Prime (Information) Brokerage*

Nitish Kumar † Kevin Mullally ‡ Sugata Ray§ Yuehua Tang**

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ABSTRACT

We document a channel of information flow from prime brokers to their hedge fund clients. We examine whether hedge funds make informed trades on the stocks of firms to which their prime broker's affiliated bank initiates a syndicated loan. We find that these connected hedge funds make abnormally large trades prior to a loan announcement, compared to their own trades in other stocks or to the trades in the borrowing firm's stock by unconnected hedge funds. More importantly, we find that the connected hedge funds' trades subsequently generate superior performance compared to other trades. The outperformance is highest for trades of connected hedge funds that have high revenue generation potential for their prime brokers, and amounts to 7.2% – 8.7% per annum.

Keywords: hedge funds, prime brokers, informed trading, information leakage, loan originations

JEL Classification: G11; G12; G14; G23

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† Nitish Kumar is from the University of Florida, Warrington College of Business, Box 117168, Gainesville FL 32611, USA. E–mail: nitish.kumar@warrington.ufl.edu. Tel: +1–352–392–0115.

‡ Kevin Mullally is from the University of Alabama, Culverhouse College of Business, Box 870224, Tuscaloosa, AL 34587, USA. E-mail: kmullally@cba.ua.edu. Tel: +1-205-348-7858.

§ Sugata Ray is from the University of Alabama, Culverhouse College of Business, Box 870224, Tuscaloosa, AL 34587, USA. E–mail: sugata.ray@cba.au.edu. Tel: +1–205–348–5726.

** Yuehua Tang is from the University of Florida, Warrington College of Business, Box 117168, Gainesville FL 32611, USA. E–mail: yuehua.tang@warrington.ufl.edu. Tel: +1–352–392–9985.

1. Introduction

In this study, we document a channel of information flow from prime brokers to their hedge fund clients. Numerous prior studies show that hedge funds are informed traders, though less attention is paid to the exact source of their information advantage.[1] Although being informed could well be due to managers' genuine skill, there are growing concerns that some hedge fund managers gain an information advantage via more controversial channels.[2] Our paper aims to study one such information channel that is potentially available to all hedge funds: non-public information from their prime broker regarding their corporate banking clients.

We focus on the flow of information from prime brokers to hedge funds for two reasons. First, as a key participant in the capital markets, broker-dealers often receive private information regarding their corporate clients as part of their advisory and origination activities. Second, the highly profitable nature of prime brokerage services could incentivize the brokers to "tip" information to their hedge fund clients. Although Chinese walls are set up to prevent such information transfer, various academic studies and regulatory reports suggest that these information barriers are often not adequate.[3] Consistent with this idea, we document strong evidence that hedge funds make abnormally large and profitable trades in stocks on which their prime brokers have private information.

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[1] Studies documenting informed trading by hedge funds include, among others, Brunnermeier and Nagel (2004), Aragon and Martin (2012), Agarwal et al. (2013), Klein and Li (2015), Gao and Huang (2016), and Gargano, Rossi, and Wermers (2016).

[2] See, for example, "Hedge Fund Billionaire Is Guilty of Insider Trading," *New York Times*, May 11, 2011; "Steve Cohen Misses His Chats with Corporate Insiders," *Bloomberg View*, June 4, 2012; "Surveys Give Big Investors an Early View from Analysts," *New York Times*, July 15, 2012.

[3] Academic studies that investigate the information flow across the Chinese wall include Acharya and Johnson (2007), Massa and Rehman (2008), and Chen and Martin (2011). Additionally, the SEC published "Staff Summary Report On Examinations of Information Barriers: Broker-Dealer Practices Under Section 15(g) of the Securities Exchange Act of 1934" in September, 2012. The report notes that controls to prevent misuse of material non-public information (MNPI) were not often adequate. For example, the report states, "the apparent absence of related monitoring or other controls raises serious concerns about the ability of broker-dealers to guard adequately against misuse of MNPI in firm and customer trading".

In our empirical tests, we examine whether hedge funds make informed trades on the stock of a firm to which their prime broker's affiliated bank initiates a syndicated loan. We refer to the stocks of firms that receive a syndicated loan as treated stocks, and the hedge funds whose prime broker initiates the loan as connected hedge funds. We develop two hypotheses around this question. First, if prime brokers provide such information to their hedge funds clients, we should expect hedge fund clients of prime brokerages that also originate a loan to a firm to exhibit abnormal trading in that firm's stock. Second, we expect the trades in treated stocks by connected hedge funds to perform better compared to an appropriate control group.

We test these hypotheses on the data using a merged dataset of hedge funds and their prime brokers from TASS, loan originations from Dealscan, and hedge fund holdings from 13F filings. This merged dataset allows us to test these hypotheses with two appropriate control groups. First, we compare the trades in treated stocks by connected hedge funds to the trades in other stocks in the fund's portfolio (referred to as "same fund, different stocks," or SFDS). Second, we compare the trades in treated stocks by connected hedge funds to the trades in the same treated stock by unconnected hedge funds (referred to as "same stock, different funds," or SSDF).

We illustrate our test design with the following example. Hedge fund H1 uses prime broker P1. Hedge fund H2 uses prime broker P2. Both funds own and trade actively in Microsoft and Apple shares. Prime broker P1's debt capital markets division makes a loan to Microsoft. We refer Microsoft as the treated stock and H1 as the connected hedge fund. If our hypothesized channel is true, H1 is informed with respect to Microsoft. Our analysis examines whether H1 makes larger and more profitable trades in Microsoft trades prior to the loan announcement (i.e., the trade in treated stock by connected fund), compared to H1's trades in Apple (i.e., the trade in untreated

stock by connected fund, in a SFDS context) and H2's trades in Microsoft (i.e., the trade in treated stock by unconnected fund, in a SSDF context).

Our empirical analysis supports the hypothesis that information flows from prime brokers to their hedge fund clients. Our first set of analyses shows that connected hedge funds make abnormally large trades in treated stocks as measured by the absolute changes in holdings scaled by fund's assets under management (AUM). We measure funds' holding changes in the quarter prior to a loan announcement and find that the absolute holding changes by connected hedge funds in treated stocks are 8.8 bps higher than in untreated stocks (SFDS test). In addition, the absolute holding changes in treated stocks by connected hedge funds are 8.3 bps higher than the trades in the same stock by unconnected hedge funds (SSDF test). These findings are economically significant given that the average absolute holding change in our sample is 22 bps. In our robustness analysis, we do not find similar evidence of abnormal trading by connected hedge funds in time-series placebo tests using one- or two-year prior to loan announcement as the event date. We also do not find any abnormal trading in treated stocks if we carry out the SFDS test using unconnected hedge funds in cross-sectional placebo tests.

We next examine whether the trades in treated stocks by connected hedge funds perform better. Our performance measures are computed by multiplying the sign of position changes in the quarter prior to the loan announcement by the return of the stock. Returns are computed from the beginning of the quarter of the loan announcement to two days after the loan announcement is made public. This follows the technique used in Ivashina and Sun (2011). In the SFDS context, trades by connected funds in treated stocks significantly outperform their trades in other stocks. For instance, the outperformance on an annualized basis amounts to 2.1% as measured by Carhart (1997) four-factor alpha and 2.4% as measured by Daniel, Grinblatt, Titman, and Wermers

(DGTW, 1997) characteristic-adjusted return. Similarly, in the SSDF context, trades in treated stocks by connected funds outperform, on an annualized basis, trades in the same stock by unconnected funds by 3.1% based on four-factor alpha and by 4.0% based on DGTW characteristic-adjusted return.[4] We also find that the outperformance of these trades is concentrated in connected hedge funds' buys rather than their sells, which could be due to the fact that 13F holdings data only capture long, but not short, positions. In addition, we find that larger trades in treated stocks by connected funds deliver higher future performance.

Finally, we investigate whether the information flow is more prevalent for certain hedge funds. Specifically, we expect that prime brokers provide more valuable information to hedge funds that have greater revenue potential to retain these clients. Consistent with this idea, we find that connected hedge funds with higher AUM in equity styles (i.e., long-short equity or market neutral) earn higher returns in treated stocks compared to other connected funds.[5] Specifically, connected hedge fund companies with equity AUM in the top quartile earn 5.9%– 8.3% higher on their trades in treated stocks relative to funds with lower levels of equity AUM. Furthermore, we find similar results for connected funds with higher equity turnover and high leverage use − proxies for commission and lending based revenue, respectively.

