

Is There a Quid Pro Quo between Hedge Funds and Sell-Side Equity Analysts?

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ABSTRACT: *In this article, the authors posit a quid pro quo in economic benefits between sell-side equity analysts and large hedge fund managers. They show that large hedge funds opportunistically trade one to four days prior to the publication of a recommendation change, a finding consistent with flow of information from analysts to hedge funds. Next, the authors demonstrate that in return for the information provided, analysts benefit from (1) better external evaluations and (2) higher trading commissions and fees for their brokerage firm. Notably, pre-trading occurs only when the analyst issuing the recommendations has a high external evaluation and the analyst's brokerage house is a prime broker to the hedge fund.*

TOPICS: *Manager selection, fundamental equity analysis, portfolio construction**

Sell-side equity analysts play an important role in US capital markets, often providing value-relevant information to investors; however, a large body of literature suggests analysts' economic incentives may not be aligned with their providing unbiased forecasts or stock recommendations. These incentives include access to management (Chen and Matsumoto 2006), investment banking business (Agarwal and Chen 2008), or trading commissions for the analyst's brokerage firm (Jackson 2005; Cowen, Groysberg, and Healy 2006). In all

cases, it is purported that the analyst's total compensation (short or long term) increases by knowingly providing biased stock recommendations or optimistic earnings forecasts.

In response to these allegations, the SEC enacted several regulations. Regulation FD, passed in 2000, placed limitations on private communications between analyst and management. The 2003 Global Analyst Research Settlement (Global Settlement) separated the investment banking business from sell-side research for 10 large brokerage firms; contemporaneous stock exchange rules extended these rules to all brokerage firms. Recent papers find evidence consistent with these regulations being successful in limiting analysts' access to management and the production of less biased stock recommendations (Mohanram and Sunder 2006; Kadan et al. 2009; Cohen, Frazzini, and Malloy 2010).

Nevertheless, regulations sometimes have unintended consequences, and one consequence is that analysts' compensation has shifted away from serving their investment banking division's needs and toward satisfying analysts' clients. In fact, NYSE Rule 472 and NASD Rule 2711, as amended in August 2003, specifically cite the overall rating received from clients as a factor to be used by the analyst's brokerage house when determining that analyst's compensation. Thus, analysts have economic incentives to cooperate and help their major clients.

In this article, we propose that one form of cooperation is an early leakage of analysts' stock recommendation changes to *hedge fund* clients.¹ Specifically, we posit a quid pro quo between an analyst providing upcoming stock recommendation changes to a large hedge fund in return for (1) the analyst's brokerage firm earning higher trading commissions and fees and (2) the analyst receiving better external evaluations. As previous studies show, both factors are related positively to analyst compensation (e.g., Groysberg, Healy, and Maber 2011; Brown et al. 2015).

Our empirical results support a quid pro quo exchange of benefits between hedge fund managers and sell-side equity analysts. Using a sample of FirstCall stock recommendations by 11 large brokerage houses from 2006 through 2011, we find that, on average, large hedge funds opportunistically trade one to four days *prior* to the publication of a recommendation change, with significant net purchases preceding upgrades and significant net sales preceding downgrades; however, the magnitude of the trade is not homogenous across all stock recommendation changes. Instead, we present evidence that net purchases or net sales (trade imbalances) are significantly greater if the analyst publishing the recommendation change is from the hedge fund's prime broker and/or the analyst receives a higher external ranking.

When hedge funds trade externally, they often designate one or more brokerage houses as their prime broker(s).² Prime brokers consolidate hedge fund trades into one venue, thus earning substantive trading commissions. Other fee-driven services are the lending of stocks for short-selling and providing short-term loans for margin calls. These commissions and fees

in turn enrich the analyst's brokerage house, which translates into higher compensation for the recommending analyst (Groysberg, Healy, and Maber 2011). We present evidence that opportunistic hedge fund trading is significantly higher when the analyst's buy or sell recommendation originates from the hedge fund's prime broker. This link is consistent with a quid pro quo exchange of benefits between hedge fund and sell-side equity analysts.

Using a survey of analysts, Brown et al. (2015) reported a positive link between analyst compensation and an analyst's external ranking. This finding is not surprising, considering exchange regulations mandate the use of client rankings in determining their pay packages. We use annual analyst rankings from *Institutional Investor* (II) magazine as a proxy for individual analyst rankings, an external metric found to be highly correlated with client ratings (Groysberg, Healy, and Maber 2011). We show that hedge fund trade imbalances prior to the publication of a stock recommendation change are significantly higher if that recommendation is made by a more highly rated II analyst. Furthermore, we find that these heightened imbalances occur *only* when the higher ranked analyst's brokerage house also serves as the hedge fund's prime broker. Thus, we present evidence of a second quid pro quo exchange of benefits between hedge fund managers and sell-side equity analysts. We interpret this finding as evidence in favor of a beneficial arrangement between hedge fund and analyst—the hedge fund gains value relevant information about upcoming stock recommendation changes from an analyst in exchange for better external evaluations and higher trading commissions.

All of our analyses are multivariate regression estimations using a large number of hedge funds and analysts' stock recommendations. Our regressions include various control variables for the stock's media coverage, SEC filings, earnings announcements, and stock returns on and prior to the published recommendation change. We also control for fixed time effects.

Our findings are consistent with brokerage house analysts tipping forthcoming recommendations to hedge fund clients; however, a plausible alternative explanation for our hedge fund trading patterns is that causality could be reversed—that is, analysts may change their recommendations after observing abnormal levels of hedge fund trade imbalances. We specifically test for

¹ We choose to concentrate on hedge funds because they are the institutional investors most likely to seek alpha returns through gaining an information edge on other investors. Hedge funds subscribe to trade associations and private research firms for early access to economic data and reports, such as the Michigan consumer sentiment survey and the manufacturing index from the Institute for Supply Management (Mullins et al. 2013). They solicit illegal inside information, as witnessed by recent insider-trading cases prosecuted against hedge fund managers of Galleon Group and S.A.C. Advisors. Unlike mutual funds, hedge fund investments are relatively opaque because, generally, they are not required to register under the Investment Company Act of 1940.

² As Brown et al. (2008) showed, about two-thirds of hedge funds do not have their own trading desks, but instead trade on external platforms.

this phenomenon and provide empirical evidence that is not consistent with this explanation.³

Our article complements and extends prior studies on institutions trading opportunistically prior to public disclosures of recommendation changes (see, e.g., Irvine, Lipson, and Puckett 2007; Christophe, Ferri, and Hsieh 2010; and Kadan, Michaely, and Moulton 2015) in three ways. First, we provide evidence against the alternative explanation that abnormally high pre-disclosure trading volume is driven solely by superior research ability. Second, we show that analysts have possible gains from providing these stock recommendations to hedge fund managers. Third, ours is the first article to use data exclusively after the 2003 Global Settlement, thus providing evidence that analyst tipping behavior was not curtailed by that agreement.

Our study also contributes to an important and growing literature investigating different avenues in which hedge funds obtain material nonpublic information and trade on it. Prior studies usually focused on sources of private information discovered from transactions in which the hedge fund itself is a participant (see, e.g., Morgenson [2012] on mergers and acquisition deals and Massoud et al. [2011] on syndicated loans), whereas in this study, the apparent source is a third party: sell-side analysts working for large brokerage firms.

COMPETING HYPOTHESES

Information Leakage Hypothesis

Our first hypothesis is that hedge funds learn about analysts' stock recommendations prior to their publication, and they subsequently profit from this information by trading in these securities. We call this the *information leakage hypothesis*. The advantage to a hedge fund from obtaining information from an analyst about a forthcoming stock recommendation change prior to its

publication is straightforward. In Online Supplement A, we demonstrate that hedge funds can formulate a profitably trading strategy using the information.⁴

Our second hypothesis is that the information leakage hypothesis is more salient between a hedge fund and an analyst if the analyst receives a personal benefit. We offer and ultimately test for two personal benefits—increased commissions and higher external rankings—both being related to the analyst's compensation package.

