# Prime (Information) Brokerage*

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

June 2018

**ABSTRACT**

This paper documents that hedge funds gain an information advantage from their prime brokerage services-providing banks regarding the banks' corporate clients. We find that hedge funds make informed trades in the stocks of firms that obtain loans from their prime-broker banks. The connected hedge funds make abnormally large trades prior to the loan announcement and these trades display superior performance compared to other trades. The outperformance is greater for (i) trades of connected hedge funds that have higher revenue generation potential for prime brokers and (ii) trades in borrowing firms with higher information asymmetry. Finally, we find that the information edge connected hedge funds have is about the borrowing firm in general, rather than purely about the loan.

Keywords: hedge funds, prime brokers, investment banks, informed trading, loan originations

JEL Classification: G11; G12; G14; G23

* We have benefitted from helpful comments and suggestions from Vikas Agarwal, George Aragon, Eser Arisoy, David Brown, Chris Clifford, Serge Darolles, Richard Evans, Mark Flannery, Francesco Franzoni, Chris James, Andy Naranjo, Jay Ritter, Michael Ryngaert, Eddie Sanchez, Andrew Sinclair, Shelly Wong, and conference and seminar participants at the University of Alabama, University of Florida, University Paris Dauphine, CQA Fall 2017 Conference, Conference on Hedge Funds and Other Collective Investment Funds (Manchester, UK), 2017 ESMT Asset Management Conference (Berlin, Gemany), the RSFAS Summer Research Camp (2017), the Finance Down Under Conference (2018), and the Chicago Financial Institutions Conference (2018). We thank Charlie Costello, Nick DeRobertis, Pablo Gutierrez, and Haoran Lin for excellent research assistance. We gratefully acknowledge the award from the Chicago Quantitative Alliance 2017 Annual Academic Competition.

† Nitish Kumar is from the University of Florida, Warrington College of Business, PO 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.ua.edu. Tel: +1 205–348–5726.

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

## 1. Introduction

Prime brokers are central to the operation of most hedge funds. In addition to execution and custody services, prime brokers provide financing to hedge funds for their leveraged and short positions. In return, investment banks receive a substantial amount of revenue from hedge funds that use their prime brokerage services.[1] While the importance of the traditional services that hedge funds receive from their prime brokers is well-understood (e.g., Aragon and Strahan (2012)), this study uncovers a new benefit that hedge funds get from their prime-broker banks: an information advantage regarding the banks' corporate clients.

Investment banks often receive private information regarding their corporate clients as part of their advisory and origination activities. We use the setting of loan originations to identify the possession of nonpublic information by banks. A large literature in banking argues that banks obtain access to nonpublic information concerning the borrower as part of the due diligence process (e.g., Rajan (1992), Sufi (2007), Demiroglu and James (2010)). We argue that information-hungry hedge funds could benefit from the unique relationship they have with their prime-broker banks by availing of such non-public information.[2] If hedge funds do gain an information edge due to their prime-broker connections, we would expect hedge funds to make informed trades in the shares of firms that borrow from the fund's prime-broker bank.

We test this hypothesis by combining data on hedge fund prime-broker banks, loan originations, and hedge fund firms' 13F stock holdings. Using the merged dataset, we examine

[1] According to an estimate published on *Forbes*, prime brokerage services revenue account for about 35% of total equities trading revenues of investment banks (see "Improving Prime Brokerage Market Share Should Lift Profits at Goldman, Morgan Stanley", October 7, 2015). Another article published in *Bloomberg News* on March 21, 2005, "Investment Banks Are Too Dependent on Hedge Funds", estimates that more than one in every eight dollars of investment bank revenue comes from hedge fund clients.

[2] Hedge funds constantly seek for an information edge. For some anecdote evidence, 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.

whether hedge funds make larger, more profitable trades on the stocks of firms to whom their prime-broker bank originates loans. We refer to the stocks of firms that receive a bank loan in a given quarter as *treated* stocks in that quarter, and the hedge funds whose prime-broker bank originates the loan as *connected* hedge funds in that quarter. Our unique setting allows us to test the hypothesis in several different specifications. Our first test compares connected hedge funds' trades in treated stocks to these same funds' trades in non-treated stocks.[3] The second test compares connected hedge funds' trades in treated stocks to the trades in the same treated stock by unconnected hedge funds.

Our final and most robust specification includes both fund-company × quarter and stock × quarter fixed effects and tests for abnormally profitable trading in treated stocks by connected funds. It allows us to simultaneously explore (i) across-stock variations within each hedge fund portfolio and (ii) across-fund variation within each stock event. This test addresses both the concerns that (i) treated stocks are different from non-treated stocks and (ii) connected funds are different from non-connected funds. It helps us rule out alternative explanations that connected hedge funds make informed trades in treated stocks for reasons unrelated to their prime-broker connection.

Our results support the hypothesis that hedge funds gain an information advantage from their prime-broker banks. First, we find that connected hedge funds make abnormally large size trades in treated stocks *prior to* loan announcements. We measure trade size using the absolute value of quarterly holding changes scaled by the fund's assets under management (AUM). Our result shows that the absolute value of portfolio weight changes in treated stocks by connected hedge funds are 6.9 basis points (bps) higher than the control groups. This finding is economically

[3] We only observe portfolio holdings at the hedge fund company level. We use hedge fund and hedge fund company interchangeably in the context of portfolio holdings.

significant given that the sample mean and median of absolute portfolio weight changes are 30 bps and 5 bps, respectively.

More importantly, we find that connected hedge funds perform better in their trades of treated stocks compared to various control groups. We measure the return that a fund earns in a trade by multiplying the portfolio weight change in the quarter prior to the loan announcement with the abnormal stock return in the subsequent quarter. We calculate abnormal stock returns using both Carhart (1997) four-factor alphas and Daniel et al. (DGTW, 1997) characteristic-adjusted returns. Our most robust test shows that the contribution of a trade in a treated stock to the fund's quarterly abnormal portfolio return is 0.122 bps to 0.132 bps higher compared to other trades. This effect is economically significant as its magnitude is almost twice as large as the sample average of 0.07 bps. In dollar terms, this outperformance translates to $35.4k - $38.3k in abnormal quarterly profits per trade of a treated stock for an average connected hedge fund company. As the average connected fund company holds six treated stocks in a given quarter, it means that the fund company generates additional abnormal profits of $212.3k - $229.7k per quarter from their trades in the stocks of firms to whom the fund's prime-broker bank provides a loan. To ensure that our results are not spurious, we carry out a falsification test by changing the loan origination dates to one- or two-years prior to the actual dates and do not find any evidence of outperformance.

Next, we conduct several additional cross-sectional tests. First, we test whether the information advantage that connected hedge funds have is increasing in the strength of their relationship with the prime-broker bank. We use a hedge fund's revenue generation potential to the prime-broker bank to proxy for their relationship strength. We find that connected hedge funds with higher AUM in equity styles (i.e., long-short equity) or high leverage usage earn significantly

higher returns in treated stocks compared to other connected funds.[4] Second, we test whether the information edge of connected hedge funds depends on the information asymmetry of the borrowing firm. We follow prior literature and use three proxies for the borrowing firm's information asymmetry: (i) senior unsecured rating, (ii) number of lenders, and (iii) number of lead arrangers. As expected, we find that connected hedge funds' outperformance is greater for their trades on borrowing firms with higher information asymmetry.

Our next set of analyses investigates whether the information that connected hedge funds have is specific about the loan or about the firm in general. To test this idea, we repeat our main analysis but remove the three-day announcement return of the loan from the treated stock return and find similar results. It suggests that the information edge that connected funds have is about the firm in general, rather than purely about the loan.

Finally, while all of the analyses above focus on hedge funds' connection to prime-broker banks that are the lead arrangers of a given loan, we also analyze whether hedge funds gain an information edge from their connections to prime-broker banks that are mere participants in a loan. Consistent with the unique role of lead banks in the loan origination process (e.g., Sufi (2007)), we find no evidence that the hedge funds whose prime-broker banks are not a lead arranger in a loan gain an information edge about the borrowing firm.

Overall, while our evidence is consistent with prime-broker banks sharing material nonpublic information with their hedge fund clients, an alternative explanation is that the information shared is immaterial on its own but becomes valuable once combined with other information signals that the connected hedge funds have. The former explanation is in line with

[4] Because prime brokers generate revenue through commissions by executing trades and fees by providing financing for leveraged and short positions, hedge funds that primarily trade in equities and those who take short positions have particularly high revenue potential. A report on prime brokerage by Barclays Capital Solutions Group in 2015 notes that long-short equity funds are one of the most valuable types for prime brokerage revenues.

the studies that argue that private information could flow from the corporate loan desk to other affiliated groups of investment banks (e.g., Acharya and Johnson (2007), Massa and Rehman (2008), and Chen and Martin (2011)).[5] The latter explanation is consistent with the evidence in the literature that hedge funds are better at processing information (e.g., Solomon and Soltes (2015)). Regardless of how connected hedge funds gain an edge, our results suggest that prime-broker banks provide a valuable function of "information brokerage" to hedge fund clients.

Our study adds to the strand of literature that analyzes trading of nonpublic information by hedge funds.[6] In particular, Ivashina and Sun (2011) and Massoud et al. (2011) show that hedge funds that directly invest in syndicated loans make informed trades in the equity of the borrowing firm. Our paper differs from these two studies as we focus on the role of prime broker in the information channel.[7] In addition, Qian and Zhong (2017) find that hedge funds earn abnormal returns in stocks after the IPO, especially when their prime brokers serve as the IPO underwriters. Share allocation in IPOs plays a critical role in their setting and could well be driving their main results. Our setting avoids this pitfall and allows for a cleaner test of any information advantage hedge funds have because of their prime broker connection.

