How Constraining Are Limits to Arbitrage?[*][†]

Alexander Ljungqvist
Stern School of Business
New York University
and *NBER*

Wenlan Qian
NUS Business School

June 18, 2014

How Constraining Are Limits to Arbitrage?

Abstract

We examine to what extent institutional frictions such as short-sale constraints deter entry into informational arbitrage ex ante and reduce informational efficiency ex post. We focus on small arbitrageurs who target hard-to-short companies with correspondingly high potential for overvaluation. Being price-takers, they cannot correct mispricing through trading. Instead, they reveal their information to the market in an effort to induce *long* investors to sell so that prices fall. As long as the information is credible, revealing it accelerates price discovery and so reduces noise trader risk. By implication, even extreme short-sale constraints need not constrain arbitrage, as is often assumed.

Economists continue to debate whether or not financial markets price securities efficiently. Proponents of a behavioral view argue that biases such investor sentiment and limited attention can cause prices to deviate from fundamental values and point to various limits to arbitrage (i.e., institutional frictions) as the reason why mispricing may persist for a long period of time. In this paper, we aim to move beyond the question whether or not prices are efficient and focus instead on the process by which they may become so. We are particularly interested in the extent to which institutional frictions such as short sale constraints and an inability to raise arbitrage capital affect the incentive to become an arbitrageur ex ante and constrain informational arbitrage ex post.

A novice arbitrageur faces a daunting challenge: if her capital is too small to move prices, mispricing could get worse in the short run, forcing early liquidation of her position at a loss. This noise trader risk (DeLong et al. (1990)) makes it hard for investors to evaluate her skill: was she wrong or simply unlucky? As a result, a novice arbitrageur cannot easily raise funding for her trades (Shleifer and Vishny (1997)), leaving her with too little capital to move prices. This catch-22 may lead to insufficient entry into informational arbitrage. The problem is particularly acute in the case of overvaluation, as short sale constraints slow down price discovery and thereby exacerbate noise trader risk. To the extent that established arbitrageurs ignore stocks that are substantially overvalued but so hard to short that expected arbitrage profits are relatively small, informational efficiency in the marketplace would suffer if small information producers were deterred from entering.

Our main contribution is to show how this challenge can be overcome. We present empirical evidence showing that novice arbitrageurs with limited capital can help make prices efficient, and that they can do so even in situations characterized by what otherwise look like formidable limits to arbitrage. As we show, to overcome the obstacles in their path, capital-constrained information producers seek to induce unconstrained investors to trade on their behalf.

To understand the mechanism, consider models of informed trading such as Grossman and Stiglitz (1980) and Kyle (1985). In these models, information is incorporated into prices exclusively

through trading. In equilibrium, traders will engage in costly information production only if there are frictions that slow down information revelation, for example due to noise trading. These frictions provide cover for informed traders to take positions before prices reveal their information. But, we argue, they may not benefit all informed traders. Suppose that small informed traders are price-takers: their trades have little impact on prices. This may sound advantageous – they can trade on their private signals without moving prices – but it leads to a conundrum: if prices do not move *eventually*, how will they earn a return on their information production? Moreover, until prices adjust, they are exposed to noise trader risk: prices could move further away from the efficient level, wiping out their limited capital in margin calls.

Small informed traders thus cannot rely on their trades incorporating their information into prices. Instead, they do something we do not usually associate with arbitrage: they reveal their information to the market. Why reveal the information? The aim, as we argue, is to engage the one group of investors who are not constrained: the target company's current shareholders (the "longs"). If the longs can be persuaded to sell, this will not only correct the mispricing but in the process also reduce the duration (and hence risk) of arbitrage by accelerating price discovery.[1]

For the strategy to work, it is critical that the arbitrageurs (or "arbs" for short) bring their information to the longs' attention in a way that cannot be ignored. They do so by way of detailed reports which they make available for free and to which they draw maximum media attention. Drawing on public sources, the reports contain a wealth of new facts, often assembled with the help of forensic accountants and professional investigators, and tend to focus on questionable governance practices and aggressive accounting (sometimes bordering on fraud). They include "smoking guns" in the form of recorded phone calls, video surveillance, photographs, etc. By

---

[1] A few words on terminology. It is useful to distinguish between informational arbitrage – which is risky as there is no perfectly correlated asset with which to hedge the short position in the overvalued stock – and statistical arbitrage as defined by Hogan et al. (2004) and Bondarenko (2003). To avoid clutter, we refer to the former as simply "arbitrage." We follow the literature on risky arbitrage and use the term "arbitrageur" rather than the more generic term "short seller." This helps distinguish our arbitrageurs from other short sellers, discussed in Section 3.2, who might mimic their trades in the spirit of Abreu and Brunnermeier (2002).

presenting new facts that are impossible to ignore or dismiss out of hand, the arbs hope to induce a stampede (similar to a bank run) in which no long investor wants to be the last to sell.[2]

Our sample consists of 31 novice arbitrageurs who are either individuals or small boutique hedge funds with insufficient capital to move prices through their trades. Consistent with Stambaugh, Yu, and Yuan (2012), they target companies with the most potential for overpricing, namely those with high idiosyncratic volatility and severe short sale constraints in the form of a low and inelastic supply of shortable stock, high lending fees, and expensive put options.

Despite these constraints, the arbs manage to correct mispricing. On average, the prices of the 124 target companies in our sample fall by 7.5% when a report is released and then continue to drift lower as further negative information is released: down by 26.2% over three months and by 42.9% over 12 months, net of market movements. Based on the three-month change in market value, we estimate that the average target was overvalued by an economically meaningful $124.8 million.

The observed price corrections appear sufficiently large to make arbitrage profitable. We estimate that the arbs earn cumulative abnormal profits averaging 25.1% over three months, net of short-sale fees and risk-adjusted using the three Fama-French factors and momentum. In dollar terms, these trading profits amount to $251,000 in gains for every $1 million in shorts. Given their shallow pockets and the unusually tight shorting conditions for their targets, the arbs can only short a few million dollars, which we estimate is nonetheless sufficient to cover the information production costs they incur in identifying and investigating their targets.

These numbers highlight the economic importance of small arbitrageurs to the market's informational efficiency: while the extent of overvaluation – an aggregate of $15.5 billion across the 124 targets – is large, the magnitude of the arbitrage opportunity is relatively small, owing to the difficulty of shorting these particular targets. If it is too small to attract the attention of deep-

---

[2] Prominent examples include Muddy Waters' June 2011 report on Sino-Forest, a Chinese company listed in Toronto which a year later went bankrupt, and Citron Research's January 2011 report on China MediaExpress, a Chinese company delisted from Nasdaq six weeks later. Around half of the companies in our sample are Chinese firms listed in the U.S.; the other half are American.

pocketed arbitrageurs, overvaluation will persist unless small information producers, such as the arbs in our sample, can go after it profitably.

Much of our analysis focuses on empirically identifying the mechanism that allows these small information producers to move prices and thereby make profits on their short positions. Consistent with our argument that their aim is to induce unconstrained investors to trade on their behalf, we find that investors appear to pay attention. Volatility spikes up by 236% on average the day the arbs release their reports, as market participants process the information. Turnover spikes by even more, up by 339%, and liquidity improves in its wake, up by 164%.

Very little of the price correction comes from the short side of the market. While we see evidence of the arbs building significant (albeit relatively small) short positions *before* releasing their reports, once the reports are out, there is no further abnormal shorting activity. This reflects a dramatic worsening in short sale constraints: the cost of initiating new shorts jumps by 50% on average when a report is released, putting it in the 79th percentile of the distribution of all stocks in CRSP. Over the next three months, the cost continues to climb, reaching the 88th percentile (up by a total of 201% compared to the pre-release period). At the same time, the supply of lendable stock available for borrowing falls and put options become unusually expensive.

The price falls instead come about because of the trading behavior of the one group of investors who are unconstrained: investors with long positions in the targets. We find that turnover involving longs spikes by 524% on average when the arbs release their reports.

Clearly, the reports should only induce the longs to sell if the information they contain is credible. When we condition investors' responses on an arb's track record, we find that only arbs with a history of making credible claims are able to induce the longs to sell and thereby put pressure on a target's share price. And it is only credible reports that generate profits for the arbs, net of shorting fees: absent credibility, prices do not fall significantly.

Credibility matters, but not absolutely: to be listened to, an arb also has to have something new

to say. We show that reports that present new facts previously unknown to investors result in longs selling and rapid price corrections whereas reports that merely reinterpret known data do not. As a result, only reports that contain "scoops" generate significant profits for the arbs.

There is no indication that the arbs in our sample are "bear raiders" intent on manipulating share prices by disseminating falsehoods (a strategy sometimes called "short and distort"). In fact, subsequent events usually prove the arbs factually right. For example, 40% of targets are later delisted, 35% replace their auditors or see their auditors resign, and 22% restate earnings. Investigations by third parties such as the SEC, the Department of Justice, or a stock exchange come to similar conclusions as the reports in fully 83% of the cases. This is remarkable given that our sample is unbiased: we have a complete, ex ante list of target companies (rather than a self-reported selected list of only those that made money for the arbs).

Our paper contributes to the asset pricing and behavioral finance literatures by showing how novice arbitrageurs can overcome what look like significant barriers to entry to informational arbitrage: as long as they have enough capital to fund information production and establish a track record, the fact that they are price-takers who cannot easily (or quickly) move prices by trading their capital need not discourage entry. Over time, as they use their track record to raise funding from investors, they may eventually become large enough to impact prices through their own trades.

Our paper also sheds light on how short sellers produce and transmit information. There is little prior evidence on what short sellers know or how they acquire information. Our data allow us to observe the information discovery process at the level of individual information producers and to study how the information the arbs discover is then incorporated in security prices.[3]

---

[3] Previous research on short sales finds that they predict lower subsequent returns (Figlewski (1981), Desai et al. (2002), Cohen, Diether, and Malloy (2007), Boehmer, Jones, and Zhang (2008), Diether, Lee, and Werner (2009)), target overvalued firms (Dechow et al. (2001), Hirshleifer, Teoh, and Yu (2011)), and often precede negative corporate events such as negative earnings announcements, analyst downgrades, or financial misconduct (Christophe, Ferri, and Angel (2004), Desai, Krishnamurthy, and Venkataraman (2006), Christophe, Ferri, and Hsieh (2010), Karpoff and Lou (2010), Chen (2014)), though Engelberg, Reed and Ringgenberg (2012) find short sellers are more likely to trade *after* corporate events. Another strand of the literature documents that short sale constraints lead to overvaluation by withholding negative information from the market (Lamont and Thaler (2003), Nagel (2005), Beneish, Lee and Nichols (2013)).

An implication of our findings is that even extreme short sale constraints need not constrain arbitrage, as is often assumed. In fact, the arbs are attracted to firms with extreme short sale constraints (such as the targets in our sample) precisely because they are most likely to be overpriced. But the short sale constraints are not meaningfully binding (beyond limiting the size of the arbs' short position, which would anyway be small given their shallow pockets): it is by inducing the unconstrained longs to sell that the arbs correct the mispricing.

What can and cannot be arbitraged this way? Since persuading the longs is key, arbs are unlikely to target companies for which new and persuasive facts cannot easily be discovered at reasonable cost. This may seem to rule out the possibility that the arbs can help prick asset pricing bubbles. Nonetheless, they may inadvertently contribute to doing so. As Kovbasyuk and Pagano (2014) show in a contemporaneous theory paper, "advertising" arbitrage opportunities can be particularly effective when the mispricing is caused by limited attention: by focusing unconstrained investors' attention on a mispriced stock, mispricing can be reduced. This in turn can help deflate broader bubbles. When confronted with new information about specific targets, investors may start to pay closer attention to similar companies whose characteristics make them unsuitable targets for the arbs. We present suggestive evidence consistent with such informational spillovers. Specifically, we show that as a critical mass of negative reports about Chinese companies listed in the U.S. accumulated, other U.S. listed Chinese stocks eventually saw steep price falls.

The paper proceeds as follows. Section 1 presents our sample. Section 2 gives a flavor of the lengths to which the arbs go to discover mispricing and the resulting richness of the data they assemble for their reports. Section 3 documents the market's reaction to the release of their information and the ensuing price correction. Section 4 attempts to pinpoint the mechanism by conditioning the market's reaction on the credibility of the arb and the content of the report and discusses the limits to the arbs' short-then-publish strategy. Section 5 concludes.

1. Sample and Data

1.1 Arbitrageurs and Reports

The arbitrage strategy we describe relies on publicity to induce the longs to sell and thereby generate a return on identifying overvalued companies. This makes finding the relevant arbitrageurs relatively straightforward: they are in the habit of drawing attention to their reports via the media and popular investor websites such as seekingalpha.com.

We search news sources (accessed via Factiva) as well as the internet for information producers who satisfy three main criteria: they target what they claim are overvalued companies listed in the U.S.; they disclose having a short position; and they share their information freely with the investing public in the form of written reports. The second criterion restricts the sample to investors who make a living from information production by filtering out occasional bloggers who post casual comments on internet forums. The third criterion filters out larger hedge funds that restrict access to their information to their own investors via password-protected websites or that "talk their book" at invitation-only investor conferences not open to the public. Our sample starts in July 2006 (when DataExplorers first makes daily shorting data available) and ends in December 2011.[4]

Our search yields 31 arbs, listed in Table 1. The pioneer is Asensio & Co., which was founded in 1992 and started publishing reports on overvalued companies in 1994. The most prolific arb in our sample is Citron Research, which has been in business since 2001 and which describes itself as an "activist short seller." A firm that has come to prominence in the media is Muddy Waters, which describes itself as a "pioneer in on-the-ground, freely published investment research."

Because private firms in the U.S. do not generally have to make public disclosures, we are unable to provide summary statistics on the 31 arbs. Inspection of their websites suggests that they are either one-man-bands or small hedge funds. Except for Asensio & Co., Bronte Capital, Kerrisdale, and Spruce Point, none of the arbs currently is, or has ever been, registered as an

---

[4] The ongoing battle between Bill Ackman, the manager of a large hedge fund, and Herbalife started in December 2012 and so is not in our sample.

investment adviser or broker-dealer with the SEC or FINRA, suggesting that the arbs generally do not manage money on behalf of external clients (at least not in the U.S.).