Brokerage houses earn substantive trading commissions and other fees when taking on the role of a hedge fund's prime broker. Groysberg, Healy, and Maber (2011) and Brown et al. (2015) showed a strong connection between an investment bank's trading commissions and its analysts' compensation.⁵ One explanation is that higher trading commissions produce bigger bonus pools for the bank, resulting in increased compensation for all its employees, analysts included. Thus, we propose that analysts reward hedge fund managers who choose to trade with their brokerage firm by providing them with prior knowledge of upcoming stock recommendation changes.

Previous papers related analysts' coverage/recommendations to their own brokerage house's trading volume. Using data from the Toronto Stock Exchange, Irvine (2000) found a brokerage house's trading volume is higher on its covered stocks than on its uncovered stocks. Irvine (2004) extended his findings by correlating the higher trading volume to its analyst making either a bold recommendation or, more generally, issuing a buy recommendation. These studies, however, were silent on who does the trading and whether there is an exchange of information about these recommendations between the analyst and any specific investor. This study bridges this gap by examining this connection.

A second benefit for analysts is higher evaluative ratings given by hedge fund managers to analysts. The Global Settlement, NASD Rule 2711, and NYSE Rule 472 specifically forbade investment banking houses from

³Our findings also are inconsistent with a different alternative explanation advanced by Kadan, Michaely, and Moulton (2015), who posited that a hedge fund's research about a stock may coincide with an analyst's research, resulting in a similar timing about a stock's future prospects; however, if a hedge fund's pre-recommendation trading patterns are due to its superior research ability, then we should observe no differential trading patterns regarding whether the analyst's recommendation originates in the hedge fund's prime broker's firm or whether the analyst receives a higher external evaluation. Our evidence rejects this alternative explanation.

⁴Our results indicate that on the announcement date, upgrades have an average abnormal stock return of greater than 1%, and downgrades have an average abnormal return of less than -3%.

⁵Groysberg, Healy, and Maber (2011) used proprietary compensation data for sell-side analysts from two investment banking houses. Their data spanned 1988 through 2005 and did not differentiate between pre- and post-Global Settlement time periods. Brown et al. (2015) used survey data for sell-side analysts from 2011 to 2012.

using their own investment banking personnel's ratings of their own analysts as a factor in determining their analysts' compensation.⁶ Initially, the Global Settlement and these rules were silent on what other factors should be considered in determining an analyst's compensation. On July 29, 2003, the NASD and NYSE amended their rules to delineate the criteria investment banks *must* use when determining their analysts' compensation. One *required* factor is "the overall ratings received from **clients** [author emphasis], sales force and peers independent of the member's investment banking department, and other independent rating services" (NASD Rule 2711 d(2)(C) and NYSE Rule 472 h(2)(iii)). Thus, beginning in 2003, analysts' compensation is directly linked to how well they were perceived by their clients relative to other analysts in the same industry.

Anecdotally, Brown et al. (2015) reported that 67% of surveyed sell-side analysts cite their standing in analyst rankings or broker votes as being "very important" to their compensation.⁷ Thus, we propose that analysts curry better evaluations by hedge fund managers by providing them with prior knowledge of upcoming stock recommendation changes. Ideally, we would like to have each analyst's evaluation from each individual hedge fund. Unfortunately, we do not have these data;

⁶Rule 2711(d) states that "No member [investment bank] may pay any bonus, salary or other form of compensation to a research analyst that is based upon a specific investment banking services transaction." Rule 472 states that "No member or member organization may compensate an associated person(s) for specific investment banking services transactions. An associated person may not receive an incentive or bonus that is based on a specific investment banking services transaction." The Global Settlement was announced in December 2002 (SEC 2002). NASD Rule 2711 was passed in May 2002. NYSE Rule 472 was amended in May 2002 to be consistent with NASD Rule 2711. On July 26, 2007, the Financial Industry Regulatory Authority (FINRA) was established. FINRA is the successor to the NASD and the regulation, enforcement, and arbitration arm of the NYSE. NASD Rule 2711 is now called FINRA Rule 2711. NYSE Rule 472 remains the same.

⁷In a face-to-face discussion with a former analyst, we were told that his yearly bonus was greatly influenced by how his "team" performed on two surveys: Overall Sector Research Rankings by Institutional Investor, Inc., and a confidential survey by Greenwich Associates. Both contain rankings of different brokerage firms based on surveys of supply-side analysts' clients' perception of how valuable and helpful the analysts were to them. This analyst also provided us with a copy of each survey for his industry. As an example of the importance of responsiveness, the Greenwich Associates survey ranks brokerage firms by how "intense" their service is and on the strength of the relationship between client and analyst.

however, Groysberg, Healy, and Maber (2011) found a relation between analyst compensation and whether that analyst is ranked by *Institutional Investor* magazine as an All-Star analyst.⁸ They found that All-Star recognition closely proxies for the underlying votes of the analysts' institutional clients. Therefore, we use the *Institutional Investor* magazine ranking as a proxy for the hedge fund votes. Thus, our third hypothesis is that hedge fund trading activity prior to the publication of an analyst's upgrade or downgrade is positively associated with the analyst's *Institutional Investor* rating.

LEGAL AND INSTITUTIONAL BACKGROUND TO TIPPING

To our knowledge, there is only one legal US securities case involving tipping between a brokerage house research department employee and a hedge fund manager. This case was against an executive director in the equity research department at UBS. The director pled guilty to selling information about upcoming stock upgrades and downgrades for cash to a hedge fund manager, who used that information to trade for two hedge funds he managed (SEC Litigation Releases No. 20022, March 2007; No. 21086, June 29; No. 21244, October 2009). The SEC complaint explicitly refers to these transactions as trading "illegally tipped, material nonpublic information" by the director for a share of the "illicit profits" gained from "trading on that information."

In US securities law, illegal trading on nonpublic information (insider trading) falls under the purview of securities fraud as proscribed by Section 10(b) of the 1934 Securities and Exchange Act (see *Chiarella v. United States*, 445 US; 1980). As articulated in *United States v. Newman*, 773 F.3d 438 (2d Cir. 2014), there are two theories of insider trading: classical and misappropriation. Under the classical theory, a corporate insider—for example, a CEO or CFO of a corporation—violates Section 10(b) if he or she trades in the corporation's

⁸*Institutional Investor* magazine sends out questionnaires each year to research directors and the chief investment officers of major asset management firms. The 2015 All-America Research Team questionnaire was returned by over 3,800 individuals at more than 1,000 firms (see *Institutional Investor* methodology at www.institutionalinvestor.com/Research/5939/Methodology.html). They organize analysts' research sectors by industry and designate the top three recipients as All-Star analysts.

securities on the basis of “material, nonpublic information” about the corporation. The classical theory is based on a relationship of trust between management and shareholders and the “necessity of preventing a corporate insider from taking unfair advantage of uninformed stockholders” (*Chiarella v. United States* 1980).

Under the misappropriation theory, illegal trading on nonpublic information extends to outsiders who do not have a fiduciary duty to shareholders. Instead, a person in possession of material nonpublic information (the “tipper”) passes this information on to someone who uses it to trade (the “tippee”). Both the tipper and tippee are potentially liable as violators of Section 10(b), and each can be prosecuted by the SEC. The major Supreme Court case on tipping is *Dirks v. S.E.C.*, 463 US 646 (1983). To be liable for illegal trading under the misappropriation theory, two legal standards must be met. First, there must be a breach of the duty of confidentiality between the tipper and the owner of the nonpublic information. Second, the tipper must receive a personal benefit in exchange for disclosing the confidential information. Under *Dirks*, the “personal benefit” includes “a pecuniary gain or a reputational benefit that will translate into future earnings.”

In 2013 and 2014, respectively, two states, Massachusetts and New York, investigated and came to agreements with Citigroup Global Markets and BlackRock for analysts’ selectively disseminating confidential information to large hedge fund clients.⁹ The agreements cite written policies between analysts and their brokerage houses prohibiting the dissemination of an analyst’s research reports or inputs prior to them becoming public as a breach of confidentiality. The New York agreement describes two alleged benefits to the analyst from providing this confidential information to the hedge fund: increased trading volume by the hedge fund with the brokerage house and “higher [participating analyst] ratings in prominent financial industry magazine rankings” by the recipient hedge fund manager. These are the two benefits we examine in this study.

