

# ARBITRAGE INVOLVEMENT AND SECURITY PRICES

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We argue that hedge funds more aggressively buy underpriced stocks when they can short and, as such, protect their stock purchases from industry fluctuations. We utilize the institutional feature in Hong Kong in virtue of which only stocks added to a special list can be shorted. Our first-stage analysis uses hedge fund holdings data and provides evidence that the emergency of shortable securities, indeed, causes hedge funds to more aggressively buy seemingly underpriced stocks. Our second-stage analysis presents evidence that hedge funds' increased involvement in these stocks helps correct under-pricing and moves prices in the direction of fundamentals.

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## 1. Introduction

Over the past few decades, the financial marketplace has seen a proliferation of hedge funds, which, now, are estimated to control more than \$3.2 trillion in assets (2016 Prequin Global Hedge Fund Report). Hedge funds are investment companies that are exempt from a wide range of rules to which other investment companies must adhere. As a result, hedge funds are relatively unconstrained in what they do and generally feature a more aggressive investment style. Given the growing relevance of these companies and the tremendous price impact they can exert, questions naturally arise as to what determines their involvement and what effect they have on financial markets.

In this paper, we argue that a crucial but, up to this point, somewhat overlooked determinant of how aggressively hedge funds pursue underpriced stocks is the presence of a deep and liquid short-selling market. In the presence of a well-functioning short-selling market, hedge funds can buy seemingly underpriced stocks and simultaneously short industry peers to protect their stock purchases from industry- and market fluctuations. This essentially lets hedge funds purchase a security without having to worry about the portion of the security's return volatility that is due to industry or market shocks, effectively increasing their "risk-bearing capacity" and allowing them to pursue "attractive buys" more aggressively (e.g., Shleifer and Summers 1990).

To test the relevance of this mechanism, we turn to Hong Kong. In the Hong Kong stock market, only stocks on a list of designated securities can be sold short. This short-sale list is revised on a (mostly) quarterly basis. The short-sale list was introduced in 1994 and, initially, contained seventeen securities. Since then, more securities have been added and, as of August 2012 (the end of our sample period), the list contained 562 securities. Short selling is now estimated to make up 10.3% of the daily trading volume in Hong Kong (Hong Kong Stock Exchange 2014).

To illustrate our empirical design by example, consider HSBC Holdings (HSBC) and Chong Hing Bank (CHB) both of which are publicly traded banks in Hong Kong. In May 1994, HSBC was added to the short-sale list and became the first publicly traded bank whose shares can be shorted, (HSBC  $\equiv$  "hedge

stock” ). CHB had a substantially lower MB than its industry peers and, at least by that metric, appeared undervalued (CHB  $\equiv$  “seemingly underpriced stock” ). We argue that the addition of HSBC to the short-sale list produced substantial improvements in the ability to hedge *industry* risk and we test whether the addition of HSBC to the short-sale list encouraged hedge funds to (more) aggressively buy shares of CHB, leading to a permanent rise in CHB’s stock price.

Consistent with our argument, we find that, around addition events, hedge funds substantially increase their long holdings in “seemingly underpriced stocks”; seemingly underpriced stocks are defined as stocks that are in the same industry as the stock being added to the short-sale list, that are themselves not being added to the list and that have relatively low market-to-book ratios (MB). We observe no such pattern for high MB stocks and among investors that are long-only and to whom the ability to hedge industry risk via short positions has little consequence.

The impact of addition events on long-short investors’ risk-bearing capacity should be particularly strong when the stock being added to the list resides in an industry that has very few shortable securities prior to the addition event. This is because, in industries that already have many shortable securities, the addition of one more shortable security only marginally improves long–short investors’ ability to hedge industry risk. The impact should also be stronger when the seemingly underpriced stocks have high industry exposure and operate in a very volatile industry, as the benefit of industry hedging and the associated incremental rise in risk-bearing capacity is particularly high in that case. Finally, the impact should be stronger when the hedge stock itself has high industry exposure, as the hedge stock provides a better industry hedge when its industry beta is high rather than low.

Consistent with these conjectures, we find that the increase in holdings in seemingly underpriced stocks is noticeably stronger for “first-time additions”, stronger when the seemingly underpriced stocks have high industry risk, and stronger when the stock being added to the short-sale list, itself, has high industry exposure. Again, these observations apply only to hedge funds and there is no reliable change in holdings among investors that are long-only.

Our second-stage analyses investigate how this more aggressive buying of seemingly underpriced stocks relates to prices and market efficiency. We find that seemingly underpriced stocks experience strong positive abnormal returns around addition events. No such pattern is observed among stocks with high MB ratios. The positive performance accrues only once the addition becomes effective and not when the addition is announced; announcements are usually made one week prior to the effective date.

In line with our hedge fund holdings results, we detect stronger positive abnormal returns for “first-time additions”. Our results also strengthen when the seemingly underpriced stocks have high industry risk and when the hedge stock itself has high industry exposure.

The positive abnormal performances we observe are economically meaningful. They also do not revert. For instance, for seemingly underpriced stocks whose MB ratios are in the bottom quintile, cumulative abnormal returns are +0.01% in the week from the announcement day to the effective day. They are +0.64% in the first calendar week following the effective day, +0.81% after two calendar weeks, +0.79% after three calendar months and +1.29% after one calendar year. Overall, our findings suggest that greater hedge fund buying activity due to the presence of a well-function short-selling market helps correct underpricing and improves market efficiency.

As we discuss below, additions of stocks to the short-sale list are not random. Our analysis is thus subject to an omitted-variable concern. Our analysis also suffers from a potential reverse-causality concern: investors short overvalued stocks once they are added to the short-sale list and hedge their short positions by buying stocks of industry peers. This buying pressure causes prices of industry peers to temporarily shoot up.

We detail our analysis regarding these two concerns in Section 4.2. To preview some of our exposition, regarding the reverse-causality concern, we note that, in contrast to what the price-pressure theory predicts, prices of seemingly underpriced stocks do not revert. In addition, we observe very similar results when the stock added to the list is more likely to be shorted for hedging considerations and less likely to be targeted by short-sellers for being overvalued by reference to various firm characteristics. Regarding the omitted-variable concern, we conduct a discontinuity analysis: The primary reason stocks in

our sample get added to the short-sale list is because their market capitalization and trading volume exceed a certain threshold set by Hong Kong regulators. Our results for seemingly underpriced stocks continue to hold when one of their industry peers passes the official market-capitalization and trading-volume threshold (and, consequently, is added to the short-sale list) even when the corresponding rise in market capitalization and trading volume is miniscule. In sharp contrast, our results for seemingly underpriced stocks do not hold when one of their industry peers experiences a rise in market capitalization and trading volume that is dramatic, yet, nevertheless, fails to pass the official threshold. Combined with the fact that our results are specific to the effective date (not the announcement date) and to hedge funds (not long-only investors), this discontinuity suggests that our results are generated by a rise in risk-bearing capacity due to addition events as opposed to some unobserved industry events.

Our study addresses a couple of lines of research. By providing evidence that hedge fund buying activity is tied to the presence of a well-functioning shorting market and that greater hedge fund involvement helps correct mispricing, our study adds to the literature on what determines hedge fund activity and how hedge fund involvement affects financial markets (e.g., Brunnermeier and Nagel 2004; Griffin and Xu 2009; Aragon and Martin 2012; Ben-David, Franzoni and Moussawi 2012; Cao, Chen, Goetzmann and Liang 2017).

Our work also contribute to the literature on short selling. The question as to how the practice of short selling affects capital markets has been of great interest to the financial community and, accordingly, has motivated a significant amount of research. The focus of the short-selling literature has generally been on how the ease with which certain stocks can be shorted affects the prices of the shorted stocks themselves (e.g., Miller 1977; Figlewski 1981; Cohen, Diether and Malloy 2007; Boehmer, Jones, and Zhang 2008; Diether, Lee, and Werner 2009a, 2009b). Chang, Cheng, and Yu (2007), in particular, examine how the addition of stocks to the Hong Kong short-sale list affects the returns of the added stocks themselves.

