The Small World of Investing: Board Connections and Mutual Fund Returns

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This paper uses social networks to identify information transfer in security markets. We focus on connections between mutual fund managers and corporate board members via shared education networks. We find that portfolio managers place larger bets on connected firms and perform significantly better on these holdings relative to their

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nonconnected holdings. A replicating portfolio of connected stocks outperforms nonconnected stocks by up to 7.8 percent per year. Returns are concentrated around corporate news announcements, consistent with portfolio managers gaining an informational advantage through the education networks. Our results suggest that social networks may be important mechanisms for information flow into asset prices.

Information moves security prices. How information disseminates through agents in financial markets and into security prices, though, is not as well understood. We study a particular type of this dissemination in the form of social networks. Social networks are network structures composed of nodes (usually people or institutions) that are connected through various social relationships ranging from casual to close bonds. In the context of information flow, social networks allow a piece of information to flow, often in predictable paths, along the network. Thus, one can test the importance of the social network in disseminating information by testing its predictions on the flow of information.

One convenient aspect of social networks is that they have often been formed ex ante, sometimes years in the past, and their formation is frequently independent of the information to be transferred. In this paper we explore a specific type of social network that possesses exactly this feature: connections based on shared educational backgrounds. The nodes of our social networks are mutual fund portfolio managers and senior officers of publicly traded companies. We believe that these two agents provide a useful setting because one side likely possesses private information, and the other side has a large incentive to access this private information. Further, the stock market is an ideal laboratory to examine private information flow through a social network because of the information's eventual revelation in prices and so easy relation to stock return predictability.

Our tests focus on educational institutions providing a basis for social networks. We use academic institutions attended for both undergraduate and graduate degrees as our network measure and test the hypothesis that mutual fund managers are more likely to place larger bets in firms run by individuals in their network and to earn higher average returns on these investments. We motivate the use of educational institutions in three ways. First, people often select into undergraduate and graduate programs made up of social groups having interests aligned to their own, generating both a higher level of interaction and a longer relationship length from relationships built (see Richardson 1940; Lazarsfeld and Merton 1954; Fischer et al. 1977; McPherson, Smith-Lovin, and Cook 2001). Second, outside of donations to religious

organizations, educational institutions are the largest beneficiary of individuals' charitable donations. Over $1 out of $7 donated in 2005 went to educational institutions, suggesting the presence of ties to academic institutions past graduation.[1] Finally, there is direct evidence that school relationships are, on average, more homophilous than those formed in other settings (Flap and Kalmijn 2001) and that communication between parties is more effective when the two parties are more alike (Bhowmik and Rogers 1971).

There are a number of potential ways information could be moving through networks. First, there could be a direct transfer from senior firm officers to portfolio managers. Second, the networks could simply lower the cost of gathering information for portfolio managers. So, for instance, it may take fewer calls, or people may be more forthcoming with information if they are inside the network. This explanation would be a case in which agents have comparative advantages in collecting certain types of information. Third, it could be that networks may make it cheaper to access information on managers and so assess managerial quality (for reasons similar to those mentioned above). We are not able to completely rule out any of these mechanisms, although our results are generally less consistent with a story based on superior assessments of managerial quality.

To test whether information is disseminated through education networks, we use the trading decisions of mutual fund portfolio managers in firms that have senior officials in their social network (connected firms) and firms that do not (nonconnected firms). Grossman and Stiglitz (1976) offer a simple intuition that when agents have comparative advantages in collecting certain types of information, we should observe them earning abnormal returns to this information. We attempt to identify precisely those situations in which portfolio managers are expected to have a comparative advantage from their respective social networks. We then examine both their portfolio allocation decisions and their ability to predict returns, in both the connected and nonconnected classes of stocks.

Our results reveal a systematic pattern, in both holdings and returns, across the entire universe of U.S. mutual fund portfolio managers: fund managers place larger concentrated bets on companies to which they are connected through an education network and perform significantly better on these connected positions than on nonconnected positions.

We create calendar time portfolios that mimic the aggregate portfolio allocations of the mutual fund sector in connected and nonconnected

[1] Data come from the Giving Institute (2006). In 2005, 15 percent of charitable donations ($38.6 billion) were given to educational institutions. The largest recipient, religious organizations, received 36 percent ($93.2 billion).

securities and show that portfolio managers earn higher returns on their connected holdings. A strategy of buying a mimicking portfolio of connected holdings and selling short a mimicking portfolio of nonconnected holdings yields returns up to 7.84 percent per year. Furthermore, the portfolio of connected stocks held by portfolio managers outperforms the portfolio of connected stocks that managers choose not to hold by 6.84 percent per year. Both the portfolio allocation and return predictability results are increasing with the strength of the connection.

We also examine the returns of connected and nonconnected stocks around news events. If the higher return on connected securities is due to information flow through the network, we would expect to see the bulk of the return premium when the news is eventually released to the investing public. Consistent with this hypothesis, we find that nearly the entire difference in returns between holdings within and outside a manager's network is concentrated around corporate news announcements.

We then look at changes in a fund's portfolio manager and focus on the specific case in which the previous manager and the new manager share no educational connection. We find that incoming managers unload securities within the old manager's network and at the same time purchase securities within their own network.

We test a number of alternative hypotheses. We include firm characteristics, fund characteristics, and industry dummies, none of which can explain managers' large bets on connected stocks or the abnormal returns managers earn on these connected positions. We also show that our results are not driven by the geographical effects documented in Coval and Moskowitz (2001), by the "SAT effect" documented in Chevalier and Ellison (1999) and described below, by small managers, by a few top schools (e.g., Ivy League schools), by a certain type of firm, or by a certain part of our sample period.

I. Background and Literature Review

Our work links a large literature on the portfolio choices and investment performance of mutual fund managers with a growing literature on the role of social networks in economics. The strand of the mutual fund literature most closely related to our paper is the body of work exploring whether mutual fund managers possess stock-picking ability. The evidence on this question is decidedly mixed. Several papers (Jensen 1968; Malkiel 1995; Gruber 1996; Carhart 1997) find that active managers fail to outperform passive benchmark portfolios (even before expenses); others (Grinblatt and Titman 1989, 1993; Grinblatt, Titman, and Wermers 1995; Daniel et al. 1997; Wermers 1997) find that active managers

do exhibit some stock-picking skills.[2] The evidence is similarly mixed as to whether it is possible to identify particular types of mutual funds (or managers) that perform consistently better than others.[3]

Among the very few papers that have been able to successfully link mutual fund outperformance to measurable characteristics, Chevalier and Ellison (1999) investigate biographical data on managers and find that fund managers from undergraduate institutions with higher average Scholastic Aptitude Test (SAT) scores earn higher returns. Other evidence from manager-level data indicates that fund managers tend to overweight nearby companies (Coval and Moskowitz 1999) and earn higher returns on their local holdings (Coval and Moskowitz 2001), suggesting a link between geographic proximity and information transmission.[4] We add to this list by exploring educational connections between board members and mutual fund managers and, in doing so, identify another channel through which fund managers achieve superior returns.