⁹ See “In the Matter of the Investigation of BlackRock, Inc.” by Eric T. Schneiderman, Attorney General of the State of New York (Assurance No. 14-007; 2014), and “In the Matter of Citigroup Global Markets, Inc.” by the Commonwealth of Massachusetts Office of the Secretary of the Commonwealth Securities Division (Docket No. 2013-0014; 2013). The named investment firms are SAC Capital, Citadel, LLC, GKG Partners, and T. Rowe Price (Massachusetts).

SAMPLE SELECTION

Our tests require data on analysts’ stock recommendations, analysts’ external rankings, hedge fund trading volume, prime broker identifications, and stock return data.

Analysts’ Recommendations and Analysts’ External Rankings

Analysts’ recommendations are from the FirstCall database.¹⁰ FirstCall presents five classifications of stock recommendations: strong buy, buy, hold, underperform, and sell, with 1 representing a strong buy and 5 being a sell. Similar to prior research, we flip the numerical order; thus, a larger number represents a more optimistic stock recommendation.

Our sample spans January 1, 2006, through December 31, 2011. When an analyst issues a new recommendation, we compare that recommendation with the prior one and designate the new recommendation to be an upgrade, a downgrade, or no change in recommendation. To ensure our results are not influenced by subsequent recommendation changes, we remove *all* recommendations occurring within 14 days of the original recommendation change. As the first line of Exhibit 1, Panel A, reports, we have an initial sample of 157,161 upgrades, 98,237 downgrades, and 55,652 no change in recommendations over our time period.

We limit our sample of recommendations to 11 brokerage firms scrutinized for their analysts’ practices since 2002. Nine are part of the 2003 Global Settlement (Bear Stearns, Credit Suisse—North America, Goldman Sachs, JPMorgan, BofA Merrill Lynch, Morgan Stanley, Citigroup, UBS Equities, and Bancorp Piper Jaffray).

¹⁰ We use the FirstCall database instead of the I/B/E/S database for two key reasons. First, FirstCall updates its recommendations in real time. I/B/E/S, on the other hand, updates its recommendations on a weekly or monthly basis. Therefore, the published date on FirstCall is more accurate. A number of prior studies using the FirstCall database when timing is important include studies by Green (2006) and Christophe, Ferri, and Hsieh (2010). Second, Ljungqvist, Malloy, and Marston (2009) documented widespread changes to the historical I/B/E/S analyst stock recommendations database, including alterations of recommendations and additions and deletions of records. Barber, Lehavy, and Trueman (2010) found no such inconsistencies in the FirstCall database. Therefore, the FirstCall database may provide more accurate recommendation data.

EXHIBIT 1

Descriptive Data on Recommendation Changes and Number of Hedge Funds

Panel A: Number of Recommendation Changes

No. of Unique Recommendations	Upgrades	Downgrades	No Change	Total
From FirstCall	157,161	98,237	55,652	311,050
From the 11 prominent brokerage firms	40,562	28,453	19,470	88,485
Traded on by the HF between days -10 and -1				
<i>All</i>	19,775	14,444	9,711	43,930
<i>Prime broker only</i>	3,924	3,007	1,952	8,883
<i>Identifiable analysts only</i>	12,540	9,001	5,456	26,997
<i>Identifiable analysts and prime broker</i>	2,715	755	524	3,994

Panel B: Number of Hedge Funds

	HF Not Identified	#HF Families Included
From <i>Institutional Investor</i> magazine		228
Less not found in trading dataset	(159)	69
Less no trading between 2006 and 2011	(26)	43

Panel C: Number of Hedge Funds with Prime Broker Information

	HF Not Identified	#HF Family Included	# Individual Funds
From Panel B		43	1,151
Less not found in TASS	(15)	28	460
Less no prime broker information	(6)	22	400
Less not from the 11 brokers in our dataset	(8)	14	291

Panel D: Summary Statistics for Regression Variables

	All	Downgrade	No Change	Upgrade	Upgrade vs. Downgrade	t-Stat
<i>Trade Imbalance</i> _{<i>j,k,t</i>} (%)	-0.0004	-0.0083	-0.0015	0.0008	0.0091***	3.53
<i>10K</i> _{<i>j,t</i>}	0.0029	0.0039	0.0024	0.0038	-0.0001	-0.2
<i>10Q</i> _{<i>j,t</i>}	0.0113	0.0113	0.0111	0.0114	0.0001	0.07
<i>8K</i> _{<i>j,t</i>}	0.0039	0.0049	0.0041	0.0029	-0.0021	-0.14
<i>Quarterly Earnings Announcement</i> _{<i>j,t</i>}	0.0222	0.0216	0.0207	0.0233	0.0017**	2.00
<i>Analyst Forecast</i> _{<i>j,t</i>}	0.1318	0.1374	0.1077	0.1394	0.0020	0.72
<i>#News Articles</i> _{<i>j,t</i>}	4.7191	5.1093	4.6472	4.9654	-0.1439	-1.51
<i>Sentiment</i> _{<i>j,t</i>}	49.9186	49.8503	49.9173	49.9757	0.1254***	5.49
<i>Sentiment</i> _{<i>j,lagged</i>}	51.0469	50.8092	51.8374	52.2130	1.4038***	7.39
<i>CAR</i> _{<i>j,lagged</i>} (%)	0.0075	-0.0140	0.0011	0.0106	0.0246***	4.48

Notes: Panel D presents summary statistics for dependent and independent variables used in this article. Only hedge funds in the *Institutional Investor* magazine top 100 between 2006 and 2011 that also appear in our trading dataset are included. See Appendix A for variable definitions.

*** significant at 0.01% level; ** significant at 0.05% level.

The missing Global Settlement firm, Lehman Brothers, is not covered by FirstCall. The other two brokerage firms are BlackRock and Deutsche Bank. Both are alleged to have been part of a global surveying system between analysts and hedge fund clients intended to provide information to hedge funds about upcoming

recommendation changes (Morgenson 2012; Attorney General Schneiderman 2014).¹¹ These 11 brokerage

¹¹ Eight brokerage firms were alleged to be part of the global survey system. The other six firms are part of the Global Settlement: Citigroup, Credit Suisse, Goldman Sachs, JPMorgan Chase, Merrill Lynch, and UBS.

firms yield 88,485 individual recommendation changes, encompassing 28.4% of the full FirstCall database. The firms covered by these 11 brokerages are similar in composition to the full FirstCall and Compustat universe of firms (see Online Supplement B).

Analysts' external rankings are from the yearly October issue of *Institutional Investor* magazine (II). In that issue, II presents "All-Star" (currently All-American) analysts, derived from their surveys of research directors and chief investment officers of major asset management firms. II orders and lists the top three analysts by industry each year. We use the I/B/E/S identification list to match each analyst in our sample with the II list—the match is made for the year in which II was published.

Hedge Fund Trades

Our hypotheses presume a favored relation between the analyst and the hedge fund. To maximize the probability that our sample of hedge funds comprises preferred clients, we begin our sample selection by including only the top 100 hedge funds by assets under management, as listed each year in II from 2006 through 2011. II lists the hedge funds by manager (e.g., JP Morgan) and not by individual funds (e.g., JP Morgan Growth Fund A or JP Morgan Growth Fund B). After removing duplicate funds, we have an initial sample of 228 unique hedge fund families.

We use a proprietary database to obtain hedge fund trading transactions. This database contains executed equity trades and provides information on the identity of the trader, the date of the trade, whether the trade was a buy or a sell, the number of shares traded, and the execution price. Thus, we are able to determine the date, the direction, and the number of shares traded by each hedge fund in our database on a daily basis. We aggregate trades by fund manager (e.g., JP Morgan) on a daily basis. For our time period of 2006 through 2011, our database contains trades by 564 unique hedge fund families and other institutions. In terms of coverage, our database accounts for approximately 11% of the total daily CRSP trading volume.