Our paper contributes to the literature in several ways. First, our study adds to the strand of literature that analyzes trading of non-public information by hedge funds. Ivashina and Sun (2011) show that institutional investors that invest in corporate loans use private information disclosed by the borrowing firms during loan amendments to trade in the stock of the borrowing

[4] Since the returns to the stock are exactly the same in the SSDF context, the outperformance is entirely driven by the sign of the trades by the connected and non-connected hedge funds. The connected funds "get it right" significantly more often than unconnected funds trading connected stocks.

[5] Barclays' Capital Solutions Group's 2015 report on prime brokerage notes that long-short equity and statistical arbitrage funds are the two most valuable types for prime brokerage revenues. Our setting does not have a large impact on statistical arbitrage funds given their investment strategies.

firm. Massoud et al. (2011) find that hedge funds that co-invest in syndicated loans short-sell the equity of the borrowers prior to public announcements of both loan originations and loan amendments. Our paper is different from these two studies as we focus on the role of prime broker in the information channel. A recent study by Qian and Zhong (2017) finds that hedge funds earn abnormal returns in IPO stocks, and more so when their prime brokers serve as the IPO underwriters. Share allocation in IPOs plays a critical role in their setting and it is difficult to isolate the effect of information sharing by prime brokers given that there is no way to observe trading before the IPO. Our setting avoids this pitfall and allows for a cleaner test of information sharing by prime brokers to their hedge fund clients.[6]

Second, our paper adds to the literature that focuses on information flow from the lending unit of a financial institution to other units within the institution or to their outside clients. Acharya and Johnson (2007) argue that bank lenders use insider information about their borrowing clients in the credit default swap market. Massa and Rehman (2008) provide evidence that private information about the banks' borrowing firms flows from banks to their affiliated mutual funds. Ivashina et al. (2009) find that the probability of a borrowing firm becoming a target increases when the acquirer and the target have the same lender, suggesting information flow from the bank to potential acquirers. Chen and Martin (2011) demonstrate that bank-affiliated analysts use private information from the banks' lending activities to improve their forecast accuracy. Our paper adds to this literature by showing that hedge funds trade and capitalize on loan information that their prime-brokers' affiliated banks possess due to their privileged relationship with borrowing firms.

Finally, our paper directly complements the findings of Chung and Kang (2016). They document strong evidence of co-movement in the returns of hedge funds sharing the same prime

[6] In a related study, Di Maggio et al. (2017) find that brokers gather information after executing informed trades and then leak this to their best institutional investor clients.

broker. While Chung and Kang (2016) provide evidence that is consistent with prime brokers providing information to their hedge fund clients, they do not focus on the exact nature or source of the information being shared. Our paper identifies a specific channel through which such information could be passed on to hedge fund clients. The results in our paper and Chung and Kang (2016) both suggest that investment banks share private information to hedge funds who are their prime brokerage clients.[7]

2. Data and Variable Construction

2.1. Data

We combine four different datasets for our analysis. The first is the Trading Advisor Selection System (TASS) hedge fund database. TASS contains information on hedge funds' returns, assets under management (AUM), contractual features, and service providers. The information on funds' service providers includes the name of each fund's prime broker. Because TASS started distributing its data in 1994, its data does not contain information on funds that failed prior to 1994. To mitigate concerns about this survivorship bias, we only focus on data from 1994 through 2012. The second dataset is the Thomson Reuters 13F Institutional Holdings data. Institutions that hold at least $100 million in 13(f) securities are required to disclose their institution-level holdings on a quarterly basis. The third dataset is the Center for Research in Security Prices (CRSP) which we use to obtain stock prices and returns.

Finally, we obtain information about corporate loans from Loan Pricing Corporation's (LPC) Dealscan database. This database contains detailed information about bank loans made to

[7] In contrast, Griffin, Shu, and Topaloglu (2012) find little evidence of informed trading by the average brokerage house client of investment banks.

US and foreign corporations, with coverage starting from around mid-1980s. We use the Compustat-Dealscan link made publicly available by Michael Roberts (see Chava and Roberts (2008)) to link this database with Compustat. Using information from the dataset, we identify the lead arranger(s) for each loan. Since a lending relationship involves repeated interactions and exchange of information between the lender and borrower, we examine loan initiations to ensure that the lender had no material information about the borrowing firm before the beginning of the loan initiation process. Hence, for each lead bank-borrowing firm pair in the dataset, we retain the first loan in our sample.[8] This also ensures that we are strictly looking at new loans rather than renegotiation of an existing loan.[9]

To ensure the accuracy of our data, we also address a major concern about the Dealscan data. Financial institutions have multiple subsidiaries and often engage in mergers and acquisitions that change their holding structure. Dealscan, unfortunately, does not retain the historical ownership structure. Instead, all lending entities are linked to their most recent parent. This leads to many loans being attributed incorrectly. For example, if Merrill Lynch made a loan in 2001, that loan will be attributed to Bank of America even though the two firms did not merge until 2008. We examine each of the individual lenders in our sample to ensure that the actual lender is correctly identified. We also eliminate all loans to borrowers that do not have common stocks in the CRSP database.

Our merged dataset is constructed as follows. First, we merge the Dealscan data to TASS by manually matching the prime brokers in TASS to the primary lenders in Dealscan. Next, we eliminate fund-broker-loan observations made to companies before a hedge fund's inception date

[8] Our results are qualitatively similar if we consider all loan events in Dealscan.
[9] Roberts and Sufi (2007) find that 47% of loan renegotiations they identify from direct SEC filings are reported as independent observations (new loans) in Dealscan.

or after a fund died. Lastly, we manually match hedge fund companies in TASS to those in the 13F database and obtain their quarterly stock holdings. Because 13F filings are at the company-level, we exclude duplicate fund company holding observations (e.g., cases where multiple funds from the same fund company use the same prime broker). Our final sample contains 320 hedge fund companies and their quarterly holdings from 2,479 distinct fund quarters. These companies use 34 different prime brokers and hold the stocks of companies that received 2,556 distinct loans.

2.2. Variable Construction

We construct several stock characteristic variables. Specifically, *Size* is the natural logarithm of market equity. *Book to Market* is the ratio of book equity to market equity. *Momentum* is the past 12-month cumulative stock return. *Return Volatility* is the standard deviation of the past 12 monthly stock returns. *Volume* is the past 12-month average of shares traded divided by total shares outstanding. *Institutional Ownership* is the percentage of shares outstanding held by 13F institutions. *Amihud* is the absolute value of the stock's monthly return divided by its price times its monthly trading volume.

Next, we also construct several hedge fund company-level variables. *Fund Return* is calculated as the average of a company's cumulative hedge fund returns over the past 12 months. *Fund Flow* is the average of a company's hedge funds percentage flows over the past 12 months. *Fund Size* is the natural logarithm of the company-level average of funds' AUMs. *Management Fee*, *Incentive Fee*, and *Lockup Period* are the company-level averages of funds' management fees, incentive fees, and lockup periods within a given company. Lastly, *Offshore* and *High Water Mark* are the percentages of a company's funds that are domiciled offshore and have high water mark provisions, respectively.

2.3. Summary Statistics

We report summary statistics in Table 1. Panel A contains the statistics for the fund company variables, aggregated at the quarterly horizon. The average (median) fund company holds 296 (148) stocks. The average (median) fund company in our sample holds $1,979 ($605) million in long equity positions. Panel B contains the statistics on the stock and position level variables. The average (median) quarterly position change in our sample is 0.22% (0.04%). The means and medians of the other stock characteristic variables are all of reasonable magnitude.