What is unique about our setting is that these small, shallow-pocketed arbs not only trade against overvaluation but also share the information they have acquired with the investing public. For each arb, we collect *every* report for *every* target, so there is no selection bias.[5] Specifically, from the arbs' websites, we download all 401 reports the arbs have published since July 2006.[6] We ignore reports published after December 2011, so that we have at least a year of post-report share prices in CRSP to identify price corrections and measure the arbs' trading profitability. We remove 31 reports on firms that are traded over-the-counter or on the Pink Sheets (for which we have no share price or other trading data) and 12 reports on firms that are listed outside the U.S. (for which we have no short selling data; this filter removes perhaps the most famous target firm, Sino-Forest, which was listed in Toronto). This leaves a set of 358 reports.

Of the 31 arbs in our sample, 14 initiate coverage on a single company. The remaining 17 "repeat" arbs publish an average of 20 reports each over our sample period. As Table 1 shows, Citron Research accounts for 106 of the reports, followed by Alfred Little with 37 reports, and Asensio & Co. with 34 reports. (The Internet Appendix shows that all our results are qualitatively unchanged if we exclude Citron from the sample.)

In total, the 31 arbs target 124 U.S. listed companies over our sample period. This means there are 2.9 reports per company on average. Of the 358 reports in our sample, 126 are "first" reports in which a company is targeted by one of the arbs for the first time. (In two cases, two arbs initiated coverage of the same company on the same day.) The remaining 232 are follow-on reports, usually written by the same arb, though in 25 cases authored by one or more other arbs. Citron Research publishes the most first reports, 43, followed by Bronte Capital with 9. Given its longer history,

---

[5] To check how comprehensive our list of reports is, we use the Internet Archive (also known as the Wayback Machine), which stores historical web pages. We find no instance of an arb removing any reports.
[6] Four of the arbs (Chimin Sang, Ian Bezek, Shareholder Watchdog, and The Forensic Factor) do not have websites of their own and disseminate their research solely via third-party websites. As we show in the Internet Appendix, our results are qualitatively unchanged if we exclude these four arbs from the sample.

Citron also covers the largest number of targets, at 46.

To dispel the notion that the patterns we document are driven by Chinese companies listed in the U.S., which have received bad press over the last few years, we note that far from all sample companies are Chinese: 60 of the 124 companies come from China (48.4% of the sample) and the remaining 64 come from the U.S. (51.6%). As the Internet Appendix shows, all our results are qualitatively unchanged if we exclude Chinese targets from the sample.[7]

For each target firm in our sample, we know the arb who first targeted it and the exact date of each report. (We describe the target companies in Section 1.3 and the contents of the reports in Section 2.) We also extract information on material events before and after a report is released from SEC filings (such as 10-Ks, 10-Qs, and 8-Ks) and from Factiva. This gives us a complete timeline of all material events surrounding each report through December 2012.

Table 1 presents, for each of the 31 arbs, summary statistics for abnormal share price returns on the day a company first becomes a target, cumulative abnormal returns from the report date to 60 trading days later, and an estimate of the arb's trading profit. For 14 of the 17 repeat arbs, share prices fall on average when a report is released. Alfred Little has the largest immediate market impact, averaging -17.9%, followed by Muddy Waters at -17.3% and GeoInvesting at -12.1%. The average repeat arb's average report is associated with a 7.2% price fall. One-time arbs have a similar market impact, averaging a -9.5% price fall when sharing their information.

Measured over three months from the release date, 14 of the 17 repeat arbs see significant price falls (adjusted for the three Fama-French factors and momentum). Over this timeframe, Shareholder Watchdog has the largest price correction, averaging -62.4%, followed by Absaroka Capital Management at -55.7% and Spruce Point at -49.6%. In the three months following a first report, prices fall by 19.2% and 42% on average for the average repeat and one-time arb, respectively. Only four repeat arbs see prices move against them on average over this timeframe.

---

[7] This mirrors Lee et al.'s (2013) conclusion that U.S. listed Chinese firms as a group do not differ much from their U.S. counterparts, despite the bad press a minority of them have received.

As an estimate of the arbs' trading profits, Table 1 reports returns to a marked-to-market borrow-and-hold strategy that shorts the target stock five days before the report day and closes out the short position three months after the report is released.[8] The returns are net of shorting costs and risk-adjusted using the three Fama-French factors and momentum. (For all variable definitions and details of their construction, see Appendix A.) By this measure, Spruce Point's reports yield the highest returns, averaging 58.4% over three months (not annualized), followed by Absaroka Capital Management at 53% and Shareholder Watchdog at 47%. For the average repeat and one-time arb, this borrow-and-hold strategy yields an average return of 17% and 39.2%, respectively.

1.2 Other Data Sources

Daily price and trading data for the target companies are obtained from CRSP, accounting data from Compustat, intra-day share price data from TAQ, and option data from OptionMetrics. Equity lending data come from DataExplorers, a research company that collects lending data directly from the security lending desks of leading financial institutions. The database contains comprehensive information on the supply of shares available for borrowing, the number of shares out on loan, and loan fees for over 85% of the global equity lending market (though our subscription only covers the U.S. market).[9] Following convention, we proxy for actual short sales using shares out on loan.[10]

1.3 Target Companies

Table 2 characterizes the 124 target companies by providing a snapshot of firm characteristics and shorting conditions as of one month before a first report is released. At that time, the average target is a midcap stock; its market capitalization of $969.3 million puts it in the 54th percentile of the distribution of CRSP firms. It has a book-to-market ratio of 0.38 (equal to the 28th percentile) and so comes from the growth part of the value-growth spectrum. Its daily share turnover averages 1.13% of shares outstanding (70th percentile). And it is relatively liquid, with an Amihud (2002)

---

[8] Results are not sensitive to when we assume the arb initiates his short position, as we will see later.

[9] A detailed description of these data can be found in Saffi and Sigurdsson (2011) and Jain et al. (2012).

[10] During our sample, naked short selling is generally discouraged and short selling must be associated with stock borrowing, suggesting that the number of shares out on loan is a good indicator for actual short selling.

illiquidity measure of 0.06 (44th percentile).

Shorting conditions are relatively tight. One month before the first report is released, the average target company has a shorting fee of 4 basis points a day (10.6% annualized), which is in the right tail of the CRSP distribution (74th percentile). Consistent with Beneish, Lee, and Nichols (2013), this reflects a relatively tight supply of lendable stock: on average, only 5.43% of shares outstanding are available for borrowing (40th percentile). Putting downward pressure on a target's share price via the options market would also be difficult, as its put options are unusually expensive: the ratio of the implied volatility of puts to the implied volatility of calls on the target's shares – which absent short sale constraints would equal one – averages 1.15 (69th percentile).[11] Finally, idiosyncratic volatility is high, averaging 3.61% per month (76th percentile). As Pontiff (2006) argues, this imposes a high holding cost on short-sellers.

In sum, targets are growth companies of average size whose shares are heavily traded and quite liquid. But they are also hard to arbitrage, as lending fees are high, lendable stock is tight, put options are pricey, and volatility is high. And yet, as we will show, arbitrageurs manage to systematically correct mispricing in spite of these short sale constraints.

2. Discovering Mispricing

2.1 Identifying Mispriced Firms

While we do not know how the arbs identify targets, there are some telltale signs. The arbs typically pick up suspicious signals from publicly observable information that the market, arguably, had simply missed or misinterpreted.[12] Several targets caught the arbs' attention due to unusual patterns of behavior (for example, constantly raising equity from shareholders while claiming to have large unused cash balances) or implausible, too-good-to-be-true margins. The following example illustrates the latter:

> *"[The company] boasts an unjustifiable 40%+ gross margin in the domestic business and reports operating*

---

[11] Unfortunately, meaningful estimates of put option spreads are not available in our data source, OptionMetrics.
[12] In a different context, see Dechow, Lawrence, and Ryans (2013) for evidence that U.S. short sellers trade on SEC comment letters that other investors appear to have overlooked.

margins 46% higher than its strongest competitor, which is over 8x its size. With all of the major competitors being much larger publicly traded companies with manufacturing facilities and cost structure similar or superior, I see no validity to the Company's explanation of its high margins due to its purportedly lower cost base and greater economy of scale."

Other telltale signs include the individuals behind the firms. Some Chinese targets, for example, used the services of a particular "promoter" to obtain a listing in the U.S., and once some of the promoter's companies became involved in regulatory investigations, his other clients also came into the arbs' crosshairs. In other cases, target firms shared a little known boutique auditor that had become the subject of an investigation by the Public Company Accounting Oversight Board for violating quality control and auditing standards.

In sum, the arbs in our sample conform well to patterns of behavior commonly assumed in the investment literature: they typically identify mispricing based on publicly observable signals such as company financials (Hirshleifer, Teoh, and Yu (2011)) or accounting irregularities (Desai, Krishnamurthy, and Venkataraman (2006)).

Why the market failed to pick up on these signals is an interesting question. One potential explanation, emphasized by Kovbasyuk and Pagano (2014), is limited attention: investors may simply have insufficient resources to process all value-relevant information.[13] Another is that some investors may deliberately ignore information that does not conform to their beliefs – a form of confirmation bias (Shefrin (1999)). In addition, investors' attention and their information processing efforts may vary with their moods (Hirshleifer and Shumway (2003)). The U.S. listed Chinese stocks in our sample may be a case in point: swept up in "China euphoria", investors may have paid too little attention to some firms' fundamentals.

2.2 Investigating Their Targets

Once they have identified a potential target using publicly observable signals, the arbs follow up with in-depth investigations. Investigations may start with an extensive document review, not only

---

[13] See Peng and Xiong (2006) for a theoretical treatment and Barber and Odean (2008) and DellaVigna and Pollet (2009) for empirical evidence consistent with limited attention affecting asset prices.

of SEC filings but also of harder-to-access documents such as purchase agreements, customer orders, auditor reports, or tax returns, as well as the filings of key competitors. (A favorite, in the context of Chinese companies listed in the U.S., is a comparison of Chinese-language filings with local regulators and English-language filings with the SEC, which often reveals aggressive accounting that flatters the company's U.S. earnings.)

In a process that can take weeks, many investigations involve poking holes in claims the target made in public disclosures (such as its SEC filings) or conference calls. To this end, arbs may contact target firms' management to clarify doubts (while secretly recording the conversations); consult industry experts for independent opinions; arrange authorized or unauthorized site visits, accompanied by industry experts or private investigators; or put a target's production facilities under video surveillance. To illustrate,

> *"Our on-site due diligence confirmed our thesis that the company is nowhere near the scale that it claims to be. On our visit, we saw a very small operation that appeared to be formerly government owned, and probably privatized for very little money. [The company] claims to have six legacy paper production lines, but despite our prior agreement to see all lines, it showed us only two. […] The equipment is clearly dated …"*

Arbs may also visit a target's distributors or customers to gauge the reliability and strength of its revenue prospects, or contact the target's business partners and competitors to verify specific claims made by the target. For example, one arb conducted an extensive 10-city, 60-store channel check:

> *"[T]he investigators were instructed to count the number of small kitchen appliance brands, note the prices each brand was selling for, and ask the store/department managers and at least two different sales clerks a short list of questions about their experience selling products manufactured by the company and its competitors. For purpose of verification, the investigators were also instructed to record the name, address, phone # of the stores, as well as the name and cell phone # of the managers they spoke to."*

This particular channel check revealed that the target's sales were suspiciously slow given the firm's reported revenue growth.

The costs and risks of this information discovery process are not trivial. Besides the difficulty of obtaining evidence to support their suspicions, the arbs often face open resistance, and occasionally hands-on obstruction, from target companies. The following example illustrates:

> *"Surveillance efforts are costly and difficult to conduct under very threatening conditions. […] Agents first*

must spend a few weeks watching and evaluating factory operations to determine the production cycle, factory entrances, and security surrounding the facility. The expensive cameras must be hidden so that the company does not find them, typically quite some distance from the factory and requiring use of a good zoom lens. […] Sometimes the cameras get stolen, in which case a backup camera is always on hand. Each day the local operative replaces the camera batteries (usually in the darkness of night) and memory card. […] The local operatives […] have been detained, questioned, and beaten by company security."

Though their reports enjoy first-amendment protection as free speech, the arbs also face the risk of being sued by their targets.[14] On a more positive note, the risk of lawsuits will, to some extent, keep the arbs from making claims they cannot substantiate. This, in turn, will make it likelier that their claims will be believed in the first place.

2.3 Making Their Case

Once an investigation is completed, the evidence is assembled into a detailed report that is subsequently disclosed to the investing public. To attract investors' attention, reports often have catchy titles such as "*Credibility is like virginity; once you lose it, you can never get it back.*" (See Table A1 in the Appendix for further examples.) Figure A1 in the Appendix shows the cover pages of three representative reports released by arbs in our sample.

Each report prominently discloses that the arb has a short position in the target stock. Effectively, therefore, arbs (legally) front-run the publication of their reports. However, given how costly the targets are to arbitrage, there is a substantial risk that the arbs' short positions are insufficient to correct the mispricing on their own – and thus that prices will move against the arbs, resulting in potentially unlimited losses. We argue that to counteract this risk, the arbs share their information with the market in an effort to convince the long investors to sell.

To be as convincing as possible, the reports include in-depth coverage of the issues identified during the investigation, often supplemented with scanned copies of original company documents, photos (of production facilities or distribution channels), and links to videos taken during site visits and audio recordings of conversations with target executives. (See Figure A2 in the Appendix for examples.) In several cases, reports provide "smoking gun" evidence in the form of audio clips of

---

[14] See also Lamont (2012) who describes the range of tactics target companies engage in to squeeze short sellers.

employees admitting misrepresentation, video clips contradicting production claims, or irreconcilable discrepancies between foreign and U.S. filings. One particularly egregious example involves apparent evidence of fraud (the target was subsequently investigated by the SEC and delisted by Nasdaq):

> *"We recorded a telephone conversation that contains an admission that [the company] is engaging in securities fraud."*

2.4 Types of Reports

All sample reports claim targets are overpriced, but they differ in the grounds for their claims and the evidence they can marshal. Based on a careful reading of the reports, we divide the sample into those reports that convey the results of information production (i.e., the discovery of hard and verifiable information previously overlooked or ignored by investors) and those that result from information processing (i.e., the reinterpretation of already known data).