Directly exploring the role of social networks, connections, and influence in financial markets is a relatively new development in the finance literature.[5] Closest to our work are the findings of Hong, Kubik, and Stein (2005), who document word-of-mouth effects between same-city mutual fund managers with respect to their portfolio choices, and Kuhnen (2008), who documents a link between past business connections between mutual fund directors and advisory firms and future preferential contracting decisions.[6] Also related are the findings in Massa and Simonov (2005), documenting a relation between the portfolio choices of individual investors and their past educational backgrounds.[7]

Our empirical strategy is motivated by a network sociology literature (see, e.g., Mizruchi 1982, 1992; Useem 1984) that employs corporate board linkages as a measure of personal networks. Board linkages are typically isolated by looking at direct board interlocks between firms (as

[2] Note that Berk and Green (2004) argue that failing to beat a benchmark does not imply that a manager lacks skill.

[3] See Elton et al. (1993), Hendricks, Patel, and Zeckhauser (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), and Gruber (1996) for evidence of persistence at various horizons up to 5 years; see Malkiel (1995) and Carhart (1997) for countervailing evidence. See also Cohen, Coval, and Pastor (2005).

[4] Christoffersen and Sarkissian (2002) and Chen et al. (2004) also explore how location affects mutual funds' behavior.

[5] See Jackson (2006) for a survey on the economics of social networks.

[6] See also Hong, Kubik, and Stein (2004) for evidence that measures of sociability are linked to increased stock market participation; Hochberg, Ljungqvist, and Lu (2007) for evidence of a positive impact of venture capital networks on investment performance; and Perez-Gonzalez (2006) for evidence of a negative impact of nepotism on firm performance in the context of chief executive officer (CEO) succession.

[7] Parkin (2006) identifies school clustering of lawyers at law firms that cannot be explained by quality or location and a link between promotion chances in law firms and the concentration of partners with similar educational backgrounds.

in Hallock [1997]), "backdoor" links among directors across firms (as in Larcker et al. [2005] and Conyon and Muldoon [2006]), or direct and indirect links between board members and government agencies or officials (as in Faccio [2006] and Fisman et al. [2006], among others), and they have been shown to be important mechanisms for the sharing of information and the adoption of common practices across firms.[8] Our approach is different in that we focus on direct connections between board members and mutual fund managers via shared educational backgrounds.

II. Data

The data in this study are collected from several sources. Our data on mutual fund holdings come from the Thomson Financial CDA/Spectrum Mutual Funds database, which includes all registered mutual funds filing with the Securities and Exchange Commission (SEC). The data show holdings of individual funds collected via fund prospectuses and SEC N30D filings at either a quarterly or semiannual frequency. We focus the analysis on actively managed U.S. equity funds by including funds with the investment objectives of aggressive growth, growth, or growth and income in the CDA data set. Additionally, we manually screen all funds and exclude index funds, foreign-based funds, U.S.-based international funds, fixed-income funds, real estate funds, precious metal funds, balanced funds, closed-end funds, and variable annuities.

We obtain portfolio managers' biographical information from Morningstar. For each mutual fund, Morningstar provides the name(s) of the portfolio manager(s), a brief vita including the manager's starting date as well as previous funds managed, all the undergraduate and graduate degrees received, the year in which the degrees were granted, and the institution granting the degree. Morningstar started collecting managers' educational backgrounds in 1990. We match Morningstar's biographical data to the CDA fund holdings using the MFLINKS data link provided by Wharton Research Data Services. Our final mutual fund sample includes survivorship bias–free data on holdings and biographical information for 1,648 U.S. actively managed equity funds and 2,501 portfolio managers between January 1990 and December 2006. This is the base sample of our tests.[9]

Biographical information on boards of directors and senior company officers was provided by BoardEx of Management Diagnostics Limited,

[8] Examples of the latter include the adoption of poison pills (Davis 1991), corporate acquisition activity (Haunschild 1993), CEO compensation (Khurana 2002), and the decision to make political contributions (Mizruchi 1992).

[9] The online Appendix contains other details on the construction of our sample.

a private research company specialized in social network data on company officials of U.S. and European public and private companies. The data contain relational links among boards of directors and other officials for active companies. Additionally, BoardEx provided us with historical files on inactive companies. Links in the data set are constructed by cross-referencing employment history, educational background, and professional qualifications. A typical entry would be as follows: in the year 2001, Mr. Smith, CEO of Unicorn, was "connected" to Mr. White, president of ABC, since between 1992 and 1997 they both served on the board of directors of XYZ, respectively as chief financial officer (CFO) and chief operations officer (COO). The data contain current and past roles of every company official with start date (year) and end date (year), a board dummy indicating whether the individual serves (served) on the board of directors in the current (past) employment position, all the undergraduate and graduate degrees received, the year in which the degrees were granted, and the institutions granting the degrees. Firms are identified by CUSIP number (Committee on Uniform Security Identification Procedures).

For each firm in the sample, we use the historical link files for all individuals to reconstruct the annual time series of identities and educational background of board members and senior officers (defined as CEO, CFO, or chairman). The first entry in our sample is in the year 1939; the last is in 2006. Given the focus of our analysis, we restrict the sample to U.S. publicly traded firms. Stock return and accounting data come from the Center for Research on Security Prices (CRSP)/COMPUSTAT. We focus the analysis on common stocks only (CRSP share codes 10 and 11). We also collect headline news from Dow Jones news wires for all CRSP firms between 1990 and 2006.

The social networks we examine in the paper are defined over educational institutions, and thus we have to link each member of the social network by these institutions. Thus, we match institutions and degrees on Morningstar and BoardEx. We group the degrees into six categories: (i) business school (Master of Business Administration), (ii) medical school, (iii) general graduate (Master of Arts or Master of Science), (iv) Doctor of Philosophy, (v) law school, and (vi) general undergraduate. Finally, we match company officials' biographical information to stock return data from CRSP. The final sample includes educational background on 42,269 board members and 14,122 senior officials for 7,660 CRSP stocks between January 1990 and December 2006.

Table 1 gives summary statistics for the matched sample of firms-boards-funds from January 1990 to December 2006. From panel A, we average 879 funds per year, which constitute 83 percent of the total assets in the mutual fund universe. Our sample of firms averages roughly 4,800 per year, which constitute 99 percent of total market capitalization.