[Insert Table 1 about here]

3. Empirical Analysis

3.1. Hedge Fund Trading Ahead of Loan Events

We begin our empirical analysis by examining hedge funds' trading behavior in the stocks of firms to whom their prime broker's affiliated bank initiates a syndicated loans. Specifically, we analyze funds' holding changes in the calendar quarter before a loan announcement. In the analysis that follows, an event is defined as a bank initiating a loan to a firm in a given quarter. The stock of the borrowing firm is designated as the treated stock for that loan event. All hedge funds whose prime brokers are affiliated with the lending bank are designated as connected funds for that loan event. Our hypothesis is that, if hedge funds obtain information about these stocks, they will make bigger changes in their portfolios for these treated stocks in the quarter before the loan event. As mentioned earlier, our empirical strategy relies on two control groups: (i) the same fund's trades in non-treated stocks (i.e., the SFDS test) and (ii) unconnected funds' trade in the treated stock (i.e, the SSDF test).

To examine this hypothesis, we estimate the following linear regression:

$$\Delta Ownership_{i,j,t-1} = \beta Loan_{i,j,t} + \delta' StockVars_{j,t-1} + \theta' CompVars_{i,t-1} + \gamma_{k,t-1} + \varepsilon_{i,j,t-1}, \quad (1)$$

where *i* indexes fund companies, *j* indexes stocks, and *t* indexes time. The dependent variable in this regression is $\Delta Ownership_{i,j,t-1}$ which is the absolute value of the change in fund company *i*'s ownership in stock *j* scaled by its AUM in the quarter prior to the loan being initiated (i.e., change from the holdings at the end of t-2 to the holdings at the end of t-1). $Loan_{i,j,t}$ is an indicator variable equal to 1 if fund company *i*'s prime broker initiates a loan to stock *j* at time *t*. $StockVars_{j,t-1}$ is a vector of stock-level variables that includes *Size*, *Momentum*, *Return Volatility*, *Volume*, and *Institutional Ownership*. $CompVars_{i,t-1}$ is a vector of company-level variables that includes *Fund Size*, *Fund Return*, *Fund Flows*, *Management Fee*, *Incentive Fee*, *Lockup Period*, *High Water Mark*, and *Offshore*. $\gamma_{k,t-1}$ represents fund company×quarter and stock×quarter fixed effects for the SFDS and SSDF tests, respectively, in our most robust specifications. We also estimate these regressions by including fund company and quarter fixed effects in the SFDS test or stock and quarter fixed effects in the SSDF test rather than the aforementioned fund company×quarter or stock×quarter fixed effects.

The results are presented in Table 2. Panel A contains the regressions using the SFDS control group. This analysis contains fund company-quarter observations where the fund's prime broker initiated a loan to a borrowing firm in the subsequent quarter. Hence, this analysis contains all connected funds. The regression compares a connected fund's holdings changes for the treated stock against that fund's holdings changes for the untreated stocks. The key coefficient of interest, *Loan*, is positive and statistically significant at the 1% level for all specifications. In our basic case regression (i.e., column 1 of Panel A) as an example, the coefficient on *Loan* is 0.171 with a *t*-statistic of 5.48. In our most exhaustive specification (column 4 of Panel A) that includes

fund×quarter fixed effects and controls for stock characteristics such as size and liquidity, our point estimate remains highly statistically significant (β = 0.088, with *t*-stat = 3.86). Our results are also economically significant. For instance, based on results in column 4, connected hedge funds make 0.088 percentage point larger changes in the stocks of companies to whom their prime brokers make loans as compared to the stocks of non-loan receiving companies in their portfolios. Considering that the average change in a fund company's positions is 0.218%, this difference is economically significant (i.e., equal to 40% of the average ownership change).

[Insert Table 2 about here]

Panel B contains the results when we use the SSDF control group. This regression compares the changes in the stock-ownership of treated stocks (companies who receive bank loans) by fund companies whose prime brokers initiate loans ("treated" fund company) against funds whose prime brokers are not involved in the loan initiation ("untreated" fund companies). The coefficient on *Loan* in column 1 is 0.140 and has a *t*-statistic of 4.26. In the most robust specification with stock-quarter fixed effects, our point estimate remains highly economically (β = 0.083) and statistically (*t*-stat = 2.09) significant. This result suggests that fund companies whose prime brokers initiate these loans make 0.083% larger changes in their portfolios in these stocks than do fund companies whose brokers do not initiate these loans. Combined, the results in Table 2 suggest that hedge funds make abnormally large trades in the stock of the companies to whom their prime broker's affiliated bank initiates a syndicated loan.

3.2. Placebo Tests on Trading Behavior

Although the results above provide preliminary evidence that hedge funds trade aggressively on stocks in which their prime brokers have private information, there could be other explanations

for these results. For the SFDS case (Panel A), an alternative explanation could be that private information about the loan spills over to the public market. Hence, all funds would trade these stocks more aggressively. For the SSDF case (Panel B), one could argue that the treated hedge funds are fundamentally different from the control funds. For example, the treated funds just trade more aggressively all the time.[10] In each of these cases, the alternative explanation is inconsistent with the results from the other control specification. For example, if the SFDS results are driven by private information about the loan spilling over to the public market, we are unlikely to observe SSDF results. Similarly, if the SSDF results are driven by the alternative explanation that treated hedge funds are fundamentally different from the control funds, we would be unlikely to observe the SFDS results. To ensure such alternatives are not driving our results, we perform a series of cross-sectional and time series placebo tests.

We start with the cross-sectional placebo tests to address omitted variable concerns in the SFDS specification. If the results in Panel A of Table 2 are driven by information spillover about borrowing firms through other channels, then we should find similar results when analyzing unconnected funds. Keeping the event definition same as in Panel A, we switch from analyzing connected funds' trading behavior to analyzing unconnected funds' trading behavior during the event windows. We compare unconnected funds' holding changes in the treated stocks to their holding changes in the other stocks in their portfolios by estimating equation 1 for the sample of unconnected funds. Because these funds' prime brokers are not initiating the loans for these stocks, we expect that their trading in these stocks will be significantly lower than that that of connected

[10] Our test setting and regression specification minimizes this concern. By construction, each fund in our dataset gets treated at least once. We do not include funds whose prime brokers are not affiliated with any financial institution active in syndicated loan underwriting. This ensures that control funds are not very different from treated funds for a given loan event. In addition, our regression specification controls for several fund characteristics. The only remaining concern is that some hedge funds get treated more often than others, and those that are treated frequently might be different from those that get treated less often.

funds whose prime brokers actually do initiate the loans. We use *F*-tests to determine whether the trading behavior for the two groups of funds is statistically different from one another.

The results of these tests are contained in column 1 of Table 3. The coefficient on *Loan* is higher for the connected sample of funds as compared to the unconnected sample. As shown in row (c), the difference in coefficients is economically large and statistically significant at the 1% level (diff.=0.063, with a *p*-value of 0.8%). This cross-sectional placebo test provides further evidence that connected hedge funds' trades are especially large in the companies to whom their prime brokers are giving loans.

[Insert Table 3 about here]

Next, we use time-series placebo tests to alleviate concerns that our SSDF results are driven by time-invariant omitted variables. We repeat our prior SSDF analyses of connected hedge funds except artificially changing the loan initiation dates to 1- and 2-years before the loans took place. Our hypothesis is that prime brokers could pass along information to their hedge fund clients about the companies to whom they are giving loans. If our results are instead driven by time invariant omitted fund characteristics, then we should find similar results during the placebo periods. Columns 2 and 3 report results of these analyses. The coefficient on *Loan* for the connected sample of funds is economically and statistically insignificant for the two placebo time periods. In particular, as shown in row (a), the point estimates are 0.002 and 0.007 for 1- and 2-years before the loan event, respectively. This implies that in the placebo time periods, connected funds' trading in treated stocks is not different from their trading in other stocks. In row (d), we further formally test the difference in the coefficients on *Loan* for the actual vs. the placebo periods. Our results show that the differences are statistically significant and large in magnitude (diff.=0.085 and *p*-value=0.8% for minus 1 year, and diff.=0.081 and *p*-value=0.6% for minus 2 year).