We merge the 228 large hedge fund families from II with this database. As Exhibit 1, Panel B, shows, 159 hedge funds are not in our trading database, and 26 additional hedge funds are in the database but did not record trades between 2006 and 2011. After removing

these hedge funds, we have a final sample of 43 large hedge fund families. These fund families account for 1,151 separate hedge funds.

Prime Broker and Other Required Data

Each hedge fund can trade securities on its own platform, or it can use one or more external broker-dealers. According to the Hedge Fund Marketing Association, (<http://www.hedgefundmarketing.org>), prime brokers provide specialized services to hedge funds. Two prominent services are (1) acting as a centralized clearing house where all executing brokers settle their trades, and (2) lending cash and securities for margin requirements and/or short-selling by the hedge fund. The top 10 prime brokers in April 2016 in terms of number of hedge fund clients were Goldman Sachs, Morgan Stanley, JPMorgan, Credit Suisse, Deutsche Bank, UBS, Bank of America, Citigroup, Barclays, and BNP Paribas (<https://www.hfalert.com/rankings/rankings.pl>). Our sample of large brokers includes the top nine prime brokers.

We use the TASS database to determine if a hedge fund has a prime broker and the brokers' identities. TASS is a voluntary data collection source; hedge funds choose whether they wish to be included in the database. Therefore, it is possible that some prime brokers are never reported to TASS. Our analyses rely on comparing differences in hedge fund behavior between recommendations issued by prime brokers and non-prime brokers. To the extent that our approach incorrectly classifies a prime broker as non-prime, it biases against our findings. The TASS database is a yearly compilation, containing information on both live and defunct hedge funds. Because hedge funds may change their prime broker affiliations over time, we use separate TASS datasets for each year of our sample—2006 through 2011.

TASS lists its funds at the fund level—for example, JP Morgan Growth Fund A or JP Morgan Growth Fund B. It also indicates who the fund manager is—for example, JP Morgan. Because our transaction database shows trades by fund manager only, we group TASS individual hedge funds by firm managers. Thus, each hedge fund family consists of one or more individual hedge funds.

Exhibit 1, Panel C, illustrates how we obtain our sample of prime brokers. First, we begin with the 43 large (manager level) hedge fund families from the

transaction database. On a yearly basis, we merge this file with the TASS database, ultimately eliminating 15 hedge fund families not found in TASS. We next examine the TASS service provider tab for each individual hedge fund. Six hedge fund families report no prime broker information for any of their individual funds and are removed from the sample. The remaining 22 hedge fund families have prime broker information for at least one individual hedge fund. We retain the hedge fund families that use one of the 11 large brokerage houses in our FirstCall sample. Because each manager-level hedge fund may manage multiple individual funds, we have instances in which individual funds may use several prime brokers. In these instances, we treat all of the brokers as prime brokers at the manager-level hedge fund. In all, we have prime broker information on 14 hedge fund families, encompassing 291 individually managed funds.

Stock return data are from CRSP, and accounting data are from Compustat. All variables are winsorized at the extreme 1%.

TRADING BEFORE THE RECOMMENDATION DATE: METHODOLOGY AND EMPIRICAL RESULTS

We begin our analyses by testing for higher hedge fund trade imbalances prior to the public release of an analyst upgrade or downgrade for the full set of 43 hedge funds. We predict that hedge funds buy prior to upgrades and sell prior to downgrades. For our first set of regressions, we do not include analysts' incentives (e.g., trading commissions or ratings by investors) as additional variables.

Methodology

We estimate the following regressions for each day $-t$ portfolio, where t is the number of trading days prior to a published stock recommendation change:

$$\text{Trade Imbalance}_{j,k,-t} = \alpha_{-t} + \beta_{-t} \Delta Rec_{j,0} + \text{Control Variables}_{j,-t} + FE_T, \quad (1)$$

$\text{Trade Imbalance}_{j,k,-t}$ is the number of shares purchased less shares sold on stock j by hedge fund k on day $-t$, divided by the total number of shares outstanding in the

quarter-end preceding day $-t$. A positive trade imbalance indicates a net purchase of stock j by hedge fund k on day $-t$. A negative number represents a net sale of stock k by hedge fund k on day $-t$. Thus, instead of looking at aggregate trade imbalances for any stock (e.g., Christophe, Ferri, and Hsieh 2010), we use individual hedge fund trades prior to recommendation changes.

$\Delta Rec_{j,0}$ is an indicator representing the direction of a sell-side published recommendation on day 0 on stock j . $\Delta Rec_{j,0}$ takes on values of 1 for an upgrade, -1 for a downgrade, and zero if the analyst issues a no-change recommendation. A significantly positive coefficient on β_{-t} for any day $-t$ is consistent with there being a significant trade imbalance on day $-t$, with large purchases being associated with upgrades, and large sales being associated with downgrades.

We include several control variables to account for news events other than a forthcoming stock recommendation on day 0 that may influence trading on day $-t$. $10K_{j,-t}$, $10Q_{j,-t}$, and $8K_{j,-t}$ are indicators for whether firm j filed a 10-K, 10-Q, or 8-K filing with the SEC on day $-t$. $\text{Quarterly Earnings Announcement}_{j,-t}$ is an indicator for whether firm j announced its quarterly earnings on day $-t$. $\text{Analyst Forecast}_{j,-t}$ is an indicator if any analyst issued a new forecast of firm j 's earnings-per-share on day $-t$. $CAR_{j,\text{lagged}}$ is the cumulative abnormal return on stock j accrued over days $-t - 4$ through days $-t - 1$. We use a four-factor Fama-French momentum model to calculate firm j 's CAR. This variable controls for information content over the three days before the trading date, as well as observed price movements that may influence a hedge fund's trading activity.

We use the RavenPack News Analytics database to construct control variables for news stories about firm j . RavenPack covers all news items disseminated by Dow Jones Newswires. Using advanced textual analyses, RavenPack creates variables related to the news items, including a relevance score and a sentiment score. The relevance score is from 0 (low relevance) to 100 (high relevance), with each score indicating the degree to which firm j is related to the underlying story. Following Bushman, Williams, and Wittenberg-Moerman (2017), we include only full-size articles with a RavenPack relevance score of 75 and above. Using this cutoff, we create $\#News\ Articles_{j,-t}$, which is the number of news stories about firm j on day $-t$ as reported in RavenPack. We use RavenPack's Composite Sentiment Score (CSS), which

ranges from 0 (most negative) to 100 (most positive), to assess the tone of the news articles. $Sentiment_{j,-t}$ is the CSS for day $-t$; $Sentiment_{j,lagged}$ is the CSS averaged over days $-t - 90$ through $-t$. Thus, we account for news events occurring on the trading day and over the 90-day period preceding the trading day.

Finally, we control for yearly fixed effects (e.g., microeconomic conditions) by including the variable FE_{jt} , an indicator for the year of the recommendation.

We estimate Equation 1 separately for days -1 through -10 ; that is, we examine trading behavior by hedge funds for each day in the two-week period (10 trading days) prior to the public announcement of the sell-side recommendation. This gives us an indication of when hedge funds trade. Because $\Delta Rec_{j,0}$ takes on a value of $+1$ for an upgrade and -1 for a downgrade, both net purchases for an upgrade or net sales for a downgrade would result in significantly positive β_{-t} coefficients on $\Delta Rec_{j,0}$. Because Equation 1 is estimated with pooled data, individual hedge funds and brokerage firms may appear more than once. Therefore, we two-way cluster our standard errors by hedge fund and brokerage firm (Thompson 2010).

SAMPLE SUMMARY STATISTICS

Exhibit 1, Panel D, has summary statistics for the variables in Equation 1. The average trade imbalance is -0.0083 for downgrades and 0.0008 for upgrades. In dollar terms, hedge funds invest an average of \$1.2 million more in firms with upcoming upgrades than downgrades.¹² Thus, initial evidence shows that hedge funds have net sales prior to downgrades, but net purchases before published upgrades. See Online Supplement C for additional summary statistics on our full sample.