The vast majority of the reports (295 of 358) reveal new and hard information. Panel A of Table 3 tabulates the kinds of new information they contain. We distinguish between allegations regarding financial reporting (such as accounting irregularities or misleading disclosure) and questionable corporate governance practices (such as forgivable loans to executives) on the one hand, and concerns that arise from "red flag" events (such as suspicious acquisitions, self-dealing, undisclosed related-party transactions, and questionable insider trades) on the other hand. Accounting irregularities are particularly prominent.

The 63 sample reports which reveal no new information argue that a target is overvalued based on reinterpretations of known facts, claiming for example that a particular business model is unsustainable or expressing disagreements about industry trends or macroeconomic forecasts. These reports are thus essentially opinions, given the lack of new evidence, and so are more similar to "sell" recommendations issued by Wall Street analysts. As such, we might expect them to have little more impact on share prices than Wall Street analysts tend to have when they downgrade a stock.

As we will see, our estimates are consistent with this prediction.[15]

3. Correcting Mispricing

3.1 Reaction in the Equity Market: Prices

Table 4, Panel A shows cumulative abnormal returns (adjusted for the three Fama-French factors and momentum) over various time windows around the release of a "first" report on a target company. Between trading days -20 and -6, target companies' share prices rise by a significant 3.16% on average, net of market movements ($p=0.047$). This suggests that the arbs are not trend chasers; they may even be timing the release of their reports to coincide with price run-ups.

Over the week leading up to the release, prices fall by a cumulative 1.05% net of market movements, though this is not statistically significant ($p=0.252$). Assuming that the arbs build (or add to) their short positions over this timeframe, the absence of a significant price correction just before they make their information public suggests that the arbs are unable to build sufficiently large short positions to correct the mispricing on their own. This is indicative of frictions in the arbitrage process, consistent with the challenging shorting conditions for target stocks seen in Table 2, and confirms our assumption that the arbs are price-takers.

Once the arbs release their reports to the public, investors react strongly. On the release day, prices fall by an average of 7.5%; the median price fall is 4.7%, and fully 93 of the 124 targets experience a fall in price. The reaction to a follow-on report, shown in Panel B, is smaller, with price falls averaging 3.1%. Each of these statistics is significant at the 1% level.

These patterns suggest that the reports contain relevant and novel information which investors take seriously. And investors appear to price in the information fairly rapidly. In five cases, we know the exact time of the report release. Figure 1 below shows average continuously compounded raw returns over five-minute intervals during the eight trading hours before and after the release of a first report. At least for these five reports, prices fall by more than 10% within two hours of release.

---

[15] Using I/B/E/S data to identify 1,366 downgrades to strong sells in the universe of CRSP stocks (rather than in our sample of targets), we estimate that analyst downgrades trigger price falls averaging 2.98% during our sample period.
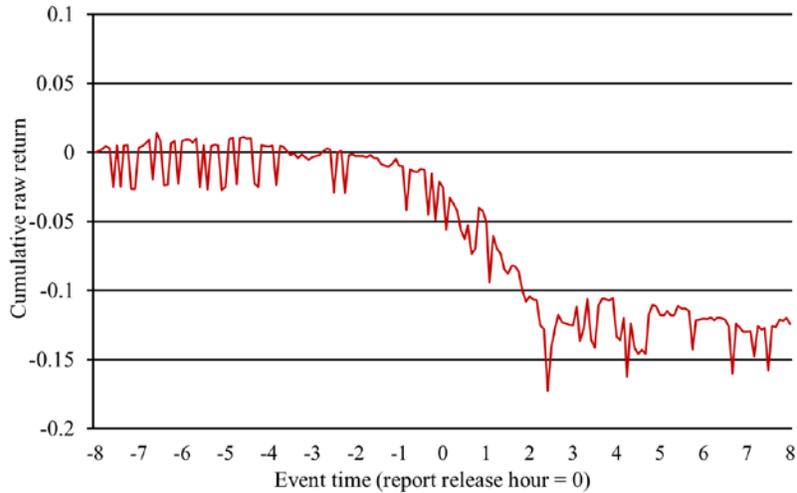
Figure 1. Price Adjustment on the Report Date

In the full sample, prices fall by an additional 19.8% on average over the next three months, leaving them 26.2% below the closing price on day -1.[16] As Figure 2 shows, at no time over this window do prices recover. Over a one-year window, prices fall by a total of 42.9% on average, with 106 of the 124 targets experiencing negative abnormal returns. This suggests that the information the arbs release usually proves correct.
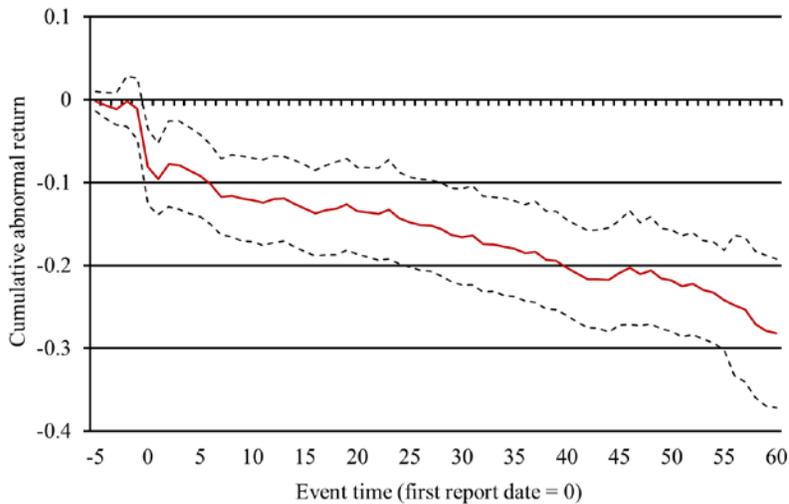

Figure 2. Cumulative Abnormal Returns Around Report Releases

To provide an estimate of the extent of overvaluation that the arbs help correct, we compute

---

[16] The drift reflects two things: further revelations of negative information that were unanticipated by the market, and revisions, in response to these revelations, of the market's beliefs of the likelihood that the arbs' claims are true.

17

dollar changes in market value (not adjusting for market movements). As Table 4 shows, the average (median) target's market value falls by $124.8 million ($40.0 million) over the three months starting the day before a report is released, and by $139.3 million ($86.1 million) over one year. In aggregate, therefore, market values fall by $15.5 billion over three months and by $17.3 billion over one year. These numbers highlight the economic importance of small arbitrageurs to the market's informational efficiency.

3.2 Reaction in the Equity Market: Volatility, Turnover, and Liquidity

Just how big a shock to investors' information sets the reports represent can be seen in Figure 3 below, which shows that volatility spikes when a report is released: on average, volatility increases by 236% on the release day, compared to the firm's baseline volatility estimated in a three-month window ending 21 trading days before the report day.[17] The dashed lines, which represent 95% confidence intervals, indicate that this increase is highly statistically significant. Volatility remains significantly elevated for the next five days, suggesting investors take up to a week to process the information revealed in the average report.
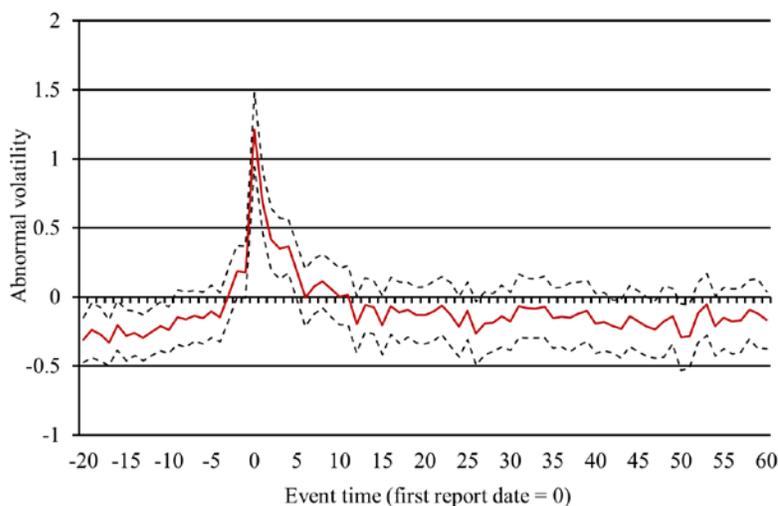

Figure 3. Average Abnormal Volatility

---

[17] In this and subsequent figures, we compute percentage changes relative to a baseline estimated over a three-month period ending one month before a report date. Specifically, the "abnormal" value of variable X is computed as the log difference between X on day t and average daily X in a three-month period beginning 80 trading days and ending 21 trading days before a report date. The log increase in volatility in Figure 3 shown for day 0 is 1.211, meaning volatility is $\exp(1.211) - 1 = 236\%$ higher on day 0 than during the baseline period.

The reports also trigger a massive increase in trading activity. Figure 4 shows that share turnover (i.e., number of shares traded scaled by shares outstanding) begins to rise significantly relative to the baseline around four days before the report day (perhaps because the arbs build their short positions) and then spikes at 339% above the baseline on the release day (i.e., by exp(1.480) – 1). In dollar terms, this represents a jump from an average baseline turnover of $8.9 million per day to an average of $26.8 million on the release day. Turnover stays significantly higher than normal for the next 23 trading days before returning to baseline levels.
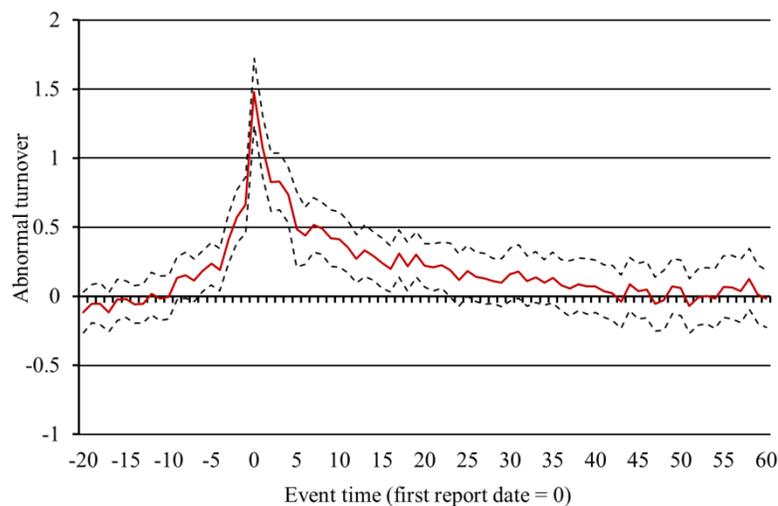
Figure 4. Average Abnormal Turnover

All this extra trading improves liquidity as measured by Amihud's (2002) illiquidity measure. Figure 5 shows that liquidity spikes on the release day at 164% above the average firm's baseline value (i.e., exp(abs(-0.969)) – 1) and remains significantly elevated for 31 trading days. (Interestingly, liquidity is unusually high in the month leading up to the report date. This coincides with the large pre-report price *increases* between trading day -20 and trading day -6 seen in Table 4, suggesting significant buyer interest in the target stocks in the run-up to the subsequent report release.)
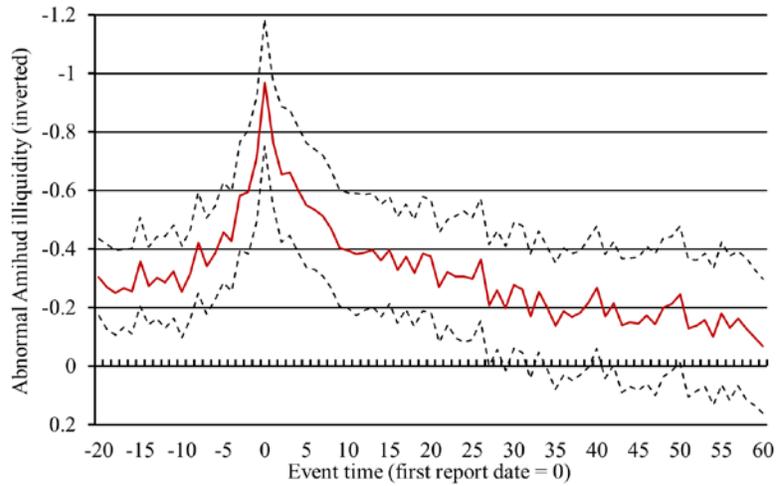
Figure 5. Average Abnormal Amihud Illiquidity Measure

3.3 Reaction in the Short Sale and Options Markets

Who is responsible for the additional trading? Clearly, each trade involves a buyer and a seller, and only short sellers and current shareholders (the "longs") can sell the stock. So the price pressure we see on the report day either comes from increased short selling or from increased selling by the longs. We first consider the short side of the market. Figure 6 tracks the contribution of short sellers to the trading spike by plotting the average daily number of new shorts (scaled by outstanding shares) relative to the pre-event baseline. One day before the release, new shorts spike at $\exp(0.417)$ $- 1 = 52\%$ above baseline (p=0.008), perhaps as the arbs build or add to their short positions.
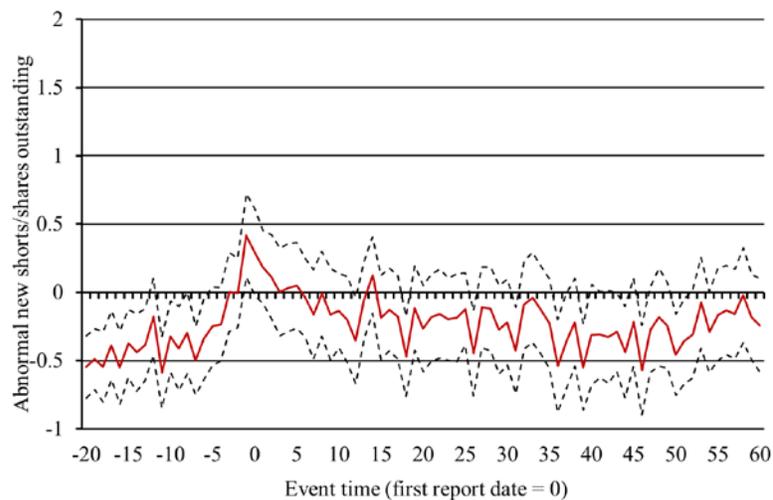
Figure 6. Average Abnormal Short Trades

20

The spike is, however, economically small: on average, only 0.45% of outstanding shares are newly shorted on day -1. Given an average day -1 market capitalization of $951 million, this means that new shorts amount to only around $4.28 million in trading (i.e., 0.0045*$951m), not all of which will involve the arb in question. These small numbers underscore the fact that the arbs in our sample do not have particularly deep pockets. And yet, as our results show, they have a large price impact and eventually manage to help correct a substantial amount of misvaluation: shorts amounting to at most a few million dollars can help correct more than a hundred million dollars in overvaluation on average.