Finally, we combine the cross-sectional and time-series placebo tests and conduct a diff-in-diff-diff test. As in our analysis in column 1, we first carry out the cross-sectional placebo tests by comparing the connected funds and the unconnected funds during these placebo periods. Our results suggest that the difference in trading behavior is economically small and statistically insignificant during these placebo periods, as shown in row (c) and columns (2) and (3). Hence, the only time the two groups of funds differ in their trading behavior is in the period in which connected funds' broker-affiliated banks actually initiate the loans. Next, we compute the difference in the differences calculated above in row (c) for the actual period and the two placebo periods. As presented in row (e) of Table 3, both differences are large in magnitude and statistically significant at 10% or better. Taken together, our results in this section provide further evidence that hedge funds make abnormally large trades in stocks of the corporate clients of their prime brokers.

3.3. Trading Performance

The results in Section 3.1 and 3.2 provide strong evidence that hedge funds make abnormally large trades in the stocks to which their prime brokers initiate a loan. Since this evidence is on the absolute trade size, it does not necessarily suggest that these are informed trades. If hedge funds gain an information advantage due to their connection via their prime brokers, one would expect that these funds not only make larger size, but also more profitable trades. In this section, we investigate whether connected hedge funds have abnormal performance in their trades of these treated stocks.

To do so, we adopt an event study methodology and begin by calculating several performance measures for each stock using its daily returns. We compute each variable for the

period that begins at the beginning of the quarter the loan is initiated and ends two trading days after the loan is initiated. The first variable we compute is *Raw Return*, which is equal to the cumulative return over the period. Next, *4-Factor Alpha* is calculated by regressing a stock's daily returns on the Fama-French (Fama and French (1993)) market, size, and value factors plus the Carhart (1997) momentum factor. The intercept of the regression is *4-Factor Alpha*. Finally, we compute *DGTW* as the difference between the stock's cumulative daily return and that of its characteristic-based portfolio as in Daniel et al (1997).

Following Ivashina and Sun (2011), we compute our performance measure based on whether a fund increases or decreases its position in a given stock. Specifically, we create a variable *I* that is equal to 1 if a fund increases its position in a stock, 0 if a fund maintains its current position in a stock, and -1 if a fund decreases its position in a stock. We then multiply the stock's actual return (or alpha) by *I* and compare the performance of the funds' trading in the stocks receiving loans to our two control groups, the SFDS and SSDF.

The results for the SFDS group are presented in Table 4. We begin in Panel A by comparing the difference in the means of the two groups using univariate *t*-tests. Our main result is that connected funds' trades in stocks that receive loans outperform their trades in other stocks by 1.87 – 2.12% on an annual basis. The difference in performance is statistically significant for all four performance measures. For example, trades in loan stocks earn an annual return of 2.76% based on *4-Factor Alpha* and 2.24% based on *DGTW*, while trades in stocks not receiving loans only earn an annual return of 0.90% based on *4-Factor Alpha* and 0.12% based on *DGTW*.

[Insert Table 4 about here]

To confirm that our results are not driven by the stocks' characteristics, we estimate the following linear regressions:

$$I_{i,j,t-1} * Return_{j,t} = \beta Loan_{i,j,t} + \delta StockVars_{j,t-1} + \gamma_{i,t} + \varepsilon_{i,j,t-1} \quad (2)$$

where *Loan* is as defined throughout the paper and *StockVars* is a vector of stock characteristics that includes market capitalization, book-to-market, momentum, liquidity, average trading volume, and institutional ownership. γ is a vector of fund×loan fixed effects. Essentially, for a given fund-quarter, we compare the trading performance in treated vs. non-treated stocks. If connected hedge funds do receive information from their prime brokers, we expect the coefficient on *Loan* to be positive and significant.

Panel B of Table 4 contains the results of these regressions. The coefficients on *Loan* are uniformly positive and statistically significant at the 10% level or better. The coefficients range from 0.021 to 0.024. As the results in columns (3) and (4) suggest, connected hedge fund performance on treated stocks are better than non-treated stocks by 2.1% and 2.4% per year based on *4-Factor Alpha* and *DGTW*, respectively.

Next, we repeat our performance analysis using the SSDF control group. If funds receive information from their prime brokers, we expect that the funds whose brokers make the loans will outperform the funds whose brokers do not make the loans on these stocks' trades. Since the return on the treated stock is exactly the same for both types of funds, this difference is driven entirely by the informed funds trading more "correctly" than their uninformed peers. In other words, they are more likely to buy future winners and sell future losers than their unconnected peers.

Table 5 contains the results. We present the univariate analysis in Panel A and the multivariate regression results in Panel B. In the univariate comparisons, we find that the trades in treated stocks by connected funds outperform the trades in the same stocks by unconnected funds by 1.8% – 2.9% annually. These differences are statistically significant at the 10% level or better in all four cases.

[Insert Table 5 about here]

Panel B contains the results from the multivariate regressions. Again, the coefficients on *Loan* are uniformly positive and range from 0.024 to 0.045. Each of the coefficients is statistically significant at the 5% level with the exception of the coefficient in Column 2 which is significant at the 10% level. These results suggest that, even after controlling for stock characteristics, connected funds outperform their counterparts by an annualized 2.5% – 4.5% on their trades of treated stocks. It is important to note that, because these regressions are estimated on our SSDF sample, the only difference in the dependent variable is based on whether a fund increased or decreased its position on the treated stock. Thus, the results suggest that connected funds whose brokers are those initiating loans trade in the correct direction on the treated stocks more frequently. Combined, the results in Tables 4 and 5 provide strong evidence in favor of our hypothesis that a fund's prime broker is a source of information about the stocks to whom they give loans.

Our next set of tests examines funds' performance on these loan stocks separately for their buys and sells. One major limitation of 13F filings is that they only include the filer's long positions. Thus, if a prime broker passes along negative information to a fund and the fund shorts that stock, we will be unable to see that trade. For this reason, we expect that much of the outperformance we are documenting will be concentrated in the positive portfolio changes. To examine this hypothesis, we estimate the regressions in Equation 2 separately for each fund's buys and sells using the SFDS sample.

Table 6 contains the results. Consistent with our conjecture, for the sample of buy positions, we see that the coefficients on *Loan* are positive for all four regressions and statistically significant in 3 out of 4 cases. The coefficients range from 0.018 for *4-Factor Alpha* to 0.047 for *DGTW*.

However, for the regressions conducted on the sample of sell positions, the coefficients on *Loan* are equally likely to be positive or negative and none are statistically significant. These results suggest that either funds benefit most by trading on positive information or that data limitations (only long positions are reported in 13F filings) prevent us from finding evidence of informed trading on negative information.

[Insert Table 6 about here]

3.4. Additional Analysis of Trading Performance

3.4.1. Revenue Potential for Prime Brokers and Trading Performance

In this subsection, we examine whether trading is more profitable for certain types of fund companies. If prime brokers are providing information to their hedge fund clients, one should expect them to provide better information to clients who give them more business. Although we cannot directly observe the fees each hedge fund client pays to its broker(s), we can use proxies for this variable. One proxy of this variable would be the level of a fund company's AUM in equity strategies (long-short equity and equity market neutral). Because prime brokers earn commissions by executing trades and providing financing for these trades, fund companies that primarily trade in equities and those who take short positions would presumably pay higher fees. We expect prime brokers to provide better information to clients that generate high brokerage revenue, which would, in turn, mean that these clients should perform better on the loan stocks in their portfolios.

To test this conjecture, we construct an indicator variable, *High Equity AUM*, to be equal to 1 when a fund company is in the top quartile of equity AUM and 0 otherwise. We then augment the regressions in Equation 2 by adding *High Equity AUM* and its interaction with *Loan*.[11] If prime

[11] Note that the direct effect of *High Equity AUM* gets absorbed in the fund × loan date fixed effects.

brokers give better information to more profitable clients, we expect the coefficient on the interaction term, *Loan* × *High Equity AUM*, to be positive and statistically significant. We present the results in Table 7 Panel A. The evidence supports our claim. The coefficients on *Loan* × *High Equity AUM* are large and statistically significant at the 1% level for all four performance measures. The magnitude of the coefficients ranges from 0.059 – 0.083 which means that connected fund companies with high levels of equity AUM outperform connected funds with lower levels of equity AUM on their trades of treated stocks by 5.9% - 8.3%. The sum of the coefficients on *Loan* and the interaction captures the outperformance in treated vs. non-treated stocks for connected hedge funds in the top quartile of equity AUM. Our results indicate that this outperformance amounts to 7.2% based on four-factor alpha and 8.7% based on DGTW characteristic-adjusted return, on an annualized basis.