TABLE 1
Summary Statistics: Mutual Funds
A. Time Series (Annual Observations, 1990–2006)

	Mean	Median	Minimum	Maximum	Standard Deviation
Funds per year	879	887	335	1,222	249
Portfolio managers per year	958	1,051	406	1,182	227
% of active equity fund universe:					
% of funds	.76	.74	.69	.86	.05
% of total assets	.83	.83	.72	.92	.05
Firms per year	4,827	4,837	3,408	6,154	930
Firms' senior officers per year	5,495	5,794	1,885	8,244	2,368
% of CRSP common stock universe:					
% of stocks	.81	.84	.61	.92	.10
% of total market value	.99	1.00	.98	1.00	.00
Academic institutions per year	341	356	197	396	54

B. Top Five Most Connected Academic Institutions, 1990–2006

Academic Institution	Average No. of Firms	Average % of CRSP Firms	Academic Institution	Average No. of Managers	Average % of Managers
Harvard Univ.	732	.10	Harvard Univ.	149	.17
Stanford Univ.	278	.04	Univ. Pennsylvania	100	.11
Univ. Pennsylvania	247	.04	Univ. Chicago	94	.09
Columbia Univ.	189	.03	New York Univ.	93	.09
Univ. Chicago	141	.02	Columbia Univ.	86	.09

C. Distribution of Degree and Graduation Years

Degree	Firm's Senior Officers	Portfolio Managers	Graduation Year	Firm's Senior Officers	Portfolio Managers
Business school	.38	.44	≤ 1950	.01	.02
Medical school	.01	.00	1950–59	.10	.03
Graduate (nondescript)	.19	.15	1960–69	.33	.24
PhD	.07	.03	1970–79	.35	.31
Law school	.08	.02	1980–89	.18	.35
Undergraduate	.91	.89	≥ 1990	.03	.05

Note.—Panel A reports summary statistics as of December of each year for the sample of mutual funds and their common stock holdings between 1990 and 2006. We include in the sample of funds/portfolio managers actively managed, domestic equity mutual funds from the merged CDA/Spectrum–Morningstar data with a self-declared investment objective of aggressive growth, growth, or growth and income and nonmissing information on the portfolio manager's identity and educational background. The sample of stocks includes the funds' holdings in common stocks (CRSP share code 10 or 11) from the merged CRSP/BoardEx data with nonmissing information on the educational background of senior officers of the firm (CEO, CFO, or chairman). Panels B and C show summary statistics of the sample of academic institutions between 1990 and 2006. Panel B shows the top five most-connected academic institutions, ranked by the average number of connected firms (portfolio managers) over the period 1990–2006. In this table an institution is defined as connected to a firm (fund) if a senior officer (portfolio manager) holds any degree from that institution. Panel C shows the distribution of degrees and graduation years over the entire sample.

The number of academic institutions in our sample averages 341 per year.

Our data also allow us to quantify how "connected" universities are to both publicly traded firms and mutual funds. In panel B of table 1, we list the academic institutions most connected to both firms and mutual funds. Here, a connection to an academic institution is defined as follows: (i) for firms, any of the senior officers (CEO, CFO, or chairman) having attended the institution and received a degree; and (ii) for funds, any of the portfolio managers having attended the institution for a degree. Thus, a given firm (fund) can be connected to multiple academic institutions. From panel B, the university most connected to both publicly traded firms and mutual funds is Harvard. Harvard is connected to 10 percent of U.S. publicly traded firms. These connections are not merely to mid-level managers, but to senior officers in the firm. Similarly, Harvard is connected to 17 percent of active equity mutual funds. University of Pennsylvania, University of Chicago, and Columbia University also consistently appear in the top five of schools most connected to both publicly traded firms and mutual funds. It is worth noting that excluding the top connected academic institutions does not affect any of the results in the paper.[10]

The breakdown of the degrees is shown in panel C of table 1. In a comparison of graduate degrees between senior officers and portfolio managers, portfolio managers are more likely to have any postundergraduate degree, with a higher frequency of MBA degrees. The right side of panel C shows the graduation dates of senior officers and portfolio managers. There is a large overlap in graduation dates between the two groups, occurring in the 1960s and 1970s. The distribution of graduation years suggests that portfolio managers may be, on average, younger than senior top officers at firms, since the portfolio managers received their degrees later. The significant overlap in years, however, allows us to exploit variation in the networks of those attending the same institution during the same years.

III. Results: Holdings of Connected Securities

In this section we examine mutual fund managers' portfolio choices. Equity portfolio managers may exhibit preferences for certain securities based on a number of characteristics. Managers may tend to overweight all securities in their network, perhaps because of a form of familiarity bias (see Huberman 2001), or managers may place large concentrated bets in certain connected securities because of comparative advantages in collecting information through their network. Our focus is on the

[10] See the discussion in Sec. VI and table 6.

role of the social network in the transfer of information to security prices via the trading of actively managed funds. Thus, we look at stocks that managers actively choose to hold and compare portfolio allocations in stocks to which they are connected within their education network, relative to stocks to which they are not.

In order to examine these portfolio choices, we first need a metric to define "connected" holdings. We define four types of connections between the portfolio manager and the firm, based on whether the portfolio manager and a senior official of the firm (CEO, CFO, or chairman) attended the same school (CONNECTED1), attended the same school and received the same degree (CONNECTED2), attended the same school at the same time (CONNECTED3), and attended the same school at the same time and received the same degree (CONNECTED4).[11] We attempt to define these in increasing degree of strength of the link. We view CONNECTED1 as the weakest type of connection since it requires one only to have attended the same university as someone else, even if at different times or for different degrees. We do not take a strong stand on the relative strength of CONNECTED2 versus CONNECTED3. However, we do view CONNECTED4 as the strongest type of link and one that provides the highest likelihood of direct social interaction with the connected individual while attending school.

Table 2 shows ordinary least squares (OLS) pooled regressions of portfolio weights on connected dummies and a series of controls. The dependent variable is the fund's portfolio weight in a given stock, in basis points. The units of observation are stock-fund-quarter. All regressions include quarter fixed effects. Controls include %STYLE, the percentage of the fund's total net assets invested in the style corresponding to the stock in question (the stock's style is calculated as in Daniel et al. [1997]); market value of equity (ME); book to market (BM); and past 12-month return (R12). Columns 1–4 show the basic result: compared to the average weight in a given stock, mutual funds place larger bets on connected securities. As seen in column 1, compared to the average weight of 91.8 basis points, mutual funds invest an additional 25.8 basis points in securities of firms whose senior officials attended the same institution. Moreover, the additional allocation to connected securities is increasing with the strength of the connection: fund managers place an additional 40 basis points in firms whose senior officer and portfolio manager overlapped on the school campus at the same time and received the same degree, roughly 43 percent higher

[11] In unreported tests we also use boards of directors to measure connectedness. We define a board as being connected if at least 50 percent of its members have an education connection to the portfolio manager. These results, which are very similar to those reported here, are available on request.