The spike in new shorts on day -1 is not only small but also short-lived. Beginning on the release day itself, new shorts are no more numerous than during the pre-release baseline month. Thus, new shorts do not appear to be responsible for the massive increase in trading we saw in Figure 4. This is somewhat unexpected. Abreu and Brunnermeier (2002) argue that arbitrageurs face "synchronization risk", meaning they do not know when other arbs will start targeting an overvalued firm. If a critical mass of arbs is required for a shorting strategy to be profitable, synchronization risk can lead to a coordination problem and so to insufficient arbitrage. However, by publishing their information, arbs remove the synchronization risk; the publication is essentially a coordination device. And yet we see no increase in shorting activity. Why not?

The reason is simple. The lack of unusual activity in the shorting market, once a report has been released, reflects a drastic increase in the cost of shorting and a concomitant fall in the supply of lendable stock available for shorting. Figure 7a below shows that the cost of initiating new shorts rises significantly one day before a report is released (perhaps in response to the arbs building their short positions) and then jumps to 50% above the baseline on the release day on average. It continues to drift higher, to a level 201% above the baseline by trading day 60 (i.e., $\exp(1.103) - 1$). As Figure 7b shows, this puts the cost of initiating new shorts in the 79th percentile on the release day, drifting up to the 88th percentile over the next three months.
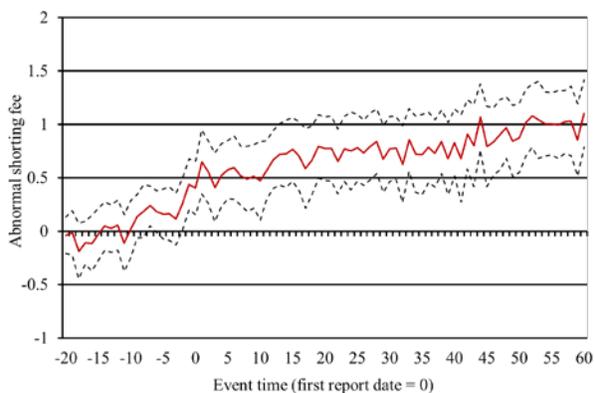
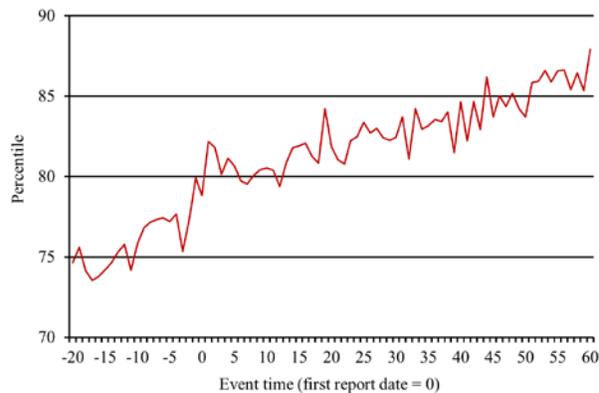Figure 7a. Average Abnormal Shorting Fee

Figure 7b. Mean Percentile Rank

Part of the reason for the cost increase is presumably an increase in demand by short sellers, but part of it appears to be the result of a fall in the supply of lendable stock. Anecdotally, some targets put pressure on their shareholders to recall stock out on loan, to put a squeeze on short sellers.[18] Figure 8, though noisy, shows that the supply of lendable stock becomes unusually low, relative to the baseline, on the report date and remains at 20% to 30% below the baseline for the next three months. Notably this occurs even while lending fees are exceptionally high.
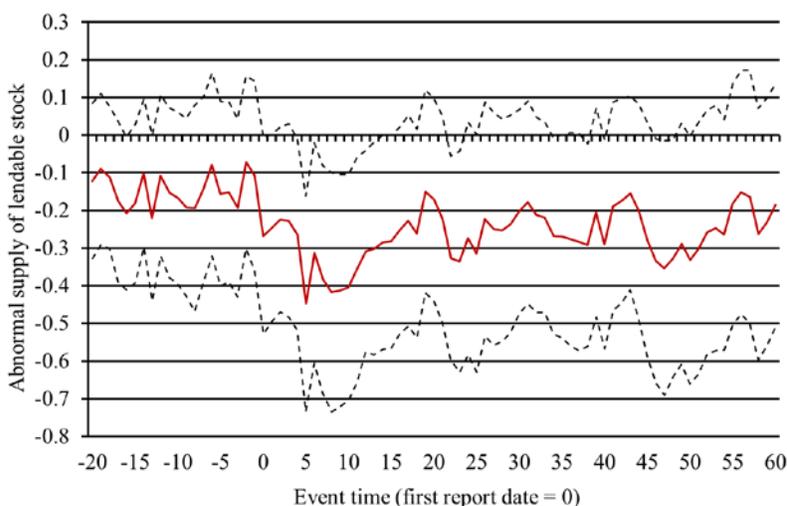

Figure 8. Average Abnormal Supply of Lendable Shares

---

[18] For example, a target company issued the following press release in response to the release of a report: "The Company believes that short sellers' attempts to drive down the stock price and harm the Company's shareholders are likely to increase […] In this context, the Company believes that an important way to protect shareholder value is to limit short sellers' ability to borrow stocks and shareholders can contribute by reviewing whether their custodians or brokers are lending their shares to third parties." (PR Newswire, August 3, 2011)

In light of this tightening in the short sale market, investors might try to trade on the information revealed in the arbs' reports via the option markets instead. However, this too appears to be difficult. Figure 9 shows an uptick in put option trading on the report date among the 77 targets with traded options, but the uptick is not statistically significant and anyway short-lived.
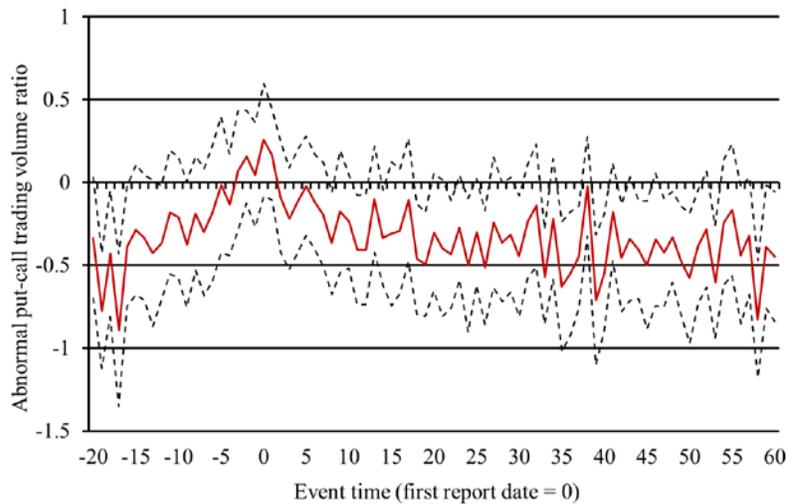

Figure 9. Average Abnormal Put Option Trading Volume

Figure 10a shows why the put trading volume does not increase significantly when a report is released: puts become unusually expensive. The implied volatility of puts drifts up significantly in the three weeks before the report date (consistent with arbs buying puts to profit from the negative information they are about to release) and spikes at 44% above baseline on the report day. Part of this spike reflects the volatility increase shown in Figure 3, but whereas volatility quickly reverts to the baseline, implied put-option volatility remains significantly elevated, at around 25% above baseline, for the next three months. This suggests that puts are in unusually high demand.
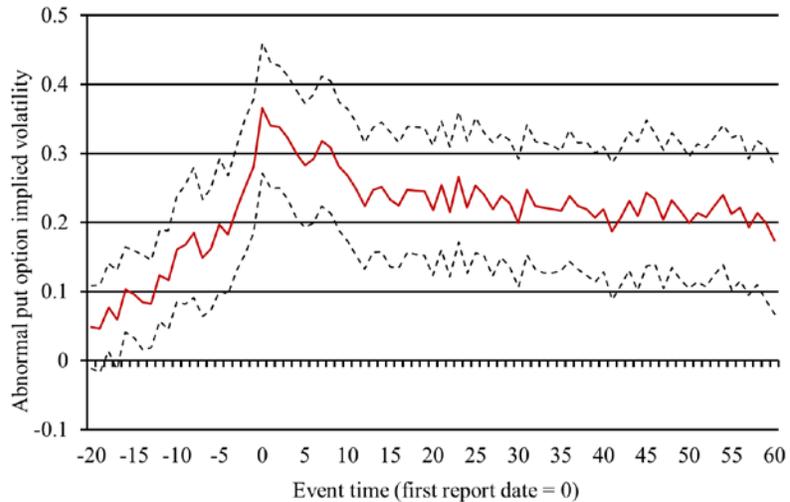
Figure 10a. Average Abnormal Cost of Put Options

Another way to see that puts become expensive – beyond what is reasonable given the

(temporary) increase in volatility shown in Figure 3 – is to compare the implied volatilities of puts

to the implied volatilities of calls with the same strike price and exercise date. By put-call parity, the

implied volatilities of puts and calls must be identical and so the ratio of put and call implied

volatilities should be one – unless there are significant costs of carry, such as short sale constraints.

Figure 10b shows that puts begin to depart from parity three days before the report date on average,

with the ratio settling at 10% above the pre-event baseline once the report has been released and

remaining there for the next three months. This is consistent with short sale constraints becoming

even tighter, making puts unusually expensive. As Figure 10c shows, once the arbs release their

reports, target companies' put prices move into the top quartile of the CRSP distribution.
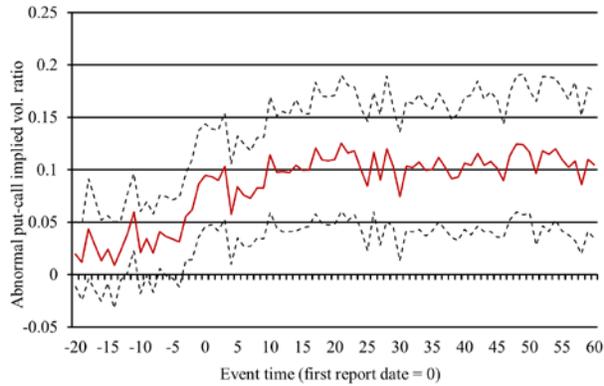
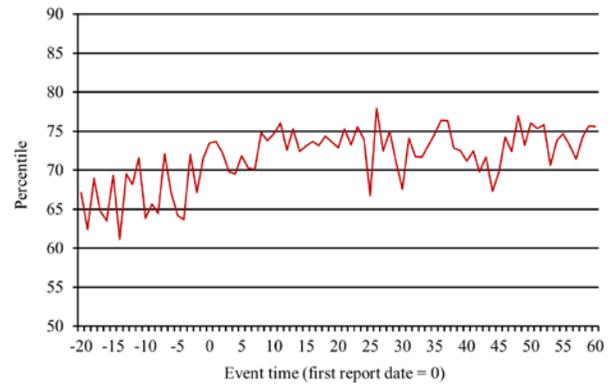**Figure 10b. Abnormal Cost of Puts Relative to Calls**   **Figure 10c. Mean Percentile Rank**

In summary, the companies targeted by the arbs in our sample are simply too hard to arbitrage

directly – through shorting or put options – for publication of the reports to act as a coordination

device in the sense of Abreu and Brunnermeier (2002).[19] Another mechanism is therefore needed.

3.4 Reaction by Long Investors

The patterns in Figures 6 to 10 show that neither new shorts nor trading in the options market

are likely to be the main cause of the report-day price falls shown in Table 4. As noted earlier, this

is not surprising, given that both targets and arbs have many of the characteristics traditionally

associated with short sale constraints and limits to arbitrage.

What then explains the price falls? The answer is, trading by the one group of investors who are

unconstrained: investors with long positions in the target companies' shares. Figure 11 illustrates

that the spike in overall trading volume we saw in Figure 4 is driven by a massive increase in

trading by the longs. On the report day, long trading is 524% above the baseline ($=\exp(1.831) - 1$)

and stays significantly elevated for the next month. Note that long trading necessarily involves

selling by the targets' existing investors: after removing new shorts from trading volume, the only

investors who can sell and thereby contribute to the spike in volume seen in Figure 11 are those

who already own the stock. Buyers on the other side of the trades are either new or existing

investors who doubt the arbs' claims or short-sellers who close out their positions.

---

[19] But see Zuckerman (2011) for evidence of synchronized arbitrage involving public announcements in a setting where limits to arbitrage are much less likely to be binding.
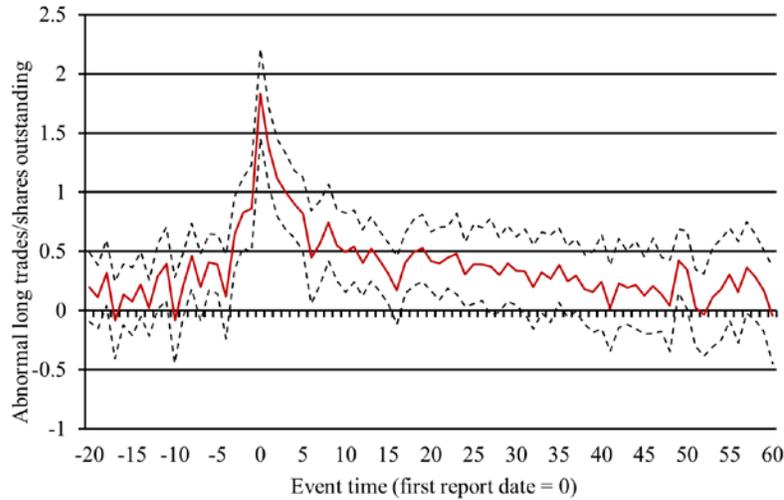
Figure 11. Average Abnormal Long Trades

3.5 How Accurate Are the Reports?

The reports not only make an impression on investors; they also influence the SEC, the stock exchanges – and of course trial lawyers. Using SEC filings and Factiva searches, we find that through the end of 2012, 52% of targeted companies are involved in class action lawsuits, 40% are delisted by an exchange (usually out of public-interest concerns), and 23% are formally investigated by the SEC or the Department of Justice (occasionally for fraud).[20] Investigations by regulators such as the SEC or the DoJ or by an exchange back up the reports in fully 83% of the cases.