[Insert Table 7 about here]

Next, we construct two new variables that directly measure the two broad sources of revenue for prime brokers – turnover and financing. We construct the dollar turnover measure for each fund company from the holding changes reported in 13F. Our financing measure for each fund company is constructed by multiplying the equity AUM by an indicator variable that takes the value of 1 if the fund uses leverage or margin financing. The variable *High $ Turnover* equals 1 when a fund company is in the top quartile of dollar turnover and 0 otherwise. Similarly, the variable *High Leverage* equals 1 when a fund company is in the top quartile of our measure of financing and 0 otherwise. Panel B tests whether funds that provide more execution business to prime brokers outperform other funds. The results suggest that high turnover funds outperform the lower turnover funds on their trades of treated stocks by 4.5% - 6.6%. Similarly, the results in Panel C imply that funds with higher broker financing outperform funds with lower broker

financing on their trades of treated stocks by 3.6% - 6.6%. These results provide further evidence in support of our main hypothesis as they suggest that the quality of the information provided to hedge fund firms depends on their value to the prime broker.

3.4.2. Are Larger Trades More Profitable?

If connected hedge funds receive private information from their prime brokers and make trades in treated stocks based on this information, then both the direction and size of these trades should be informative about future stock performance. In this subsection, we test whether larger trades by connected hedge funds before loan events predict larger future abnormal returns for the treated stock.

To perform this analysis, we focus on the connected funds, treated stocks sample. We estimate the following linear regression:

$$Return_{j,t} = \beta \Delta Ownership_{i,j,t-1} + \delta' StockVars_{j,t-1} + \theta' CompVars_{i,t-1} + \gamma_i + \mu_{t-1} + \varepsilon_{i,j,t-1} \quad (3)$$

where i indexes fund companies, j indexes stocks, and t indexes time. The dependent variable is stock performance measure computed for the period that begins at the beginning of the quarter the loan is initiated and ends two trading days after the loan is initiated. The key explanatory variable is $\Delta Ownership_{i,j,t-1}$ which is the change in fund company i's ownership in stock j scaled by its AUM in the quarter prior to the loan being initiated. $StockVars_{j,t-1}$ is a vector of stock-level variables, $CompVars_{i,t-1}$ is a vector of company-level variables, and γ_i and μ_{t-1} represent fund and year fixed effects, respectively.

If connected funds' trades in treated stocks are really driven by private information about these stocks, then relatively larger trades in treated stocks should be associated with relatively larger future stock performances. Hence, we should expect the coefficient on $\Delta Ownership_{i,j,t-1}$

to be positive and statistically significant. Table 8 reports the results of this analysis. The coefficients on $\Delta Ownership_{i,j,t-1}$ range from 0.130 to 0.173 and are statistically significant at the 5% level or better in all four specifications. Economically, the coefficient of 0.142 in column 3 suggests that one standard deviation increase in holdings change in a treated stock by a connected fund is associated with a 3.23% increase in four-factor alpha on an annualized basis. Similarly, thet coefficient of 0.130 in column 4 suggests that one standard deviation increase in holdings change in a treated stock by a connected fund is associated with a 3.00% increase in DGTW characteristic-adjusted return on an annualized basis. These results provide further support to the hypothesis that hedge funds trade on private information about syndicated loan events that they receive from their prime brokers.

[Insert Table 8 about here]

4. Conclusion

The popular press often accuses hedge funds of trading on information not available to other market participants. In this paper, we provide evidence that one source of such private information is a fund's prime broker. Specifically, we find that hedge funds engage in abnormal trading activity in the stocks of firms to which their prime broker's affiliated bank initiates a syndicated loan. Moreover, these trades subsequently generate superior performance compared to other trades. In particular, the outperformance amounts to 7.2% – 8.7%, annualized, for trades by hedge funds in the top quartile of revenue generation potential for prime brokers.

Our results have implications for academics, regulators, and corporations. For academics, our paper contributes to our understanding of informed trading by hedge funds, and documents evidence suggestive of information leakage by lending institutions. For regulators, our paper's

results suggest that financial institutions may be breaching the Chinese walls that are supposed to exist between divisions to provide information to more favored clients. Lastly, our results imply that corporations should be concerned about the security of the information that they provide to their lenders.

References

Acharya, V., and Johnson, T., 2007. Insider Trading in Credit Derivatives. Journal of Financial Economics. 84, 110-141.

Agarwal, V., Jiang, W., Tang, Y., Yang, B., 2013. Uncovering Hedge Fund Skill from the Portfolio Holdings They Hide. Journal of Finance. 68, 739-783.

Aragon, G., and Martin, J. S., 2012. A Unique View of Hedge Fund Derivatives Usage: Safeguard or Speculation? Journal of Financial Economics. 105, 436-456.

Brunnermeier, M., and Nagel, S., 2004. Hedge Funds and the Technology Bubble. Journal of Finance. 59, 2013-2040.

Carhart, M., 1997. On Persistence in Mutual Fund Performance. Journal of Finance. 52, 57-82.

Chava, S., Roberts, M., 2008. How Does Financing Impact Investment? The Role of Debt Covenants. Journal of Finance. 63, 2085-2121.

Chen, T., and Martin, X., 2011. Do Bank-Affiliated Analysts Benefit from Lending Relationships? Journal of Accounting Research. 49, 633-675.

Chung, J., Kang, B., 2016. Prime Broker-Level Comovement in Hedge Fund Returns: Information or Contagion? Review of Financial Studies. 29, 3321-3353.

Daniel, K., Grinblatt, M., Titman, S., Wermers, R., 1997. Measuring Mutual Fund Performance with Characteristic-Based Benchmarks. Journal of Finance. 52, 1035-1058.

Di Maggio, M., Franzoni, F., Kermani, A., and Sommavilla, C., 2017. The Relevance of Broker Networks for Information Diffusion in the Stock Market. NBER Working Paper No. w23522.

Fama, E. F., and French, K. R., 1993. Common risk factors in the returns on stocks and bonds, Journal of Financial Economics, 33: 3-56

Gargano, A., Rossi, A. G., and Wermers, R., 2016. The Freedom of Information Act and the Race Toward Information Acquisition. Forthcoming, Review of Financial Studies.

Gao, M., Huang, J., 2016. Capitalizing on Capitol Hill: Informed trading by hedge fund managers. Journal of Financial Economics. 121, 521-545

Griffin, .John M., Tao Shu, Selim Topaloglu, 2012. Examining the Dark Side of Financial Markets: Do Institutions Trade on Information from Investment Bank Connections?. The Review of Financial Studies, 25, 2155–2188

Ivashina, V., and Sun, Z., 2011. Institutional stock trading on loan market information. Journal of Financial Economics. 100, 284-303.

Ivashina, V., Nair, V., Sauders, A., Massoud, N., and Stover, R., 2009. Bank Debt and Corporate Governance. Review of Financial Studies. 22, 41-77.

Klein, A., and Li, T., 2015. Acquiring and Trading on Complex Information: How Hedge Funds Use the Freedom of Information Act. Working Paper.

Massa, M., and Rehman, Z., 2008. Information Flow Within Financial Conglomerates: Evidence from the Banks-Mutual Funds Relationship. Journal of Financial Economics. 89, 288-306.

Massoud, N., Nandy, D., Saunders, A., Song, K., 2011. Do hedge funds trade on private information? Evidence from syndicated lending and short-selling. Journal of Financial Economics. 99, 477-499.

Rhinesmith, J., 2015. Conviction and volume: Measuring the information content of hedge fund trading. Working Paper.

Roberts, M., Sufi, A., 2009. Renegotiation of financial contracts: Evidence from private credit agreements. Journal of Financial Economics. 93, 159–184.

Qian, H., and Zhong, Z., 2017, Do Hedge Funds Possess Private Information in IPO Stocks? Evidence from Post-IPO Holdings. *Forthcoming*, Review of Asset Pricing Studies.