While investors clearly use shorting to trade on overpricing, in this paper, we find evidence that hedge funds also use shorting to hedge out risk in long positions. Our finding has potentially important implications. Prior literature argues that in the absence of a deep and liquid short-selling market,

arbitrageurs cannot trade against overpricing. Our paper suggests that in the absence of a deep and liquid short-selling market, arbitrageurs also cannot trade aggressively on underpricing as they cannot hedge their long positions. As such, the commonly held view that imposing short-sale constraints helps elevate stock price levels is incomplete. By making it difficult for investors to hedge and aggressively trade on underpricing, imposing short-sale constraints can actually cause stock prices to go down or remain at depressed levels. To the best of our knowledge, we are the first to formally make this point and we hope this point becomes part of the broader discussion on the implications of short-sale constraints.

## 2. Hypothesis Development

To discipline our empirical analysis, we begin by formalizing how the relaxation of short-sale constraints affects arbitrageurs' risk-bearing capacity:

Consider the presence of two risky assets,  $i$  and  $h$ , and a risk-free asset. Risky assets  $i$  and  $h$  are in the same industry. Without loss of generality, we determine that these risky assets' return and variance are as follows:

$$r_s - r_f = \alpha_s + \beta_s^m r_m + \beta_s^{in} r_{in} + \epsilon_s \quad \sigma_s^2 = (\beta_s^m)^2 \sigma_m^2 + (\beta_s^{in})^2 \sigma_{in}^2 + \sigma_{\epsilon_s}^2,$$

where  $s$  is either asset  $i$  or asset  $h$ . That is, risky assets are subject to market shocks, industry shocks and firm-specific shocks.

In our simple model, rational arbitrageurs perceive risky asset  $i$  as offering superior returns because asset  $i$  is underpriced and mispricing subsequently corrects itself. We model the superior returns by assigning risky asset  $i$  a positive alpha, i.e.,  $\alpha_i > 0$ . Risky asset  $h$  is correctly priced, i.e.,  $\alpha_h = 0$ . Risky asset  $h$  also is shortable and later serves as the "hedge stock".

### 2.1 Baseline Model

Our baseline model, which does not consider the shorting channel, is straight from the textbook: The investor constructs a portfolio that takes advantage of the superior returns of risky asset  $i$ . At the same time,

the investor aims to maintain her portfolio risk,  $\sigma_p$ , below a certain threshold (“volatility limit”),  $\overline{\sigma_p}$ , which is determined by her risk aversion. The volatility limit puts a cap on how aggressively the investor pursues asset  $i$ . Specifically, the investor constructs a portfolio  $p$  based on asset  $i$  and risk-free asset  $f$ :

$$r_p = w_i * r_i + (1 - w_i) * r_f. \quad (1a)$$

The maximum fraction of wealth the investor can put in asset  $i$ ,  $w_{i,Baseline}$ , is,

$$w_{i,Baseline} = \frac{\overline{\sigma_p}}{\sigma_i}. \quad (1b)$$

Our equation reveals that the degree to which the investor pursues the underpriced asset  $i$ ,  $w_{i,Baseline}$ , increases with the volatility limit,  $\overline{\sigma_p}$ , and decreases with the risk of asset  $i$ ,  $\sigma_i$ .

## 2.2 Extended Model

In the extended model, a shortable security emerges and the investor can now short hedge stock  $h$  to immunize her portfolio against industry risk. That is, the investor can now pursue the underpriced asset  $i$ , while maintaining a portfolio that has an industry beta of zero.

Without loss of generality, we assume that  $\rho_{ih} > 0$ ,  $\beta_i^{in} > 0$  and  $\beta_h^{in} > 0$ . To make the portfolio industry-neutral, the investor sets  $w_i \beta_i^{in} + w_h \beta_h^{in} = 0$  ( $\rightarrow w_h = \frac{-\beta_i^{in}}{\beta_h^{in}} w_i$ ). Intuitively, immunizing a portfolio against industry shocks (by shorting the hedge stock) lowers risk and, as such, increases the investor’s ability to pursue the underpriced asset without hitting the volatility limit. However, this proposition holds only if the idiosyncratic risk introduced by the hedge stock is not overly high.

To formalize, let the fraction of the investor’s overall wealth in the risky portfolio be  $w_{ih}$ . Since

$r_{ih} = w_i r_i + w_h r_h = w_i r_i - \frac{\beta_i^{in}}{\beta_h^{in}} w_i r_h$ , we have the following:

$$\begin{aligned} r_p &= w_{ih} * r_{ih} + (1 - w_{ih}) * r_f \\ &= w_{ih} * [w_i r_i - \frac{\beta_i^{in}}{\beta_h^{in}} w_i r_h] + (1 - w_{ih}) * r_f \end{aligned} \quad (2a)$$

Consequently,

$$\begin{aligned}
\sigma_p^2 &= w_{ih}^2 [w_i^2 \sigma_i^2 + w_i^2 \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 \sigma_h^2 - 2w_i^2 \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right) \text{cov}(r_i, r_h)] \\
&= w_{ih}^2 w_i^2 [\sigma_i^2 + \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 \sigma_h^2 - 2 \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right) (\beta_i^m \beta_h^m \sigma_m^2 + \beta_i^{in} \beta_h^{in} \sigma_{in}^2)] \\
&= w_{ih}^2 w_i^2 [\sigma_i^2 + \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 (\beta_h^m)^2 \sigma_m^2 + \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 \sigma_{\epsilon,h}^2 - 2 \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right) \beta_i^m \beta_h^m \sigma_m^2 - (\beta_i^{in})^2 \sigma_{in}^2].
\end{aligned} \tag{2b}$$

Ultimately, the maximum fraction of wealth the investor can devote to the underpriced asset  $i$ ,  $w_{i,Extended}$ , without hitting the volatility limit is

$$\begin{aligned}
w_{i,Extended} &= w_{ih} w_i \\
&= \frac{\bar{\sigma}_p}{\sqrt{[\sigma_i^2 + \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 (\beta_h^m)^2 \sigma_m^2 + \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 \sigma_{\epsilon,h}^2 - 2 \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right) \beta_i^m \beta_h^m \sigma_m^2 - (\beta_i^{in})^2 \sigma_{in}^2]}}
\end{aligned} \tag{2c}$$

### 2.3 The Effect of the Relaxation of Short-Sale Constraints on Investors' Risk-Bearing Capacity

When comparing how aggressively the investor pursues the underpriced stock in the absence of a shorting market,  $w_{i,Baseline}$ , with how aggressively she pursues the stock once short-sale constraints are relaxed,  $w_{i,Extended}$ , we can see that the difference comes from the following terms in the denominator:  $\left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 (\beta_h^m)^2 \sigma_m^2 + \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right)^2 \sigma_{\epsilon,h}^2 - 2 \left(\frac{\beta_i^{in}}{\beta_h^{in}}\right) \beta_i^m \beta_h^m \sigma_m^2 - (\beta_i^{in})^2 \sigma_{in}^2$ . The lower the denominator, the more aggressively the investor pursues the underpriced asset. The reduction in the denominator due to the final term,  $-(\beta_i^{in})^2 \sigma_{in}^2$ , comes from the investor immunizing her portfolio against industry risk. The first three terms reflect risk introduced by shorting the hedge stock.

In the end,  $w_{i,Extended} > w_{i,Baseline}$  if and only if the following applies:

$$(\beta_s^{in})^2 \sigma_{in}^2 > \left(\frac{\beta_i^{in}}{\beta_s^{in}}\right)^2 (\beta_s^m)^2 \sigma_m^2 + \left(\frac{\beta_i^{in}}{\beta_s^{in}}\right)^2 \sigma_{\epsilon,s}^2 - 2 \left(\frac{\beta_i^{in}}{\beta_s^{in}}\right) \beta_i^m \beta_s^m \sigma_m^2. \tag{3}$$



Our inequality reveals the following :

1. Shorting allows investors to more aggressively pursue the underpriced asset  $i$ , if asset  $i$  has high industry exposure, i.e., if  $\beta_i^{in}$  is high, and if the industry in which asset  $i$  operates is highly volatile, i.e., if  $\sigma_{in}^2$  is high. This is because, if  $\beta_i^{in}$  and  $\sigma_{in}^2$  are high, the benefits from industry hedging are high.
2. Shorting allows investors to more aggressively pursue the underpriced asset  $i$ , if the hedge stock has high industry exposure, i.e., if  $\beta_s^{in}$  is high, and if the hedge stock used to eliminate industry exposure has low idiosyncratic risk, i.e., if  $\sigma_{\epsilon,s}$  is low. The reason for the former is that if  $\beta_s^{in}$  is high, one need short only a small quantity to make the overall portfolio industry-neutral. This limits the amount of idiosyncratic risk introduced by shorting the hedge stock. Regarding the latter, the hedge stock can be construed to be a single shortable security; single securities, on average, have relatively high  $\sigma_{\epsilon,s}$ . Alternatively, the hedge stock can be construed to be a *portfolio* of shortable securities; portfolios, naturally, have relatively low  $\sigma_{\epsilon,s}$ . Consequently, the more shortable stocks there are in the industry in which asset  $i$  operates, the higher is  $w_{i,Extended}$  relative to  $w_{i,Baseline}$ .
3. When solving for the inequality numerically, we find that, under most reasonable parameters,  $w_{i,Extended}$  exceeds  $w_{i,Baseline}$ . The simulation results are available upon request.<sup>1</sup>

In our model, assets are sensitive to news about both the industry and the market. Yet, the investor in our model is set up to be only concerned with exposure to industry fluctuations. One may argue that investors also care about market exposure. In addition, assets are sensitive to factors other than industry and market, such as momentum or liquidity.