TABLE 2
OLS Regression: Portfolio Weights in Connected vs. Nonconnected Stocks

	1	2	3	4	5	6	7	8	9	10
Constant	91.84*	92.59*	93.01*	93.07*	91.84*	−75.11*	−66.59*	−13.59*	−71.95*	−34.76*
	[.05]	[.03]	[.01]	[.01]	[.05]	[3.80]	[3.87]	[6.47]	[3.63]	[3.49]
CONNECTED1	25.84*				25.34*	9.15*	8.54*	1.34*	9.28*	10.38*
	[1.01]				[.93]	[.77]	[.67]	[.61]	[.75]	[.62]
CONNECTED2		23.31*								
		[1.51]								
CONNECTED3			35.88*							
			[2.85]							
CONNECTED4				40.17*	16.11*	12.60*	12.02*	9.21*	12.65*	9.50*
				[3.93]	[3.24]	[2.61]	[2.57]	[2.51]	[2.59]	[1.66]
Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Fixed effect	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter
Fixed effect							Industry	Firm	IOC	Fund
R^2	.01	.01	.01	.01	.01	.24	.25	.29	.24	.49

NOTE.—This table reports pooled OLS quarterly regressions of mutual funds' portfolio weights in connected and nonconnected stocks. The sample period is 1990–2006, and the units of observation are fund-stock-quarter. The dependent variable in the regressions is the fund's dollar investment in a stock as a percentage of total net assets of the fund (w). The independent variables of interest are those measuring the connection of the portfolio manager to the given firm. In the top part of the table, these are categorical variables for whether a senior officer (CEO, CFO, or chairman) of the given firm and the given mutual fund manager received any degree from the same institution as the fund's portfolio manager (CONNECTED1), received the same degree from the same institution as the fund's portfolio manager (CONNECTED2), received any degree from the same institution as the fund's portfolio manager and overlapped with the portfolio manager during the pursuit of the degree (CONNECTED3), or received the same degree from the same institution as the fund's portfolio manager and overlapped with the portfolio manager during the pursuit of the degree (CONNECTED4). The control variables included where indicated are %STYLE, the percentage of the fund's total net assets invested in the style corresponding to the stock being considered (style is calculated as in Daniel et al. [1997]), and ME, BM, and R12, which are percentiles of market value of equity, book to market, and past 12-month return. Quarter fixed effects are included in each regression, and industry (Fama-French 48), firm, fund's investment objective code (IOC), and fund fixed effects are included where indicated. Standard errors are adjusted for clustering at the quarter level and are reported in brackets below the coefficient estimates.

* 5 percent statistical significance.

relative to nonconnected stocks.[12] In addition, in other specifications, we use industry, firm, fund, and fund investment objective code fixed effects.[13] Although these do explain part of the variation in managers' portfolio choices, all the specifications tell a consistent story: portfolio managers place larger bets in connected securities.

IV. Results: Returns on Connected Holdings

A. Portfolio Tests

The mere fact that fund managers place large bets in connected stocks need not imply that these portfolio choices are beneficial. In this section we explore the performance of fund managers' connected holdings compared to their nonconnected holdings and test the hypothesis that managers earn higher returns on securities within their network.

We use a standard calendar time portfolio approach. At the beginning of each calendar quarter, we assign stocks in each mutual fund portfolio (based on the most recent Thomson file date) to one of two portfolios: connected or nonconnected. We use the same four types of connections defined in Section III. We compute monthly returns on connected and nonconnected holdings between reports, on the basis of the assumption that funds did not change their holdings between reports. Portfolios are rebalanced every calendar quarter, and within a given fund portfolio, stocks are weighted by the fund's dollar holdings (i.e., connected stocks are weighted by the fund's dollar holdings in the connected portfolio, and nonconnected stocks are weighted by the fund's dollar holdings in the nonconnected portfolio). Finally, we compute value-weighted calendar time portfolios by averaging across funds, weighting individual fund portfolios by the fund's total net asset value at the end of the previous quarter. This approach has the advantage of corresponding to a simple investment strategy of investing in connected and nonconnected securities in proportion to the amount held by the universe of funds.

We also analyze the risk-adjusted returns of our calendar time portfolios. We risk-adjust by computing characteristically adjusted returns

[12] As mutual funds tend not to short (nor have portfolio weights above 100 percent), we have both left- and right-censored portfolio weight data, and so OLS may not be appropriate. To deal with this, in unreported tests we run the portfolio weight specifications using Tobit regressions with zero and 100 as lower and upper bounds. The results look nearly identical in terms of magnitude and significance.

[13] The additional weight is more difficult to interpret with controls since now the constant is measured relative to these. In cols. 5–10 we include CONNECTED1 and CONNECTED4 together in each regression. The reason we do not include all connections is that most of our degrees are either an undergraduate degree or an MBA. This causes CONNECTED1 and CONNECTED2 to be highly correlated (0.71), as well as CONNECTED3 and CONNECTED4 (0.70). Thus, we include only one from each pair.

(DGTW returns) as in Daniel et al. (1997) and by computing four-factor alphas (Carhart 1997). We compute DGTW returns by subtracting the return on a value-weighted portfolio of all CRSP firms in the same size, market-book, and 1-year momentum quintile from each stock's raw return. The four-factor alpha is the intercept on a regression of monthly portfolio excess returns on the monthly returns from the three Fama and French (1993) factor-mimicking portfolios and Carhart's (1997) momentum factor.

Panel A of table 3 illustrates our main result: connected holdings outperform nonconnected holdings in a statistically and economically significant way for all four degrees of connectedness.[14] Connected holdings earn between 15.33 percent and 20.53 percent annually in raw returns. The magnitude of the long-short portfolio returns is large and increases as the strength of the connection increases: the portfolio earns 2.64 percent ($t = 2.60$) for same-school connections (CONNECTED1) and up to 7.84 percent ($t = 4.07$) for school/degree/year connections (CONNECTED4). The corresponding DGTW returns range from 1.61 percent to 5.69 percent annually; similarly, four-factor alphas range from 2.49 percent to 8.47 percent annually. In unreported tests, we also find that these economically large average returns on connected stocks are not accompanied by increased levels of risk: the Sharpe ratio on CONNECTED4 holdings equals 0.83 (compared to 0.48 for all holdings and 0.47 for nonconnected holdings). The Sharpe ratio on the connection premium (i.e., the annual average return of the long-short portfolio that buys the portfolio of CONNECTED4 stocks and sells short the portfolio of nonconnected stocks) is even higher at 0.99.

In addition to examining replicating portfolios of the fund's holdings, we also compute returns on the connected stocks that managers choose not to hold. Untabulated statistics indicate that mutual fund managers tend to underweight connected stocks relative to their weights in the market portfolio for all four connection definitions; this result suggests that managers do not simply overweight all connected stocks, as a familiarity explanation might suggest, but instead actively decide which connected stocks to hold and which not to hold. Since we are interested in testing the hypothesis that managers have an informational advantage in securities within their network and since mutual funds are often restricted from short selling, their active portfolio allocation may not reflect their full information advantage. Using the same portfolio construction approach as before, we compute value-weighted returns on portfolios of connected securities that managers choose not to hold.

[14] For brevity, we do not report results for the equally weighted calendar time portfolios, which are qualitatively and quantitatively similar to those shown here. These results are available on request.

For example the "connected not held portfolio" would consist of a value-weighted portfolio of all Stanford stocks that a Stanford manager chooses not to hold in a given quarter. As shown in panel B of table 3, the portfolio of connected stocks held by portfolio managers outperforms the portfolio of connected stocks that managers choose not to hold by up to 6.84 percent per year ($t = 3.46$) for the strongest connection, CONNECTED4.

Overall, our results lend support to the hypothesis that fund managers have comparative advantages in gathering information about connected firms. Funds place large bets and earn large abnormal returns on holdings for which the portfolio managers and the firm's senior management have a higher likelihood of social interaction. As a result, a long-short equity portfolio that replicates aggregate funds' holdings in connected and nonconnected securities earns large subsequent returns.