Appendix

Variable Definitions

Variable	Description
Fund-company variables	
Number of Stocks Held	The total number of stocks disclosed in the fund company's 13F filing in a given quarter.
Fund Returns	The average of the annual returns of the hedge funds managed by a fund company.
Fund Flows	The average of annual percentage flows of the hedge funds managed by a fund company.
Fund Size	The average of the assets under management of the hedge funds managed by a fund company.
Management Fee	The average management fee changed by the hedge funds managed by a fund company.
Incentive Fee	The average incentive fee changed by the hedge funds managed by a fund company.
Lockup Period	The average lockup period, in months, enforced by the hedge funds managed by a fund company.
High Water Mark	The percentage of hedge funds managed by a fund company that have a high water mark provision.
Offshore	The percentage of hedge funds managed by a fund company that are domiciled offshore.
Stock-holding variables	
Change in Ownership	The absolute value of the percentage change of a fund company's AUM for a given stock holding.
Momentum	The cumulative stock return for the prior 12 months.
Volume	The average trading volume for a given stock over the past 12 months, scaled by shares outstanding.
Return Volatility	The standard deviation of the prior 12 monthly returns
Institutional Ownership	The percentage of shares outstanding owned by 13F institutions
Market Capitalization	The total number of shares outstanding multiplied by current share price.
Amihud	The square root of the absolute value of the daily return over daily dollar volume.
Book to Market	Book assets divided by (book assets − book equity + market equity).

Table 1 – Summary Statistics

Panel A reports summary statistics for the fund company variables we use in our analysis. We report the statistics of these variable tabulated at the fund company – quarter horizon. Panel B contains summary statistics for the stock holding variables we use in our analysis. The statistics for these variables are tabulated at the individual holding level. All variables are defined in the Appendix and are winsorized at the 1% and 99% levels.

Panel A. Fund Company Variables

Variable	Mean	Median	Std. Dev	N
Number of Stocks Held	296.13	148.00	376.15	2,479
Fund Returns	11.40%	9.23%	17.99%	2,234
Fund Flow	39.53%	6.41%	120.19%	1,965
Fund Size (in $mill.)	336.23	108.31	566.78	2,080
Management Fee (%)	1.34	1.38	0.41	2,290
Incentive Fee (%)	18.20	20.00	4.52	2,290
Lockup Period (in months)	12.95	12.00	4.95	2,290
High Water Mark (0/1)	0.75	1.00	0.37	2,290
Offshore (0/1)	0.52	0.50	0.36	2,290

Panel B. Stock Holding Characteristics

Variable	Mean	Median	Std. Dev	N
|Change in Ownership| (scaled by AUM)	0.22%	0.04%	0.74%	728,901
Momentum	16.54%	11.40%	44.25%	705,825
Volume	0.21%	0.17%	0.15%	705,825
Return Volatility	11.52%	9.93%	6.16%	705,825
Institutional Ownership	68.95%	72.22%	21.55%	726,946
Market Capitalization ($ millions)	12,494	2,050	35,042	726,802
Amihud	0.013	0.001	0.032	726,799
Book to Market	0.579	0.410	0.708	690,540

Table 2 – Hedge Fund Trading in Connected Stocks

This table provides results on whether hedge funds trade abnormally in the stocks of firms to which their prime brokers initiate syndicated loans. We regress hedge funds' absolute changes in ownership on *Loan* and other stock and fund characteristics. *Loan* is an indicator variable equal to 1 if the fund company's prime broker initiates a loan on the stock in the following quarter, and 0 otherwise. The stock and hedge fund control variables are as defined in the appendix. Panel A contains the regressions for the same fund, different stocks specification (SFDS). Panel B contains the regressions for the same stock, different funds specification (SSDF). Standard errors are adjusted for heteroscedasticity and clustered at the fund company (Panel A) or the stock level (Panel B) and *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Same Fund, Different Stocks Specification

	Dep. Var. = |ΔOwnership| (scaled by AUM)			
	(1)	(2)	(3)	(4)
Loan	0.171***	0.149***	0.130***	0.088***
	(5.48)	(4.26)	(5.10)	(3.86)
Market Cap. (log)		0.047***		0.049***
		(10.53)		(11.51)
Momentum		0.009***		0.010***
		(3.74)		(4.36)
Return Vol.		-0.020		-0.031
		(-0.73)		(-1.13)
Volume		7.359***		6.946***
		(5.09)		(5.02)
Institutional Ownership		0.018		0.021
		(1.25)		(1.39)
Fund Returns		-0.045**		
		(-2.10)		
Fund Flows		0.000		
		(1.21)		
Log Fund Size		-0.000		
		(-0.82)		
Management Fee		-0.007		
		(-0.22)		
Incentive Fee		-0.005**		
		(-2.17)		
Lockup Period		-0.005		
		(-1.28)		
High Water Mark		0.062*		
		(1.73)		
Offshore		0.026		
		(0.67)		
Fund Co. and Qtr. FE	Yes	Yes	No	No
Fund Co. × Qtr. FE	No	No	Yes	Yes
Observations	728,899	573,574	728,899	699,855
R-squared	0.222	0.244	0.287	0.313

Panel B. Same Stock, Different Funds Specification

	Dep. Var. = |ΔOwnership| (scaled by AUM)			
	(1)	(2)	(3)	(4)
Loan	0.140***	0.089**	0.133***	0.083**
	(4.26)	(2.31)	(4.01)	(2.09)
Market Cap. (log)		0.205***		
		(5.31)		
Momentum		0.000		
		(0.60)		
Return Vol.		0.366		
		(1.02)		
Volume		20.665*		
		(1.85)		
Institutional Ownership		0.024		
		(0.13)		
Fund Returns		-0.148*		-0.161**
		(-1.79)		(-2.06)
Fund Flows		0.001***		0.001***
		(32.36)		(18.35)
Log Fund Size		-0.000***		-0.001***
		(-2.84)		(-3.52)
Management Fee		0.006		0.007
		(0.31)		(0.40)
Incentive Fee		0.017***		0.016***
		(8.32)		(7.89)
Lockup Period		0.011***		0.011***
		(4.65)		(4.67)
High Water Mark		-0.037**		-0.024
		(-1.10)		(-0.71)
Offshore		-0.097***		-0.092***
		(-3.34)		(-3.08)
Stock and Qtr FE	Yes	Yes	No	No
Stock × Qtr FE	No	No	Yes	Yes
Observations	43,656	33,980	43,645	35,031
R-squared	0.0551	0.074	0.087	0.106

Table 3 – Placebo Tests

This table compares regression results of changes in stock holdings for samples of *Connected* versus *Unconnected* hedge fund companies. *Connected* fund companies are those fund companies whose prime brokers initiate loans to a given stock while *Unconnected* fund companies are those who hold a given stock but whose prime brokers did not initiate a loan to that stock. We use the regression specification in column (4) of Panel A in Table 2 using the actual date of loan initiation as well as for two placebo periods: minus 1 year and minus 2 years. *Loan* is an indicator variable equal to 1 if the stock received a loan in the next quarter and 0 otherwise. The differences in coefficients as well as *F*-tests of the significance of these differences are reported. Standard errors are adjusted for heteroscedasticity and clustered at the fund company level and *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

	(1) Actual Period	(2) Minus 1 Year Placebo	(3) Minus 2 Year Placebo
(a) Connected Funds: *Loan*	0.088***	0.002	0.007
(b) Unconnected Funds: *Loan*	0.025***	0.007	-0.004
Cross-sectional placebo test			
(c) Difference for Connected – Unconnected [(a) - (b)]	0.063***	-0.005	0.011
p-value of the Difference	(0.008)	(0.848)	(0.530)
Time-series placebo test: Connected Funds			
(d) Difference for Actual – Placebo [(1) - (2)] & [(1) - (3)]		0.085***	0.081***
p-value of the Difference		(0.008)	(0.006)
Combination of cross-sectional and time-series placebo tests			
(e) Diff. in diff. for Connected – Unconnected and Actual – Placebo		0.068**	0.052*
p-value of the Difference		(0.046)	(0.086)