When looking at other news items, we note that approximately 14% of firms have an analyst earnings forecast within the 10-day period prior to the issuance of a recommendation change. This forecast is from any analyst and may or may not be related to the analyst issuing the new recommendation. We also find that 2.22% of firms have an earnings announcement over the 10-day interval. SEC filings are more rare, although 1.13% of

firms did file a Form 10Q with the SEC. Finally, the average Composite Sentiment Score is approximately 50.0, which indicates, on average, a neutral news story tone about the individual company.

REGRESSION RESULTS: FULL SAMPLE

Exhibit 2, Panel A, presents summary statistics for Regression 1. We include the recommendation only if at least one hedge fund traded on that stock on day $-t$.

Consistent with an information leakage hypothesis, the coefficients on β_{-t} for days -1 , -2 , -3 , and -4 are significantly different from zero. Each coefficient represents the average net trading volume as a percent of total shares outstanding. For day -1 , the average amount of net shares traded is 0.0054%; for day -2 , it is 0.0024%; for day -3 , it is 0.0064%; and for day -4 , it is 0.0030%. This compares to average daily trade imbalances of -0.0004% over days -10 through -1 , respectively (see Exhibit 1, Panel D).

When we compare these coefficients and significance levels with days -5 through -10 , we find that (1) none of the coefficients for these days are significantly different from zero at conventional levels, and (2) the percent of outstanding shares traded on each of these days is lower. Thus, hedge funds appear to trade opportunistically one to four days prior to a recommendation change.¹³ In Online Supplement D, we examine upgrades and downgrades separately and find similar results.

Several of the control variables are significantly different from zero. For the regressions in Exhibit 2, the following control variables are significantly different from zero in at least five out of the ten regressions: $Sentiment_{j,-t}$ (positive), $CAR_{j,lagged}$ (positive), and $\#News\ Articles_{j,-t}$ (negative).

The results in Panel A are consistent with an overall information tipping hypothesis about upcoming changes in analysts' stock recommendations in the days just prior to the analyst recommendation publication. The results also suggest that pre-trading is unlikely to be driven by hedge fund forecasting ability. If hedge funds were able to forecast these changes, we would expect to see increased trading across the 10-day window; they

¹² Our result likely underestimates the magnitude of the underlying event because reporting to our private trading database is voluntary, and it is possible that not all transactions executed are captured.

¹³ We also extend the period to 20 days prior to the published recommendation [untabulated] and find insignificant coefficients for days -11 through -20 .

EXHIBIT 2

Regression Results for Hedge Fund Trade Imbalances on Future Recommendation Changes

Panel A: All Recommendation Changes

$$\text{Trade Imbalance}_{j,k,-t} = \alpha_{-t} + \beta_{-t} \Delta \text{Rec}_{j,0} + \text{Control Variables}_{j,-t} + FE_T$$

Day _{-t}	β_{-t}	t-Stat	Number of Observations	Control Variables
-t = 1	0.0054**	2.50	50,149	10K _{j,-t}
-t = 2	0.0024*	2.02	50,864	10Q _{j,-t}
-t = 3	0.0064***	3.20	51,351	8K _{j,-t}
-t = 4	0.0030*	1.89	50,062	Quarterly Earnings
-t = 5	0.0021	1.27	49,765	Announcement _{j,-t}
-t = 6	0.0014	0.82	49,229	Analys Forecast _{j,-t}
-t = 7	-0.0003	-0.35	48,664	#News Articles _{j,-t}
-t = 8	0.0017	0.59	48,409	Sentiment _{j,-t}
-t = 9	0.0016	0.59	48,642	Sentiment _{j,lagged}
-t = 10	0.0008	0.41	48,200	CAR _{j,lagged}

Panel B: Recommendations Issued by Prime vs. Non-Prime Brokers

$$\text{Trade Imbalance}_{j,k,-t} = \alpha_{-t} + \beta_{-t} [\Delta \text{Rec}_{j,0} * \text{Prime Broker}_{j,k}] + \gamma_{-t} \Delta \text{Rec}_{j,0} + \zeta_{-t} \text{Prime Broker}_{j,k} + \text{Control Variables}_{j,-t} + FE_T$$

Day _{-t}	β_{-t}	t-Stat	γ_{-t}	t-Stat	ζ_{-t}	t-Stat	No. Obs.	Control Variables
-t = 1	0.0119**	2.38	0.0141**	2.56	-0.0239**	-2.93	12,345	Same controls as Panel A
-t = 2	0.0171**	2.26	0.0036	1.50	0.0041	0.70	12,085	
-t = 3	0.0308**	2.42	0.0013	0.24	-0.0083	-0.99	12,032	
-t = 4	0.0306***	4.22	0.003	1.10	0.0168	1.35	11,607	
-t = 5	0.0048	0.55	-0.0027	-1.68	0.0112**	2.48	11,491	
-t = 6 to 10	See Online Supplement E							

Panel C: Recommendations Conditioned on Prime Broker and CAR

$$\text{Trade Imbalance}_{j,k,-t} = \alpha_{-t} + \beta_{-t} [\text{CAR}_{j,0+3} * \text{Prime Broker}_{j,k}] + \gamma_{-t} \text{CAR}_{j,0+3} + \zeta_{-t} \text{Prime Broker}_{j,k} + \text{Control Variables}_{j,0-t} + FE_{t-1}$$

Day _{-t}	β_{-t}	t-Stat	γ_{-t}	t-Stat	ζ_{-t}	t-Stat	No. Obs.	Control Variables
-t = 1	0.2034***	3.62	-0.0863*	-2.22	-0.0235**	-2.94	12,345	Same controls as Panel A
-t = 2	0.2304***	3.40	-0.1731**	-3.08	0.003	0.52	12,085	
-t = 3	0.1115*	1.69	0.0433	0.83	-0.0111	-1.32	12,032	
-t = 4	0.2029***	3.44	-0.149	-1.28	0.0191*	1.84	11,607	
-t = 5	-0.2684	-1.33	0.0311	0.62	0.0106*	1.88	11,491	
-t = 6 to 10	See Online Supplement E							

Notes: Exhibit 2 presents summary statistics from regressing trade imbalances on subsequent recommendation changes. Our sample consists of hedge funds listed in the top 100 in terms of size by Institutional Investor magazine between 2006 and 2011 with required trading data. In Panel A, we present results with our full sample; in Panels B and C, only trades from hedge funds that use one of the 11 brokers as their prime brokers are included.

Trade Imbalance_{j,k,-t} is the number of shares purchased less shares sold on stock j by hedge fund k on day -t, divided by the total number of shares outstanding in the quarter-end preceding day -t. $\Delta \text{Rec}_{j,0}$ is an indicator representing a sell-side published recommendation change on stock j on day 0. ΔRec_j takes the value of 1 for an upgrade, a value of -1 for a downgrade, and zero if the analyst issues a "no change" recommendation on day 0. Prime Broker_{j,k} is an indicator variable that takes a value of 1 if the broker issuing the recommendation is a prime broker for the hedge fund, and zero otherwise. CAR_{j,0+3} is the abnormal return on stock j for days 0 through +3, where day 0 is the published recommendation date. We estimate the regression individually for each Day_{-t} subgroup, where t represents the number of trading days before the recommendation change is issued, and goes from -1 through -10. Annual fixed effects (FE_T) are included, and standard errors are two-way clustered by the hedge fund and brokerage firm. Observations falling on the extreme 1% are winsorized.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

cannot forecast the precise timing of the subsequent upgrade or downgrade. The short window, on the other hand, is consistent with hedge funds having advance notice of the date of the public release of recommendation changes.

LINKAGES BETWEEN OPPORTUNISTIC HEDGE FUND TRADING AND ANALYSTS' BENEFITS

Increased Trading Commissions

Hypothesis 2 predicts a positive association between hedge fund trade imbalances and the analyst's brokerage firm acting as the hedge fund's prime broker. The rationale behind Hypothesis 2 is a purported quid pro quo between analyst and hedge fund. The prime broker firm analyst's compensation is related to the firm's increased trading commissions and additional fees. The hedge fund earns abnormal market returns from trading prior to the recommendation.