Note that despite these large abnormal returns on connected holdings, funds invest a very small portion of their assets into these connected stocks, which implies that the annual outperformance attributable to investing in connected stocks is small overall. Column 1 of table 3 indicates that the percentage of assets invested in connected stocks is only 6.28 percent (and only 0.22 percent for CONNECTED4 stocks). Therefore, the outperformance of 7.84 percent for CONNECTED4 stocks translates to only 2 basis points of observed outperformance. Later in the paper we examine why managers choose to invest so little in connected stocks given the high returns we observe in the data.

In unreported tests, we also examine purchases and sales of connected versus nonconnected stocks.[15] As in our findings on holdings, we find that purchases of connected stocks outperform purchases of nonconnected stocks by 8.30 percent annually (t-statistic = 3.60) for CONNECTED4. However, we are unable to reject the hypothesis of no predictability on the sales of connected stocks. This asymmetry in trading performance is consistent with fund managers receiving only positive news (perhaps because senior firm officers may be more reluctant to disclose negative information about the firm's prospects) or acting upon only the positive news they receive (perhaps because of a tacit agreement with management).

[15] We have experimented with three different definitions of purchases/sales: (1) simple changes in portfolio weights in a given stock, (2) changes in the number of shares bought or sold, and (3) changes in the "active weight," defined as the change in the portfolio weight that is not generated by price movements. The finding reported here uses definition 1, but results are very similar using any of these specifications.

TABLE 3
Connected Holdings: Value-Weighted Annual Returns, 1990–2006

		A. Connected Holdings vs. Nonconnected Holdings						B. Connected Minus Connected Not Held		
	% of Assets	Raw Return		DGTW-Adjusted		4-Factor Alpha		Raw Return	DGTW-Adjusted	4-Factor Alpha
All holdings	100.00	12.77*		.22		−.40				
		(2.90)		(.36)		(−.76)				
Nonconnected holdings	93.72	12.69		.22		−.47				
		(2.89)		(.37)		(−.87)				
		Connected Holdings	Long/ Short	Connected Holdings	Long/ Short	Connected Holdings	Long/ Short	Long/ Short	Long/ Short	Long/ Short
CONNECTED1	6.28	15.33*	2.64*	1.82	1.61	2.01*	2.49*	1.77	1.08	.98
		(3.22)	(2.60)	(1.89)	(1.92)	(2.26)	(3.06)	(1.81)	(1.71)	(1.24)
CONNECTED2	2.86	15.49*	2.80*	1.89*	1.67*	2.07*	2.54*	2.05*	1.17	1.13
		(3.28)	(2.62)	(2.01)	(1.97)	(2.24)	(2.97)	(2.17)	(1.60)	(1.32)

CONNECTED3	.46	18.37*	5.69*	4.21*	4.00*	5.39*	5.87*	4.64*	3.30*	4.06*
		(3.71)	(3.74)	(2.52)	(2.74)	(3.28)	(3.74)	(2.95)	(2.40)	(2.43)
CONNECTED4	.22	20.53*	7.84*	5.91*	5.69*	8.00*	8.47*	6.84*	4.95*	6.59*
		(4.26)	(4.07)	(2.83)	(2.92)	(3.51)	(3.83)	(3.46)	(2.70)	(2.85)

NOTE.—This table shows calendar time portfolio returns. At the beginning of every calendar quarter, stocks in each mutual fund portfolio (based on the most recent SEC filing) are assigned to one of two portfolios (connected and nonconnected). Connected companies are defined as firms for which at least a senior official (CEO, CFO, or chairman) received any degree from the same institution as the fund's portfolio manager (CONNECTED1), received the same degree from the same institution as the fund's portfolio manager (CONNECTED2), received any degree from the same institution as the fund's portfolio manager and overlapped with the portfolio manager during the pursuit of the degree (CONNECTED3), or received the same degree from the same institution as the fund's portfolio manager and overlapped with the portfolio manager during the pursuit of the degree (CONNECTED4). We compute monthly returns on connected and nonconnected holdings between reports based on the assumption that funds did not change their holdings between reports. Portfolios are rebalanced every calendar quarter, and within a given fund portfolio, stocks are value weighted by the fund's dollar holdings. Finally, we compute value-weighted calendar time portfolios by averaging across funds, weighting individual fund portfolios by the fund's total net asset value at the end of the previous quarter. This table includes all available stocks and all available funds. We report average returns, DGTW-adjusted returns, and four-factor alphas in the period 1990–2006. DGTW characteristic-adjusted returns are defined as raw returns minus the returns on a value-weighted portfolio of all CRSP firms in the same size, market-book, and 1-year momentum quintile. Alpha is the intercept on a regression of monthly portfolio excess returns. The explanatory variables are the monthly returns from Fama and French (1993) mimicking portfolios and Carhart (1997) momentum factor. Panel A reports returns on connected stocks held by the mutual fund managers compared to their nonconnected holdings. Panel B reports returns on connected stocks held by mutual fund managers compared to the connected stocks they choose not to hold. Returns and alphas are annual percentages. Long-short is the annual average return of a zero cost portfolio that holds the portfolio of connected stocks and sells short the portfolio of nonconnected stocks (in panel A) or the portfolio of connected but not held stocks (in panel B). % of assets is the average fraction of fund assets (in percent) invested in each group of stocks. *t*-statistics are shown below the coefficient estimates.

* 5 percent statistical significance.

B. Returns around News

In this subsection we begin to explore the mechanism behind the high returns earned by portfolio managers on securities within their network. If the returns to connected stocks are driven by information flow through the network, we would expect to see managers making the bulk of the return premium when the news that was transferred through the network (and so caused the manager to purchase the stock) is eventually incorporated into prices. In order to test this hypothesis, we split the daily returns for each individual stock into returns on earnings announcements (defined as returns within 2 trading days [−1, 0, 1] from a scheduled quarterly earnings release), returns on "other headlines" (defined as returns in calendar days with at least one news announcement on the Dow Jones news wires but no scheduled earnings announcements), and "no-news returns" (defined as returns in calendar days with no news announcements on the Dow Jones news wires and no scheduled quarterly earnings releases). We then compound these daily returns to compute monthly news returns and no-news returns on connected and nonconnected holdings.[16]

In panel B of table 4, we report the average return of the long-short portfolio that holds the portfolio of connected stocks and sells short the portfolio of nonconnected stocks, and we test the null hypothesis that the difference in returns between the connected and the nonconnected portfolios on news (no news) is equal to zero. Looking at months with no headlines or earnings announcement, we are unable to reject the null hypothesis of no difference between the connected and the nonconnected portfolios. Looking at the return on earnings announcements or other headline news reveals that the difference in average returns between a portfolio of connected holdings and one of nonconnected holdings is almost entirely concentrated in news months. For example, the premium of CONNECTED4 holdings over nonconnected holdings is large and significant on days with corporate news announcements (2.26 percent annually around earnings announcements and 4.86 percent around other headline news events) but is not statistically different from zero in months with no headline news; also, 91 percent of the total connection premium for CONNECTED4 stocks is concentrated around corporate news announcements. Note that in unreported tests we also compute "simulation-adjusted" news returns by employing a matched sample of stocks with similar levels of returns, since it is possible to expect most of the difference in returns between any two portfolios

[16] This decomposition is similar to that in Baker et al. (2005). Focusing on trades (rather than level holdings) prior to earnings announcements, they find that mutual fund managers do seem to exhibit ability in predicting future returns around these earnings announcements.

