-managers. Degree of separation refers to geodesic distance, which is the number of relationships along the shortest possible path between a pair of underwriters.

| Co-managers selected within | Equity | Debt |
|---|---|---|
| 1 degree of separation | 79.61% | 90.12% |
| 2 degrees of separation | 89.86% | 92.89% |
| 3 degrees of separation | 90.41% | 92.96% |
| 4 degrees of separation from the book manager | 90.57% | 92.97% |

## 4.6. Conclusions

In this paper, we examine the impact of underwriter peer networks on the underwriters' market share by using measures from social network analysis and sample of U.S. equity and debt securities issued between 1970 and 2007. The network measures

are constructed using ties that result from underwriting syndicates. Using these peer networks, an underwriter can improve its market share and consequently its revenues.

We find that underwriters, especially commercial bank underwriters, with larger networks occupying central positions capture higher market shares in the following year in equity underwriting. We obtain similar results when we estimate the likelihood of an underwriter winning the book manager position in individual equity deals. Moreover, commercial banks experience higher market shares from diverse peer networks, whereas investment banks are more likely to benefit from networks that are more homogenous in terms of the partners' industry and geographical specialization in equity underwriting. In debt underwriting, some of the aspects of peer network remain significant for underwriters, but, in general, the effect of network on their overall market share is smaller.

Having a larger network with higher closeness and betweenness also increases the likelihood of an underwriter being selected as a co-manager in both equity and debt underwriting. Proximity to the specific book manager is also important. Underwriters that are further away from the book manager are less likely to be selected as a co-manager, but this effect is weaker for commercial banks. The evidence shows that underwriters prefer to work with their previous partners as the majority of the actual co-managers are the previous partners of the book managers.

The main contribution of this study is to illustrate the impact of peer network on underwriter market share in the U.S. capital market. Market share is a central driver of revenues in investment banking, an industry that has garnered increased attention recently. We also highlight the differences between commercial bank and investment

bank underwriters. Commercial banks utilize peer networks and generate greater deal flow from these networks compared to investment banks, and they also benefit from ties to diverse partners, while homogenous networks are more beneficial to investment banks. Overall, this study adds to our knowledge of the role of social networks for underwriters in the security issuance process.

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