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<sup>1</sup> Specifically, we set the market betas equal to one and the market variance equal to the sample variance of the monthly Hang Seng Index returns from 2001 through 2012. We allow industry betas to fluctuate between zero and two (in 0.1 increments). We allow the industry variance to fluctuate between the lowest and the highest sample variance of monthly HK industry returns from 2001 through 2012 (in 0.01 increments). Stocks are assigned to industries based on their four-digit-GICS industry code. The idiosyncratic variance of a hedge stock is the variance of the residuals from regressions of monthly hedge stock returns on monthly market returns and monthly industry returns; we allow the idiosyncratic variance of a hedge stock to fluctuate between zero and the highest sample variance (in 0.01 increments). We compare  $w_{i,Extended}$  with  $w_{i,Baseline}$  for all permutations and we find that the former exceeds the latter in 85.34% of cases.

Our focus on the industry aspect is motivated by empirical-design considerations. Compared with style factors, such as momentum or liquidity, industries are relatively easy to quantify objectively. Moreover, our laboratory, which we describe in the next section, produces significant improvements in the ability to hedge industry risk but not market risk.

In a separate version of our model, we also have investors immunize their portfolios against market-wide news. The predictions that the separate version generates are the same as the predictions generated by the simpler model presented in this paper but the predictions are less tractable (the derivation is available upon request). To the extent that investors care about minimizing their exposure to a variety of factors, whatever effect we may find that can be tied to industry hedging (alone) can be construed as a mere prelude to the overall effect of hedging considerations in determining security prices.

### **3. Laboratory: The Hong Kong Short-Sale List**

Our analysis uses data from Hong Kong: We discuss the data in Section 3.1 and we discuss our empirical design in Section 3.2.

#### **3.1. Data**

Prior to 1994, short-selling in the Hong Kong stock market was extremely restrictive. While it was not illegal, short-selling was a blunt instrument because the Stamp Duty Ordinance allowed the lending of shares for only 14 days for the sole purpose of settling trades (Evans 1993). In 1993, the Hong Kong stock exchange announced a pilot scheme for regulated short selling. Based on the pilot scheme, which was implemented in 1994, the Hong Kong market allows short sales of securities that are included in an official short-sale list that is revised on a mostly quarterly basis.<sup>2</sup> As alluded to in the introduction, the initial short-sale list contained seventeen securities. As of August 2012 (the end of our sample period), the list had expanded to 562 securities.

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<sup>2</sup> Although the Hong Kong Stock Exchange states on its website that the list is revised on a quarterly basis, we observe, in a limited number of cases, addition events between quarterly revisions.

The selection of stocks for the list is based on criteria set out by the Hong Kong Stock Exchange and the Securities and Futures Commission, which is the Hong Kong equivalent of the Securities and Exchange Commission in the United States. Securities declared eligible for short selling are essentially any of those that exceed a certain market capitalization level and a trading volume threshold (We list the various addition criteria in Appendix A1).

We detail our data collection efforts in Appendix A2. In short, we collect addition announcements directly from the website of the Hong Kong Stock Exchange. The website contains Hong Kong Stock Exchange news releases starting from 2001. Our sample period therefore spans January 2001 through August 2012. Each news release pertinent to the announcement of a security's addition to the list contains the company name, the stock code ("Ticker"), the announcement date, and the effective date. Addition announcements are generally made one week prior to effective dates. We augment each observation with the corresponding International Securities Identification Number (ISIN) via historical Bloomberg data, which enables a merge with data from COMPUSTAT GLOBAL.

We also obtain annual stock-level data on the number of shares shorted and the value of short-sale transactions from the Hong Kong Stock Exchange's annual "Fact Book". The annual stock-level data are available for all stocks being shorted in a given year, including those that were added to the short-sale list prior to 2001. We are thus able to gauge whether a security added to the list, and subsequently shorted, is one of the first securities from its industry that is being shorted. Other data, including daily stock prices, dividends, number of shares outstanding, four-digit-GICS industry codes, and accounting data come from COMPUSTAT GLOBAL.

After merging Hong Kong Stock Exchange data with COMPUSTAT GLOBAL data and imposing various financial market and financial statement data requirements (described in Appendix A2), we arrive at our final sample of 707 common-stock additions from January 2001 through August 2012. These 707 addition events cover 444 distinct stocks (some stocks are added to the list only to be removed later and

then added again).<sup>3</sup> A stock added to the list has, on average, 60 industry peers; industry peers are firms that are in the same four-digit-GICS industry code. The 707 addition events are thus associated with a total of 42,640 addition-event/industry-peer observations. Table 1 reports descriptive statistics for the stocks added to the short-sale list as well as for their industry peers. Table 1 shows that stocks added to the short-sale list have, in general, higher market capitalization and higher liquidity than their corresponding industry peers.

We augment our base dataset with holdings data from the historical FactSet/LionShares database. FactSet/LionShares uses data from public filings supplemented by companies' annual reports to compute the fraction of shares held by institutions. The dataset is free from survivorship bias. For Hong Kong (as with all countries other than the US), FactSet/LionShares provides data only on the *long* positions of *foreign* institutions. 48.93% of data is reported biannually and 51.07% is reported annually. The average foreign institutional holdings across our addition-event/industry-peer observations are 4.15%. This number is similar to the number Bartram, Griffin, Lim, and Ng (2015) report in their online appendix.<sup>4</sup>

In our analysis, we contrast the holdings of institutions characterized as hedge funds, many of which we presume to be long-short investors, to the holdings of other institutions (mutual funds, pension funds, closed-end funds) most of which we presume to be long-only investors. FactSet/LionShares characterizes institutions by their "fund type." However, upon close examination, we find the FactSet/LionShares characterization to be incomplete. We therefore identify hedge funds by manually checking the website of each institution in our sample to examine whether its primary business is hedge fund-related. For institutions that do not maintain a website, we identify whether they are a hedge fund through Factiva and Google news searches. We deem 10.24 % (170 out of 1,660) of institutions to be hedge funds.

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<sup>3</sup> Appendix B1 lists the number of addition events by calendar year, and Appendix B2 presents a frequency distribution by four-digit-GICS industry code.

<sup>4</sup> Bartram, Griffin, and Ng's (2015) sample does not fully overlap with ours. However, Bartram, Griffin, and Ng report the average holdings for multiple sample periods and various subsets of Hong Kong stocks. We refer here to the portion of Bartram, Griffin, and Ng's subsample that overlaps to the greatest extent with our sample.

## 3.2. Methodology

Our main inferences are drawn from (a) hedge funds' changes in long positions in seemingly underpriced stocks relative to those of investors who are long-only as well as from (b) cumulative abnormal returns of seemingly underpriced stocks.

Seemingly underpriced stocks are defined as stocks that are (1) in the same four-digit-GICS industry as the hedge stock, (2) themselves not being added to the short-sale list at time  $t$ , and (3) in the bottom quintiles of their corresponding four-digit-GICS industries based on their MB ratios. For comparison, we also report results for stocks that are in the bottom and top MB halves. In using low MB ratio as an indicator of underpricing, we are following prior literature (e.g., Lakonishok, Shleifer and Vishny 1994; Dechow, Hutton, Meulbroek and Sloan 2001; Baker and Wurgler 2002).