We create an indicator, *Prime Broker_{j,k}*, equal to 1 if the stock recommendation on stock *j* is from the hedge fund's prime broker, *k*, and zero otherwise. To test Hypothesis 2, we estimate the following equation for each day $-t$:

$$\begin{aligned} Trade\ Imbalance_{j,k,-t} = & \alpha_{-t} + \beta_{-t}[\Delta Rec_{j,0} * Prime\ Broker_{j,k}] \\ & + \gamma_{-t}\Delta Rec_{j,0} + \zeta_{-t}Prime\ Broker_{j,k} \\ & + Control\ Variables_{j,-t} + FE_T \end{aligned} \quad (2)$$

The key variable is the interaction term between $\Delta Rec_{j,0}$ and *Prime Broker_{j,k}*. A positive coefficient on β_{-t} for day $-t$ is consistent with the view that hedge fund trade imbalances are significantly higher for upcoming recommendation changes when these changes originate from their prime broker.

We estimate Equation 2 over trade imbalances by hedge funds in which we are able to determine the prime broker. If the hedge fund identifies one or more prime brokers in the TASS database, we keep all trades made by that hedge fund around recommendation change dates. In all, we have 43,930 recommendations in which at least one hedge fund traded; of these, 8,883 recommendations are trades associated with recommendation

changes issued by the hedge fund's prime broker (see Exhibit 1, Panel A).

Regression results are shown in Exhibit 2, Panel B. As before, we estimate Equation 2 separately for days -1 through -10 . Consistent with Panel A, in which trading behavior is not conditioned on the identity of a hedge fund's broker, the coefficients on γ_{-t} are significantly positive for day -1 only. This coefficient measures the trading activity for hedge funds in which the recommendation change does *not* originate with the fund's prime broker.

Nonetheless, consistent with Hypothesis 2, we find significantly positive β_{-t} coefficients for days -1 through -4 . These coefficients measure the incremental trading activity by hedge funds prior to recommendations in which the recommendation change *originates* with the fund's prime broker vis-à-vis a non-prime broker. The β_{-t} coefficients vary from 0.0119 through 0.0308, suggesting an increase of 0.01% to 0.03% of total shares outstanding being traded (in the direction of the recommendation change) on each of these four trading days. Thus, Panel B presents evidence consistent with an information leakage between analyst and hedge fund being more prominent when the analyst's brokerage house is also the prime broker for the hedge fund.

Implicit in the quid pro quo argument is that hedge funds earn abnormal profits from trading prior to the recommendation change. We therefore test whether trade imbalances on prime broker analyst recommendation changes will be higher if the expected economic gains from trading are more substantive. Using perfect foresight (or rational expectations), we use actual returns for days 0 through $+3$ as our measure of expected economic gains from trading prior to day 0. Specifically, we estimate for days -10 through -1

$$\begin{aligned} Trade\ Imbalance_{j,k,-t} = & \alpha_{-t} + \beta_{-t}[CAR_{j,0+3} * Prime\ Broker_{j,k}] \\ & + \gamma_{-t}CAR_{j,0+3} + \zeta_{-t}Prime\ Broker_{j,k} \\ & + Control\ Variables_{j,0-t} + FE_T \end{aligned} \quad (3)$$

Exhibit 2, Panel C, presents summary statistics on estimating Equation 3. γ_{-t} is significantly negative, for days -1 and -2 , indicating that hedge funds trade fewer shares or in the incorrect direction for larger price movement recommendations made by analysts of non-prime broker firms. In contrast, β_{-t} is significantly

positive at the 0.01 level for days -1 , -2 , and -4 , and at the 0.10 level for day -3 . For days -1 through -4 , the incremental trade imbalances are 0.2034%, 0.2304%, 0.1115%, and 0.2029%. These findings are consistent with trade imbalances on upcoming recommendations being positively associated with immediate economic gains from trading *only* when those changes originate from the hedge fund's prime broker.

In tandem, the findings of Exhibit 2, Panels B and C, are consistent with a quid pro quo explanation behind the information leakage hypothesis of analysts tipping hedge funds about future stock recommendation changes.

EXTERNAL ANALYSTS' RANKINGS AND PRIME BROKER

Hypothesis 3 predicts a positive association between hedge fund trading prior to a recommendation change and the analyst's external ranking. NASD Rule 2711 and NYSE Rule 472 explicitly require brokerage houses to consider the analyst's external ranking as part of the analyst's overall compensation package. The rationale behind Hypothesis 3 is that hedge fund managers reward analysts who provide them with information about their future stock recommendation changes by giving these analysts more favorable analyst rankings.

We do not have direct data on analysts' rankings by hedge fund clients. Instead, we use II analysts' rankings as a proxy variable. II conducts its own survey, in which it asks all fund managers to rank specific analysts within an industry. In its October issue, II presents its results by listing the names and affiliations of the top three analysts ranked within each industry—II designates these three analysts as "All-Star Analysts."

We use II rankings to create a variable, *All-Star-Rank_k*. *All-Star-Rank_k* takes on the values of 3, 2, 1, and 0 by whether an individual analyst, k , is ranked first, second, or third, or not ranked, respectively, by II in the October issue of II at the time of the analyst's recommendation. Thus, unlike prior research, we differentiate among All-Star analysts by incorporating the ranking itself into a multi-level variable.

In this test, we combine the two possible compensation channels and examine if hedge fund trading activity is jointly related to (1) the analyst's relative ranking and (2) the analyst's brokerage house acting as

a prime broker to the hedge fund. We examine this by estimating the following equation separately for stock recommendations by hedge fund prime brokers only and for recommendations by non-prime brokers.¹⁴

$$\begin{aligned} Trade\ Imbalance_{j,k,-t} = & \alpha_{-t} + \beta_{-t}[\Delta Rec_{j,0} * All-Star-Rank_k] \\ & + \gamma_{-t}\Delta Rec_{j,0} + \zeta_{-t}All-Star-Rank_k \\ & + Control\ Variables_{j,-t} + FE_T \end{aligned} \quad (4)$$

Exhibit 3, Panel A, presents summary statistics for regressions of Equation 4 for stock recommendations by hedge fund prime brokers, and Panel B has the statistics for stock recommendations by non-prime brokers. Comparisons between the two panels reveal stark empirical differences, and, consequently, different inferences. In Panel A, γ_{-t} is significantly positive for days -1 through -4 . These coefficients measure trade imbalances for recommendations published by prime broker analysts who do not achieve the All-Star ranking in year T . Thus, as before, we see evidence of a link between hedge fund trade imbalances and whether the recommendation originates from the hedge fund's prime broker firm. Moreover, as evidenced by the significant positive coefficients, β_{-t} , for days -1 through -3 , recommendations by prime broker analysts who also obtain a higher analyst rating are associated with higher trade imbalances. These additional trade imbalances are, on average, 0.0053%, 0.0042%, and 0.0031%.

In contrast, in Panel B, γ_{-t} and β_{-t} are insignificantly different from zero. The insignificant coefficients, γ_{-t} , are consistent with prior results shown in Exhibit 2 that recommendations originating from non-prime broker analysts are not significantly associated with hedge fund trade imbalances. The insignificant coefficients, β_{-t} , suggest that trading prior to these recommendations does not significantly change according to whether the issuing analyst has a higher or lower external rating.

In summary, the findings in this section are consistent with a quid pro quo theory of tipping between

¹⁴ Alternatively, we could re-estimate Equation 3 with an added three-way interaction term among ΔRec , All-Star-Rank, and Prime Broker. The inferences and results are similar when we employ this three-way interaction term, but we prefer the simpler presentation of comparing Panels B and C.