Our paper also contributes to the nascent literature on hedge funds' prime brokers. A number of studies in this literature show that prime broker distress can cause contagion among

[5] Although Chinese walls are set up to prevent such information transfer, as noted by the U.S. Securities and Exchange Commission (SEC), these information barriers could be not adequate. 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."

[6] The literature that analyzes informed trading by hedge funds includes, 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). There is also a large literature that studies hedge funds' ability to generate positive alpha (e.g., Brown, Goetzmann, and Ibbotson (1999), Agarwal and Naik (2000), Kosowski, Naik, and Teo (2007), Aggarwal and Jorion (2010), Jagannathan, Malakhov, and Novikov (2010), and Sun, Wang, and Zheng (2012)).

[7] To ensure that we are not simply picking up the effects of hedge funds directly participating in the loan syndicates, we remove all hedge fund companies that ever participate in a loan syndicate.

hedge funds sharing the same broker (e.g., Klaus and Rzepkowski (2009), Boyson, Stahel, and Stulz (2010), and Aragon and Strahan (2012)). We add to this literature by uncovering a function of "information brokerage" that prime-broker banks provide to hedge fund clients. In this regard, our study is related to Chung and Kang (2016), who document co-movement in the returns of hedge funds sharing the same prime broker. While Chung and Kang's (2016) evidence is consistent with prime brokers sharing information with hedge fund clients, their setting does not let them to directly test the hypothesis of information sharing. Our paper uses detailed holdings level data combined with corporate events when such information sharing is possible and carefully controls for many unobservable factors using both fund-company × quarter and stock × quarter fixed effects. Our study also differs from Chung and Kang (2016) by documenting that only certain groups of hedge fund clients enjoy an information advantage from their prime broker connection.[8]

The remainder of this paper proceeds as follows. Section 2 describes data and variable construction. Section 3 discusses the design of our empirical analyses. Section 4 examines the size and performance of trades by hedge funds. Section 5 sets forth our conclusions.

## 2. Data and Variable Construction

### *2.1. Data*

We combine a multitude of datasets for our analysis. First, information on hedge funds and their prime brokers comes from Mullally (2016), who forms a union of four commercial hedge fund databases (the "union" database) based on the algorithm of Joenväärä, Kosowski, and Tolonen (2014). Specifically, the union database combines the Trading Advisor Selection System

[8] Griffin, Shu, and Topaloglu (2012) find there is little evidence of informed trading by the average brokerage house client of investment banks. Recently, Di Maggio et al. (2017) find that, after large informed trades, a significantly higher volume of other institutional investors execute similar trades through the same broker.

(TASS), Hedge Fund Research (HFR), EurekaHedge, and Morningstar hedge fund databases. The union database 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. To mitigate concerns about survivorship bias in the commercial hedge fund databases, we only use data from 1994 through 2014.

Jorion and Schwarz (2014) document that hedge funds often report to multiple databases and begin doing so at different points in time. We take advantage of these strategic listing decisions to create a time series of hedge fund – prime broker observations. Specifically, for each hedge fund in the union database, we assume that the first broker a fund reports to any commercial database was the fund's broker since its inception. If the fund subsequently begins reporting to another database and lists a different prime broker, we update that fund's broker accordingly and fill in the broker data until the fund reports to another database or the sample period ends in 2014. We employ this algorithm for each fund in the union database and then aggregate the funds' brokers at the fund company level to create a list of brokers that each fund company uses in each month.

Next, we obtain stock holdings data from two sources. First, we use the Thomson Reuters 13F Institutional Holdings data to obtain information on stock holdings at the hedge fund company level. Institutions that hold at least $100 million in Section 13(f) securities are required to disclose their institution-level holdings on a quarterly basis.[9] However, as noted by Ben-David et al. (2016), the Thomson Reuters 13F database suffers from several data quality issues such as stale and omitted institutional reports and excluded securities after June 2013. To mitigate these concerns, we use a second source of holdings data from June 2013 onward: the 13F filing data directly obtained from the SEC's EDGAR website and made available to researchers via the Wharton

[9] Section 13(f) securities are primarily U.S. exchange-traded stocks (e.g., NYSE, AMEX, NASDAQ). See the following link for more information on 13F filings: https://www.sec.gov/divisions/investment/13ffaq.htm.

Research Data Services (WRDS) platform. We obtain data on stock prices and returns from the Center for Research in Security Prices (CRSP).

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 US and foreign corporations, with coverage starting from around mid-1980s. Chava and Roberts (2008) report that Dealscan coverage is comprehensive from 1995 onward. We use the Compustat-Dealscan link made publicly available by Michael Roberts (see Chava and Roberts (2008)) to link this database with Compustat. We manually name-match each lender in the Dealscan data to our list of prime brokers. In our main analysis, we focus on hedge funds' connections to the lead arrangers since it is the job of the lead arranger to conduct due diligence on the borrower and process information (e.g., Sufi (2007), Ivashina (2009)).

Prior studies have shown that some hedge funds directly invest in loans to obtain private information about the borrowing firm, especially during loan renegotiations (e.g., Ivashina and Sun (2011) and Massoud et al. (2011)). We manually compare our list of hedge funds and our list of lenders (at the time of loan announcement) to identify instances in which a hedge fund also participates in a given loan. To ensure that hedge funds' direct investment into loans do not drive our results, we exclude hedge fund companies (39 in total) that have ever co-invested in a syndicated loan.

To ensure the accuracy of our data, we address an important concern about the Dealscan data. Financial institutions have multiple subsidiaries and often engage in mergers and acquisitions that change their holding structures. Unfortunately, Dealscan does not retain the historical ownership structure. Instead, all lending entities are linked to their most recent parent. This practice leads to many loans being incorrectly attributed to the wrong parent bank. For example, Dealscan

attributes loans made by Merrill Lynch in 2001 to Bank of America even though the two firms did not merge until 2008. We examine each of the individual lender names in our sample and match the lending entity to the correct parent bank at the time of loan origination to ensure that the actual lender is correctly identified. Lastly, we eliminate all loans to borrowers that do not have common stocks in the CRSP database.

We construct our merged dataset as follows. First, we merge the Dealscan data to the union hedge fund database by manually matching the prime broker names in the union database to the lead lenders in Dealscan. This generates a mapping from each loan event to a set of hedge funds that are "connected" to the loan through their prime broker(s). The unit of observation in this merged dataset is a fund-broker-loan combination where each loan is denoted by a stock-quarter pair. Second, we eliminate fund-broker-loan observations made to companies before a hedge fund's inception date or after a fund died. Third, we manually match hedge fund companies in the union database to those in the 13F database and obtain their quarterly stock holdings. We eliminate any fund quarters in which the fund company held fewer than 10 stocks. Finally, we only retain 13F institutions that are classified as pure play hedge funds firms as defined in in Agarwal et al. (2013).

After the above procedures, our final sample contains 514 hedge fund companies and their quarterly holdings from 13,090 distinct fund-quarters from 1994Q1 to 2014Q4. These companies use 77 different prime brokers and hold the stocks of companies that received 9,064 distinct loans. 54 out of the 77 brokers in our sample are associated with a bank that made at least one loan during our sample period. In 6,142 out of the 13,090 distinct fund-quarters in our sample, hedge funds hold the stock of at least one firm to whom their prime-broker bank originates a loan.

*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. *Institutional Ownership* is the percentage of shares outstanding held by 13F institutions. *Amihud* is the absolute value of the stock's daily return divided by its price times its daily trading volume.

We also construct several hedge fund company-level variables that are weighted by the company's funds' assets. *Fund Return* is calculated as the weighted average of a company's cumulative hedge fund returns over the past 12 months. *Fund Flow* is the weighted 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 weighted 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 assets 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 184 (79) stocks. Across all fund-quarters in our sample, on average, fund companies hold the stocks of 2.8 firms that received loans from the fund company's prime-broker bank. However, for quarters in which the fund company holds the stock of at least one firm to whom its broker makes

a loan, funds hold an average (median) of 5.9 (2) stocks that receive loans. The mean (median) hedge fund company in our sample holds $1,587 ($403) million in long equity positions.

[Insert Table 1 about here]

Panel B contains the statistics on the stock position level variables. The average (median) absolute quarterly position change in our sample is 0.30% (0.05%), scaled by the hedge fund company's AUM. For an average (median) position, the quarterly *Four-Factor Alpha* is 0.04% (-0.52%) and the quarterly *DGTW* is 0.17% (-0.57%). The average values of our two trade return measures, $Alpha \times \Delta Ownership$ and $DGTW \times \Delta Ownership$, are 0.066 bps and 0.073 bps. The median values of both measures are close to zero. It suggests that the incremental contribution to the fund company's quarterly abnormal return from a typical position change is relatively small. The means and medians of the other stock characteristic variables are comparable to those found in the literature. The statistics on the loan variables are contained in Panel C. The average (median) loan is $1,053 ($500) million dollars, has 10.71 (8) members in the syndicate, has 2.2 (2) lead lenders, and have 1.4 (1) facilities.