### 3.2.1 Holdings

We conjecture that the emergence of a hedge stock encourages hedge funds to (more) aggressively buy shares of seemingly underpriced stocks. To test this hypothesis, we report the average fraction of shares held in seemingly underpriced stocks by hedge funds before the addition event (*HFH Prior to Addition*), the average fraction of shares held by hedge funds after the addition event (*HFH After Addition*), and the before-and-after difference in hedge fund holdings ( $\Delta HFH$ ). We also report the before-and-after difference in holdings for long-only investors ( $\Delta LIH$ ) and the difference-in-difference ( $\Delta\Delta = \Delta HFH - \Delta LIH$ ).

### 3.2.2 Returns

If hedge funds' more aggressive pursuit of seemingly underpriced stocks helps correct mispricing, then these stocks should experience strong positive abnormal returns once the addition becomes effective; this positive performance should not revert. To test this prediction, we follow the IPO literature (Ritter 2003) and match each seemingly underpriced stock with stocks that are in the same size decile and that are "themselves not being affected by the addition event at time  $t$ ." Of the stocks that meet these two criteria,

we pick the stock that has the closest MB to the seemingly underpriced stock. Our measure of abnormal returns is the difference in returns between the seemingly underpriced stock and its matching stock.<sup>5</sup>

That the matching stock is “itself not being affected by the addition event at time  $t$ ” is defined as follows: When, for a given event date  $t$ , securities from various industries  $x$  are being added to the list, we consider only firms outside of industries  $x$  as matching candidates for the seemingly underpriced stock. We do so as we do not want to benchmark the performance of our low-MB firms with that of other low-MB firms that are equally affected by the same addition event.

We examine cumulative abnormal returns over  $t=[-5,-1]$  and  $t=[0,+5]$ , where  $t=0$  represents the effective date from which the hedge stock can be shorted, and where  $t=-5$  and  $t=+5$  represent five trading days before and after the effective date, respectively. In additional tests, we also report cumulative abnormal returns for the following holding periods:  $[0,+1]$ ,  $[0,+10]$ ,  $[0,+60]$  and  $[0,+240]$ .

#### 4. Main Results

Table 2 shows that *long* holdings of hedge funds in seemingly underpriced stocks strongly and disproportionately increase when one of their industry peers is added to the short-sale list. Specifically, we find that, prior to the addition event, hedge funds hold 1.71% of the shares in seemingly underpriced stocks. After the addition event, their holdings increase to 2.22%. The +0.51% increase from before the addition event to after the addition event has a  $t$ -statistic of 15.18. In comparison, holdings of long-only investors in the same set of securities and over the same time period increase by +0.18%. The difference-in-difference is 0.33% and has a  $t$ -statistic of 9.95.

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<sup>5</sup> Chang, Cheng, and Yu (2007), who examine Hong Kong short-sale-list additions, consider two measures of abnormal returns: cumulative abnormal returns based on market-adjusted returns (MA-Ret) and cumulative abnormal returns based on market-model-adjusted returns (MMA-Ret). The former represents the difference between raw returns and value-weighted market returns on stocks listed in Hong Kong. The latter is based on a market-model regression. In untabulated analyses, we obtain marginally stronger results than those presented in this study for MA-Ret and MMA-Ret. However, given that in our analysis we separate stocks by their MB ratios to test whether low-MB stocks react differentially to the emergence of a hedge stock than their high-MB counterparts, and given that value firms tend to outperform growth firms in a manner that is not captured by the market beta, we adopt an alternative methodology to compute abnormal returns (Chui and Wei (1998) provide evidence that MB ratio and size are related to average returns in Hong Kong.)

In line with the holdings results, the emergence of a hedge stock is accompanied by strong *positive* abnormal returns among seemingly underpriced stocks. The positive abnormal performance accrues only in the days after the hedge stock can be shorted and not on the announcement date. In particular, we observe that over [-5,-1] seemingly underpriced stocks experience cumulative abnormal returns of +0.01% ( $t$ -statistic = 0.07). Over [0,+5], the cumulative abnormal performance changes to +0.64% ( $t$ -statistic = 4.17). To put this number in perspective, over [0,+5], the cumulative abnormal performance of stocks whose MB is in the top half is 0.18% ( $t$ -statistic = 0.66).

The spike in abnormal performance following the addition event is accompanied by significant abnormal trading activity. For seemingly underpriced stocks, the average daily turnover over [0,+5] in excess of the average daily turnover in the month prior to the effective date is 0.19% ( $t$ -statistic = 3.90). In comparison, the average excess daily turnover over [0,+5] for stocks whose MB are in the top half is -0.39% ( $t$ -statistic = -1.59).

Figure 1 shows that the abnormal returns we observe do not revert. We plot average cumulative abnormal returns for stocks whose MB are in the bottom quintile and for stocks whose MB are in the bottom half, along with the corresponding 95% confidence intervals. We do so for the following holding periods: [0,+1], [0,+5], [0,+10], [0,+60] and [0,+240]. We find that for stocks whose MB are in the bottom-quintile, cumulative abnormal returns grow from +0.23% after one trading day to +0.64% (one calendar week) to +0.81% (two calendar weeks) to +0.79% (three calendar months) to +1.29% (one calendar year).

Similarly, we observe that for stocks whose MB are in the bottom half, cumulative abnormal returns grow from +0.23% after one trading day to +0.48% (one calendar week) to +0.66% (two calendar weeks) to +0.75% (three calendar months) to +1.28% (one calendar year). The cumulative abnormal returns after three months and after one year are no longer statistically significantly different from zero, which is typical in long-run event studies (Ritter 2003).

## 4.1 Moderating Factors: Hedging Demand and Hedging Candidate Quality

To better understand the mechanisms at hand, we consider three moderating factors. First, we attempt to capture two factors related to differences in hedging demand prior to the addition event. Second, we attempt to capture differences in the quality of the hedge stock.

### 4.1.1 Hedging Demand

We divide our sample by whether, prior to the addition event, hedging of industry risk was “more-difficult-to-do” versus “less-difficult-to-do.” As discussed in Section 2, if our elimination-of-underpricing hypothesis represents an accurate description of the true data-generating process, then the emergence of a shortable security should have a greater impact if, prior to the addition event, hedging of industry risk was more-difficult-to-do.

We capture difficulty of shorting stocks in an industry in four ways: each year, the Hong Kong Stock Exchange publishes an annual Fact Book, detailing which stocks, to what degree, are shorted in that year. To construct our first two measures, we use information from the Fact Book and compute, for every year and each four-digit-GICS industry, the fraction and number of stocks with nonzero short-selling volumes. Consider an addition event occurring in industry  $g$  during year  $t$ . Under our first measure, hedging of industry risk prior to the addition event is defined as having been more-difficult-to-do if industry  $g$ 's fraction of shorted stocks in year  $t-1$  is in the bottom decile of its distribution; otherwise, hedging industry risk is defined as having been less-difficult-to-do. Our second measure is analogous to the first measure but it is based on the number of shorted stocks, not the fraction of shorted stocks.

While our first two measures assess an industry's short-selling capacity by the fraction and the number of stocks that were *actually shorted* in the *previous year*, measures (3) and (4) assess an industry's short-selling capacity by the fraction and the number of stocks that *could be shorted this year*. Unfortunately, the Hong Kong Stock Exchange does not publish historical short-sale lists. We can therefore only partially re-construct the historical lists and estimate the fraction and number of stocks that could be shorted. In particular, we begin with the list of stocks that were shorted in 2000 (based on the 2000 annual



Fact Book). We then use the addition and removal announcements from 2001 through 2012 to partially reconstruct the lists of stocks that are shortable. Our list is partial because we miss out on stocks that were added to the short-sale list prior to 2001, but not shorted in 2000 and, thus, not included in the 2000 version of the Fact Book.

Under our third and fourth measure, an observation is categorized as coming from a more-difficult-to-short industry if the relevant industry is in the bottom decile based on its estimated fraction and number of stocks that are on the short-sale list, and as coming from a less-difficult-to-short industry otherwise.

We make similar observations under all four measures. To conserve space, we focus our discussion on the results generated by the first measure. The results generated by measures (2) through (4) are tabulated in Appendix B3.