EXHIBIT 3

Recommendations Issued by Analyst's External Ranking

Panel A: All-Star Analysts Ranking (prime broker recommendations only)

Day _{-t}	β_{-t}	t-Stat	γ_{-t}	t-Stat	ζ_{-t}	t-Stat	No. Obs.	Control Variables
-t = 1	0.0053**	2.50	0.0051**	1.96	-0.0009	-1.04	2,217	10K _{j,-t}
-t = 2	0.0042***	2.85	0.0067***	3.00	-0.0016**	-2.2	2,060	10Q _{j,-t}
-t = 3	0.0031**	2.55	0.0067***	2.79	0.0013	1.64	2,066	8K _{j,-t}
-t = 4	0.0013	1.47	0.0044*	1.74	-0.0014*	-1.68	1,956	Quarterly Earnings
-t = 5	0.0005	0.64	0.0015	0.63	0.0002	0.20	1,854	Announcement _{j,-t}
-t = 6	0.0001	0.10	0.0008	0.33	-0.0003	-0.37	1,744	Analyst Forecast _{j,-t}
-t = 7	0.0012	1.30	0.0031	1.16	0.0010	1.19	1,764	#News Articles _{j,-t}
-t = 8	-0.0009	-1.22	-0.0015	-0.72	0.0009	1.26	1,888	Sentiment _{j,-t}
-t = 9	0.0005	0.67	0.0012	0.55	-0.0004	-0.63	1,834	Sentiment _{j,lagged}
-t = 10	0.0003	0.35	0.0016	0.65	-0.0016	-1.99	1,684	CAR _{j,lagged}

Panel B: All-Star Analysts Ranking (non-prime broker recommendations only)

Day _{-t}	β_{-t}	t-Stat	γ_{-t}	t-Stat	ζ_{-t}	t-Stat	No. Obs.	Control Variables
-t = 1	0.0010	1.07	0.0046	1.09	0.0043***	2.55	4,197	10K _{j,-t}
-t = 2	0.0000	0.01	-0.0007	-0.17	-0.0010	-0.73	4,034	10Q _{j,-t}
-t = 3	0.0019	1.27	0.0056	1.32	-0.0001	-0.04	4,032	8K _{j,-t}
-t = 4	0.0006	0.41	0.0054	1.32	0.0000	-0.01	3,878	Quarterly Earnings
-t = 5	0.0007	0.53	0.0053	1.39	0.0018	1.38	3,878	Announcement _{j,-t}
-t = 6	0.0020	1.37	0.0080	1.90	-0.0014	-0.94	3,669	Analyst Forecast _{j,-t}
-t = 7	0.0002	0.14	0.0015	0.31	-0.0008	-0.50	3,986	#News Articles _{j,-t}
-t = 8	-0.0006	-0.35	-0.0006	-0.11	-0.0004	-0.26	4,033	Sentiment _{j,-t}
-t = 9	0.0009	1.08	0.0012	1.22	-0.0013	-0.71	3,861	Sentiment _{j,lagged}
-t = 10	-0.0026	-1.56	-0.0037	-0.77	-0.0016	-1.03	3,737	CAR _{j,lagged}

Notes: Exhibit 3 presents summary statistics from regressing trade imbalances on subsequent recommendation changes. Only FirstCall recommendations that can be matched with I/B/E/S recommendations are included. In Panel A, we present results with prime broker recommendations only, and in Panel B, we present results with non-prime broker recommendations only. The estimated regression is:

$$\begin{aligned} \text{Trade Imbalance}_{j,k,-t} = & \alpha_{-t} + \beta_{-t}[\Delta \text{Rec}_{j,0} * \text{All-Star-Rank}_k] \\ & + \gamma_{-t} \Delta \text{Rec}_{j,0} + \zeta_{-t} \text{All-Star-Rank}_k, \\ & + \text{Control Variables}_{j,-t} + \text{FE}_T \end{aligned}$$

All-Star-Rank_k is the ranking given to the analysts by Institutional Investor magazine at the time of the stock recommendation. It takes the value of 3, 2, 1, and 0 if the analyst is ranked #1, #2, or #3, and not ranked, respectively. See Appendix A for other variable definitions. We estimate the regressions individually for each Day_{-t} subgroup, where t represents the number of trading days before the recommendation change is issued, and goes from -1 through -10. Annual fixed effects are included, and standard errors are two-way clustered by the hedge fund and brokerage firm. Observations falling on the extreme 1% are winsorized. The estimation period is from 2006 to 2011.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

analyst and hedge fund trader. Specifically, we document evidence that hedge funds trade more heavily and in the correct direction prior to stock recommendations if these recommendations originate from the hedge fund's prime broker and if the analyst has a higher external rating.

TESTS ON REVERSE CAUSALITY

Under a reverse causality hypothesis, the flow of information goes from the hedge fund to the analyst, and not the other way around. In the prior section, we document a significant increase in trading activity prior to an analyst recommendation change, with net buys

preceding upgrades and net sells preceding downgrades. We interpret these findings as evidence of analysts providing private information to hedge fund traders.

Nevertheless, an investor's aggregate trade imbalance is public information, and therefore is observable to analysts when they make their recommendations. There is some evidence that market participants pay attention to hedge fund trading. Brown and Schwarz (2013) and Wong (2019) found excess trading volume in the week prior to hedge funds filing their Form 13Fs and Form 13Ds, respectively. Therefore, the documented abnormal trading volume by hedge funds prior to the recommendation change could be evidence that analysts change their recommendations after observing a high level of trade imbalances. If this is true, then we would expect the recommendation change and trade imbalances relationship to be strongest for hedge fund trades that are highly visible (i.e., represent a large percentage of the total trading volume); however, we find no evidence that this is the case. In particular, we find no evidence that the highly visible trades by hedge funds (trades that account for 5%, 15%, or 25% of the total CRSP volume) are followed by more new analyst recommendations than other less visible trades. (Results are available upon request.)

CONCLUSIONS

In this article, we examine the information flow between sell-side equity analysts for 11 large brokerage firms and 43 large hedge funds. We posit a quid pro quo exchange of benefits between these market participants. Specifically, we propose that analysts leak upcoming stock recommendation changes to large hedge fund clients in exchange for increased compensation through trading commissions and fees and for higher analyst external ratings. Our data are from 2006 through 2011, a time after the 2003 Global Research Analyst Settlement and stock exchange rules put into place rules intended to curtail opportunistic behavior by sell-side analysts.

We present four main results. First, we show that hedge funds, on average, trade ahead in the direction of stock recommendation changes. Second, we present strong evidence that trade imbalances (net buys or net sales) are positively associated with the upcoming stock recommendation change originating from the hedge fund's prime broker firm. Prime brokers act as clearing houses for hedge fund trades, thus earning commissions for their firms. Prime brokers also earn revenues through lending securities to hedge funds as margin or shorting interests. Thus, we show an association between trade imbalances prior to stock recommendations and analysts' future compensation through their firms' receipt of trading commissions and other revenue streams (Groysberg, Healy, and Maber 2011). Third, we present evidence of a positive link between hedge fund trade imbalances prior to a stock recommendation change, and whether the recommendation originates from a highly ranked analyst, as proxied by II. Stock exchange amendments instituted in 2003 mandate brokerage houses to use an analyst's external ranking as an input in determining the analyst's future compensation. Thus, we present a second link between hedge fund trading on an upcoming recommendation and the issuing analyst's future compensation.

Our article speaks to the difficulties of regulating analyst and hedge fund behavior as it applies to the exchange and use of private information.