Moreover, subsequent actions taken by the target companies indirectly confirm that the arbs' information is usually accurate rather than manipulative. Through December 2012, 78% of targets change management, 35% replace the auditor or see their auditor resign, and 22% restate earnings.

3.6 Do The Arbs Make Money on Their Information Production?

Our data allow us to estimate the arbs' trading profits, gross of the costs involved in identifying and investigating targets. Assuming that the arbs take a short position five days before the report day (which looks consistent with the patterns found in Figures 6 and 7) and then follow a marked-to-market borrow-and-hold strategy, their cumulative abnormal profit equals the negative of the

---

[20] The SEC and the DoJ launch fraud investigations in 14 cases and bring fraud charges in 9 cases. Fraud is not an exclusively Chinese phenomenon: regulators charge about the same number of U.S. and Chinese companies.

cumulative abnormal return shown in Figure 2 minus the cumulative shorting fee. Figure 12 shows that this strategy turns profitable as soon as the report is released, making an average return of 9.4% on the report day and a cumulative abnormal profit of 25.1% over three months.
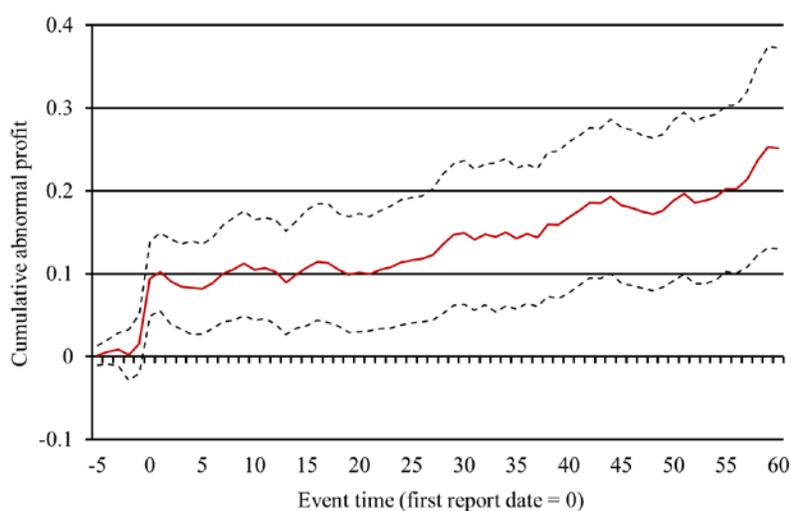

Figure 12. Average Cumulative Abnormal Profit Around Report Releases

These profit estimates are conservative to the extent that they ignore the potential for additional – and leveraged – returns through the use of put options.[21] They also ignore that the arbs, knowing that their reports will cause short-term spikes in volatility, could potentially set up profitable trading strategies in the options market (such as zero-beta straddles or butterflies) designed to capitalize on the volatility spike shown in Figure 3.

Whether the estimated trading profits are likely to cover the arbs' information production costs depends on three factors: the dollar size of their short position, the cost of investigating each target, and the "yield", i.e., how many companies have to be investigated to produce a viable target. Precise data on these factors are not publicly available, but with the help of interviews we have conducted with the arbs, it is possible to estimate ballpark numbers.

We know that the arbs have shallow pockets and that the targets are expensive to short. This

---

[21] Anecdotally, we are told that the arbs tend to first buy puts, where possible, and then short the underlying stock.

implies relatively small short positions, averaging a few million dollars.[22] (Figure 6 suggests abnormal shorting on the day before a report is released amounts to no more than $5 million on average.) The average 25.1% risk-adjusted return net of shorting fees seen in Figure 12 implies dollar gains of $251,000 on a short position of $1m, $502,000 on a short position of $2m, $753,000 on a short position of $3m, and so on – plus whatever profits the arbs can make through option trading strategies. Anecdotally, the arbs tell us that an investigation typically costs between around $10,000 and $100,000. One of the early adopters of the short-then-publish strategy claims a close to 100% yield; a later entrant claims to find three viable targets for every four he investigates. These numbers, if representative, suggest that the trading profits are large enough to cover analyst salaries, private investigators, and so on.

Another data point comes from Kerrisdale Capital, one of the arbs in our sample, whose performance data are available online.[23] Since inception in 2009, Kerrisdale has generated a cumulative return of 753.6% (net of fees to investors), compared to cumulative returns of 90.2% on the S&P500 Index and 31.8% on the Barclays Hedge Fund Index.

It is unlikely that the short-then-publish strategy will continue to generate returns of this magnitude. Eventually, entry will reduce returns by reducing the yield. As Table 1 shows, the strategy has already attracted increasing numbers of entrants. While we know of only five arbs who practiced it up to 2008, the strategy was adopted by five new arbs in 2009, seven in 2010, and fifteen in 2011. According to the developer of a soon-to-be-launched commercial database tracking "activist shorts", more than 200 U.S. listed companies were targeted in 2012 and 2013, nearly twice as many as over our 2006-2011 sample period.

4. Pinpointing the Mechanism

The results so far suggest that the arbs do not have deep enough pockets to correct the

---

[22] Consistent with a prediction in Kovbasyuk and Pagano (2014), we are told that the arbs in our sample tend to take concentrated short positions, resulting in underdiversified portfolios. They also tend to target one company at a time.
[23] See http://www.scribd.com/doc/156970121/Kerrisdale-Quarterly-Letter-6-30-13.

mispricing on their own, given the short sale constraints surrounding their targets. Our conjecture is that the arbs attempt to circumvent these constraints by making their information public, in an effort to persuade the longs to sell. This would be consistent with the observed massive increase in trading by the longs. If successful, this strategy will not only result in a price correction that translates into gains on the arbs' short positions; it will also reduce noise trader risk by making it less likely that prices diverge even further from fundamentals in the short-run and thereby put a squeeze on the arbs' short positions.

For the short-then-publish strategy to work, the reports need to contain credible information. In Section 4.1, we show that only credible reports result in price corrections and profits to the arbs. Section 4.2 adds nuance to this result by showing that only reports containing new information that is costly to acquire move prices. Section 4.3 asks what kind if mispricing can be arbitraged away using a short-then-publish strategy.

4.1 Credibility

Reports should only induce longs to sell if the information they contain is credible. The arbs clearly understand this: many prominently post their past performance on their websites. For example, Citron Research maintains a list of its targets that have subsequently been targeted by regulators – more than 50 as of January 2014 (see http://en.wikipedia.org/wiki/Andrew_Left).

Rather than relying on these posts, we construct our own measure of credibility. Specifically, to determine whether a report is likely to be considered credible, we examine each arb's prior track record, on the assumption that arbs with a stronger track record are more readily believed when they target a stock. We measure an arb's track record at time t as the rolling mean of the three-month cumulative abnormal returns of all his previous reports (issued at least three months before time t, to avoid look-ahead bias).[24] Using all 358 reports in our sample, we then code a report issued at time t as more credible if the arb's prior track record produced profits (a negative rolling mean CAR), and

---

[24] We require each arb to have issued at least two reports before we compute a track record. Results are not sensitive to the choice of a three-month window.

29

as less credible otherwise. This approach assumes that trading profits are a sufficient statistic for the market's assessment of the credibility of an arb's previous reports.

We obtain 202 reports coded as more credible and 35 reports coded as less credible.[25] Note that an arb's track record evolves over time such that he can gain or lose credibility depending on how accurate his reports prove to be. The final column of Table 1 reports what fraction of each arb's reports is coded as more credible.

Table 5, Panel A splits the sample by this measure of credibility. When a more credible arb is the first to issue a report on a target, the target's share price falls by an average of 8.8% on the report day, net of market movements ($p<0.001$). This is a significantly larger than the 2.3% average price fall for less credible reports, which in turn is not significantly different from zero ($p=0.492$). If we include follow-on reports by this or other arbs, the pattern is similar: more credible reports are greeted with a significant price fall averaging 5.3% on the release day ($p<0.001$), compared to a price fall of only 1.4% for less credible reports ($p=0.315$). Turnover tells a similar story. Both overall turnover and trading involving longs respond significantly more strongly, on the report day, to more credible reports.

Consistent with these turnover patterns, prices converge faster in response to more credible reports. As Figure 13 shows, a borrow-and-hold strategy initiated five days before the release day of a more credible report becomes profitable immediately upon release and generates abnormal profits, net of shorting fees, averaging 17.8% by day +60. The rapid speed with which the price correction occurs implies a much reduced noise trader risk. Less credible reports, in contrast, do not move prices significantly, either on the release day or with any kind of lag. By day +60, for example, cumulative abnormal profits average an economically small and statistically insignificant 2.2% net of shorting fees ($p=0.767$).

---

[25] We lose 121 of the 358 reports, in part because we require at least two reports to compute a track record; and in part because we require that prior reports are at least 60 trading days old before we can classify the current report as more or less credible.
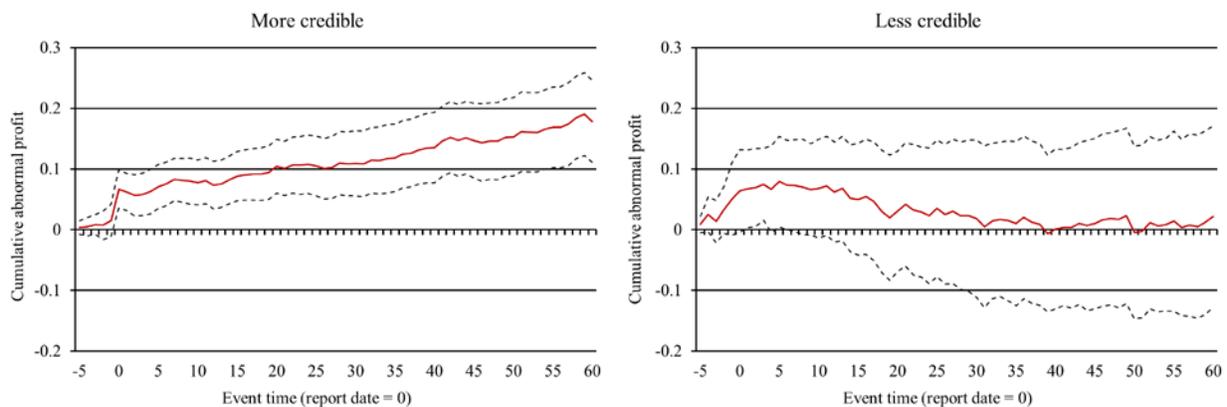
Figure 13. Cumulative Abnormal Profits Sorted by Credibility

4.2 Report Content

Credibility appears to be necessary but is probably not sufficient to ensure the longs will listen. What likely also matters is what the arb has to say. Table 5, Panel B splits the sample of reports into those that reveal new evidence and those that merely reinterpret already known data. On first-report days, abnormal returns average -9.5% for evidence-based reports ($p<0.001$), compared to a statistically insignificant -2.2% for opinion-based reports ($p=0.151$). In other words, investors largely ignore claims of overvaluation if not backed up by new facts and hard evidence. The difference between the two cases is highly statistically significant ($p=0.002$). Turnover tells a similar story: both the overall increase in turnover and the reaction by the longs is significantly stronger for reports that reveal new evidence.

These patterns imply that reports containing new and hard facts should make higher profits than simple claims a stock is overvalued without the support of new information. Figure 14 bears this prediction out. Evidence-based reports generate significant profits as soon as they are released, peaking at 15.9% by day +60 on average. Opinion-based reports, on the other hand, do not induce investors to sell and end up never making significant profits (not even after three months).
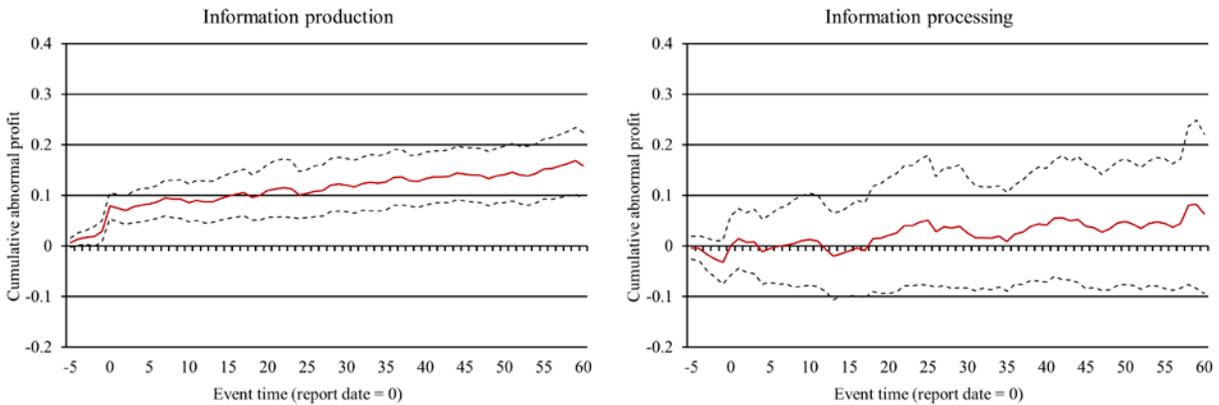
31

Figure 14. Cumulative Abnormal Profits Sorted by Type of Report

4.3 What Can Be Arbitraged Using The Short-Then-Publish Strategy?

Our results suggest that arbs who credibly reveal novel information about their targets are able to persuade long shareholders to sell and thereby contribute to a price correction which in turn generates an economically meaningful return on the arbs' information production. What are the limits to this short-then-publish strategy?

To have an incentive to engage in information discovery, two conditions must hold: the arbs need to be able to take a sufficiently large short position, via the cash or the options markets, to cover their expected information discovery costs; and they need to expect to find sufficiently compelling hard evidence with which to induce the longs to sell. This implies that they are unlikely to target companies whose potential for misvaluation is too expensive to investigate or for which hard facts are unlikely to be discovered.