Table 3 shows that the effect is substantially more positive for addition events in more-difficult-to-short industries. In more-difficult-to-short industries, hedge funds increase their holdings in seemingly underpriced stocks by +0.70% compared to long-only investors. In less-difficult-to-short industries, hedge funds disproportionately increase their holdings by only +0.31%.

Consistent with our theory, we observe that more aggressive involvement on the long side comes with more heavy shorting of the hedge stock on the short side: in more difficult-to-short industries, hedge stocks' short interest is 0.48%, whereas in less difficult-to-short industries, hedge stocks' short interest is only 0.31%.

When looking at the corresponding stock market performances, we find that when the hedge stock emerges in a more-difficult-to-short industry, seemingly underpriced stocks experience cumulative abnormal returns of +1.65% ( $t$ -statistic = 2.48). When the hedge stock emerges in a less-difficult-to-short industry, the average cumulative abnormal return is only +0.56% ( $t$ -statistic = 3.56).

The fact that our effect remains noticeable even in less-difficult-to-short industries is consistent with our model. This is because the emergence of additional shortable securities allows investors to short a bigger collection of securities. Shorting a bigger (more diversified) collection of securities lowers the

amount of firm-specific risk introduced via shorting and therefore incrementally increases investors' risk-bearing capacity.<sup>6</sup>

Our hypothesis development section discusses a second moderator of changes in hedge fund involvement, namely that of industry risk of the seemingly underpriced stock. Industry risk in our model is the product of the security's industry exposure,  $\beta_i^{in}$ , and the volatility of the industry the security operates in,  $\sigma_{in,i}^2$ . The benefits from being able to hedge industry risk and the associated incremental rise in risk-bearing capacity are particularly high when industry risk is high. Hedge funds should therefore become particularly more involved after addition events when the "attractive buys" have high industry exposure and operate in highly volatile industries.

To test this hypothesis, we compute both  $\beta_i^{in}$  and  $\sigma_{in,i}^2$  using daily stock-return data over a one-year period prior to the addition event; we exclude data from two calendar weeks prior to the addition event to avoid distortions associated with the addition event. In line with our model, the industry beta is estimated from a regression of excess stock returns on market returns and industry returns. An observation is categorized as having high industry risk if its  $(\beta_i^{in} * \sigma_{in,i}^2)$  is in the top decile of its distribution, and as having low industry risk otherwise.

The results are summarized in Table 4. When seemingly underpriced stocks have high industry risk and the benefits from industry hedging are high, hedge fund holdings in seemingly underpriced stocks disproportionately rise by +0.76% ( $t$ -statistic = 8.44). In comparison, when seemingly underpriced stocks have low industry risk, hedge fund holdings rise by only +0.46% ( $t$ -statistic = 12.76). Relatedly, when the seemingly underpriced stocks have high industry risk, the corresponding hedge stock has a short interest of 0.50%, on average. When the seemingly underpriced stocks have low industry risk, the corresponding hedge stock has a short interest of only 0.30%. Finally, when hedging demand is high and a shortable security

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<sup>6</sup> Our argument that the relaxation of short-sale constraints helps correct not only overpricing but also underpricing naturally extends to the prediction that the MB distribution be tighter in less-difficult-to-short industries than in more-difficult-to-short industries. Appendix B4 provides evidence to this regard.

emerges, seemingly underpriced stocks experience cumulative abnormal returns of +1.85% ( $t$ -statistic = 3.24). When hedging demand is low, cumulative abnormal returns are only +0.49% ( $t$ -statistic = 3.04).

#### **4.1.2 Quality of the Hedge Stock**

Our third and final moderating factor captures differences in the quality of the hedge stock. Our model argues that investors more aggressively pursue the underpriced asset after the addition event if the hedge stock, itself, has high industry exposure, i.e., if  $\beta_h^{in}$  is high. This is because, when the hedge stock has high industry exposure, one need short only a small portion of it to make the overall portfolio industry neutral. This limits the (extra) idiosyncratic risk introduced via shorting.

Analogously to the previous tests, a hedge stock is categorized as having high industry exposure if its industry beta is in the top decile of its distribution, and as having low industry exposure otherwise.

Table 5 shows that the results are stronger when the hedge stock provides a better industry hedge, albeit the effect is weaker than for the previous two moderators. When the hedge stock has high industry exposure and, as such, serves as a good hedge, hedge fund holdings in seemingly underpriced stocks disproportionately rise by +0.58% ( $t$ -statistic = 5.32). When the hedge stock has low industry exposure and, as such, serves as less good of a hedge, the corresponding number is +0.50% ( $t$ -statistic = 14.12). We again observe that more aggressive involvement on the long side comes with more heavy shorting of the hedge stock on the short side: when the hedge stock serves as a good hedge, the short interest of the hedge stock is 0.35%; when the hedge stock serves as less good of a hedge, the short interest is 0.31%. When looking at the performances of the seemingly underpriced stocks, we find that the emergence of a hedge stock of better hedging quality is accompanied by cumulative abnormal returns of +1.24% ( $t$ -statistic = 1.99). When the hedge stock is of worse hedging quality, that number shrinks to +0.58% ( $t$ -statistic = 3.70).

#### **4.2 Discussion and Additional Analyses**

Our test is essentially a difference-in-difference analysis around additions of stocks to the short-sale list. Appendix A1 provides a complete list of the criteria developed by Hong Kong regulators that qualify a

stock to be added to the short-sale list. The primary mechanism through which stocks are added to the short-sale list is stocks' market capitalization and "liquidity ratio" rising above HK\$1 billion and 0.40, respectively; the liquidity ratio is defined as the aggregate HK\$ trading volume over the preceding 12 months, divided by the stock's market capitalization. Both the market-capitalization- and the liquidity-ratio thresholds have to be crossed for a stock to qualify for an addition to the short-sale list.<sup>7</sup>

Since the addition events are not random and, instead, a function of rises in firm size and liquidity, our empirical design is subject to an omitted variable bias. In the final subsection of this paper, we discuss this possibility and other potential concerns (Sections 4.2.1 – 4.2.6). We also discuss what happens to the hedge stocks themselves once they are added to the short-sale list (Section 4.2.7). Finally, we provide evidence from an experiment that uses an alternate proxy for underpricing (Section 4.2.8).

#### **4.2.1 Omitted Variable Bias**

Since addition events are the result of hedge stocks experiencing a rise in market capitalization and liquidity, an alternative interpretation of our results is that the behavior of hedge stocks and our outcome variables are all jointly determined by positive industry news.

To explore the industry-news interpretation, we conduct a discontinuity analysis around the thresholds set by Hong Kong regulators. Specifically, we look at stock/year-quarter ends, where the stock has a liquidity ratio above the 0.40 threshold, but the market capitalization falls just short of the HK\$ 1 billion cutoff ( $\text{HK\$ } 0.9 \text{ billion} \leq x < \text{HK\$ } 1.0 \text{ billion}$ ). In our sample, there are 77 such events. In all 77 cases, the stock is eventually added to the short-sale list and the average rise in the market capitalization that leads to the eventual addition, compared to the market capitalization one quarter ago, is HK\$ 0.16

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<sup>7</sup> Across the 707 addition events in our sample, we find that in 87% of cases, the hedge stock just passed the HK\$ 1 billion market capitalization and the 0.40 liquidity threshold, OR if the stock's market capitalization was already above HK\$ 1 billion, just passed the 0.40 liquidity threshold, OR if the stock's liquidity ratio was already above 0.40, just passed the HK\$ 1 billion market capitalization threshold. We speculate the remaining 13% of observed addition events occur because the added stock satisfied other criteria that cause stocks to be added to the list (We list all addition criteria in Appendix A1).

billion. Such a rise is not economically meaningful given that market capitalization has an upward time trend (the average quarterly change in market capitalization in our sample is HK\$ 0.2 billion).

As reported in Panel A of Table 6, we observe results that are very similar to our main results when restricting ourselves to this special subset of eventual addition events. In sharp contrast, we observe that our results disappear when looking at the 89 stock/year-quarter ends, in which the stock has a liquidity ratio above the 0.40 threshold and the stock's quarterly market capitalization rises by more than HK\$ 0.5 billion<sup>8</sup> yet, nevertheless, fails to cross the official HK\$ 1 billion threshold (Panel B of Table 6).