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APPENDIX

EXHIBIT A1

Definitions of Variables

Variables	Definition
$Trade\ Imbalance_{j,k,-t}$	The number of shares purchased less shares sold on stock j by hedge fund k on day $-t$, divided by the total number of shares outstanding in the quarter-end preceding day $-t$
$\Delta Rec_{j,0}$	Indicator representing the direction of a sell-side recommendation change on stock j for day 0, which is equal to -1 if any analyst in our sample issues a downgrade, $+1$ for an upgrade, and 0 for no recommendation issued
$10K_{j,-t}$	Indicator variable that takes the value of 1 if a Form 10-K was filed on day $-t$
$10Q_{j,-t}$	Indicator variable that takes the value of 1 if a Form 10-Q was filed on day $-t$
$8K_{j,-t}$	Indicator variable that takes the value of 1 if a Form 8-K was filed on day $-t$
$Quarterly\ Earnings\ Announcement_{j,-t}$	Indicator variable that takes the value of 1 if a quarterly report was announced on day $-t$
$Analyst\ Forecast_{j,-t}$	Indicator variable that takes the value of 1 if any FirstCall analysts issued any earnings forecast on day $-t$
$CAR_{j,logged}$	Abnormal stock return for firm j over three days prior to day $-t$
$\#News\ Articles_{j,-t}$	The number of relevant news articles (relevant score of ≥ 75) reported on day $-t$ about the underlying firm in RavenPack
$Sentiment_{j,-t}$	The Composite Sentiment Score for the underlying firm on day $-t$, as reported by RavenPack
$Sentiment_{j,logged}$	The average Composite Sentiment Score for the underlying firm, as reported by RavenPack over the past 90 days
$Prime\ Broker_{k,j}$	Indicator variable that takes the value of 1 if the broker issuing the recommendation is a prime broker for the hedge fund, and zero otherwise
$CAR_{j,0+3}$	Abnormal return on stock j for days 0 through $+3$, where day 0 is the published recommendation date
$All-Star-Rank_k$	The ranking given to the analyst by <i>Institutional Investor</i> magazine at the time of the analyst recommendation. It takes the value of 3, 2, 1, and 0 if the analyst is ranked 1, 2, or 3, and not ranked, respectively
$Visible_{i,j,k}$	Indicator variable that takes the value of 1 if the trade by the hedge fund on that day is larger than 5%, 15%, or 25% of the total CRSP trading volume
$NewRec_{j,Days[+1,+3]}$	Indicator representing the direction of a sell-side analyst recommendation change on stock j for the three days after day i , which is equal to -1 if any analyst in our sample issues a downgrade, $+1$ for an upgrade, and 0 for no recommendation issued

REFERENCES

- Agarwal, V., and M. Chen. 2008. "Do Analyst Conflicts Matter? Evidence from Stock Recommendations." *Journal of Law and Economics* 51: 503–537.
- Attorney General Schneiderman, E. T. "A. G. Schneiderman Announces Agreement with BlackRock to End Its Analyst Survey Program Worldwide." Press release, January 9, 2014.
- Barber, B., R. Lehavy, and B. Trueman. 2010. "Ratings Changes, Ratings Levels, and the Predictive Value of Analysts' Recommendations." *Financial Management* 39 (22): 533–553.
- Brown, L. D., A. C. Call, M. B. Clement, and N. Y. Sharp. 2015. "Inside the 'Black Box' of Sell-Side Financial Analysts." *Journal of Accounting Research* 53 (1): 1–47.
- Brown, S., W. Goetzmann, B. Liang, and C. Schwarz. 2008. "Mandatory Disclosure and Operational Risk: Evidence from Hedge Fund Registration." *The Journal of Finance* 63 (6): 2785–2815.
- Brown, S., and C. Schwarz. "Do Market Participants Care about Portfolio Disclosure? Evidence from Hedge Funds' 13F Filings." Working paper, New York University and University of California at Irvine, 2013.
- Bushman, R. M., C. D. Williams, and R. Wittenberg-Moerman. 2017. "The Informational Role of the Media in Private Lending." *Journal of Accounting Research* 55 (1): 115–152.
- Chen, S., and D. Matsumoto. 2006. "Favorable Versus Unfavorable Recommendations: The Impact of Analyst Access to Management-Provided Information." *Journal of Accounting Research* 44: 657–689.
- Chiarella v. United States 445 US 222. 1980.
- Christophe, S. E., M. G. Ferri, and J. Hsieh. 2010. "Informed Trading Before Analyst Downgrades: Evidence from Short Sellers." *Journal of Financial Economics* 95 (1): 85–106.

- Cohen, L., A. Frazzini, and C. Malloy. 2010. "Sell-Side School Ties." *The Journal of Finance* 55 (4): 1409–1437.
- Cowen, A., B. Groysberg, and P. Healy. 2006. "Which Types of Analyst Firms Are More Optimistic?" *Journal of Accounting and Economics* 41 (1–2): 119–146.
- Green, T. C. 2006. "The Value of Client Access to Analyst Recommendations." *Journal of Financial and Quantitative Analysis* 41 (1): 1–24.
- Groysberg, B., P. M. Healy, and D. A. Maber. 2011. "What Drives Sell-Side Analyst Compensation at High-Status Investment Banks?" *Journal of Accounting Research* 49 (4): 969–1000.
- Irvine, P. 2000. "Do Analysts Generate Trade from Their Firms? Evidence from the Toronto Stock Exchange." *Journal of Accounting and Economics* 30 (2): 209–226.
- . 2004. "Analysts' Forecasts and Brokerage-Firm Trading." *The Accounting Review* 79 (1): 125–149.
- Irvine, P., M. Lipson, and A. Puckett. 2007. "Tipping." *The Review of Financial Studies* 20 (3): 741–768.
- Jackson, A. 2005. "Trade Generation, Reputation, and Sell-Side Analysts." *The Journal of Finance* 40 (2): 673–717.
- Kadan, O., L. Madureira, R. Wang, and T. Zach. 2009. "Conflicts of Interest and Stock Recommendations: The Effects of the Global Settlement and Related Regulations." *The Review of Financial Studies* 22 (1): 4189–4217.
- Kadan, O., R. Michaely, and P. C. Moulton. 2015. "Trading in the Presence of Short-Lived Private Information: Evidence from Analyst Recommendation Changes." *Journal of Financial and Quantitative Analysis* 53 (4): 1509–1546.
- Ljungqvist, A., C. Malloy, and F. Marston. 2009. "Rewriting History." *The Journal of Finance* 64 (4): 1935–1960.
- Massoud, N., D. Nandy, A. Saunders, and K. Song. 2011. "Do Hedge Funds Trade on Private Information? Evidence from Syndicated Lending and Short-Selling." *Journal of Financial Economics* 99 (3): 477–499.
- Mohanram, P., and S. Sunder. 2006. "How Has Regulation FD Affected the Operations of Financial Analysts?" *Contemporary Accounting Research* 23: 491–525.
- Morgenson, G. "Surveys Give Big Investors an Early View from Analysts." *The New York Times*, July 16, 2012.
- Mullins, B., M. Rothfeld, T. McGinty, and J. Strasburg. "Traders Pay for an Early Peek at Key Data." *The Wall Street Journal*, June 12, 2013.
- Securities and Exchange Commission. 2002. "SEC Fact Sheet on Global Analyst Research Settlements." May 6, 2019, <http://www.sec.gov/news/speech/factsheet.htm>.
- Thompson, S. 2010. "Simple Formulas for Standard Errors That Cluster by Both Firm and Time." *Journal of Financial Economics* 99 (1): 1–10.
- Wong, F. 2019. "Wolves at the Door: A Closer Look at Hedge-Fund Activism." *Management Science*, forthcoming.
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ADDITIONAL READING

Are Emerging Market Equities a Separate Asset Class?

ANTHONY SAUNDERS AND INGO WALTER

The Journal of Portfolio Management

<https://jpm.pm-research.com/content/28/3/102>

ABSTRACT: Historically, fund managers and investors making portfolio allocation decisions have considered emerging market equities a separate asset class. More recently, a number of economic, legal, accounting, and financial developments have eroded the root differences between emerging and developed country financial markets. These liberalizations include capital market reforms that have reduced the constraints and limits on foreign portfolio investment. The authors find that empirical evidence strongly supports the view that the world's financial markets are becoming increasingly integrated, and that the integration process encompasses emerging markets. As a result, the idea of a rigid separation between emerging market and developed market pools of investible funds (and adoption of separate performance benchmarks) seems no longer appropriate. Indeed, recent moves by international investors to benchmark their portfolios to MSCI's all-country world index and related world indexes, which include both emerging market and developed market securities, seem a step in this direction.