## 3. Empirical Design

The objective of our empirical analysis is to investigate whether hedge funds gain an information edge from their relationships with the prime-broker banks that possess non-public information about corporate clients. To examine this question, we use the setting of loan originations by banks to corporate borrowers. Banks expend considerable resources in performing due diligence and screening of firms before granting loans. For our sample of loans, the median time between the day a bank receives the mandate for a loan and the day the loan is closed is 75 days. As argued by both academics and practitioners, the bank screens the firm and obtains

nonpublic information about the firm during the loan origination process (e.g., Rajan (1992), Sufi (2007), Taylor and Sansone (2007), Demiroglu and James (2010)). Thus, the event of loan origination, over which the lead bank collects non-public information about the borrower, provides a unique setting to investigate whether hedge funds could potentially gain an information advantage from their prime-broker connections.

Hedge funds' trades should reflect this information edge. Therefore, in our empirical analysis we test whether hedge funds make informed trades on the stocks of firms to whom their prime broker's affiliated bank initiates bank loans. We refer to the stocks of firms that receive a bank loan as treated stocks and the hedge funds whose prime broker initiates the loans as connected hedge funds. We have two conjectures if connected hedge funds gain an information edge due to their prime-broker connection. First, we expect these hedge fund clients to exhibit abnormal trading activity (i.e., make larger trades) in treated stocks prior to the loan announcements. Second, we expect the trades in treated stocks by connected hedge funds to be more profitable when compared to appropriate control groups.

To test the hypothesis, we use the dataset described in Section 2 above that combines data on hedge funds, hedge fund prime-broker banks, loan originations, and hedge fund 13F stock holdings. Our unique setting allows us to explore across-stock variations within each hedge fund portfolio and across-fund variation within each stock event. 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 in Microsoft and Apple shares. Prime broker P1's affiliated bank makes a loan to Microsoft. We refer Microsoft as the treated stock and H1 as the connected hedge fund. If our hypothesis is true, H1 would be more informed about Microsoft. Our analysis examines whether H1 makes larger and more profitable trades in Microsoft prior to the loan announcement

(i.e., the trade in treated stock by connected fund), compared to other trades, i.e., H1's trades in Apple and H2's trades in Microsoft.

In particular, we carry out the following regressions to test our hypothesis:

$$y_{i,j,t} = \beta * Loan_{i,j,t} + \delta' StockVars_{j,t-1} + \gamma_{i,t} + \varepsilon_{i,j,t}, \quad (1)$$

$$y_{i,j,t} = \beta * Loan_{i,j,t} + \theta' CompVars_{i,t-1} + \kappa_{j,t} + \mu_{i,j,t}, \quad (2)$$

$$y_{i,j,t} = \beta * Loan_{i,j,t} + \gamma_{i,t} + \kappa_{j,t} + \eta_{i,j,t}, \quad (3)$$

where *i* indexes hedge fund firms, *j* indexes stocks, and *t* indexes time. The dependent variable is either the size or next-quarter performance of the trade by hedge fund company *i* in stock *j* in quarter *t*. $Loan_{i,j,t}$ is an indicator variable equal to one if hedge fund company *i*'s prime-broker bank initiates a loan to stock *j* in the subsequent quarter, i.e., quarter *t+1*. $StockVars_{j,t-1}$ is a vector of stock-level variables, $CompVars_{i,t-1}$ is a vector of hedge fund company-level variables. $\gamma_{i,t}$ and $\kappa_{j,t}$ represent fund-company × quarter fixed effects and stock × quarter fixed effects, respectively.

The specification in Equation (1) with fund-company × quarter fixed effects explores across-stock variations (i.e., treated vs. untreated stocks) for each connected fund-quarter combination. In the context of our example above, it tests whether H1 makes larger and more profitable trades in Microsoft prior to the loan announcement compared to the trades H1 makes in Apple. We refer to this specification as "same fund, different stocks," or SFDS test. Similarly, the specification in Equation (2) with stock × quarter fixed effects explores across-fund variations (i.e., connected vs. non-connected funds) for each treated stock event. Using our example above, it tests whether H1 makes larger and more profitable trades in Microsoft prior to the loan announcement compared to the trades made by H2 in Microsoft. We refer to this specification as referred to as "same stock, different funds," or SSDF test.

Equation (3) is our most robust specification and includes both fund-company × quarter and stock × quarter fixed effects. It simultaneously explores (i) across-stock variations within each hedge fund portfolio and (ii) across-fund variation within each stock event. Our data have unique features that allow us to include both sets of high-dimensional fixed-effects. For a given loan event, certain hedge funds may gain an information advantage based on their prime-broker banks whereas others do not. This variation allows us to include stock × quarter fixed effects. Similarly, for a given hedge fund company in a quarter, some of the fund's stock positions are in firms that obtain a loan from the fund's prime-broker banks while other stock positions are in firms that either do not obtain a loan or obtain a loan from a different bank. This variation allows us to use fund-company × quarter fixed effects. Using our example above, this test uses all four trades in the estimation and filters out any time variant omitted variable specific to fund H1 or Microsoft in that quarter.

The model in Equation (3) simultaneously addresses the concerns that (i) treated stocks are different from non-treated stocks and (ii) connected funds are different from non-connected funds. In particular, it eliminates the following two concerns at the same time: (i) that the SFDS test does not rule out the possibility that value-relevant nonpublic information about the treated loan stock reaches both connected and non-connected hedge funds through other channels; (ii) that the SSDF test does not rule out the possibility that connected hedge funds are simply more skilled and thus make informed trades in both treated and untreated stocks. In short, this specification allows us to control for many potential confounding effects and rules out alternative explanations that connected hedge funds make informed trades in treated stocks for reasons unrelated to their prime-broker connection.

## 4. Empirical Results

### *4.1. Do Hedge Funds Trade More Before Loan Announcements?*

In this section, we examine hedge funds' trades of the stocks of firms to whom their prime broker's affiliated bank initiates a loan. Specifically, we analyze funds' holding changes in the calendar quarter before a loan announcement. We define a loan event as an instance where a bank initiates a loan to a firm. Our hypothesis is that, if hedge funds obtain an information advantage from their prime-broker connection about these stocks, they will make bigger changes in their portfolios for these treated stocks in the quarter before the loan event.

As discussed in Section 3 above, we estimate regressions as in Equations (1), (2), and (3) to test this hypothesis. However, unlike other events like mergers, the direction of the stock price reaction to the announcement of a loan is not obvious ex-ante. In fact, just 52.41% of these loan events have positive 3-day (-1 day to +1 day) cumulative abnormal returns. For this reason, we use $|\Delta Ownership|_{i,j,t}$, 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*-1 to the holdings at the end of *t*), as the dependent variable in these regressions. Note that quarter *t* refers to the quarter prior to the loan announcement quarter in our regression specifications. We use the change in stock holdings for the quarter prior to the loan announcement to ensure that we are not capturing trade decisions driven simply by the public announcement of the loan. Stock-level controls include *Size*, *Momentum*, *Book-to-Market*, and *Institutional Ownership*, while hedge fund company-level controls include *Fund Size*, *Fund Return*, *Fund Flows*, *Management Fee*, *Incentive Fee*, *Lockup Period*, *High Water Mark*, and *Offshore*.

[Insert Table 2 about here]

We present the regression results in Table 2. Columns 1 and 2 contains the results for the SFDS specifications; Columns 3 and 4 contain the results from the SSDF tests; Column 5 contains the results from the most robust specification that includes both fund-company × quarter and stock × quarter fixed effects. The key coefficient of interest, *Loan*, is positive and statistically significant at the 1% level in all five specifications. In Column 5, the coefficient on *Loan* for our most robust specification is 0.069 with a *t*-statistic of 11.71. Our result indicates that connected hedge funds make trades in treated stocks that are 6.9 bps larger in size than the trades in the control groups. Given that the sample mean and median of $|\Delta Ownership|$ are 30 bps and 5 bps, this effect is economically large.

*4.2. Hedge Fund Trading Performance*

The results in Section 4.1 show that hedge funds make abnormally large trades of the stocks of firms that obtain loans from their prime brokers' affiliated banks. Since this evidence is on the absolute trade size, it does not necessarily indicate that these are informed trades. If hedge funds gain an information advantage due to their relationship with their prime brokers, one would expect these funds to make both larger and more profitable trades before loan events. In this section, we investigate whether connected hedge funds have abnormal performance in their trades of these treated stocks.

To do so, we estimate the regressions described in Equations (1), (2), and (3) in which the dependent variable is a measure of trade performance. We create trade performance measures at the fund-stock-quarter level by combining information on a given stock's abnormal returns over a performance window and a given fund's trade on that stock. The nature of the 13F holdings data dictates our choice of the beginning of the return window. We calculate a stock's cumulative

abnormal return over each calendar quarter. This makes performance comparison across funds and stocks straightforward since different loans are initiated on different dates during any given quarter. The first stock abnormal return measure we compute is *Four-Factor Alpha*. It is calculated using the Carhart (1997) model, which includes the Fama-French (1993) market, size, and value factors plus the momentum factor (Jegadeesh and Titman (1993)). We first estimate the betas for each stock in a quarter using the past year's daily stock returns. We then calculate the quarterly *Four-Factor Alpha* as the fund's cumulative return for a given quarter minus the sum product of its factor exposures times the factors' cumulative returns. Our second return measure is *DGTW*, which we compute as the difference between the stock's cumulative monthly return and that of its characteristic-based portfolio as in Daniel et al. (1997). We use the change in ownership from the quarter prior to the loan is announced to remove any influence of the public announcement on the hedge funds' portfolio decisions.