TABLE 4
RETURNS AROUND CORPORATE NEWS ANNOUNCEMENTS

	No News	Earnings Announcements	Other News
	A. Distribution of News (No. of News Events: 4,849,469; Average No. of News per Year: 269,417)		
Fraction of CRSP daily returns: equal weighted	.92	.01	.07
Fraction of CRSP daily returns: value weighted	.68	.01	.31
	B. Return around News: Connected Minus Nonconnected		
CONNECTED1	.02	.70*	1.93*
	(.02)	(2.16)	(2.10)
CONNECTED2	−.34	.75*	2.39
	(−.45)	(2.38)	(1.95)
CONNECTED3	1.31	.66	3.72*
	(1.16)	(1.25)	(2.54)
CONNECTED4	.72	2.26*	4.86*
	(.38)	(2.75)	(2.68)
	Fraction of Total Long/Short Return		
CONNECTED1	.01	.26	.73
CONNECTED2	−.12	.27	.85
CONNECTED3	.23	.12	.65
CONNECTED4	.09	.29	.62

NOTE.—This table shows calendar time portfolio returns. At the beginning of every calendar quarter, stocks in each mutual fund portfolio (based on the most recent SEC filing) are assigned to one of two portfolios (connected and nonconnected). For each individual stock, we assign daily stock returns into returns on earnings announcements, "earnings announcements" defined as returns within 2 trading days (−1, 0, 1) from a scheduled quarterly earnings releases, "other news" defined as returns in calendar dates with at least one news announcement and no scheduled earnings announcements, and "no-news returns" defined as returns in calendar days with neither news announcements nor scheduled quarterly earnings releases. We compound these daily returns to compute monthly returns on connected and nonconnected holdings between reports based on the assumption that funds do not change their holdings between reports. Portfolios are rebalanced every calendar quarter, and within a given fund portfolio, stocks are value weighted by the fund's dollar holdings. Finally, we compute value-weighted calendar time portfolios by averaging across funds, weighting funds' portfolios by the total net asset value at the end of the previous quarter. This table includes all available stocks and all available funds. Panel A reports the distribution of the news events in the period 1990–2006. Panel B reports the average return of a zero cost portfolio that holds the portfolio of connected stocks and sells short the portfolio of nonconnected stocks. Returns are annual percentages. *t*-statistics are shown below the coefficient estimates.
* 5 percent statistical significance.

to be concentrated around news releases;[17] adjusting for the average return around news and no news times does reduce the magnitude of

[17] At the beginning of every calendar quarter we sample a random portfolio of 500 stocks from the universe of mutual fund holdings and compute returns around news and no-news times. We rebalance the portfolio quarterly to maintain value weights. We bootstrap with replacement 100,000 of such random portfolios. Finally, we compute simulation-adjusted returns as raw returns minus the average return of random portfolios in the same average return quintile.

the difference in returns, but the premium of connected holdings is still large and entirely concentrated around news releases.

In summary, portfolios of stocks that are located in a fund's education network display a disproportionate amount of (net) positive news (defined as high returns in news months) with respect to a portfolio of firms outside the fund's network or a random portfolio with the same average return. Taken together, these results are consistent with the hypothesis that social networks facilitate the flow of private information. The difference in performance between connected and nonconnected stocks is disproportionatey concentrated at times when information is being released to the investing public in the form of public announcements. In other words, the transfer of information surrounding news releases seems to be a key determinant of the outperformance of connected holdings that we document in the paper.

V. Fund Manager Behavior

In this section we further examine the trading behavior of the fund managers in our sample. Our first test explores changes in a fund's portfolio manager. We use manager replacements as a convenient laboratory to study how changes in the available network influence a fund's portfolio allocation. If the effect we find in Section III is indeed driven by school connections, we expect to see incoming managers replacing stocks in the previous manager's network with securities within his own network. We follow a standard event study methodology. In order to obtain a clean measure of changes in the available network, we restrict the analysis to funds managed by a single portfolio manager (not a team) and to manager changes in which the new portfolio manager and the prior portfolio manager did not receive a degree from the same academic institution (e.g., a Yale manager replaced by a Stanford manager).

Figure 1 shows changes in portfolio allocation. We measure the changes in holdings in event time from the date of the manager change. Period -1 represents the last portfolio snapshot of the old manager and period $+1$ represents the first portfolio snapshot of the new manager. Weight is defined as the percentage holding of a stock averaged over the last 2 quarters (for event quarter < 0) or over the next 2 quarters (for event quarter > 0).[18] The line with the squares in the figure shows the fund's portfolio weights of stocks connected to the old manager (which are by definition not connected to the new manager). The line with the triangles shows the weights in stocks connected to the new

[18] We average across consecutive quarters since funds' holdings are either quarterly or semiannual.

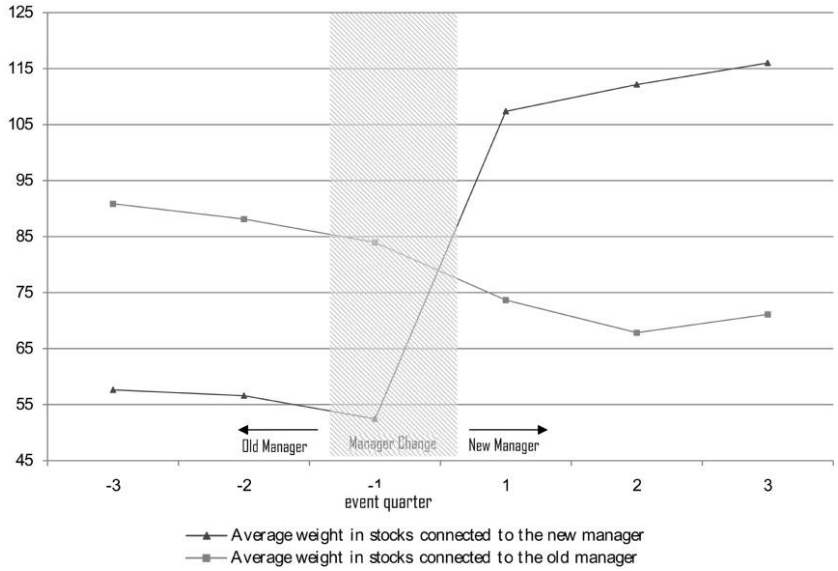

FIG. 1.—Connected weights at manager changes. This figure shows the holdings of mutual funds around changes in educational connections. In this figure, connected companies are defined as firms in which at least a senior official (CEO, CFO, or chairman) received the same degree from the same institution as the fund's portfolio manager and overlapped with the portfolio manager during the pursuit of the degree. This figure included the universe of mutual funds managed by a single portfolio manager. A manager change represents a replacement of the fund's portfolio manager in which the new portfolio manager and the prior portfolio manager did not receive a degree from the same academic institution. Quarter −1 represents the last portfolio snapshot of the old manager and quarter +1 represents the first portfolio snapshot of the new manager. Weight is defined as percentage holding of a stock averaged over the last 2 quarters (for event quarter < 0) or over the next 2 quarters (for event quarter > 0). Average weight in stocks connected to the old manager measures the weights on stocks connected to the old manager but not to the new manager. Average weight in stocks connected to the new manager measures the weights on stocks connected to the new manager but not to the old manager. Weights are given in basis points.