We conduct analogue tests for the liquidity ratio: We look at stock/year-quarter ends, where the stock has a market capitalization above the HK\$1 billion threshold, but now the liquidity ratio falls just short of the 0.40 cutoff ( $0.39 \leq x < 0.40$ ). In our sample, there are 152 such events. In all 152 cases, the stock is eventually added to the short-sale list and the average rise in the liquidity ratio that leads to the eventual addition, compared to the liquidity ratio one quarter ago, is 0.02. Such a rise is not economically meaningful given that the liquidity ratio has an upward time trend (the average quarterly change in the liquidity ratio in our sample is 0.03).

Again, we continue to observe results that are similar to our main results when restricting ourselves to this special subset of eventual addition events (Panel C of Table 6). In sharp contrast, our return results disappear and our holdings-based results go in the opposite direction when looking at the 292 events in which the stock has a market capitalization above the HK\$1 billion threshold and the quarterly liquidity ratio rises by more than 0.20, but the liquidity ratio falls short of the 0.40 cutoff<sup>9</sup> (Panel D of Table 6).

Overall, the observed discontinuity around the threshold set by Hong Kong regulators suggests that our main results are generated by the addition of stocks to the short-sale list rather than by some unobserved industry event.

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<sup>8</sup> We have experimented with other “minimum rises” in market capitalization. None of them are able to replicate the patterns we observe around actual addition events (results available upon request).

<sup>9</sup> We have experimented with other “minimum rises” in liquidity ratio. None of them are able to replicate the patterns we observe around actual addition events (results available upon request).

#### **4.2.2 Reverse Causality**

Another possible concern with our interpretation of the results is that of reverse causality: Investors short overvalued stocks made possible after inclusion on the short-sale list and hedge their short positions by buying stocks of industry peers. Buying pressure causes prices of these industry peers to temporarily rise.

It appears to us that the price-pressure interpretation cannot capture the full set of results. For one, if price pressure were generating all of our findings, we should expect prices of seemingly underpriced stocks to revert quickly. However, as shown in Figure 1, the positive cumulative abnormal returns do not revert. For instance, we observe that for stocks whose MB are in the bottom quintile, cumulative abnormal returns grow from +0.23% after one trading day to +0.79% after roughly three calendar months to +1.29% after one calendar year.

Second, as reported in Panel E of Table 6, we find that our results are still present when focusing on the subset of 88 hedge stocks that, as of the addition event, have below-median MBs and below-median past-one-year stock market performances. Instead, these 88 hedge stocks have an average share turnover and an average industry beta above the 70<sup>th</sup> percentile and the 80<sup>th</sup> percentile of that of our sample stocks, suggesting the primary reason these stocks are shorted is because they are good hedging candidates and not because they are overvalued.

#### **4.2.3 Does Industry Hedging Truly Matter to Hedge Funds?**

Our analysis assumes that the ability to hedge industry risk meaningfully improves long-short investors' risk-bearing capacity and causes them to trade more aggressively in seemingly underpriced stocks. To further gauge the plausibility of our argument, we run a simulation in which we compare how investors trading around the addition event would have performed with industry hedging,  $P_{LS}$ , versus without,  $P_L$ . The simulation results described in this subsection are tabulated in Appendix B5.

$P_L$  is invested in bottom-quintile industry peers from the day of the addition event until five trading days thereafter, and in the risk-free asset when there is no addition event.  $P_{LS}$  is similar to  $P_L$ , but long

positions in bottom-quintile industry peers are now hedged by short positions in industry peers on the short-sale list.

Consider an investor allocating her wealth across portfolio  $P_L$  and the risk-free asset. The investor attempts to maximize expected returns while keeping the monthly standard deviation of her combined portfolio below some “risk-tolerance threshold”. For the sake of illustration, assume the risk-tolerance threshold is 4% (Appendix B5 reports simulation results under alternate risk-tolerance thresholds). To keep her combined portfolio standard deviation below 4% and given the actual historical return distribution of  $P_L$  and the risk-free asset in our sample, our investor would have allocated 137% of her wealth to  $P_L$  and borrowed -37% of her wealth at the risk-free rate. Such a combined portfolio would have produced monthly returns of 0.59%. An investment of \$1 million in this combined portfolio at the beginning of our sample period would have grown to \$2.4 million by the end of our sample period.

Now consider the presence of portfolio,  $P_{LS}$ , in which long positions in bottom-quintile industry peers are hedged by short positions in industry peers on the short-sale list. Shorting industry peers immunizes the portfolio against industry shocks. Not surprisingly, in our sample,  $P_{LS}$  has similar average monthly returns as  $P_L$ , but a much lower monthly standard deviation. The lower standard deviation allows investors to more heavily invest in  $P_{LS}$  (than in  $P_L$ ) and, effectively, to more aggressively pursue underpriced securities without exceeding their risk-tolerance thresholds. In particular, to keep her combined portfolio standard deviation below 4% and given the actual historical return distribution of  $P_{LS}$  and the risk-free asset in our sample, our investor could now have allocated up to 196% of her wealth to  $P_{LS}$  and borrowed -96% of her wealth at the risk-free rate. Such a combined portfolio would have produced monthly returns of 0.85%. An investment of \$1 million in this combined portfolio at the beginning of our sample period would have grown to \$3.37 million. The magnitude of the difference in performance when investing in  $P_{LS}$  rather than in  $P_L$  (\$3.37 million versus \$2.4 million) suggests that the ability to hedge industry risk, indeed, is highly valuable to long-short investors and represents a meaningful shock to how aggressively long-short investors pursue seemingly underpriced stocks.

#### 4.2.4 Alternative Hedging Vehicles

There are other vehicles through which investors can protect themselves from industry shocks. On the one hand, the presence of substitutes to the shorting channel reduces the power of our analysis, limiting any interesting observations that may arise from it. On the other hand, if taken to the extreme, the existence of alternative hedging vehicles raises questions about whether the relaxation of short-sale constraints could plausibly be thought of as a positive shock to risk-bearing capacity.

Alternatives to the shorting channel include trading in derivative securities (options and futures), American depositary receipts (ADRs), and shorting of industry peers traded in countries other than Hong Kong.

To examine the interaction of the shorting channel with the use of derivative securities, we obtain option trading information from the *Bloomberg* database. We find no options in which the underlying asset represents an entire industry. Moreover, option holders frequently require the presence of an active shorting market to hedge their positions. So perhaps not surprisingly, we find that none of the hedge stocks are associated with open interest in call and put options in the month prior to the addition event. In general, as of May 2, 2013, of the 1,563 stocks listed on the Hong Kong Stock Exchange, only 61 had options listed on them, and many of these 61 options were characterized by zero or negligible trading volume. This suggests that in Hong Kong, for reasons that are beyond the scope of this study, options are less popular for hedging purposes. Similar observations apply to futures. Fung and Tse (2008) find that in Hong Kong, trading volume in single-stock futures is less than 0.1% of the trading volume of the underlying stock. There are no industry-specific futures.

Some Hong Kong securities have ADRs listed in the US, which, in turn, can be shorted. However, the depth of this alternative channel is limited. We find that there are only 23 ADRs from Hong Kong over our sample period. The liquidity of these ADRs is low (liquidity statistics are available upon request).

Finally, investors could short industry peers in the broader Asia-Pacific region. Of the countries in this region, only Japan appears to have a deep and liquid shorting market during our sample period (Bris, Goetzmann and Zhu, 2007). The effectiveness of this channel is hampered by the fact that stocks from the



same industry but located in other countries are not subject to the same set of shocks. Moreover, by simultaneously investing in two separate markets, investors subject themselves to exchange-rate fluctuations.

#### **4.2.5 Removals versus Additions**

Just as stocks are added to the short-sale list once they satisfy certain criteria, stocks are also removed from the list when those criteria are no longer met. We do not consider removals in our analysis as there are no clear predictions pertinent to how removals should alter hedge fund involvement. Specifically, there is no prediction pertinent to how removal events should change the involvement of *potential* investors: If long-short investors did not invest when it was relatively easy to hedge industry risk, they will also not invest when it becomes more difficult to hedge industry risk after the removal event (→ no immediate change in hedge fund involvement).