Our trade profitability measures are equal to the product of the fund's change in ownership scaled by AUM in the calendar quarter before the loan announcement and the stock abnormal return in the subsequent quarter (i.e., the quarter of the loan announcement). For example, if a fund reduces its holding for a stock in the quarter prior to the loan announcement by 1% of AUM and the abnormal return measure for the stock in the subsequent quarter is -3%, the trade profitability measure is 0.03%, or 3bps (=-1% × -3%). These measures can be interpreted as the incremental contribution to the fund company's quarterly abnormal return from the trade in a given stock. It is important to note that this calculation "signs" a given stock return variable for each fund based on the direction of that fund's trade. We then compare the performance of the funds' trading in the stocks receiving loans to appropriate control groups using these profitability measures.

*4.2.1. Are Trades by Connected Hedge Funds More Profitable?*

We begin our analysis on trade profitability using the SFDS control group. Table 3 contains the results. In Panel A of Table 3, we compare 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 0.118 – 0.120 basis points per quarter. The difference in performance is statistically significant at the 1% level for both performance measures. For example, trades in loan stocks generate an incremental return of 0.146 basis points based on *Four-Factor Alpha* and 0.152 basis points based on *DGTW*, while trades in stocks not receiving loans only earn a quarterly return of 0.028 basis points based on *Four-Factor Alpha* and 0.032 basis points based on *DGTW*. Given that the average fund company in the SFDS sample has AUM of $2.90 billion, our results indicate that the average trade in these stocks receiving loans generate additional abnormal quarterly profits of $33,930 - $34,510 for the connected fund company.

[Insert Table 3 about here]

Next, we run a regression specification (1) where the dependent variable is $\Delta Ownership_{i,j,t} * Return_{j,t+1}$, that is, the product of a fund's portfolio weight change and the subsequent quarter stock abnormal return. We control for a vector of individual stock characteristics that includes market capitalization, book-to-market, momentum, liquidity, and institutional ownership. In essence, these regressions compare the trading performance in treated stocks to the performance in the remainder of the fund's portfolio for a given fund-quarter. Again, if connected hedge funds do gain an information advantage from the relationship with their prime-broker banks, we expect the coefficient on *Loan* be positive and significant.

Panel B of Table 3 contains the results of these regressions. The coefficients on *Loan* are both positive and statistically significant at the 1% level. These coefficients suggest that, on

average, connected hedge funds' trades in treated stocks contribute 0.163 and 0.156 basis points more to their portfolio's quarterly abnormal return than their trades in non-treated stocks based on *Four-Factor Alpha* and *DGTW*, respectively. In terms of dollar profit, these numbers indicate that funds earn additional abnormal quarterly profits of $45,240 - $47,270 per trade of treated stocks.

Next, we test our hypothesis using the SSDF control group. We expect that the funds whose prime-broker banks originate a loan to a firm will generate better abnormal returns in their trade in the borrowing firm's stock compared to the funds whose prime-broker banks do not participate in the loan. Since the return on the treated stock is the same for both types of funds, this difference in performance is entirely explained by the connected funds making larger trades in the correct direction more frequently than the unconnected funds.

Table 4 contains the results from estimating the regression of Equation (2). 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 0.144 and 0.149 basis points per quarter based on *Four-Factor Alpha* and *DGTW*, respectively. These results indicate that the connected funds earn between $41,760 and $43,210 more abnormal profit each quarter per trade in the treated stocks. The differences in trading profitability are statistically significant at the 1% level or better for both *Four-Factor Alpha* and *DGTW*.

[Insert Table 4 about here]

Panel B contains the results from the multivariate regressions. Again, the coefficients on *Loan* are uniformly positive and statistically significant at the 5% level. The coefficients indicate that connected funds outperform their unconnected peers by 0.175 and 0.184 basis points per quarter on their trades of treated stocks based on *Four-Factor Alpha* and *DGTW*, respectively.

These results suggest that, even after controlling for fund characteristics, an average trade on treated stocks by connected hedge funds are between $50,750 and $53,360 more profitable in a quarter, compared to unconnected funds' trades on the same treated stocks.

As described in Section 3 above, both the SFDS and SSDF tests have potential alternative interpretations. In the case of the SFDS, it is possible that the connected funds are just trading on public information about the treated stocks. For the SSDF case, it is possible that the connected funds are simply better traders than their unconnected peers. To mitigate these concerns we estimate our most robust regression specification as in Equation (3) that has both fund-company × quarter and stock × quarter fixed effects. This test simultaneously eliminates the two above-mentioned concerns.

The results from these regressions are presented in Table 5. The coefficients on *Loan* are positive and statistically significant at the 5% level in both cases. Our results indicate that connected funds' trading in treated stocks outperform other types of trades by between 0.122 and 0.132 basis points per quarter based on *Four-Factor Alpha* and *DGTW*, respectively. In dollar terms, this outperformance translates to $35,380 - $38,280 in abnormal quarterly profits per trade for a connected hedge fund company. Given that the average connected fund company holds six treated stocks in a given quarter, this result suggests that the fund company is receiving additional abnormal profits of $212.3k - $229.7k per quarter from their trades in the stocks of firms to whom the fund's prime-broker bank provides a loan.

[Insert Table 5 about here]

*4.2.2. Placebo Tests*

The results in Tables 3-5 provide strong evidence consistent with our hypothesis. To ensure that our results are not spurious, we conduct placebo tests in which we change the loan initiation dates for each treated stock. Specifically, we estimate the same regressions of Table 5 except that we change the loan initiation dates to one or two-years prior to the actual dates. Table 6 contains the results of these placebo tests, with Panel A using minus one-year and Panel B using minus two-year. In both panels, we find that the coefficients on *Loan* are small in magnitude and statistically insignificant. These results suggest that the information connected funds are trading on is only obtained during the process in which their prime-broker bank is actually making the loan.

[Insert Table 6 about here]

*4.2.3. Revenue Potential for Prime Brokers and Hedge Fund Trading Performance*

In this subsection, we explore the economic incentives for prime brokers to provide this service to their hedge fund clients. Specifically, we examine whether the information advantage that connected hedge funds have is increasing in the strength of their relationship with the prime-broker bank. We use a hedge fund's revenue generation potential to the prime-broker bank to proxy for their relationship strength. To test this conjecture, we carry out the following regression:

$$y_{i,j,t} = \beta_1 * I_{i,t} * Loan_{i,j,t} + \beta_2 * (1 - I_{i,t}) * Loan_{i,j,t} + \gamma_{i,t} + \kappa_{j,t} + \eta_{i,j,t-1}, \qquad (4)$$

where the dependent variable is trade performance as described above; $I_{i,t}$ is an indicator variable for the strength of hedge fund *i*'s relationship with the prime broker; $\gamma_{i,t}$ represents fund-company × quarter fixed effects; $\kappa_{j,t}$ represents stock × quarter fixed effects. Note that the direct effect of the indicator variable gets absorbed in the fund-company × quarter fixed effects.

Since we do not directly observe the fees each hedge fund client pays to its broker(s), we use two proxies for this variable. Our first proxy for this variable is the level of a fund company's AUM in long-short equity strategies. Because prime brokers earn commissions by executing trades and providing financing for leveraged and short positions, fund companies that primarily trade in equities and those who take short positions would presumably generate more revenue for the prime brokers.[10] We expect investment banks to have stronger relationships with these clients. For this reason, we expect that these hedge fund clients will perform better on the loan stocks in their portfolios. In particular, 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. If larger revenue potential leads to more information edge for hedge fund clients, we expect the coefficient on *Loan* × *High Equity AUM* to be positive and statistically higher than the coefficient of *Loan* × *(1-High Equity AUM)*.

We present the results in Panel A of Table 7. The evidence supports our prediction. The coefficients on *Loan* × *High Equity AUM* are large and statistically significant at the 1% level for both profitability measures. The magnitude of the coefficients ranges from 0.289 to 0.308, which means that connected fund companies with high levels of equity AUM outperform unconnected funds on their trades of treated stocks by 0.289 – 0.308 basis points per quarter. In dollar terms, these numbers correspond to differences of $609,000 and $696,000 in abnormal quarterly trading profits per trade. Interestingly, the coefficient on *Loan* × *(1 – High Equity AUM)* is itself statistically insignificant. Moreover, connected funds with high equity AUM outperform other

[10] A report by Barclays Capital Solutions Group in 2015, titled "More with Less – Impact of Regulations on the Hedge Fund Financing Model", notes that long-short equity and statistical arbitrage funds are the two most valuable types for prime brokerage revenues. Statistical arbitrage funds do not have a large impact in our setting given their investment strategies are unlikely to rely on fundamental information, including information of the type obtained from corporate lending activities.

connected funds by 0.234 – 0.247 basis points per quarter on their trades. These differences are statistically significant at the 10% level or better for both return variables. Combined, these results suggest that the information advantage we document primarily benefits the larger, more valuable hedge fund companies.

[Insert Table 7 about here]

Next, we construct an additional variable that measures another source of revenue for prime brokers – funds' use of leverage financing. Our financing measure for each fund company is constructed by multiplying the AUM of each equity fund by an indicator variable that takes the value of 1 if the fund uses leverage or margin financing. The variable *High Leverage* equals 1 when a fund company is in the top quartile of our measure of financing and 0 otherwise. We estimate Equation (4) using this variable and present the results in Panel B. We find that funds with higher broker financing outperform other connected funds with lower broker financing on their trades of treated stocks by 0.319 to 0.323 basis points per quarter. These results provide further evidence in support of our main hypothesis as they suggest that the information advantage to hedge fund firms depends on the strength of relationship with their prime-broker banks.