manager (again by definition not connected to the old manager). Consistent with school connections having an impact on managers' portfolio choices, the incoming manager significantly decreases exposure to firms connected to the previous manager while at the same time significantly increasing exposure to firms in her network. Both the new manager's drop in portfolio weight in stocks connected to the old manager (−19.76 basis points, *t*-statistic = −5.03) and the increase in weight in stocks in her network (58.38 basis points, *t*-statistic = 4.61) are economically large, given the average weight in our sample of 92 basis points.

Given the large abnormal returns to investing in connected stocks that we document in this paper, a natural follow-up question is, Why

TABLE 5
FUND MANAGER BEHAVIOR

	AVERAGE SHARPE RATIO OF INDIVIDUAL FUNDS		
	$\overline{SR}$ (1)	Difference (2)	Funds with Potential Increase in *SR* (%) (3)
All holdings	.52		
CONNECTED1	.41	−.11*	4.53
		(−3.47)	
CONNECTED2	.40	−.12*	3.25
		(−3.82)	
CONNECTED3	.36	−.16*	1.74
		(−5.79)	
CONNECTED4	.41	−.11*	1.05
		(−3.52)	

NOTE.—This table reports average Sharpe ratios of individual funds and 5 percent rejection rates of the hypothesis that a fund's optimal weight in the portfolio of connected stocks is equal to its actual weight. For each fund manager j, we compute Sharpe ratios (SR) in connected securities and report the averages across funds: $\overline{SR} = (1/n)\sum_j SR_j$. Difference is the difference between the average Sharpe ratio across funds for connected securities minus the average Sharpe ratio across funds for all holdings. Column 3 reports the percentage of funds that could have increased their Sharpe ratio in-sample by investing more in connected stocks. To compute this percentage we run a time-series regression for each fund manager j of the fund's monthly return in connected securities (CONNRET) in excess of Treasury bills (RF) on the fund's total excess return (RET): $\text{CONNRET}_{jt} - RF_t = \alpha_j + \beta_j(\text{RET}_{jt} - RF_t) + \varepsilon_{jt}$. We report the fraction of funds for which the null hypothesis $\alpha = 0$ is rejected at 5 percent significance. This number is equal to the fraction of times a fund manager maximizing her Sharpe ratio and allowed to change only the share of assets allocated to her connected vs. unconnected stocks would have found it optimal to invest more in connected stocks during our sample period (i.e., the fraction of times she would have rejected the null hypothesis that her optimal weight in the portfolio of connected stocks was equal to the actual weight).

* 5 percent statistical significance.

don't fund managers invest even more of their portfolio in connected stocks? To explore this question we conduct two tests. The first test is to compute the average Sharpe ratios of individual mutual funds' connected holdings and overall holdings (unlike the Sharpe ratio statistics mentioned earlier, which are computed at the aggregate mutual fund portfolio level). As shown in table 5, the average Sharpe ratio at the individual fund level on CONNECTED1 stocks is significantly lower than the average Sharpe ratio at the fund level for all holdings (0.41 compared to 0.52); we obtain similar results for the other three connection definitions. This result suggests that for a given mutual fund, it may not be optimal to invest more in connected stocks given the fact that this would likely yield a much more undiversified portfolio.

To address this question formally, we conduct a second test to identify the managers for whom it would have been optimal to invest more in connected stocks during our sample period. Specifically, for each fund manager, we run a time-series regression of the fund's monthly return in connected securities on the fund's total return. A significant alpha

in this regression indicates that a fund manager could have chosen some linear combination of the left- and right-hand-side portfolios in order to have increased his in-sample Sharpe ratio. We compute the percentage of funds for which we are able to reject the null hypothesis that the alpha is equal to zero, that is, the percentage of funds that chose a suboptimal weight in connected stocks in-sample. Column 3 of table 5 shows that this number ranges from 1.1 percent of funds (for CONNECTED4 stocks) to 4.5 percent of funds (for CONNECTED1 stocks), indicating that very few funds would have been made better off by investing more than what they already did in connected stocks during our sample period. The intuition here is that the connected portfolio for a typical fund manager contains very few stocks, so putting more money in this portfolio would cause them to take on a lot of additional idiosyncratic risk, thus reducing their Sharpe ratio. By contrast, the reason our main CONNECTED4 portfolio in table 3 has such a high Sharpe ratio (0.83, as noted earlier) is that we are constructing a strategy that looks into each manager's set of holdings at the end of each quarter, picks out only the connected stocks, and then aggregates and value-weights across all managers; thus, this aggregate portfolio of connected stocks is able to diversify away a large amount of idiosyncratic risk in a way that individual fund managers are unable to do.

VI. Robustness Tests

In table 6 we report a series of robustness checks. The table reports the connection premium for CONNECTED4 holdings for various subcategories of our main sample. The table is split into three panels: panel A contains tests on subperiods and firm characteristics, panel B contains tests on academic institutions, and panel C contains tests on fund characteristics. Panel A indicates that the connection premium is large and reliable for large-cap stocks (7.27 percent annually) and for the top 500 largest firms (6.06 percent annually). Thus, it does not seem that small information-opaque firms are driving the results. The connection premium is roughly twice as large in the second subperiod (1998–2006) of our sample relative to the first (1990–97). Also, Regulation Fair Disclosure (Reg FD) was passed partway through our sample (October 2000).[19] Thus, to the extent that the type of information transfer occurring through the networks was covered by Reg FD, there may be a difference

[19] The Reg FD, instituted by the SEC in October 2000, quite openly gave as its aim the elimination of selective disclosure by firms to a subset of market participants. For instance, in the SEC release regarding Reg FD (http://www.sec.gov/rules/final/33-7881.htm), the stated goal was to eliminate situations in which "a privileged few gain an informational edge—and the ability to use that edge to profit—from their superior access to corporate insiders, rather than from their skill, acumen, or diligence."