We illustrate these limits to the strategy by sorting targets on various measures of arbitrage costs. We expect that the more expensive a stock is to arbitrage, the greater the misvaluation needs to be for the arbs to be able to cover their information discovery costs.

Our first measure sorts targets by the average daily shorting fee during the trading month ending one month before the first report and splits the sample at the median. Table 6, Panel A shows that when shorting fees are high, the arbs predominantly target companies that are more glaringly mispriced. For high-shorting-fee stocks, the cumulative abnormal three-month profits average 24%

32

(p=0.018), slightly larger than the average profit of 21.1% on low-shorting-fee stocks (p=0.003). In other words, gross returns (i.e., returns due to price corrections) are sufficiently greater in high-shorting-fee stocks to make up for the higher shorting fees, such that net returns end up fairly similar – despite the difference in the cost of building the initial short position.

We obtain similar results when we sort on the supply of lendable stock available for borrowing. Again splitting the sample at the median, Panel B shows that the arbs make money, net of shorting fees, regardless of how tight the supply of lendable stock is. If anything, they make greater returns in the harder-to-borrow stocks, averaging 25.5% (p=0.015) after 60 days, than in easier-to-borrow stocks, averaging 19.8% (p=0.004), though the difference is not statistically significant (p=0.633).

Pontiff (2006) argues that idiosyncratic volatility is a key measure of arbitrage holding costs. Panel C shows the arbs making more money, net of shorting fees, when idiosyncratic volatility is higher: cumulative abnormal profits average 39.2% after 60 days for high-volatility stocks (p<0.001) versus 12.9% for low-volatility stocks (p=0.026), and the difference is statistically significant (p=0.033). This pattern is consistent with Pontiff's argument that volatile stocks are harder to arbitrage (using conventional arbitrage strategies) and so are more prone to mispricing. This, in turn, makes them particularly suited to the short-then-publish strategy of our arbitrageurs.

Panel D, finally, splits the sample by the targets' pre-report market capitalization. Remarkably, we find that the arbs make similar trading profits when targeting larger and smaller stocks, averaging 25.9% (p<0.001) and 24.3% (p<0.001), respectively. The short-then-publish strategy thus appears effective regardless of firm size.

Table 6 further reveals that each subsample experiences similar spikes in turnover and in long trading when a report is released to the public, whether we sort on shorting fees, the supply of lendable stock, idiosyncratic volatility, or firm size. This is consistent with our proposed mechanism: if, as we propose, the price correction emanates not from the short side of the market but from long shareholders' responses to the negative information revealed in the reports, it should

make no difference how severe a set of short sale constraints a target company happens to have: after all, the longs are not constrained.

4.4 Informational Spillovers

The short-then-publish strategy appears well suited to instances in which hard information can be discovered, such as when a company is overvalued as a result of aggressive accounting or fraud. This is consistent with Kovbasyuk and Pagano's (2014) model of traders who "advertise" arbitrage opportunities. In the model, advertising helps correct mispricing that is caused by limited investor attention: by focusing unconstrained investors' attention on a mispriced stock, mispricing can be reduced. We argue that advertising may also, inadvertently, help prick bubbles: on the one-rotten-apple-spoils-the-barrel principle, investors may start to pay closer attention to similar companies when confronted with negative information about specific targets.

Chinese companies listed in the U.S. provide an opportunity to test for such informational spillovers. In 2010, Chinese stocks were in high demand in the U.S. The number of Chinese companies with a listing in the U.S. increased from 401 to462 and the Bloomberg China-U.S. index rose in value by 29%. Over the same period, Chinese companies were much less popular in China (the Shanghai SSE Composite index closed down 13%), as were U.S. firms in the U.S. (the S&P500 index closed up by only 13%).

During 2010 and especially 2011, many U.S. listed Chinese companies were targeted by arbs. As the Internet Appendix shows, the targets suffered substantial share price falls. We now examine whether the arbs' reports may have changed sentiment about China stocks more generally. Figure 15 shows what happens to the stock prices of other Chinese firms listed in the US (i.e., those not targeted by the short-sellers) as reports are released. The graph shows 12-month alphas from calendar-time portfolios formed when the first, second, third etc. report on a Chinese stock came out. The portfolios only include Chinese stocks that were not themselves targets. (See Appendix A for details of the portfolio formation strategy.)
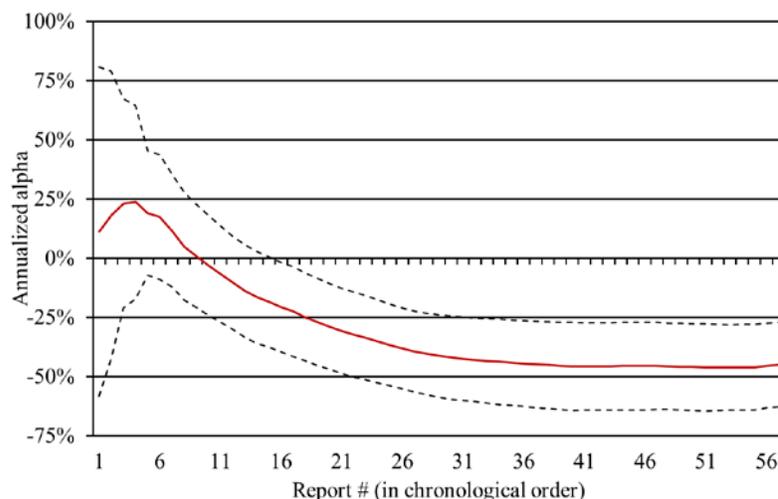
Figure 15. Calendar-time Portfolio Alphas Going Long Non-target China stocks

The first nine reports appear not to have influenced investors' views of China stocks in general. Starting with the 10th report, however, which came out on February 12, 2010, the prices of non-target China stocks started to be dragged down as well – and more so with every additional report that came out. This suggests that as a critical mass of negative reports about specific U.S. listed Chinese companies accumulated, investors began to reevaluate U.S. listed China stocks in general.

5. Conclusions

Whether financial markets price securities efficiently depends on limits to arbitrage and on traders' incentives to engage in costly information production. The former limit informed traders' ability to correct mispricing ex post (Harrison and Kreps (1978)). The latter affect whether mispricing is likely to be discovered ex ante (Nezafat and Wang (2014)). Without limits to arbitrage, behavioral finance would not be possible (Brav, Heaton, and Rosenberg (2004)).

In this paper, we present empirical evidence showing how novice arbitrageurs overcome a key barrier to entry to informational arbitrage: the fact that they have limited capital and so cannot hope to move prices through their trades. To nevertheless ensure that prices incorporate their information, they induce target company shareholders to trade on their behalf by revealing their information to the market. When the information is credible, the unconstrained investors – i.e., the longs –sell,

driving down the price. This not only helps overcome short sale constraints but also accelerates the price correction and thereby reduces the risk of noise traders moving prices even further from fundamentals in the short-run, which might otherwise force the arbs to liquidate their short positions at a loss.

Credibility is key: as our evidence shows, arbs who lack (or lose) a track record of producing reliable evidence are ignored by investors and so cannot move prices by publishing their reports. Producing evidence that is new also is key: arbs who simply express the opinion that a stock is overvalued, based purely on existing information, are similarly ignored by investors.

In principle, revealing the information creates the potential for coordinated action by multiple arbitrageurs to overcome the synchronization problem modeled in Abreu and Brunnermeier (2012). But our results show that not even that is enough, on its own, to correct mispricing in our setting. The reason is that the arbs deliberately target companies with often severe short sale constraints, limiting the scope for coordinated action.

The strategy we describe is reminiscent of large investors such as Carl Icahn, George Soros, or Warren Buffett revealing their positions in certain companies, a practice called "talking one's book." The difference is that the arbs in our sample are small price-takers, and so revealing their position would, on its own, have no impact on prices. To be listened to, the arbs also have to reveal their information. The effectiveness of their message thus depends less on who they are and how much capital they have and more on their track record and credibility. The main barrier to entry into informational arbitrage for a small arbitrageur is thus not so much a lack of trading capital but the funding required to produce credible information.

While the primary audience is the longs, without whom prices would not adjust (or at least not sufficiently quickly), a reputation for credibly identifying overvalued targets might eventually allow some arbs to raise funds from institutional and other investors. This would help overcome the limit to arbitrage identified by Shleifer and Vishny (1997): the inability to persuade investors to commit

capital to an investment strategy aimed at correcting mispricing.

An important implication of our findings is that neither limited arbitrage capital nor severe short sale constraints need constrain informational arbitrage in practice: as long as the mispricing is sufficiently large, these obstacles can be overcome by the arbitrage mechanism we describe. It may even help prick behavioral "bubbles", by confronting overly optimistic investors with cold hard facts that are impossible to ignore.

Our evidence also illustrates why financial markets need short sellers to function well. We find no support for the widely held view that short sellers are speculators who do little more than manipulate and destabilize share prices. The fact that investors ignore reports that do not contain new, hard information suggests that it is quite difficult to manipulate share prices, at least in our setting. Instead, the short sellers in our sample are information producers who help correct mispricing and thereby help make markets more efficient.[26] This is all the more remarkable given that many targets in our sample were held by highly sophisticated investors who apparently did not spot the mispricing until it was too late.[27]

---

[26] Consistent with this view, Carpenter, Lu, and Whitelaw (2014) find that stock prices became more informative about future earnings after China introduced short selling in 2006.

[27] According to media reports, investors that lost substantial amounts when arbs revealed their information include Paulson & Co. (with a $468m loss on Sino-Forest) and C.V. Starr & Co. (with a $6.5m loss on ChinaMedia Express). Other prominent investors who have suffered from the price fall upon the information release include Blackrock, Vanguard, Hartford Investment Management, Apollo Global Management, and Henderson Global Investors.

References

Abreu, Dilip, and Markus Brunnermeier, 2002, Synchronization risk and delayed arbitrage, Journal of Financial Economics 66, 341–360.

Amihud, Yakov, 2002, Illiquidity and stock returns: Cross-section and time series effects, Journal of Financial Markets 5, 31–56.

Avramov, Doron, Tarun Chordia, and Amit Goyal, 2006, The impact of trades on daily volatility, Review of Financial Studies 19, 1241–1277.

Barber, Brad M., and Terrence Odean, 2008, All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors, Review of Financial Studies 21, 785–818.

Beneish, Messod D., Charles M.C. Lee, and Craig Nichols, 2013, In short supply: Equity overvaluation and short selling, Working paper, Stanford University.

Boehmer, Ekkehart, Charles Jones, and Xiaoyan Zhang, 2008, Which shorts are informed?, Journal of Finance 63, 491–527.

Bondarenko, Oleg, 2003, Statistical arbitrage and securities prices, Review of Financial Studies 16, 875–919.

Brav, Alon, J.B. Heaton, and Alexander Rosenberg, 2004, The rational-behavioral debate in financial economics, Journal of Economic Methodology 11, 393–409.

Carpenter, Jennifer, Fangzhou Lu, and Robert F. Whitelaw, 2014, The real value of China's stock market, Working Paper, NYU.

Chen, Lei, 2014, The informational role of internet-based short sellers, Working paper, LSE.

Christophe, Stephen E., Michael G. Ferri, and James J. Angel, 2004, Short-selling prior to earnings announcement, Journal of Finance 59, 1845–1875.

Christophe, Stephen E., Michael G. Ferri, and Jim Hsieh, 2010, Informed trading before analyst downgrades: Evidence from short sellers, Journal of Financial Economics 95, 85–106.

Cohen, Lauren, Karl B. Diether, and Christopher J. Malloy, 2007, Supply and demand shifts in the shorting market, Journal of Finance 62, 2061–2096.

Dechow, Patricia M., Amy P. Hutton, Lisa Meulbroek, and Richard G. Sloan, 2001, Short sellers, fundamental analysis and stock returns, Journal of Financial Economics 61, 77–106.

Dechow, Patricia M., Alastair Lawrence, and James Ryans, 2013, SEC comment letters and insider sales, Working Paper, University of California, Berkeley.

DeLong, Bradford J., Andrei Shleifer, Lawrence Summers, and Robert J. Waldmann, 1990, Noise trader risk in financial markets, Journal of Political Economy 98, 703–738.

DellaVigna, Stefano, and Joshua M. Pollet, 2009, Investor inattention and Friday earnings announcements, Journal of Finance 64, 709–749.

Desai, Hemang, K. Ramesh, S. Ramu Thiagarajan, and Bala V. Balachandran, 2002, An investigation of the information role of short interest in the NASDAQ market, Journal of Finance 52, 2263–2287.

Desai, Hemang, Srinivasan Krishnamurthy, and Kumar Venkataraman, 2006, Do short sellers target firms with poor earnings quality? Evidence from earnings restatements, Review of Accounting Studies 11, 71–90.

Diether, Karl B., Kuan-Hui Lee, and Ingrid Werner, 2007, Short-sale strategies and return predictability, Review of Financial Studies 22, 575–607.

Engelberg, Joseph, Adam V. Reed, and Matthew Ringgenberg, 2012, How are shorts informed? Short sellers, news, and information processing, Journal of Financial Economics 105, 260–278.

Figlewski, Stephen, 1981, The informational effects of restrictions on short sales: Some empirical evidence, Journal of Financial and Quantitative Analysis 16, 463–476.

Grossman, Sanford, and Joseph Stiglitz, 1980, On the impossibility of informationally efficient markets, American Economic Review 70, 393–408.

Harrison, Michael J., and David M. Kreps,1978, Speculative investor behavior in a stock market with heterogeneous expectations, Quarterly Journal of Economics 92, 323–336.

Hirshleifer, David, and Tyler Shumway, 2003, Good day sunshine: Stock returns and the weather, Journal of Finance 58, 1009–1032.

Hirshleifer, David, Siew Hong Teoh, and Jeff Jiewei Yu, 2011, Short arbitrage, return asymmetry, and the accrual anomaly, Review of Financial Studies 24, 2429–2461.

Hogan, Steve, Robert Jarrow, Melvyn Teo, and Mitch Warachka, 2004, Testing market efficiency using statistical arbitrage with applications to momentum and value strategies, Journal of Financial Economics 73, 525–565.

Jiang, Guohua, Danielle Xu, and Tong Yao, 2009, The information content of idiosyncratic volatility, Journal of Financial and Quantitative Analysis 44, 1–28.