*4.2.4. Information Asymmetry and Hedge Fund Trading Performance*

The information edge that a connected hedge fund can potentially derive from the connection to their prime-broker banks depends on the information asymmetry between insiders of a firm and the outside market. Prior literature has shown that investment managers invest more and perform better in their trades in stocks with high information asymmetry when they have an information advantage in those stocks (e.g., Coval and Moskowitz (2002), Teo (2009)). We

construct several proxies for high information asymmetry about the borrowing firm and carry out the following regression:

$$y_{i,j,t} = \beta_1 * I_{j,t} * Loan_{i,j,t} + \beta_2 * (1 - I_{j,t}) * Loan_{i,j,t} + \gamma_{i,t} + \kappa_{j,t} + \eta_{i,j,t-1}, \qquad (5)$$

where the dependent variable is trade performance as described above; $I_{j,t}$ is an indicator variable for high information asymmetry in stock *j*; $\gamma_{i,t}$ represents fund-company × quarter fixed effects; $\kappa_{j,t}$ represents stock × quarter fixed effects. Note that the direct effect of the indicator variable for high information asymmetry gets absorbed in the stock × quarter fixed effects.

Our first proxy for high information asymmetry about the borrowing firm is based on the firm's senior unsecured ratings.[11] We divide our sample borrowers into two groups: borrowers with an investment grade rating at the time of loan and borrowers without such a rating. In the regression specification, $I_{j,t}$ equals 1 when a borrower does not have an investment grade rating. Panel A of Table 8 report the results of this analysis. Consistent with our hypothesis, we find that connected funds perform much better in their trades in treated stocks with high information asymmetry compared to their trades in treated stocks with low information asymmetry. The coefficients on the *Non-Investment Grade* dummy are 0.184 and 0.189 and statistically significant while the coefficients on (1- *Non-Investment Grade*) dummy are only 0.056 and 0.070 and statistically insignificant. We note that the differences of 0.128 and 0.119 basis points are economically large though not statistically significant at the 10% confidence level.

[Insert Table 8 about here]

Next, we use the syndicate size and the number of lead arrangers as proxies for underlying information asymmetry between borrowers and the outside market. Sufi (2007) finds that syndicate

[11] A number of prior studies, including Dennis and Mullineaux (2000), Ivashina (2009), and Ross (2010), use bond ratings as proxies for information asymmetry about a firm.

sizes are small when borrowing firms have high information asymmetry. On the other hand, when information asymmetry is not a concern, syndicates are large and the loan resembles a public debt. This follows from the intuition that banks have a relative advantage in screening and monitoring borrowers with high information asymmetry. Dennis and Mullineaux (2000) suggest that syndicated loans are positioned between the two extremes, sole-lender bank loans and public debt. We expect that connected funds' information advantage would be higher for borrowers with large information asymmetry, which we proxy by loans that have a single lender (i.e., sole-lender bank loan) or a single lead arranger.

Panel B of Table 8 reports the results of the analysis in which we use the size of the syndicate as our measure of information asymmetry. Connected hedge funds perform significantly better when the loan has a single lender as compared to loans with large syndicate size. Specifically, the coefficients for the *SoleLender* term are 0.746 and 0.726 and statistically significant at the 5% level while those on (*1 – SoleLender*) are only 0.096 and 0.011 and only marginally statistically significant at best. The differences of 0.651 and 0.621 are economically large and statistically significant at the 10% level.

Lastly, in Panel C, we measure information asymmetry by examining the number of lead arrangers in the syndicate. Again, connected hedge funds perform significantly better on loans that have a single lead arranger as compared to loans with multiple lead arrangers. Specifically, the coefficients on *Sole Lead* are 0.389 and 0.339 and both are significant at the 5% level. In contrast, the coefficients on (*1 – Sole Lead*) are only 0.053 and 0.078 and are not statistically significant at conventional levels. These differences of 0.336 and 0.261 are statistically significant at the 5% and 10% levels, respectively.

*4.2.5. Time During Quarter*

In this section, we divide our sample of loan events based on when the loan occurs during the quarter. We would expect that the 13F holdings reported at time $t - 1$ to be more likely to reflect informed trading for loans taking place in the first half of a given quarter *t*. The reason is that the quarterly frequency 13F holdings data is less likely to capture the trades prior to loan announcement if the loan occurs in the later months of the calendar quarter.

To test this conjecture, we construct two indicator variables, *Half1* and *Half2*, which are equal to 1 for stocks that announce loans in the first and second half of the quarter, respectively, and 0 otherwise. We then estimate the following regressions:

$$y_{i,j,t} = \beta_1 * Half1_{j,t} * Loan_{i,j,t} + \beta_2 * Half2_{j,t} * Loan_{i,j,t} + \gamma_{i,t} + \kappa_{j,t} + \eta_{i,j,t-1}, \qquad (6)$$

where the dependent variables are trade size or performance as described above; $\gamma_{i,t}$ represents fund-company × quarter fixed effects; $\kappa_{j,t}$ represents stock × quarter fixed effects. Note that the direct effect of the indicator variable for loan announcement time gets absorbed in the stock × quarter fixed effects. We present the results of these regressions in Table 9.

[Insert Table 9 about here]

The results are consistent with our intuition. Panel A contains the results from the regression in which we model the funds' trade size. Several findings merit discussion. First, we find the coefficients on *Half1* and *Half2* are both positive and highly statistically significant. Second, the coefficient on *Half1* (0.083) is 48% larger than that coefficient on *Half2* (0.056). Finally, this difference of 0.027 is statistically significant at the 5% level. These results indicate that hedge funds make larger trades (based on changes in quarterly holdings) on the stocks of firms who receive loans in the first half of the quarter, consistent with the funds' end of quarter holdings being more informative for events happening closer to the holdings' report date.

Panel B contains the results for the regressions of the funds' trading profitability. Again, three findings require discussion. First, we find that the coefficients on *Half1* are positive and statistically significant at the 5% level while those on *Half2* are much smaller and not statistically significant. The lack of statistical significance for the coefficient on *Half2* suggests that trades connected to loans announced in the second half of the quarter, even though statistically significant in Panel A, were not as informed as the trades in *Half1*. Second, the coefficients on *Half1* are at least 3.5 times as large as the coefficients on *Half2*. Lastly, the difference in these coefficients is statistically significant at the 10% level for the regression using *DGTW*. Combined, the results in Table 9 suggest that funds' quarterly holdings indicate larger and more profitable trades on treated stocks when loan events are closer to the holdings report date.

*4.2.6. What Type of Information Do Connected Hedge Funds Have?*

One natural question that arises when considering our results revolves around the type of information hedge funds are able to extract about the firms receiving loans. Specifically, are hedge funds receiving information specific to a given loan or are they receiving information about the borrowing firms that is uncovered during the due diligence process? To answer this question, we recompute our stock return variables by subtracting the 3-day cumulative abnormal return (-1 day to +1 day) around a loan initiation date from the entire quarterly abnormal return. We then re-estimate the regressions in Table 3 using the new stock return variables. If connected hedge funds are receiving information purely about the loans themselves, we would expect the coefficient on *Loan* to become statistically insignificant. However, if funds are receiving information about the borrowing firms in general, we expect the coefficients to remain positive and statistically significant. We present the results from these tests in Table 10.

[Insert Table 10 about here]

We continue to find positive and statistically significant coefficients on *Loan*. In fact, the coefficients for both the regressions of *Four-Factor Alpha* and *DGTW* are almost identical to those on the same regressions in Table 3. Specifically, the coefficient on *Loan* in Column 1 changes from 0.122 to 0.130 while the coefficients in Column 2 change from 0.133 to 0.125. These results suggest that the funds are receiving information about the firms in general rather than just information specific to the loans themselves.

*4.2.7. Lead vs. Non-Lead Banks*

In a syndicated loan, the lead arranger establishes a relationship with the firm, performs screening and due diligence, and negotiates terms of the contract. The lead arranger then turns to participant lenders to arrange commitments to fund portions of the loan (e.g., Dennis and Mullineaux (2000), Sufi (2007)). While the participants receive an "information memorandum" from the lead that contains descriptive and financial information concerning the borrower, participants are not involved in due diligence or negotiations with the borrower. Hence, we do not expect the participant lenders to have all nonpublic information about the borrower that the lead uncovers during the due diligence process. Consequently, hedge funds whose prime-broker banks participate in loans but do not perform the role of lead arranger might not gain an information edge.

To test this hypothesis, we rerun the analysis in Table 5 except that $Loan_{i,j,t}$ now equals one if hedge fund company *i*'s prime-broker bank is a participant in a loan to stock *j*. For this analysis, we exclude fund-stock-quarter observations where a hedge fund's prime-broker bank is a lead arranger in a loan to the firm. The results of this analysis are reported in Table 11. The coefficient

on *Loan* is small and statistically insignificant from zero in both columns. This suggests that hedge funds whose prime-broker banks are mere participants in a loan (and not the lead arranger) do not gain an information edge in their trades on the borrowing firm's stock. This result highlights the unique role of lead prime-broker banks in the information brokerage function that we document in this paper.

[Insert Table 11 about here]

## 5. Conclusion

Prime brokers' traditional roles to hedge funds include providing financing, trade execution, custody services, and capital introduction. In this paper, we document a new value-added function that prime broker banks provide to their hedge fund clients: an information advantage regarding the banks' corporate clients. We use the setting of loan originations to identify the possession of nonpublic information by banks and test whether hedge funds gain an information advantage from the unique relationship they have with their prime-broker banks. Consistent with our hypothesis, we find that hedge funds make informed trades on the stocks of firms that obtain loans from the funds' prime-broker banks.