TABLE 6
ROBUSTNESS CHECKS

	Connection Premium
A. Subperiods and firm characteristics:	
Large-cap stocks (above NYSE median)	7.27* (3.66)
Small-cap stocks (below NYSE median)	8.92 (.88)
Top 500 largest firms	6.06* (3.13)
1990–97	4.78* (2.10)
1998–2006	10.56* (3.73)
Pre–Reg FD (through 2000)	8.51* (3.16)
Post–Reg FD (2001 onward)	6.61* (2.58)
Only CEO connections	6.48* (1.99)
B. Academic institutions:	
Top 5 most connected	7.77* (4.11)
Not top 5 most connected	7.74* (4.03)
Top 25 highest SAT score	7.82* (3.95)
Not top 25 highest SAT score	7.83* (4.22)
School-adjusted return	5.11* (3.42)
Non–Ivy League	7.04* (4.12)
Ivy League	7.79* (4.15)
Only MBA degrees	9.90* (4.47)
C. Fund characteristics:	
Aggressive growth funds	7.49 (1.56)
Growth funds	6.14* (2.41)
Growth and income funds	8.14* (3.80)
Large-cap funds (above median)	7.91* (4.09)
Small-cap funds (below median)	2.94 (1.06)
Single-portfolio manager	6.80* (3.55)
Multiple-portfolio manager	11.06* (4.23)
High-performing fund (above-median returns)	7.19* (3.27)
Low-performing fund (below-median returns)	8.36* (2.66)
Distant holdings (>100 km, 1994–2006)	8.80* (3.77)

NOTE.—This table shows calendar time portfolio returns. We report the annual average return of a zero cost portfolio that holds the portfolio of connected stocks and sells short the portfolio of nonconnected stocks. Connected companies are defined as firms for which at least a senior official (CEO, CFO, or chairman) received the same degree from the same institution as the fund's portfolio manager and overlapped with the portfolio manager during the pursuit of the degree (CONNECTED4). Panel A reports results by subperiod and firm characteristics. Panel B reports results by academic institutions. School-adjusted returns are defined as raw returns minus the value-weighted average of a portfolio of all firms for which at least a senior official (CEO, CFO, or chairman) received a degree from the same institution. Top 5 most connected are academic institutions, ranked by the average number of connected firms (portfolio managers) over the period 1990–2006. Top 25 highest SAT score is defined the top 25 institutions ranked by their average SAT scores. Panel C reports results by fund characteristics.

* 5 percent statistical significance.

before and after Reg FD was put into effect. Interestingly, the premium is smaller in magnitude in the post–Reg FD period (6.61 percent annually, compared to 8.51 percent annually in the pre–Reg FD period), but not significantly so. This implies that new laws designed to reduce selective disclosure of information may have had some (limited) effect on the connection premium we document here. Finally, if we redefine our CONNECTED4 variable to include only connections to the CEO, the connection premium is still large and significant (6.48 percent annually).

Panel B of table 6 reports tests controlling for different characteristics

of the academic institutions. One possibility is that only schools with very large education networks (many firms and portfolio managers) are able to realize returns to the education social network. To test this, we split the sample into the five most connected schools (from table 1) and the rest of the sample. The connection premium is almost identical between the two subsamples, suggesting that our results are not driven solely by the most connected schools.[20] To control for the effect documented in Chevalier and Ellison (1999), we also divide our institutions up by average SAT score; after doing so, we find that the connection premium is again virtually identical for the top 25 highest SAT score schools and non–top 25 schools.[21] Further, when we look at only MBA connections, we find a large and significant connection premium (9.9 percent annually). Additionally, we test the hypothesis of a common school effect by computing "school-adjusted returns" for each stock, equal to the stock's return minus a value-weighted portfolio of all stocks that have senior officers who received at least one degree from the same institution as a senior officer from the given firm. Similarly to the connected not held results in table 3, the school-adjusted return results indicate that even after this adjustment, portfolio managers' choices of connected firms significantly outperform those connected firms that managers choose not to hold. Finally, our results do not appear to be driven by a few top schools: when we split the sample into Ivy League and non–Ivy League schools, the connection premium is roughly equivalent.

Panel C of table 6 shows that the connection premium is also not driven by a given fund investment style. It is robust across various fund manager investment objective codes (e.g., growth compared to growth and income), although it is somewhat stronger among large-cap funds. Interestingly, multimanager funds earn a higher connection premium than single-manager funds. This could possibly be due to the increased number of education networks these funds have through which to receive information. Additionally, when we split our sample into high-performing funds (above-median returns) and low-performing funds (below-median returns), we observe roughly the same connection premium for each category of fund. Finally, we control for the effect of

[20] In unreported tests we also explore whether fund managers from schools likely to have lots of connected firms have higher returns or, alternatively, whether senior managers of firms from schools likely to have lots of connected fund managers have higher returns; we find no evidence to support either possibility.

[21] Data on average SAT scores of managers' universities are collected from the Integrated Postsecondary Education Data System database that is maintained by the Institute of Education Sciences at the U.S. Department of Education. The data range from 2001 to 2005. Following Chevalier and Ellison (1999), we compute a composite SAT score by using the average of the upper and lower bounds for the verbal score plus the average of the upper and lower bounds for the math score.

geographical proximity on fund returns documented by Coval and Moskowitz (2001). We do this to rule out an alternative hypothesis whereby individuals tend to be employed close to their last academic institution (e.g., Yale graduates tend to operate in firms or funds based in Connecticut), thus generating an overlap between academic networks and geographical proximity. To control for proximity, we extract the headquarter location for firms and mutual funds in our sample from their SEC filings on the EDGAR system.[22] We compute "local" ("distant") holdings on connected and nonconnected stocks, defined as firms located within (beyond) 100 kilometers from the fund. Panel C of table 6 shows that the connection premium is equivalent for both local and distant holdings, suggesting that geographical proximity is unlikely to be driving our results.

VII. Conclusions

This paper suggests that social networks are important for information flow between firms and investors. We find that portfolio managers place larger concentrated bets on stocks they are connected to through their education network and do significantly better on these holdings relative to nonconnected holdings and relative to connected firms they choose not to hold. A portfolio of connected stocks held by managers outperforms nonconnected stocks by up to 7.8 percent per year. This connection premium is not driven by firm, fund, school, industry, or geographic location effects and is not driven by a subset of the school connections (e.g., Ivy League schools). We find that the bulk of this premium occurs around corporate news events such as earnings announcements, lending support to the hypothesis that the excess return earned on connected stocks is driven by information flowing through the network.

We believe that social networks provide a natural framework to test the flow of private information into security prices. Information can be followed in a predictable path along the network. Further, as the information will eventually be revealed in stock prices, advance knowledge implies return predictability. In this paper we exploit education networks between portfolio managers and firm senior officers. What we document using these networks is not an isolated situation or is not constrained to a few portfolio managers or firms, but rather a systematic effect across

[22] We use all the 10-K forms (firms) and NSAR forms (mutual funds) on the EDGAR system from 1993 to 2006. We match zip codes to their corresponding latitude and longitude and compute the distance between each fund and its holdings using the following approximation:

$$\text{distance} = \sqrt{[69.1(\text{latitude } 1 - \text{latitude})]^2 + [53(\text{longitude } 1 - \text{longitude } 2)]^2}.$$

the entire universe of U.S. firms and portfolio managers. We believe that future research on social networks should explore not only additional types of social networks but also the extent to which different kinds of information are delivered across different networks. Understanding these issues could give a better idea of how information flows and how investors receive information, and so allows us to better predict how and when security prices will respond to new information.

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