Jain, Archana, Pankaj K. Jain, Thomas H. McInish, and Michael McKenzie, 2013, Worldwide reach of short selling regulations, Journal of Financial Economics 109, 177–197.

Karpoff, Jonathan M., and Xiaoxia Lou, 2010, Short sellers and financial misconduct, Journal of Finance 65, 1879–1913.

Kovbasyuk, Sergei, and Marco Pagano, 2014, Advertising arbitrage, Working Paper, University of Naples.

Kyle, Albert, 1985, Continuous auctions and insider trading, Econometrica 53, 1315–1335.

Lamont, Owen A., 2012, Go down fighting: Short sellers vs. firms, Review of Asset Pricing Studies 2, 1–30.

Lee, Charles M.C., Kevin K. Li, and Ran Zhang, 2013, Shell games: Are Chinese reverse merger firms inherently toxic?, Working paper, Stanford University.

Nagel, Stefan, 2005, Short sales, institutional investors, and the cross section of stock returns, Journal of Financial Economics 78, 277–309.

Nezafat, Mahdi, and Qinghai Wang, 2014, Short sale constraints, information acquisition, and asset prices, Working paper, Georgia Institute of Technology.

Peng, Lin, and Wei Xiong, 2006, Investor attention, overconfidence, and category learning, Journal of Financial Economics 80, 563–602.

Pontiff, Jeffrey, 2006, Costly arbitrage and the myth of idiosyncratic risk, Journal of Accounting and Economics 42, 35–52.

Saffi, Pedro A.C., and Kari Sigurdsson, 2011, Price efficiency and short selling, Review of Financial Studies 24, 821–852.

Shefrin, Hersh, 1999, Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing, Harvard Business School Press (Boston, Massachusetts).

Shleifer, Andrei, and Robert Vishny, 1997, The limits of arbitrage, Journal of Finance 52, 35–55.

Stambaugh, Robert F., Jianfeng Yu, and Yu Yuan, 2012, The short of it: Investor sentiment and anomalies, Journal of Financial Economics 104, 288–302.

Zuckerman, Roy, 2011, Synchronized arbitrage and the value of public announcements, Working Paper, Rutgers University.

Appendix A. Variable Definitions.

Outcome variables

Returns and profits:

CAR is the cumulative abnormal return over a specified event window. It is constructed using the Fama-French-Carhart benchmark. Factor loadings are estimated in a one-year pre-event window ending 21 trading days before the report date, and cumulative abnormal returns during the specified event window are calculated using this estimated model as a benchmark.

Cumulative abnormal profit measures the return to a borrow-and-hold strategy that goes short the stock on day t, marks the position to market on a daily basis, and closes out the position on day T. It is measured as the negative of the cumulative abnormal return (CAR*)* net of the cumulative daily shorting fee.

Daily trading and shorting variables:

Turnover is defined as the one-way number of shares traded in a day (CRSP variable *vol* divided by 2) divided by the number of shares outstanding (CRSP variable *shrout*).

New shorts/shares outstanding is the number of new shorts initiated (as proxied by the number of new shares on loan) on a given day divided by the number of shares outstanding (CRSP variable *shrout*). The number of daily new shares on loan is obtained from DataExplorers.

Long trades/shares outstanding is equal to the difference between one-way *turnover* and *new shorts/shares outstanding* (as defined above). In other words, it is the number of (one-way) traded shares on a given day that are not attributable to short sellers, divided by the total number of shares outstanding (CRSP variable *shrout*).

Shorting fee is the daily cost of initiating new short positions (i.e., the daily cost of borrowing new shares from equity lenders), using data obtained from DataExplorers.

Supply of lendable stock is defined as the number of shares available for borrowing on a given day divided by the number of shares outstanding (CRSP variable *shrout*). Data on shares available for borrowing are from DataExplorers.

Daily variables constructed using intra-day data from TAQ:

Amihud's (2002) illiquidity measure is defined as the average, over a day, of the absolute value of the five-minute continuously compounded return multiplied by 1,000,000 which then is divided by the dollar trading volume within the same five-minute interval. We compute the continuously compounded returns using TAQ prices sampled every five minutes. Results using quote prices are very similar. The variable is winsorized at the 1% and 99% to reduce the impact of outliers.

Daily options-related variables (from OptionMetrics):

Put-call trading volume ratio is constructed as follows. First, for each pair of traded put and call options with the same strike price (OptionMetrics variable *strike_price*) and exercise date (OptionMetrics variable *exdate*), we compute the put-call ratio of the daily trading volume (OptionMetrics variable *volume*). Second, we compute the weighted average of the daily trading volume ratios for all the put and call option pairs, weighted by open interest (OptionMetrics variable *open_interest*) on the corresponding put-call option pair for a given stock.

Put option implied volatility is the weighted average of the implied volatility of all traded put options on a day for a given stock, weighted by open interest (OptionMetrics variable *open_interest*) on each of the traded put options for that stock. The implied volatility measure for each traded put option is obtained directly from OptionMetrics (variable *impl_volatility*).

Put-call implied volatility ratio is constructed as follows. First, for each pair of traded put and call options with the same strike price (OptionMetrics variable *strike_price*) and exercise date (OptionMetrics variable *exdate*), we compute

the put-call ratio of the daily implied volatilities (OptionMetrics variable *impl_volatility*). Second, we compute the weighted average of the daily implied volatility ratios for all the put and call option pairs, weighted by open interest (OptionMetrics variable *open_interest*) on the corresponding put-call option pair for a given stock.

Firm characteristics (measured as of the most recent calendar month-end before a first report):

Market capitalization is defined as the product, reported in millions, of the end-of-month share price (CRSP variable *prc*) and the total number of shares outstanding (CRSP variable *shrout*).

Book/market ratio is measured as the ratio of a firm's book value of equity (Compustat item *seq + txditc - pstkrv*) to its market value (Compustat item *prcc* multiplied by Compustat item *csho*).

Monthly idiosyncratic volatility is defined as the monthly average of the standard deviation of residuals from adjusted daily Fama-French regressions specified as in Jiang, Xu, and Yao (2009).

Monthly Amihud (2002) illiquidity measure is constructed as follows. We use daily CRSP data (CRSP variables *ret*, *prc*, and *vol*) to calculate the ratio of absolute stock return (multiplied by 1,000,000) to dollar trading volume for each day, after which we average these daily ratios over a month.

Short-seller characteristics

Credible is defined as follows. We examine the arb's prior track record, on the assumption that arbs with a stronger track record are more readily believed when they target a stock. We measure an arb's track record at time *t* as the rolling mean of the three-month cumulative abnormal returns of all his previous reports (issued at least three months before time *t*, to avoid look-ahead bias). We require each arb to have issued at least two reports before we compute a track record. A report issued at time *t* is coded as more *credible* if the arb's prior track record produced profits (a negative rolling mean CAR) and as less credible otherwise.

Portfolio formation strategy (Figure 15)

For each first report targeting a Chinese firm and released on day *t*, we estimate the abnormal return to a trading strategy that buys all non-target U.S.-listed Chinese firms when reports 1, 2, … *t* are released and sells the Fama-French and momentum portfolios. Non-targets are firms that have not themselves been targeted by sample arbs through report *t*. Abnormal returns are obtained from monthly calendar-time portfolio regressions assuming a 12-month holding period.

Figure A1. Sample Reports.

This figure shows three examples of the front page or executive summary of research reports published by sample arbitrageurs.

Muddy Waters, LLC
www.muddywatersresearch.com
info@muddywatersresearch

Director of Research: Carson C. Block, Esq.

Company:
China Media Express Holdings (CCME)

Industry:
Outdoor Digital Advertising

Recommendation:
Strong Sell

Estimated Value:
$3.54

Report Date:
March 2, 2011

Price:
$12.27

Market Cap:
$420.7 million

Float:
10.2 million

Avg Volume:
2.8 million

- Muddy Waters, LLC has amassed irrefutable evidence that CCME is a substantial fraud, and that management is engaging in a cover-up replete with further dissemination of fraudulent information.

- We present a recorded telephone conversation that contains an admission that CCME is engaging in securities fraud.

- We document that in the course of rebutting our Report, Chairman Cheng provided fabricated information.

- We present the sales presentation we received in January from the aforementioned salesperson (the "Sales Presentation") that shows CCME has fewer than half of the buses it claims.

- We present a mini-documentary of the largest purported operator – Shanghai Ba Shi – specifically focusing on its inter-city buses and drivers. The film shows that CCME's hardware is not installed on the buses, despite CCME's claim to have had hardware on these buses since at least mid-2008.

GLAUCUS RESEARCH GROUP

MARCH 2011

UNIVERSAL TRAVEL GROUP (UTA)

Things gained through unjust fraud are never secure.
- Sophocles

Company:
Universal Travel Group (NYSE: UTA)

Industry: Chinese Online Travel Services

Recommendation: Strong Sell

Estimated Value: $1.00/share

Report Date: March 8, 2011

Price: $6.28 (as of close on 3/7/11)

Float: 13.2 million

Avg. Volume 300,000 shares/day

- UTA is fabricating its publicly filed financial statements. Its actual underlying business is far smaller than its SEC filings indicate.

- UTA's business model is not credible. For example, UTA claims to have earned $110 million in net revenue in the first three quarters of 2010 on an advertising budget of $247,449 in the highly competitive leisure travel market. Its competitors spend five to 10 times more on marketing as a percentage of net revenue, casting doubt on the authenticity of UTA's revenue and net income.

- UTA has a deficient and unpopular website, boasts only a minimal brick-and-mortar retail operation and has no kiosks under its control to directly sell to consumers. Yet the company's return on assets and asset turnover figures suggest it is the most efficient company in the leisure travel space, consistently trouncing the competition.

- UTA's website is barely functional (as can be seen in our videos here, here, here, here and here), offers a terrible user experience and receives only a small fraction of the traffic of its Chinese competitors, despite the fact that the company holds itself out as an online travel service provider.

- UTA is a serial capital raiser, repeatedly returning to western investors for cash despite supposedly having, according to its balance sheet, ample cash on hand, which sits unused in an account earning .36% in interest per year. UTA is lying about the amount of cash on its balance sheet, as is evidenced by its inexplicably low interest income.

- UTA has destroyed shareholder value through a series of dilutive acquisitions. The company's acquisition targets had much smaller earnings than UTA claimed in its public filings.

- UTA's purported relationship with Agoda, a subsidiary of Priceline.com, is overstated.

- UTA has burned through 4 low-quality auditors and 3 CFOs in 5 years.

Advanced Battery Technologies, Inc.

In this report, we present compelling evidence that Advanced Battery Technologies, Inc. ("ABAT" or the "Company") is fabricating its SEC financial statements. We believe that the Company's revenue and profit are highly overstated in its SEC filings. We have created a video where we discuss our findings: Part 1 is here and Part 2 is here. Our evidence includes:

- SAIC filings show that ABAT is reporting significantly lower revenue and profit to the authorities in China. For 2009, SAIC filings showed less than $2 million of revenue, compared to $64 million in SEC filings.
- ABAT has unreasonably high margins in an established industry with strong competitors. The Company's SEC-reported margins and return on capital are virtually impossible. Out of 106 global battery manufacturers as classified by Bloomberg, ABAT has the highest operating profit margin by a wide margin. When compared to six leading Chinese battery makers, ABAT's operating margin is triple that of its closest competitor and six times that of the median operating margin of the comparable companies.
- Site visits show underutilized facilities lacking in quality control. We hired investigators to visit both the Harbin and Wuxi facilities, and provide photos as well as commentary from our investigators. Our investigators concluded that both facilities produce commodity, low-margin products that are highly unlikely to be generating industry-leading margins or return on capital.
- In December 2010, ABAT announced that it was acquiring a Shenzhen battery maker for $20 million. We believe this acquisition is a sham, and that ABAT paid $20 million in 2010 for an entity that they had previously bought in 2008 for $1 million, but had not disclosed to public investors.
- Confirmation from former customers and partners that the Company is likely a fraud. After visiting one of ABAT's plants, one customer called the facility "absolutely the biggest joke I'd ever seen". A recording of the conversation is available here. In another conversation available here and here, a customer said the CEO admitted to hiring an accounting firm "to cook his stock price up".
- Low quality auditors and high turnover. The Company has had 4 auditors in the past 7 years, with no auditor being ranked in the top global 100 auditors at the time of hire.
- Unqualified CFOs and high turnover. A CFO or auditor has resigned at least once a year. The Company's past three CFOs have included: (i) a company insider who has been general manager of the Company's main operating subsidiary since 2004, and is therefore not remotely independent, (ii) a 29-year-old who was formerly VP Finance at China Natural Gas, another fraud, and (iii) a candidate whose primary experience comprised of being a financial adviser at Smith Barney.
- Continuous share dilution through secondary offerings, despite having more than adequate cash reserves. Through repeated share issuances, the Company has grown its outstanding shares from 10.0 million following the 2004 reverse merger to 76.4 million today.

Our estimated fundamental value for ABAT is $0.00

45

Figure A2. Examples of Photos and Video Snapshots Contained in Reports

Panel A shows a photo of a target firm's production assets (left) that the report compares to a photo of the more modern looking production assets of the firm's main competitor (right). Panel B shows snapshots of video clips of a different target firm's manufacturing site taken on two different dates (the video on the left was taken three months before the video on the right), both showing an apparent lack of commercial activity of a scale commensurate with the company's financial reports.

Panel A. Photos

Panel B: Video Snapshots
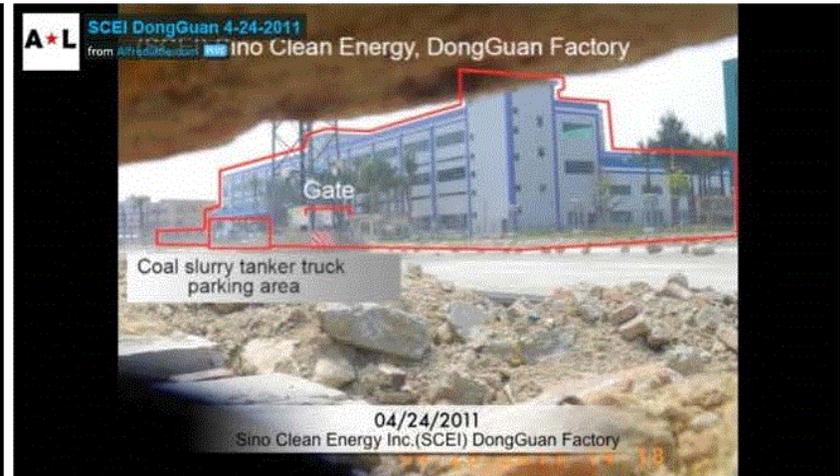
Table A1. Illustrations of Report Titles.
This table lists 20 examples of report titles used by sample arbitrageurs to attract attention to their reports.