In particular, we find that connected hedge funds make abnormally large trades prior to the loan announcement and these trades subsequently generate superior performance compared to other trades. In dollar terms, this outperformance translates to $212.3k - $229.7k in abnormal profits per quarter for an average connected hedge fund company in our sample. Furthermore, the outperformance is greater for (i) trades of connected hedge funds that have higher revenue generation potential for prime brokers and (ii) trades in borrowing firms with higher information asymmetry. In addition, we find that the information edge connected hedge funds have is about

the borrowing firm in general, rather than purely about the loan. Finally, we find that the information advantage regarding the borrowing firm is not present for hedge funds whose prime-broker banks participate in loans but do not perform the role of lead arranger.

Our evidence of informed trading ahead of loan announcements is consistent with material nonpublic information flow from prime-broker banks to their hedge fund clients. It is also possible that the information shared is immaterial on its own but becomes valuable once combined with other information signals that these connected hedge funds have. Regardless of the source of the information advantage by connected hedge funds, our analysis uncovers that prime-broker banks provide a valuable function of "information brokerage" to hedge fund clients.

Our results have implications for academics as well as regulators. For academics, our paper adds to our understanding of the roles that prime-broker banks play in the financial industry. It also sheds light on the potential sources of nonpublic information that sophisticated investors such as hedge funds enjoy. For regulators, our evidence suggests that it is possible that certain financial institutions could be breaching the Chinese walls that are supposed to exist between divisions to provide information to more favored clients.

## 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., and Yang, B., 2013. Uncovering Hedge Fund Skill from the Portfolio Holdings They Hide. *Journal of Finance* 68, 739-783.

Agarwal, V., and Naik, N.Y., 2000. Multi-period performance persistence analysis of hedge funds. *Journal of Financial and Quantitative Analysis* 35, 327–342.

Aggarwal, R.K. and P. Jorion, 2010. The performance of emerging hedge funds and managers. *Journal of Financial Economics* 96, 238-256.

Aragon, G.O. and J.S. Martin, 2012. A unique view of hedge fund derivatives usage: safeguard or speculation? *Journal of Financial Economics* 105, 436-456.

Aragon, G. O., and P. E. Strahan, 2012. Hedge funds as liquidity providers: Evidence from the Lehman bankruptcy. *Journal of Financial Economics* 103, 570-587.

Ben-David, I., F. Franzoni, R. Moussawi, and J. Sedunov, 2016, The Granular Nature of Large Institutional Investors, NBER Working Paper #22247.

Boyson, N.M., C.W. Stahel, and R.M. Stulz, 2010. Hedge fund contagion and liquidity shocks. *Journal of Finance* 65, 1789-1816.

Brown, S., W. Goetzmann, and R. Ibbotson, 1999. Offshore hedge funds: survival and performance 1989–1995. *Journal of Business* 72, 91-117.

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

Coval, J., and Moskowitz, T., 2002. Home Bias at Home: Local Equity Preference in Domestic Portfolios. *Journal of Finance* 54, 2045-2073.

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

Demiroglu, C., and James, C., 2010. The Information Content of Bank Loan Covenants. *Review of Financial Studies* 23, 3700-3737.

Dennis, S., and Mullineaux, D., 2000. Syndicated Loans. *Journal of Financial Intermediation* 9, 404-426.

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. 23522.

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. *Review of Financial Studies*, forthcoming.

Gao, M., and 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, and 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., 2009. Asymmetric information effects in loan spreads. *Journal of Financial Economics* 92, 300-319.

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

Jagannathan, R., A. Malakhov, and D. Novikov, 2010. Do hot hands exist among hedge fund managers? An empirical evaluation. *Journal of Finance* 65, 217-255.

Jegadeesh, N., and S. Titman, 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance* 48, 65-91.

Joenväärä, Juha, Robert Kosowski, and Pekka Tolonen, 2014, Hedge fund performance: what do we know?, Working paper, University of Oulu and Imperial College.

Jorion, Philippe and Christopher G. Schwarz, 2014, The strategic listing decisions of hedge funds, *Journal of Financial and Quantitative Analysis* 49, 773 – 796.

Klaus, B. and B. Rzepkowski, 2009. Hedge funds and prime brokers: The role of funding risk. Working paper, Goethe University Frankfurt.

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

Kosowski, R., N.Y. Naik, and M. Teo, 2007. Do hedge funds deliver alpha? A Bayesian and bootstrap analysis. *Journal of Financial Economics* 84, 229-264.

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

Mullally, K.A., 2016, Outside ownership in the hedge fund industry, Working Paper, University of Alabama.

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

Rajan, R., 1992. Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt. *Journal of Finance* 47, 1367-1400.

Ross, D., 2010. The "Dominant Bank Effect:" How Higher Lender Reputation Affects the Information Content and Terms of Bank Loans. *Review of Financial Studies* 23, 2730-2756.

Solomon, D., and Soltes, E., 2015. What Are We Meeting For? The Consequences of Private Meetings with Investors. *Journal of Law and Economics* 58, 325-355.

Sufi, A., 2007. Information Asymmetry and Financing Arrangements: Evidence from Syndicated Loans. *Journal of Finance* 62, 629-668.

Sun, Z., A. Wang, and L. Zheng, 2012, The road less traveled: strategy distinctiveness and hedge fund performance. *Review of Financial Studies* 25, 96-143.

Teo, M., 2009. The Geography of Hedge Funds. *Review of Financial Studies* 22, 3531-3561.

Taylor, A., and Sansone, A., 2007. The Handbook of Loan Syndication and Trading. McGraw-Hill.

## 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** | |
| $\lvert\Delta Ownership\rvert$ | 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 six months. |
| *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* | Monthly average of the square root of the absolute value of the daily return over daily dollar volume (scaled by $10^6$). |
| *Book-to-Market* | The ratio of the book value of equity (assumed to be available six months after the fiscal year end) over month-end market capitalization. |

## Table 1 – Summary Statistics

Panel A reports summary statistics for the hedge 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. *Loan* is an indicator variable equal to 1 if the hedge fund company's prime broker initiates a loan on the stock in the following quarter, and 0 otherwise. *Four-Factor Alpha* is calculated using the Carhart (1997) model. We first estimate the betas for each stock in a quarter using the past year's daily stock returns and then calculate the quarterly *Four-Factor Alpha* as the fund's cumulative return for a given quarter minus the sum product of its factor exposures times the factors' cumulative returns. *DGTW* is calculated as the difference between the stock's cumulative monthly return in a given quarter and that of its characteristic-based portfolio as in Daniel et al. (1997). All other variables in Panels A and B are defined in the Appendix and are winsorized at the 1% and 99% levels. Panel C presents summary statistics for the characteristics of loans we use in our analysis.

*Panel A. Fund Company Variables*

| | | | | Distribution | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std. Dev | 10th | 50th | 90th |
| Number of Stocks Held | 13,090 | 172.05 | 275.15 | 22.00 | 77.00 | 400.00 |
| Number of Loan Stocks Held | 13,090 | 2.77 | 7.73 | 0.00 | 0.00 | 7.00 |
| Number of Prime Brokers | 13,090 | 1.83 | 1.22 | 1.00 | 1.00 | 4.00 |
| Fund Company AUM (in $ mill.) | 13,090 | 1,587.4 | 4,310.8 | 82.5 | 403.5 | 3,087.0 |
| Fund Returns | 11,460 | 9.34% | 15.22% | -6.77% | 8.27% | 27.63% |
| Fund Flow | 11,348 | 1.10% | 3.67% | -2.71% | 0.28% | 5.90% |
| Management Fee | 11,451 | 136.75% | 36.77% | 100.00% | 1.44% | 2.00% |
| Incentive Fee | 11,452 | 18.61% | 3.54% | 15.00% | 20.00% | 20.00% |
| Lockup Period (months) | 11,460 | 9.59 | 5.69 | 3.00 | 12.00 | 12.00 |
| High Water Mark (0/1) | 12,204 | 0.85 | 0.28 | 0.50 | 1.00 | 1.00 |
| Offshore (0/1) | 12,229 | 0.38 | 0.37 | 0.00 | 0.33 | 1.00 |

*Panel B. Stock Holding Characteristics*

| | | | | Distribution | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std. Dev | 10th | 50th | 90th |
| \|ΔOwnership\| (scaled by AUM) | 2,095,932 | 0.30% | 0.68% | 0.00% | 0.05% | 0.82% |
| ΔOwnership (scaled by AUM) | 2,095,932 | 0.01% | 0.65% | -0.34% | 0.00% | 0.37% |
| Loan | 2,095,932 | 0.017 | 0.130 | 0.000 | 0.000 | 0.000 |
| Four-Factor Alpha (quarterly) | 2,095,932 | 0.04% | 20.39% | -22.12% | -0.52% | 21.39% |
| DGTW (quarterly) | 2,093,628 | 0.17% | 20.06% | -21.40% | -0.57% | 21.27% |
| Alpha × ΔOwnership (basis point) | 2,095,932 | 0.066 | 12.409 | -3.447 | 0.000 | 3.553 |
| DGTW × ΔOwnership (basis point) | 2,093,628 | 0.073 | 12.246 | -3.364 | 0.000 | 3.486 |
| Momentum | 2,094,285 | 7.59% | 34.45% | -30.84% | 5.26% | 45.28% |
| Institutional Ownership | 1,900,268 | 69.29% | 23.15% | 35.78% | 72.69% | 95.59% |
| Market Capitalization ($ million) | 2,094,581 | 7,014.15 | 9,653.34 | 191.50 | 2,173.29 | 29,218.03 |
| Amihud | 2,094,575 | 0.069 | 0.384 | 0.000 | 0.001 | 0.039 |
| Book-to-Market | 2,088,774 | 0.58 | 0.56 | 0.13 | 0.42 | 1.13 |