There is also no clear prediction pertinent to how removal events should affect the involvement of *current* investors: If long-short investors did invest because it was relatively easy to hedge industry risk, they will no longer invest or invest to a lesser degree when it becomes more difficult to hedge industry risk. However, as per the exchange ruling, existing short positions do not have to be closed out when those stocks are removed from the short-sale list. That is, even to current investors, removals do not constitute a sudden negative shock to their risk-bearing capacity (→ again, no immediate change in hedge fund involvement).

#### **4.2.6 Long-Only Investors**

Another question surrounding our analysis is why long-only investors do not trade aggressively enough in seemingly underpriced stocks such that mispricing only becomes corrected in the presence of hedge funds. Some long-only investors may be pursuing shares of seemingly underpriced stocks. But long-only investors, too, have limited risk-bearing capacity. Perhaps more importantly, for reasons that are beyond the scope of this study, we find that long-only institutions in Hong Kong strongly tilt their holdings towards glamour stocks with high MBs. In addition, stocks with increases in long-only investor holdings subsequently

underperform stocks that experience a decrease in holdings, suggesting that long-only investors in Hong Kong are perhaps not the most informed.<sup>10</sup>

#### **4.2.7 Hedge Stocks and Price Impact**

While not the focus of this study, in our tables, we also report what happens to prices of hedge stocks themselves. Table 2 shows that, in our sample period, prices of hedge stocks decline by 1.10% in the week leading up to the effective date. Once hedge stocks can be shorted, their prices decline by an additional 0.14%. One likely reason for the latter price decline is that some hedge stocks are overpriced and consequently attacked by short-sellers once they become shortable.

Prices of hedge stocks may decline for another reason: If hedge funds aggressively buy seemingly underpriced stocks and short hedge stocks to help protect their long positions, hedge funds' shorting of the hedge stocks may exert temporary downward price pressure, which subsequently reverts. Appendix B6 provides evidence to this regard as we find that hedge stocks' price decline increases with how aggressively hedge funds pursue the seemingly underpriced stocks and that hedge stocks price decline subsequently reverses.

#### **4.2.8 Post-Earnings-Announcement Drift**

Our previous analyses all use MB ratios to ascertain whether a stock is underpriced or not. In our final test, we use an alternate proxy for underpricing: The literature on the market's response to annual earnings announcements notes the presence of a post-earnings-announcement drift (PEAD; Ball and Brown 1968). This drift is commonly attributed to investor underreaction, i.e., temporary under-pricing after positive

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<sup>10</sup> In particular, we find that firms whose long-only investor holdings are above the median of its distribution in a given year have an average market-to-book ratio of 3.10; firms whose long-only investor holdings are below the median have an average market-to-book ratio of 1.89. This difference has a *t*-statistic of 4.18. In addition, stocks with above-median long-only investor holdings underperform their counterparts with below-median holdings by 7.76% over the ensuing year (*t*-statistic = -2.04). Relatedly, stocks that experience an increase in long-only investor holdings underperform stocks that experience a decrease in long-only investor holdings by 4.88% over the ensuing year (*t*-statistic = -2.69).

earnings surprises and temporary over-pricing after negative earnings surprises (DellaVigna and Pollet 2009; Hirshleifer, Lim and Teoh 2009).

As in most countries, we observe that in Hong Kong there is a positive abnormal price drift following positive earnings surprises. If the ability to hedge allows long-short investors to more aggressively pursue temporarily underpriced stocks and help correct mispricing on the long side, then we expect to see a more immediate price reaction and smaller PEAD in less-difficult-to-short industries ( $\rightarrow$  less underreaction).

To test our idea, we collect data on annual earnings announcements from Bloomberg. For consistency with prior analyses, our sample spans the 2001 through 2012 period. Each data point contains the company name, the stock ticker, and the ISIN as well as the earnings announcement date and the actual earnings announced on a per-share-basis. Following DellaVigna and Pollet (2009), we drop observations for which the earning-per-share is larger in absolute value than the price of a share. We also eliminate “penny stocks” ( $< \text{HK\$}1$ ) as well as announcements on dates when the Hong Kong stock exchange is closed. In total, our sample comprises 1,259 annual earnings announcements.

As in DellaVigna and Pollet (2009), we assign these earnings announcements to eleven portfolios. Earnings surprise is the difference between earnings-per-share in year  $t$  and earnings-per-share in year  $t-1$ , scaled by price-per-share as of five trading days prior to the announcement. We first look at the subset of negative earnings surprises and form quintile portfolios based on earnings surprise. Portfolio 1 contains the observations with the most negative earnings surprises; Portfolio 5 contains the observations with the least negative earnings surprises. Analogously, we look at the subset of positive earnings surprises and form quintile portfolios based on earnings surprise. Portfolio 7 contains the observations with the least positive earnings surprises; Portfolio 11 contains the observations with the most positive earnings surprises. Portfolio 6 contains observations that have an earnings surprise of zero.

As in DellaVigna and Pollet (2009), abnormal returns are the returns of the earnings-announcing firm minus the value-weighted average returns across all stocks traded on the Hong Kong Exchange.<sup>11</sup> We estimate a regression model where the dependent variable is the cumulative abnormal return from two trading days after the annual earnings announcement day,  $t=+2$ , to seventy-five trading days thereafter,  $t=+75$ . The independent variable of primary interest is the interaction term between *High Earnings Surprise* and *%StocksShortable*. *High Earnings Surprise* equals one for observations that are part of Portfolio 11, and zero otherwise; *%StocksShortable* is the fraction of stocks that can be shorted in the industry of the earnings-announcing firm. Other independent variables and the computation of standard errors are again as in DellaVigna and Pollet: We include indicators for the year of the announcement, indicators for the month of announcement, the decile rank of the relevant stock's market capitalization, industry fixed effects, and we cluster standard errors at the year level.

The results reported in Table 7 show that the coefficient estimate for *High Earnings Surprise* is 0.264 ( $t$ -statistic = 3.19), that is, there is a PEAD after positive earnings surprises. The coefficient estimate for the interaction term between *High Earnings Surprise* and *%StocksShortable* is -0.635 ( $t$ -statistic = -3.48). The negative coefficient estimate indicates that when it is easier to hedge industry risk, investors more aggressively pursue seemingly underpriced stocks, which leads to less PEAD after positive earnings surprises. For instance, the coefficient estimates suggest that when the fraction of shortable stocks is 0%, cumulative abnormal returns from  $t=+2$  through  $t=+75$  are 26.4%. As the fraction of shortable stocks increases to, say, 20%, cumulative abnormal returns after positive earnings surprises shrink to 13.7%.<sup>12</sup>

An alternative explanation for the fact that the PEAD is less pronounced for firms with high *%StocksShortable* is that firms with high *%StocksShortable* reside in industries that are more mature and

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<sup>11</sup> Our results are the same when we compute abnormal returns based on firms matched by size and market-to-book ratio (results available upon request).

<sup>12</sup> Curiously, our estimates also imply that when the fraction of shortable stocks becomes very large (>41.6%), cumulative abnormal returns after positive earnings surprises turn negative. The fraction of shortable stocks is rarely that high, however, as 41.6% is close to the 80th percentile. Even if the fraction of shares shortable are at the 90th percentile, our estimates imply three-months abnormal returns of -0.14% only, which is more consistent with zero PEAD than a negative PEAD.

informationally more efficient. To assess the validity of this alternative view, we look at the PEAD after negative earnings surprises. Our hedging-of-long-positions channel has no prediction pertinent to the PEAD after negative earnings surprises. On the other hand, if less-difficult-to-short industries, indeed, are informationally more efficient, we should observe less of a PEAD not only after positive earnings surprises but also after negative earnings surprises.

We form *Low Earnings Surprise*, which equals one for observations that are part of Portfolio 1, and zero otherwise, and we interact this variable with *%StocksShortable*. The coefficient estimate for *Low Earnings Surprise* is -0.144 ( $t$ -statistic = -2.02), that is, there is also a PEAD after negative earnings surprises. In contrast to what the information-view predicts, however, the interaction term between *Low Earnings Surprise* and *%StocksShortable* reveals that the PEAD after negative earnings surprises is not moderated by *%StocksShortable*.

Overall, the findings presented in Table 7 are consistent with the notion that the relaxation of short-sale constraints increases risk-bearing capacity, causes long–short investors to trade more aggressively on perceived underpricing, and thus expedites the market’s response to positive news.