1. "*Credibility is like virginity; once you lose it, you can never get it back*", January 24, 2008 (Citron Research)

2. "*Arthrocare—Something is rotten in the state of Denmark*", May 2, 2008 (Citron Research)

3. "*Emcore... Nothing plus nothing = nothing*", September 9, 2008 (Citron Research)

4. "*Citron exposes Apollo's big dirty secret – All new docs*", March 2, 2009 (Citron Research)

5. "*AOB deal questionable even without undisclosed relationship between chairman and seller*", August 5, 2009 (Asensio & Co.)

6. "*SinoCoking: Follow the money!*", March 11, 2010 (Citron Research)

7. "*Orient Paper's top supplier: An empty shell owned by ONP's CEO*", August 10, 2010 (Chinese Company Analyst)

8. "*China New Borun (BORN)—You are cold busted: Now it is time to come clean*", November 15, 2010 (Citron Research)

9. "*A stock only a trading robot could love*", December 28, 2010 (Citron Research)

10. "*Another stock only a computer could love: The sequel*", January 24, 2011 (Citron Research)

11. "*CCME: The China reverse merger stock that is "too good to be true"*", January 30, 2011 (Citron Research)

12. "*ChinaCast Education Corporation: Show me the money! Questions to management regarding acquisition #1*", February 16, 2011 (OLP Global)

13. "*Irrefutable evidence of fraud*", March 2, 2011 (Muddy Waters)

14. "*China Biotics: The best research you haven't seen*", March 12, 2011 (Citron Research)

15. "*DEER: Was the $22.3 million land use right certificate a forgery?*", March 18, 2011 (Alfred Little)

16. "*Sino Clean Energy: Who lied about the weather?*", May 12, 2011(Chimin Sang)

17. "*Gulf Resources: Financial claims are beyond reason*", May 19, 2011 (Kerrisdale Capital)

18. "*ZAGG: Is it in the covers business, or covering up its real business?*", July 13, 2011 (Citron Research)

19. "*Sino Clean Energy is a complete hoax and its shares are worthless*", April 28, 2011 (Alfred Little)

20. "*The Harbin Land shuffle: A classic bait and switch*", September 23, 2011 (GeoInvesting)

Table 1. Summary Statistics: Arbitrageurs.

The sample contains 31 arbitrageurs who target 124 firms with a total of 358 reports over the period from July 2006 to December 2011. Note that there are 126 first reports on 124 target companies, as two arbs release first reports on the same day in the case of two target companies. The table presents (for each of the 17 repeat arbs individually and for the 14 one-time arbs as a group), summary statistics on the number of reports and target firms, post-release returns and profits, and the credibility of the arbs' reports. Year started is the year in which the arb first released a report on an overvalued target. (Citron Research and Asensio & Co. started before the beginning of our sample period.) For variable definitions and details of their construction, see Appendix A.

	Year started	Number of first reports	Number of firms covered	Total number of reports	Mean abnormal return on report date (first reports only) %	Mean CAR from report date to trading day 60 (first reports only) %	Mean cumulative abnormal profit from trading day -5 to trading day 60 (first reports only) %	Fraction of all reports coded as "more credible" %
Citron Research	2001	43	46	106	-7.2	-30.1	23.2	87
Bronte Capital	2008	9	12	33	-5.8	11.7	-13.0	0
GeoInvesting	2011	8	10	16	-12.1	-45.4	44.8	56
Ian Bezek	2009	7	9	14	0.5	-29.9	32.1	57
Shareholder Watchdog	2009	7	8	9	-6.0	-62.4	47.0	44
Alfred Little	2010	6	13	37	-17.9	-24.4	2.7	73
Muddy Waters	2010	5	6	13	-17.3	-7.7	1.9	54
Kerrisdale Capital	2009	4	8	11	-7.5	-28.9	36.7	73
Asensio & Co.	1994	4	5	34	-9.3	-33.4	36.4	76
Spruce Point	2010	4	4	6	-2.7	-49.6	58.4	50
Chimin Sang	2009	3	9	18	1.0	11.6	3.4	61
Prescience Investment	2011	2	4	5	-14.5	46.6	-57.7	20
Absaroka Capital Management	2011	2	4	6	-5.5	-55.7	53.0	33
Chinese Company Analyst	2010	2	4	11	1.0	-6.0	4.5	18
The Forensic Factor	2011	2	2	6	-10.4	-24.9	9.2	33
Glaucus Research	2011	2	3	4	-5.0	12.9	-6.8	0
OLP Global	2010	2	2	3	-3.9	-11.5	13.3	n/a
Average (across the 17 repeat arbs)		7	9	20	-7.2	-19.2	17.0	46
14 one-time arbs		14	14	26	-9.5	-42.0	39.2	n/a

Table 2. Summary Statistics: Target Firms.
The sample contains 124 firms targeted by 31 arbs over the period from July 2006 to December 2011. The table reports summary statistics of key firm characteristics measured as of the most recent calendar month before the release of the first report on the target. For each characteristic, the final column reports the percentile rank of the average target firm in the CRSP universe one month before the report release date. For variable definitions and details of their construction, see Appendix A.

	Mean	Std. dev.	Lower quartile	Median	Upper quartile	Percentile in CRSP universe
Firm characteristics						
market capitalization ($ million)	969.3	2,152.8	162.6	332.7	792.3	0.54
book/market ratio	0.38	0.30	0.16	0.31	0.58	0.28
daily turnover (%)	1.13	2.28	0.26	0.50	0.96	0.70
monthly Amihud illiquidity measure	0.06	0.25	0.00	0.01	0.03	0.44
monthly idiosyncratic volatility (%)	3.61	3.11	1.95	2.87	4.31	0.76
Shorting conditions						
daily shorting fee (%)	0.04	0.06	0.00	0.01	0.05	0.74
lendable (%)	5.43	7.80	0.22	1.45	7.46	0.40
put-call implied volatility ratio	1.15	0.26	1.02	1.07	1.19	0.69

Table 3. Range of Allegations

The table provides a breakdown of the 358 sample reports according to whether they convey the results of information production (i.e., the discovery of facts previously unknown to investors) or whether they result from information processing (i.e., the reinterpretation of already known data). The former type of report contains concerns regarding financial reporting, governance, or "red flag" events. Panel A presents a frequency breakdown of the main concerns based on our reading of the reports. The latter type of report, tabulated in Panel B, essentially claims a stock is overvalued based on a different interpretation of known data.

	Fraction
Panel A: Reports producing new information (N=295)	
Concerns regarding financial reporting or governance	
Accounting irregularities	
Questionable performance	0.34
Misrepresentation of financials	0.22
Questionable balance sheet	0.11
Other misrepresentation	0.30
Disclosure problems	0.22
Management	0.19
Auditor quality	0.14
Internal controls	0.12
Red flag events	
Questionable business practice	0.26
Self-dealing/related party transactions	0.22
Questionable acquisition	0.18
Questionable insider sales	0.06
Questionable capital raise	0.06
Outstanding legal actions	0.03
Questionable stock repurchase	0.01
Panel B: Reports reinterpreting known information (N=63)	
Concerns regarding valuation	0.18

Table 4. Share Price Changes Around Report Releases.
The table reports Fama-French/momentum four-factor cumulative abnormal returns (CARs) and raw changes in the market value of equity of target firms measured over different event windows around the release of a report. Panel A focuses on first reports. Panel B focuses on follow-on reports. For variable definitions and details of their construction, see Appendix A. We perform a two-sided *t*-test for mean CARs, a Wilcoxon test for median CARs, and a generalized Z test for the number of negative CARs, and use ***, **, and * to denote significance at the 1%, 5%, and 10% level, respectively. We lack sufficient pre-report trading data to compute abnormal returns for two of the target companies.

		mean	median	positive:negative
Panel A: First reports				
Cumulative abnormal returns (%):	trading days -20 to -6	3.16**	-2.34	57:65
	trading days -5 to -1	-1.05	-2.64**	49:73
	trading day 0 (report date)	-7.51***	-4.70***	29:93***
	trading days 0 to +60	-26.15***	-27.83***	24:98***
	trading days 1 to +60	-19.83***	-23.46***	33:87***
	trading days 0 to +252	-42.86***	-55.19***	16:106***
	trading days 1 to +252	-38.31***	-52.15***	20:100***
Change in market value of equity:	trading days 0 to +60	-$124.8 m	-$40.0m	32:92
	trading days 0 to +252	-$139.3 m	-$86.1m	25:99
Panel B: Follow-on reports				
Cumulative abnormal returns (%):	trading day 0 (report date)	-3.10***	-1.67***	78:140**

Table 5. Abnormal Returns and Trading by Type of Report.
The table reports average abnormal returns and trading statistics on the report date as well as shorting profits in subsamples sorted by the credibility of the report (Panel A) and the nature of the information discovery (Panel B). Since the subsamples in Panels A and B include follow-up reports for the same target, we also report abnormal returns on the day the first report is released. For variable definitions and details of their construction, see Appendix A. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

Panel A:	More credible (N=202)	Less credible (N=35)	Difference in means
abnormal return on report date (first reports only)	-0.088^{***}	-0.023	-0.065^{*}
abnormal return on report date (all reports)	-0.053^{***}	-0.014	-0.039^{**}
abnormal turnover	1.157^{***}	0.950^{***}	0.207
abnormal long trades/shares outstanding	1.588^{***}	0.923^{***}	0.665^{*}
three-month abnormal borrow-and-hold shorting profit	0.178^{***}	0.022	0.156^{*}

Panel B:	Information production (N=295)	Information processing (N=63)	Difference in means
abnormal return on report date (first reports only)	-0.095^{***}	-0.022	-0.073^{***}
abnormal return on report date (all reports)	-0.050^{***}	-0.026^{**}	-0.024
abnormal turnover	1.074^{***}	0.726^{***}	0.348^{*}
abnormal long trades/shares outstanding	1.364^{***}	1.142^{***}	0.222
three-month abnormal borrow-and-hold shorting profit	0.159^{***}	0.064	0.094

Table 6. Abnormal Returns and Trading by Arbitrage Cost and Firm Size.

The table reports average shorting profits as well as abnormal returns and trading statistics on the first report date in subsamples sorted by various measures of arbitrage costs: shorting fees (Panel A), the supply of lendable stock available for borrowing (Panel B), idiosyncratic volatility (Panel C), and the target's market capitalization as of one month before a first report date (Panel D). Panels A and B focus on the 102 targets for which data on shorting fees and the supply of lendable stock are available as of the baseline period (one month before the release of the first report). In Panel C, we lose two observations with insufficient pre-event trading data to compute idiosyncratic volatility. For variable definitions and details of their construction, see Appendix A. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

Panel A:	High shorting fee (N=51)	Low shorting fee (N=51)	Difference in means
three-month abnormal borrow-and-hold shorting profit	0.240^{**}	0.211^{***}	0.029
abnormal return on report date	-0.073^{***}	-0.067^{***}	-0.007
abnormal turnover on report date	1.490^{***}	1.380^{***}	0.110
abnormal long trades/shares outstanding on report date	1.887^{***}	1.777^{***}	0.110

Panel B:	Low lendable (N=51)	High lendable (N=51)	Difference in means
three-month abnormal borrow-and-hold shorting profit	0.255^{**}	0.198^{***}	0.057
abnormal return on report date	-0.078^{***}	-0.062^{***}	-0.016
abnormal turnover on report date	1.636^{***}	1.235^{***}	0.401
abnormal long trades/shares outstanding on report date	1.845^{***}	1.814^{***}	0.031

Panel C:	High idio-syncratic volatility (N=61)	Low idio-syncratic volatility (N=61)	Difference in means
three-month abnormal borrow-and-hold shorting profit	0.392^{***}	0.129^{**}	0.263^{**}
abnormal return on report date	-0.090^{***}	-0.062^{***}	-0.028
abnormal turnover on report date	1.712^{***}	1.247^{***}	0.466^{*}
abnormal long trades/shares outstanding on report date	1.908^{***}	1.760^{***}	0.148

Panel D:	Small market capitalization (N=62)	Large market capitalization (N=62)	Difference in means
three-month abnormal borrow-and-hold shorting profit	0.243^{***}	0.259^{***}	-0.016
abnormal return on report date	-0.075^{***}	-0.075^{***}	0.000
abnormal turnover on report date	1.523^{***}	1.434^{***}	0.089
abnormal long trades/shares outstanding on report date	1.782^{***}	1.900^{***}	-0.118

INTERNET APPENDIX

(NOT INTENDED FOR PUBLICATION)

Table IA.1. Abnormal Returns and Trading: Alternative Samples.
The table reports average shorting profits as well as average abnormal returns and trading statistics on the first report date in subsamples that exclude either arbs who post reports exclusively on third party websites or the most prolific arb (Citron Research) responsible for 43 first reports. For variable definitions and details of their construction, see Appendix A. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Excluding third party bloggers (N=95)	Excluding Citron Research (N=85)
three-month abnormal borrow-and-hold shorting profit	0.196***	0.264***
abnormal return on report date	-0.086***	-0.077***
abnormal turnover	1.685***	1.194***
abnormal long trades/shares outstanding	2.078***	1.366***

Table IA.2. Abnormal Returns and Trading by Target Origin.
The table reports average shorting profits as well as average abnormal returns and trading statistics on the first report date in subsamples sorted by the target's origin. For variable definitions and details of their construction, see Appendix A. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	Chinese targets (N=60)	U.S. targets (N=64)	Difference in means
three-month abnormal borrow-and-hold shorting profit	0.227**	0.271***	-0.044
abnormal return on report date	-0.097***	-0.055***	-0.042*
abnormal turnover	1.585***	1.378***	0.207
abnormal long trades/shares outstanding	1.783***	1.876***	-0.093