*Panel C. Loan Characteristics*

| | | | | Distribution | | |
|---|---|---|---|---|---|---|
| | N | Mean | Std. Dev | 10th | 50th | 90th |
| Size of Loan ($ million) | 9,036 | 1053.74 | 1873.72 | 100.00 | 500.00 | 2300.00 |
| # Members of Syndicate | 9,064 | 10.71 | 9.28 | 2.00 | 8.00 | 22.00 |
| # Leads | 9,064 | 2.20 | 1.73 | 1.00 | 2.00 | 4.00 |
| # Facilities Per Loan | 9,064 | 1.42 | 0.86 | 1.00 | 1.00 | 2.00 |

## Table 2 – Hedge Fund Trading in Connected Stocks

This table provides results on whether hedge funds made abnormal size trades in the stocks of firms that borrow from the fund's prime-broker bank prior to the loan announcement. We regress hedge funds' absolute changes in ownership (in percentage points) 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. Columns 1 and 2 contain the regressions for the same fund, different stocks specification (SFDS). Columns 3 and 4 contain the regressions for the same stock, different funds specification (SSDF). Column 5 contains the regressions with both fund-company × quarter and stock × quarter fixed effects. Standard errors are adjusted for clustering at the fund company × quarter level in Columns 1 and 2; at the stock × quarter level in Columns 3 and 4; and double clustering at the fund company × quarter level and at the stock × quarter level in Column 5. *t*-statistics are reported below the coefficients in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level, respectively.

| | Dependent Variable = \|ΔOwnership\| (scaled by AUM) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | Same Fund, Diff. Stock | | Same Stock, Diff. Fund | | Triple Diff. |
| Loan | 0.069*** | 0.022*** | 0.381*** | 0.394*** | 0.069*** |
| | (11.71) | (3.34) | (7.71) | (8.16) | (11.71) |
| Size | | 0.048*** | | | |
| | | (47.10) | | | |
| Book-to-Market | | 0.001 | | | |
| | | (0.87) | | | |
| Amihud | | 0.001*** | | | |
| | | (11.42) | | | |
| Momentum | | 0.027*** | | | |
| | | (11.15) | | | |
| Institutional Ownership | | 0.030*** | | | |
| | | (6.83) | | | |
| # Stocks | | | | -0.000*** | |
| | | | | (-3.59) | |
| Management Fee | | | | 0.006 | |
| | | | | (1.47) | |
| Incentive Fee | | | | 0.000 | |
| | | | | (0.69) | |
| Lockup | | | | 0.001 | |
| | | | | (0.24) | |
| High Water Mark | | | | -0.003 | |
| | | | | (-0.66) | |
| Offshore | | | | 0.015*** | |
| | | | | (4.83) | |
| Flow | | | | -0.016 | |
| | | | | (-1.29) | |
| Average Return | | | | -0.000*** | |
| | | | | (-3.40) | |
| Log(1+AUM) | | | | -0.003*** | |
| | | | | (-3.19) | |
| Fund Comp. × Qtr. FE | Yes | Yes | No | No | Yes |
| Stock × Qtr. FE | No | No | Yes | Yes | Yes |
| Observations | 1,586,218 | 1,412,121 | 1,576,508 | 1,343,898 | 2,095,876 |
| R-squared | 0.316 | 0.324 | 0.048 | 0.050 | 0.332 |

## Table 3 – Performance of Hedge Fund Trades: Same Fund, Different Stocks

This table reports results that compare returns of hedge fund trades in stocks of firms that do and do not receive loans from their prime broker's affiliated banks. We calculate trade returns as $\Delta Ownership_{i,j,t} \times Return_{j,t+1}$, that is, the product of hedge fund company *i*'s portfolio weight change in stock *j* in quarter *t* and the subsequent quarter stock abnormal return. $Return_{j,t+1}$ is either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return for stock *j* over the quarter *t+1*. Panel A reports the univariate results and Panel B reports the results of multivariate regressions as in Equation (1) with fund-company × quarter fixed effects. The variable of interest is *Loan*, an indicator variable equal to one if hedge fund company *i*'s prime-broker bank initiates a loan to stock *j* in quarter *t+1*, and zero otherwise. The stock-level control variables are defined in the Appendix. Standard errors are adjusted for heteroscedasticity and clustered by fund-company × 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*

| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
|---|---|---|
| Loan Stocks | 0.145 | 0.152 |
| No Loan Stocks | 0.028 | 0.032 |
| Difference | 0.118*** | 0.120*** |
| *p*-value of Difference | 0.004 | 0.003 |

*Panel B. Multivariate Regressions*

| | (1)<br>Four-Factor Alpha × ΔOwnership | (2)<br>DGTW × ΔOwnership |
|---|---|---|
| Loan | 0.163*** | 0.156*** |
| | (2.85) | (2.82) |
| Log(1 + Market Cap.) | -0.006 | -0.006 |
| | (-1.37) | (-1.47) |
| Book-to-Market | -0.025** | -0.026** |
| | (-2.20) | (-2.30) |
| Amihud | -0.001 | 0.001 |
| | (-0.70) | (0.47) |
| Momentum | 0.073** | 0.069* |
| | (2.06) | (1.83) |
| Inst. Ownership | -0.019 | -0.003 |
| | (-0.50) | (-0.08) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Observations | 1,348,085 | 1,382,774 |
| R-squared | 0.019 | 0.020 |

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

This table reports results that compare returns of hedge funds trades in stocks of firms that receive loans from their prime broker's affiliated banks, to returns of the trades in the same stock of unconnected hedge funds. We calculate trade returns as $\Delta Ownership_{i,j,t} \times Return_{j,t+1}$, that is, the product of hedge fund company *i*'s portfolio weight change in stock *j* in quarter *t* and the subsequent quarter stock abnormal return. $Return_{j,t+1}$ is either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return for stock *j* over the quarter *t+1*. Panel A reports the univariate results and Panel B reports the results of multivariate regressions as in Equation (2) with stock × quarter fixed effects. The variable of interest is *Loan*, an indicator variable equal to one if hedge fund company *i*'s prime-broker bank initiates a loan to stock *j* in quarter *t+1*, and zero 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*

| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
|---|---|---|
| Connected Funds | 0.155 | 0.162 |
| Unconnected Funds | 0.011 | 0.013 |
| Difference | 0.144*** | 0.149*** |
| *p*-value of Difference | 0.000 | 0.000 |

*Panel B. Multivariate Regressions*

| | (1) | (2) |
|---|---|---|
| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
| Loan | 0.175** | 0.184** |
| | (2.42) | (2.57) |
| Management Fee | 0.003 | 0.003 |
| | (0.34) | (0.38) |
| Incentive Fee | 0.000 | 0.001 |
| | (0.38) | (0.63) |
| Lockup | 0.006 | 0.009 |
| | (0.88) | (1.24) |
| High Water Mark | 0.013 | 0.003 |
| | (1.15) | (0.31) |
| Offshore | -0.003 | -0.004 |
| | (-0.39) | (-0.47) |
| Flow | -0.014 | 0.039 |
| | (-0.14) | (0.45) |
| Average Return | -0.000 | -0.000 |
| | (-1.13) | (-0.75) |
| # Stocks | -0.000** | -0.000** |
| | (-2.55) | (-2.23) |
| Log(1+AUM) | -0.002 | -0.002 |
| | (-0.68) | (-1.00) |
| | | |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 1,343,898 | 1,343,090 |
| R-squared | 0.013 | 0.013 |

## Table 5 – Performance of Hedge Fund Trades: Regressions with Both Sets of Fixed Effects

This table reports results that compare returns on hedge funds trades in stocks of firms that receive loans from their prime broker's affiliated banks, to returns of other trades in the control group. We calculate trade returns as $\Delta Ownership_{i,j,t} \times Return_{j,t+1}$, that is, the product of hedge fund company *i*'s portfolio weight change in stock *j* in quarter *t* and the subsequent quarter stock abnormal return. $Return_{j,t+1}$ is either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return for stock *j* over the quarter *t+1*. Panel A reports the univariate results and Panel B reports the results of multivariate regressions as in Equation (3) with both fund-company × quarter and stock × quarter fixed effects. The variable of interest is *Loan*, an indicator variable equal to one if hedge fund company *i*'s prime-broker bank initiates a loan to stock *j* in quarter *t+1*, and zero otherwise. The stock-level control variables are defined in the Appendix. Standard errors are adjusted for heteroscedasticity and double clustered by fund-company × quarter and stock × quarter. *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) |
|---|---|---|
| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
| Loan | 0.122** | 0.132** |
| | (2.05) | (2.28) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,095,610 | 2,093,307 |
| R-squared | 0.028 | 0.028 |

## Table 6 – Performance of Hedge Fund Trades: Placebo Tests

This table reports results from placebo tests where we repeat the regression analysis in Table 5 with both fund-company × quarter and stock × quarter fixed effects, except that we change the loan origination dates to one- or two-years prior to the actual dates. Panel A presents the results by changing the loan origination date to one-year prior to the actual date and Panel B presents the results by changing it to two-year prior. Standard errors are adjusted for heteroscedasticity and double clustered by fund-company × quarter and stock × quarter. *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. One Year Prior*

| | (1) | (2) |
|---|---|---|
| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
| Loan | 0.041 | 0.040 |
| | (0.57) | (0.58) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock-Qtr. FE | Yes | Yes |
| Observations | 2,033,064 | 2,030,899 |
| R-squared | 0.152 | 0.155 |