Table 4 – Performance of Hedge Fund Trades: Same Fund, Different Stocks

This table reports returns of hedge fund trades in stocks of firms that do and do not receive loans from their prime brokers. Returns are calculated as $I_{i,j,t-1} \times ReturnMeasure_{j,t}$, where $I_{i,j,t-1}$ is equal to 1 if fund company *i* increased its position in stock *j* in the quarter before the loan is initiated, 0 if fund company *i* made no change in its position in stock *j*, and -1 if fund company *i* decreased its position in stock *j* in that quarter. $ReturnMeasure_{j,t}$ is either the raw return, CAPM alpha, 4-factor alpha, or DGTW measure for stock *j* and is calculated using the daily returns from the beginning of the quarter the loan is initiated until two trading days after the loan is announced. Panel A reports the univariate results and Panel B reports the results of multivariate regressions where the variable of interest is *Loan*, an indicator variable equal to 1 for stocks that receive loans and 0 for those stocks that do not receive loans. The stock-level control variables are defined in the Appendix. Standard errors are adjusted for heteroscedasticity and clustered by fund company × loan initiation date and *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Univariate Tests

	Raw Return	CAPM Alpha	4-Factor Alpha	DGTW
Loan Stocks	3.21%	2.29%	2.76%	2.24%
No Loan Stocks	1.19%	0.40%	0.90%	0.12%
Difference	2.02%*	1.89%*	1.87%*	2.12%**
p-value of Difference	0.089	0.069	0.087	0.038

Panel B. Multivariate Regressions

	(1) Raw Return	(2) CAPM Alpha	(3) 4-Factor Alpha	(4) DGTW
Loan	0.024**	0.021**	0.021*	0.024**
	(2.04)	(2.00)	(1.90)	(2.34)
Market Cap. (log)	-0.000	-0.001	-0.002***	-0.001
	(-0.03)	(-1.53)	(-4.26)	(-1.10)
Book to Market	0.002	0.001	0.000	0.002*
	(1.47)	(0.76)	(0.09)	(1.87)
Amihud	-0.000***	-0.000***	-0.000***	-0.000**
	(-3.65)	(-3.58)	(-3.41)	(-2.11)
Momentum	-0.000***	-0.000	0.000	-0.000***
	(-3.30)	(-0.01)	(0.18)	(-9.11)
Return Volatility	-0.020	-0.069***	0.004	-0.063***
	(-0.84)	(-3.81)	(0.22)	(-3.31)
Volume	0.704	0.992**	0.992*	0.600
	(1.17)	(2.02)	(1.94)	(1.23)
Inst. Ownership	0.011**	-0.004	-0.008**	-0.006
	(2.26)	(-0.97)	(-2.26)	(-1.46)
Fixed Effects	Fund × Loan	Fund × Loan	Fund × Loan	Fund × Loan
Observations	1,756,689	1,756,689	1,756,689	1,698,163
R-squared	0.021	0.006	0.004	0.008

Table 5 – Performance of Hedge Fund Trades: Same Stock, Different Funds

This table reports returns on hedge funds trades in stocks of firms that receive loans from their prime brokers, compared to the trades in the same stock of unconnected hedge funds. Returns are calculated as $I_{i,j,t-1} \times ReturnMeasure_{j,t}$, where $I_{i,j,t-1}$ is equal to 1 if fund company *i* increased its position in stock *j* in the quarter before the loan is initiated, 0 if fund company *i* made no change in its position in stock *j*, and -1 if fund company *i* decreased its position in stock *j* in that quarter. $ReturnMeasure_{j,t}$ is either the raw return, CAPM alpha, 4-factor alpha, or DGTW measure for stock *j* and is calculated using the daily returns from the beginning of the quarter the loan is initiated until two trading days after the loan is announced. Panel A reports the univariate results and Panel B reports the results of multivariate regressions where the variable of interest is *Loan*, an indicator variable equal to 1 for hedge funds whose prime broker initiates a loan to the stock and 0 otherwise. The stock-level control variables are defined in the Appendix. Standard errors are adjusted for heteroscedasticity and clustered by stock × quarter and *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Univariate Tests

	Raw Return	CAPM Alpha	4-Factor Alpha	DGTW
Connected Funds	4.68%	2.93%	2.56%	2.57%
Unconnected Funds	1.83%	1.04%	0.33%	0.77%
Difference	2.86%**	1.89%*	2.23%**	1.80%*
p-value of Difference	0.018	0.051*	0.024	0.068

Panel B. Multivariate Regressions

	(1) Raw Return	(2) CAPM Alpha	(3) 4-Factor Alpha	(4) DGTW
Loan	0.045**	0.025*	0.040***	0.031**
	(2.16)	(1.81)	(2.97)	(2.18)
Log (AUM)	-0.005	-0.001	0.001	-0.001
	(-1.49)	(-0.59)	(0.22)	(-0.25)
Fund Return	0.068	0.009	0.000	0.049
	(1.28)	(0.30)	(0.01)	(1.53)
Fund Flows	0.000*	-0.000***	-0.000***	0.001
	(1.85)	(-5.83)	(-3.94)	(0.59)
Log Fund Size	0.010***	0.003	0.003	0.003
	(2.97)	(1.28)	(1.32)	(1.45)
Management Fee	-0.031***	-0.011	-0.006	-0.011
	(-2.61)	(-1.34)	(-0.77)	(-1.39)
Incentive Fee	-0.000	0.000	-0.001	-0.000
	(-0.22)	(0.26)	(-0.87)	(-0.42)
Lockup Period	-0.002	-0.001	-0.001	-0.000
	(-1.61)	(-0.95)	(-1.44)	(-0.63)
High Water Mark	-0.008	0.002	-0.004	0.002
	(-0.34)	(0.11)	(-0.29)	(0.12)
Offshore	-0.018	-0.007	-0.017	-0.012
	(-0.91)	(-0.53)	(-1.31)	(-0.90)
Fixed Effects	Stock × Quarter	Stock × Quarter	Stock × Quarter	Stock × Quarter
Observations	32,842	32,842	29,923	29,923
R-squared	0.103	0.100	0.103	0.094

Table 6 – Performance of Hedge Fund Trades: Buys vs. Sells

This table reports returns of hedge fund trades in stocks of firms that do and do not receive loans from their prime brokers. The regressions are run separately for fund companies' position increases and decreases. Returns are calculated as $I_{i,j,t-1} \times ReturnMeasure_{j,t}$, where $I_{i,j,t-1}$ is equal to 1 if fund company *i* increased its position in stock *j* in the quarter before the loan is initiated, 0 if fund company *i* made no change in its position in stock *j*, and -1 if fund company *i* decreased its position in stock *j* in that quarter. $ReturnMeasure_{j,t}$ is either the raw return, CAPM alpha, 4-factor alpha, or DGTW measure for stock *j* and is calculated using the daily returns from the beginning of the quarter the loan is initiated until two trading days after the loan is announced. Panel A reports the univariate results and Panel B reports the results of multivariate regressions where the variable of interest is *Loan*, an indicator variable equal to 1 for stocks that receive loans and 0 for those stocks that do not receive loans. The stock-level control variables are defined in the Appendix. Standard errors are adjusted for heteroscedasticity and clustered by fund company × loan initiation date and *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Buys

	(1)	(2)	(3)	(4)
	Raw Return	CAPM Alpha	4-Factor Alpha	DGTW
Loan	0.038**	0.038**	0.018	0.047***
	(2.45)	(2.38)	(1.09)	(3.07)
Market Cap. (log)	0.014***	0.011***	0.002**	0.023***
	(10.44)	(9.12)	(2.14)	(22.67)
Book to Market	0.000	-0.006**	-0.008***	0.003*
	(0.13)	(-2.56)	(-4.99)	(1.93)
Amihud	-0.001***	-0.001***	-0.001***	-0.001***
	(-4.89)	(-3.52)	(-4.01)	(-3.49)
Momentum	0.000**	0.000***	0.000***	0.000
	(2.29)	(4.23)	(8.17)	(1.07)
Return Volatility	-0.555***	-0.414***	-0.298***	-0.460***
	(-10.09)	(-9.47)	(-10.73)	(-10.10)
Volume	-5.868***	-3.234***	0.499	-5.794***
	(-6.37)	(-3.73)	(0.57)	(-7.06)
Inst. Ownership	0.080***	0.035***	0.031***	0.063***
	(8.94)	(4.74)	(4.16)	(7.86)
Fixed Effects	Fund × Loan	Fund × Loan	Fund × Loan	Fund × Loan
Observations	862,024	862,024	862,024	832,919
R-squared	0.257	0.044	0.0144	0.031

Panel B. Sells

	(1) Raw Return	(2) CAPM Alpha	(3) 4-Factor Alpha	(4) DGTW
Loan	-0.000	-0.002	0.026	0.005
	(-0.01)	(-0.09)	(1.48)	(0.29)
Market Cap. (log)	-0.017***	-0.013***	-0.006***	-0.026***
	(-12.25)	(-10.62)	(-6.75)	(-26.56)
Book to Market	0.002	0.007***	0.008***	-0.003
	(0.66)	(2.78)	(4.93)	(-1.61)
Amihud	0.001	-0.000	0.000	0.001*
	(1.63)	(-0.06)	(0.65)	(1.71)
Momentum	-0.000**	-0.000***	-0.000***	-0.000
	(-2.41)	(-2.99)	(-8.87)	(-1.44)
Return Volatility	0.568***	0.346***	0.340***	0.438***
	(9.45)	(7.28)	(11.31)	(8.59)
Volume	5.399***	4.051***	0.866	4.915***
	(5.46)	(4.30)	(0.84)	(5.68)
Inst. Ownership	-0.103***	-0.051***	-0.054***	-0.077***
	(-12.53)	(-6.40)	(-7.00)	(-10.66)
Fixed Effects	Fund × Loan	Fund × Loan	Fund × Loan	Fund × Loan
Observations	862,024	862,024	862,024	832,919
R-squared	0.269	0.044	0.016	0.032

Table 7 – Revenue Potential to Prime Brokers and Performance of Hedge Fund Trades

This table examines whether returns of hedge fund trades are related to the revenue potential to prime brokers as proxied by hedge funds' AUM in equity styles (e.g., long-short or market neutral). We carry out the analysis using the same fund, different stocks specification. Returns are calculated as $I_{i,j,t-1} \times ReturnMeasure_{j,t}$, where $I_{i,j,t-1}$ is equal to 1 if fund company *i* increased its position in stock *j* in the quarter before the loan is initiated, 0 if fund company *i* made no change in its position in stock *j*, and -1 if fund company *i* decreased its position in stock *j* in that quarter. $ReturnMeasure_{j,t}$ is either the raw return, CAPM alpha, 4-factor alpha, or DGTW measure for stock *j* and is calculated using the daily returns from the beginning of the quarter the loan is initiated until two trading days after the loan is announced. We define a dummy variable for the top quartile hedge funds companies based on their revenue potential to prime brokers. In Panel A, revenue potential is measured by hedge funds' AUM in equity styles (e.g., long-short or market neutral). In Panel B, revenue potential is measured by hedge funds' quarterly dollar turnover in holdings. In Panel C, revenue potential is measured by hedge funds' use of prime broker financing. Broker financing is measured by multiplying AUM in equity style by a dummy that equals 1 if the fund uses leverage or margin financing. In each panel, we interact the top quartile dummy with the *Loan* indicator variable, which equals to 1 for stocks that receive loans and 0 otherwise. The stock-level control variables are defined in the Appendix. The coefficients on these control variables are not reported to save space. Standard errors are adjusted for heteroscedasticity and clustered by fund company × loan initiation date and *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. High Equity AUM

	(1) Raw Return	(2) CAPM Alpha	(3) 4-Factor Alpha	(4) DGTW
Loan × High Equity AUM	0.079**	0.083***	0.059**	0.076***
	(2.55)	(3.07)	(2.06)	(2.97)
Loan	0.007	0.004	0.013	0.011
	(0.44)	(0.34)	(0.92)	(0.90)
Fixed Effects	Fund × Loan	Fund × Loan	Fund × Loan	Fund × Loan
Stock-level Controls	Yes	Yes	Yes	Yes
Observations	1,613,425	1,613,425	1,613,425	1,558,433
R-squared	0.020	0.00593	0.00361	0.00733

Panel B. High $ Turnover

	(1) Raw Return	(2) CAPM Alpha	(3) 4-Factor Alpha	(4) DGTW
Loan × High $ Turnover	0.055*	0.066**	0.045	0.060**
	(1.81)	(2.44)	(1.59)	(2.33)
Loan	0.012	0.005	0.012	0.015
	(0.79)	(0.41)	(0.87)	(1.19)
Fixed Effects	Fund × Loan	Fund × Loan	Fund × Loan	Fund × Loan
Stock-level Controls	Yes	Yes	Yes	Yes
Observations	1,569,480	1,569,480	1,569,480	1,516,745
R-squared	0.018	0.00582	0.00358	0.00672

Panel C. High Leverage

	(1) Raw Return	(2) CAPM Alpha	(3) 4-Factor Alpha	(4) DGTW
Loan × High Leverage	0.036	0.047*	0.049*	0.066***
	(1.20)	(1.76)	(1.74)	(2.58)
Loan	0.017	0.012	0.011	0.011
	(1.27)	(0.99)	(0.90)	(0.93)
Fixed Effects	Fund × Loan	Fund × Loan	Fund × Loan	Fund × Loan
Stock-level Controls	Yes	Yes	Yes	Yes
Observations	1,756,689	1,756,689	1,756,689	1,698,163
R-squared	0.021	0.00627	0.004	0.00764

Table 8 – Are Larger Trades More Profitable?

This table reports returns on connected hedge funds trades in stocks of firms that receive loans from their prime brokers. Return is either the raw return, CAPM alpha, 4-factor alpha, or DGTW measure for stock *j* and is calculated using the daily returns from the beginning of the quarter the loan is initiated until two trading days after the loan is announced. The key variable of interest is the change in connected fund company i's ownership in treated stock j scaled by its AUM in the quarter prior to the loan being initiated. The stock-level and fund-level control variables are defined in the Appendix. Standard errors are adjusted for heteroscedasticity and clustered by fund. *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
	Raw Return	CAPM Alpha	4-Factor Alpha	DGTW
Ownership Change	0.173***	0.154***	0.142**	0.130**
	(2.75)	(2.69)	(2.54)	(2.42)
Market Cap. (log)	-0.017***	-0.013***	-0.006***	-0.026***
	(-12.25)	(-10.62)	(-6.75)	(-26.56)
Book to Market	0.002	0.007***	0.008***	-0.003
	(0.66)	(2.78)	(4.93)	(-1.61)
Amihud	0.001	-0.000	0.000	0.001*
	(1.63)	(-0.06)	(0.65)	(1.71)
Momentum	-0.000**	-0.000***	-0.000***	-0.000
	(-2.41)	(-2.99)	(-8.87)	(-1.44)
Return Volatility	0.568***	0.346***	0.340***	0.438***
	(9.45)	(7.28)	(11.31)	(8.59)
Volume	5.399***	4.051***	0.866	4.915***
	(5.46)	(4.30)	(0.84)	(5.68)
Inst. Ownership	-0.103***	-0.051***	-0.054***	-0.077***
	(-12.53)	(-6.40)	(-7.00)	(-10.66)
Fund Return	0.068	0.009	0.000	0.049
	(1.28)	(0.30)	(0.01)	(1.53)
Fund Flows	0.000*	-0.000***	-0.000***	0.001
	(1.85)	(-5.83)	(-3.94)	(0.59)
Log Fund Size	0.010***	0.003	0.003	0.003
	(2.97)	(1.28)	(1.32)	(1.45)
Management Fee	-0.031***	-0.011	-0.006	-0.011
	(-2.61)	(-1.34)	(-0.77)	(-1.39)
Incentive Fee	-0.000	0.000	-0.001	-0.000
	(-0.22)	(0.26)	(-0.87)	(-0.42)
Lockup Period	-0.002	-0.001	-0.001	-0.000
	(-1.61)	(-0.95)	(-1.44)	(-0.63)

High Water Mark	-0.008	0.002	-0.004	0.002
	(-0.34)	(0.11)	(-0.29)	(0.12)
Offshore	-0.018	-0.007	-0.017	-0.012
	(-0.91)	(-0.53)	(-1.31)	(-0.90)
Fixed Effects	Fund & Year	Fund & Year	Fund & Year	Fund & Year
Observations	3,381	3,381	3,381	3,259
R-squared	0.141	0.087	0.0792	0.093