*Panel B. Two Years Prior*

| | (1) | (2) |
|---|---|---|
| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
| Loan | 0.060 | 0.094 |
| | (0.77) | (1.11) |
| Fund Com. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,033,064 | 2,030,899 |
| R-squared | 0.152 | 0.155 |

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

This table report the estimation results of Equation (4) to examine whether the information advantage that hedge funds gain from their prime-broker connection is related to their revenue potential to prime brokers. The dependent variable is trade returns, $\Delta Ownership_{i,j,t} \times Return_{j,t+1}$, that is, the product of hedge fund company *i*'s portfolio weight change in stock *j* in quarter *t* and the subsequent quarter stock abnormal return. $Return_{j,t+1}$ is either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return for stock *j* over the quarter *t+1*. In Panel A, revenue potential is measured by hedge funds' AUM in equity styles (e.g., long-short or market neutral). The indicator variable, *High Equity AUM*, equals to 1 when a hedge fund company is in the top quartile of equity AUM and 0 otherwise. In Panel B, revenue potential is measured by hedge funds' use of prime broker financing. The variable, *High Leverage*, equals 1 when a fund company is in the top quartile of leverage usage, and 0 otherwise. Leverage usage is measured by multiplying the AUM of fund by an indicator variable that takes the value of 1 if the fund uses leverage or margin financing. Standard errors are adjusted for heteroscedasticity and double clustered by fund-company × quarter and stock × quarter. *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) | (2) |
|---|---|---|
| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
| Loan × High Equity AUM | 0.289*** | 0.308*** |
| | (2.71) | (3.00) |
| Loan × (1-High Equity AUM) | 0.055 | 0.061 |
| | (0.77) | (0.88) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,095,610 | 2,093,307 |
| R-squared | 0.028 | 0.028 |
| Difference in coefficients | 0.234* | 0.247** |
| *p*-value of Difference | 0.066 | 0.045 |

*Panel B. High Leverage*

| | (1)<br>Four-Factor Alpha × ΔOwnership | (2)<br>DGTW × ΔOwnership |
|---|---|---|
| Loan × High Leverage | 0.344*** | 0.363*** |
| | (2.61) | (2.88) |
| Loan × (1-High Leverage) | 0.025 | 0.040 |
| | (0.37) | (0.61) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 1,726,807 | 1,724,925 |
| R-squared | 0.028 | 0.028 |
| Difference in coefficients | 0.319** | 0.323** |
| *p*-value of Difference | 0.031 | 0.023 |

## Table 8 – Information Asymmetry and Performance of Hedge Fund Trades

This table report the estimation results of Equation (5) to examine whether the information advantage that hedge funds gain from their prime-broker connection is related to information asymmetry about the borrowing firm. The dependent variable is trade returns, $\Delta Ownership_{i,j,t} \times Return_{j,t+1}$, that is, the product of hedge fund company i's portfolio weight change in stock j in quarter t and the subsequent quarter stock abnormal return. $Return_{j,t+1}$ is either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return for stock j over the quarter t+1. In Panel A, information asymmetry is measured by borrowing firm's credit rating. The indicator variable, *Non-Investment Grade*, equals to 1 when a borrowing firm does not have an investment grade rating. In Panel B, information asymmetry is measured by the size of the lending syndicate. The variable, *Sole Lender*, equals 1 when a loan has exactly one lender. In Panel C, information asymmetry is measured by the number of lead arrangers in the syndicate. The variable, *Sole Lead*, equals 1 when a loan has exactly one lead arranger. Standard errors are adjusted for heteroscedasticity and double clustered by fund-company × quarter and stock × quarter. 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. Non-Investment Grade*

| | (1)<br>Four-Factor Alpha × ΔOwnership | (2)<br>DGTW × ΔOwnership |
|---|---|---|
| Loan × Non-Investment Grade | 0.184** | 0.189** |
| | (2.08) | (2.22) |
| Loan × (1- Non-Investment Grade) | 0.056 | 0.070 |
| | (0.75) | (0.93) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,095,610 | 2,093,307 |
| R-squared | 0.028 | 0.028 |
| Difference in coefficients | 0.128 | 0.119 |
| *p*-value of Difference | 0.26 | 0.29 |

*Panel B. Number of Lenders*

| | (1)<br>Four-Factor Alpha × ΔOwnership | (2)<br>DGTW × ΔOwnership |
|---|---|---|
| Loan × Sole Lender | 0.746** | 0.726** |
| | (2.17) | (2.25) |
| Loan × (1- Sole Lender) | 0.096 | 0.106* |
| | (1.59) | (1.81) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,095,610 | 2,093,307 |
| R-squared | 0.028 | 0.028 |
| Difference in coefficients | 0.651* | 0.620* |
| *p*-value of Difference | 0.06 | 0.06 |

*Panel C. Number of Lead Banks*

| | (1)<br>Four-Factor Alpha × ΔOwnership | (2)<br>DGTW × ΔOwnership |
|---|---|---|
| Loan × Sole Lead | 0.389** | 0.339** |
| | (2.52) | (2.38) |
| Loan × (1- Sole Lead) | 0.053 | 0.078 |
| | (0.85) | (1.26) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,095,610 | 2,093,307 |
| R-squared | 0.028 | 0.028 |
| Difference in coefficients | 0.336** | 0.261* |
| *p*-value of Difference | 0.04 | 0.09 |

## Table 9 – Loan Announcement Time and Hedge Fund Trades

This table report the estimation results of Equation (6) to examine whether the size and return of hedge fund trades as measured by 13F holding changes vary with the loan announcement time during the quarter. We construct two indicator variables, *Half1* and *Half2*, which are equal to 1 for stocks that announce loans in the first and second half of the quarter, respectively, and 0 otherwise. We interact each of them with the indicator variable, *Loan*. In Panel A, we analyze the size of hedge fund trade. In Panel B, we analyze the performance of hedge fund trades, measured by the product of hedge fund company *i*'s portfolio weight change in stock *j* in quarter *t* and the subsequent quarter stock abnormal return (either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return). Standard errors are adjusted for heteroscedasticity and double clustered by fund-company × quarter and stock × quarter. *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. Hedge Fund Trading*

| | \|ΔOwnership\| (scaled by AUM) |
|---|---|
| Loan × Half1 | 0.083*** |
| | (9.59) |
| Loan × Half2 | 0.056*** |
| | (7.35) |
| Fund Comp. × Qtr. FE | Yes |
| Stock × Qtr. FE | Yes |
| Observations | 2,095,610 |
| R-squared | 0.332 |
| Difference in coefficients | 0.027** |
| *p*-value of Difference | 0.017 |

*Panel B. Performance of Hedge Fund Trades*

| | (1)<br>Four-Factor Alpha × ΔOwnership | (2)<br>DGTW × ΔOwnership |
|---|---|---|
| Loan × Half1 | 0.198** | 0.236** |
| | (2.14) | (2.56) |
| Loan × Half2 | 0.056 | 0.042 |
| | (0.76) | (0.59) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,095,876 | 2,093,573 |
| R-squared | 0.028 | 0.0281 |
| Difference in coefficients | 0.015 | 0.019* |
| *p*-value of Difference | 0.214 | 0.090 |

## Table 10 – Information Content: Loan vs. Firm

In this table, we investigate whether the information that connected hedge funds have is specific about the loan or about the firm in general. To test this idea, we repeat the analysis in Table 3 except that we remove the three-day loan announcement return from the treated stock abnormal return measures. The dependent variable is trade performance, measured by the product of hedge fund company *i*'s portfolio weight change in stock *j* in quarter *t* and the subsequent quarter stock abnormal return (either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return). Standard errors are adjusted for heteroscedasticity and clustered by fund-company × 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.

| | (1)<br>Four-Factor Alpha × ΔOwnership | (2)<br>DGTW × ΔOwnership |
|---|---|---|
| Loan | 0.130** | 0.125** |
| | (2.14) | (2.13) |
| Stock Controls | Yes | Yes |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | No | No |
| Observations | 1,384,085 | 1,382,774 |
| R-squared | 0.019 | 0.020 |

## Table 11 – Performance of Hedge Fund Trades: Non-Lead Banks

This table reports results that compare returns on hedge funds trades in stocks of borrowing firms where the fund's prime-broker banks are non-lead participant banks in the loan, to returns of other trades in the control group. We calculate trade returns as $\Delta Ownership_{i,j,t} \times Return_{j,t+1}$, that is, the product of hedge fund company *i*'s portfolio weight change in stock *j* in quarter *t* and the subsequent quarter stock abnormal return. $Return_{j,t+1}$ is either the cumulative Carhart (1997) four-factor alpha or DGTW-adjusted return for stock *j* over the quarter *t+1*. Panel A reports the univariate results and Panel B reports the results of multivariate regressions as in Equation (3) with both fund-company × quarter and stock × quarter fixed effects. The variable of interest is *Loan*, an indicator variable equal to one if hedge fund company *i*'s prime-broker bank initiates a loan to stock *j* in the quarter *t+1*, and zero otherwise. The stock-level control variables are defined in the Appendix. In this analysis, we exclude fund-stock-quarter observations where a hedge fund's prime-broker bank is a lead arranger in a loan to the firm. Standard errors are adjusted for heteroscedasticity and double clustered by fund-company × quarter and stock × quarter. *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) |
|---|---|---|
| | Four-Factor Alpha × ΔOwnership | DGTW × ΔOwnership |
| Loan | 0.064 | 0.058 |
| | (1.09) | (1.00) |
| Fund Comp. × Qtr. FE | Yes | Yes |
| Stock × Qtr. FE | Yes | Yes |
| Observations | 2,059,590 | 2,057,300 |
| R-squared | 0.028 | 0.028 |