## 5. Conclusion

In this study, we look at investment companies that freely use strategies involving combinations of leverage and long–short positions in securities. The lack of regulation, combined with the immense price impact that these investors can exert, has led to scrutiny by regulators and the popular press, frequently pointing to the potential harm that hedge funds can cause (Garbaravicius and Dierick 2005). Their net effect on financial markets, however, is far from obvious. In particular, the way hedge funds trade makes them perhaps the quintessential “arbitrageurs” (Brunnermeier and Nagel 2004, Cao, Liang, Lo, and Petrasek 2017). Arbitrageurs have the potential to eliminate anomalous price differences by aggressively trading against less informed investors, ultimately making markets more efficient.

Our evidence is consistent with this view as our stock-return-based results suggest that greater hedge fund involvement helps correct mis-pricing and positively contributes to the price discovery process.

To encourage such arbitrage involvement, this paper points to the need of a well-functioning short-selling market: The presence of a deep and liquid short-selling market allows arbitrageurs to trade against overpricing. More importantly in the context of this study, it also allows arbitrageurs to aggressively trade on underpricing by letting arbitrageurs hedge their long positions. A corollary of the above proposition is that the commonly held view that a relaxation of short-sale constraints can only cause stock prices to go down is incomplete. By allowing investors to more aggressively trade on underpricing, a relaxation of short-sale constraints can also cause stock prices to go up and the evidence presented in this study indicates that the positive stock price effect can be substantial.

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## Appendix A.1

Based on the Hong Kong Stock Exchange (HKEX) website, as of August 2012 (the end of our sample period), securities declared eligible for short selling are any of those that:

- 1) are constituent stocks of indices that are the underlying indices of equity index products traded on the exchange, or
- 2) are constituent stocks of indices that are the underlying indices of equity index products traded on the Hong Kong Futures Exchange Limited (HKFE) , or
- 3) are underlying stocks of stock options traded on the exchange, or
- 4) are underlying stocks of stock futures contracts traded on the HKFE, or
- 5) are eligible for structured product issuance pursuant to Rule 15A.35 of the Main Board Listing Rules or underlying stocks of structured products traded on the exchange, or
- 6) have a market capitalization of  $\geq$  HK\$1 billion and for which the following ratio is  $\geq$  40%:  
$$\frac{\text{aggregate HK\$ trading volume over the preceding 12 months}}{\text{market capitalization}}$$
(effective July 3, 2012, HKEX altered the eligibility requirement by increasing the market capitalization requirement to \$3 billion from \$1 billion and increased the turnover-to-market capitalization ratio requirement to 50% from 40%; none of the addition events in our sample, which ends in August 2012, are subject to this new rule).
- 7) are exchange traded funds approved by the Board of the Exchange in consultation with the Securities and Futures Commission, or
- 8) are traded under the pilot scheme (i.e., are one of the first 17 securities that were approved for short selling in January 1994) , or
- 9) have been listed on the exchange for  $\leq$  60 trading days, with a public float capitalization of  $\geq$  HK\$10 billion for a period of 20 consecutive trading days commencing from the date of their listing on the exchange and an aggregate HK\$ trading volume of  $\geq$  HK\$200 million during this period, or
- 10) are underlying stocks of structured products which are based on a single class of shares traded on the exchange, or
- 11) are applicable market making securities (other than the securities described in categories 7 and 8 above) approved by the Board of the Exchange in consultation with the Securities and Futures Commission.

## Appendix A.2

### A.2.1. Background

In January 1994, the HKEX introduced a pilot program that allowed 17 securities to be shorted. Since then, the exchange has been updating the list of securities that can be shorted (“designated-securities list”), mostly at a quarterly frequency. The list includes common stocks, as well as REITs and ETFs. In our analysis, we focus on common stocks. But, initially, we also collect data on REITs and ETFs.

According to the HKEX, to be included in the designated-securities list, a security has to meet certain criteria laid out in Appendix A.1. Once these criteria are met, the exchange decides whether to add the security to the designated-securities list or not.

### A.2.2. Initial Data Collection

The HKEX publishes the most current designated-securities list on its website. However, it does not publish historical designated-securities lists. Instead, it provides data on revisions to the list from January 2001 through August 2012 (the end of our sample period).<sup>14</sup> These revisions reflect securities added to the list and securities deleted from the list. Apart from regular quarterly changes to the list, the HKEX also sometimes makes irregular changes to the list.

We collect announcements of regular quarterly changes and announcements of irregular changes. For each announcement, we have the name of the company/REIT/ETF and its stock code as well as the date the news is announced and the effective date. Typically, the effective date is one week after the announcement date.

### A.2.3. Data Cleaning

While our main analysis is based on additions of common stocks to the designated-securities list, for additional analyses, we also try to reconstruct the historical designated-securities lists: We start with the designated-securities list as of August 2012, which is the beginning of our data collection efforts and the end of our sample period, and we use the historical announcements of changes made to the list to deduct, for any given point in time, the historical designated-securities list.

When implementing this approach, we observe some anomalies: A few securities on the most current list and a few securities announced to be deleted from the list do not have records of inclusion while others that are no longer on the most current list (but were added at some point) do not have records of deletion. We believe these anomalies happen primarily for one of the following reasons:

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<sup>14</sup> The HKEX also provides revisions data for 2000, but only for the first quarter of 2000.

1. A stock moved to a different trading board. The HKEX has two trading boards: Main Board and GEM (similar to pink-sheets). Once a stock moves, its stock code changes.
2. Mergers and acquisitions.
3. Delistings.

We make the following changes to clean the data:

1. The Nov. 21, 2002 announcement is replaced by the Nov. 28, 2002 announcement, which constitutes a restatement of the earlier announcement.
2. Fourteen stocks were moved from the GEM to the Main Board. When a stock moves from the GEM to the Main Board, it is typically assigned a new trading code by the Main Board. We update the stock code accordingly.
3. Eighteen stocks were delisted. We use the actual delisting date as the effective date. Historical delisting data is from WIND.
4. Three stocks were taken over. We use the takeover-announcement date as the announcement date and the takeover-effective date as the date the stock is effectively no longer on the list. The takeover information is from news releases.
5. We delete five addition announcements because they reflect changes in stock codes of firms already on the short list. These changes are unrelated to moves from the GEM to the Main Board.

#### **A.2.4. Data Verification**

We cross-check our data by comparing the total number of permitted stocks to be shorted (as per our deduced list) with the exchange-published number; the HKEX publishes historical information on the total number of securities on the designated-securities list.

#### **A.2.5. Matching Short List Data with Accounting and Stock-Return Data**

We obtain financial market data from COMPUSTAT GLOBAL. We cannot directly match our HKEX data with COMPUSTAT GLOBAL data as there is no good common identifier. The identifier used by the HKEX is the company/REIT/ETF-name and stock code. COMPUTSTAT GLOBAL uses the company name, ISIN, GVKEY and CUSIP, but not the stock code. We find name-matching to be unreliable and to yield poor results, as HKEX and COMPUSTAT GLOBAL use different names.

Fortunately, Bloomberg data includes both stock code and ISIN. We thus add ISIN to our HKEX data via Bloomberg data. This, in turn, enables a merge with COMPUSTAT GLOBAL.

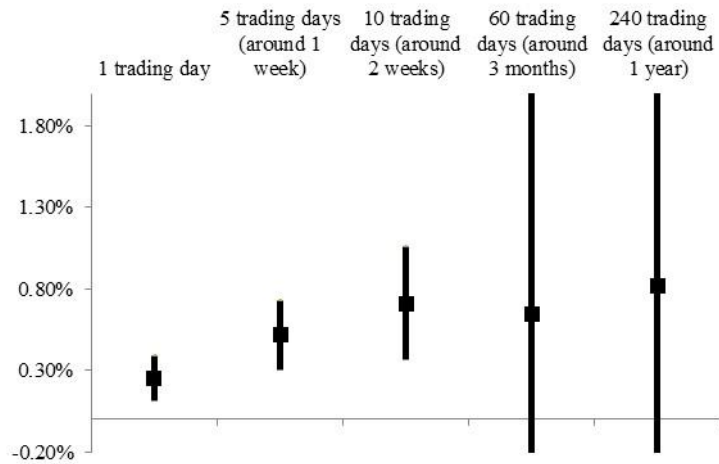
For reasons detailed in the main body of the text, we focus on additions to the designated-securities list (not on deletions). Our initial data-collection-and cleaning efforts produce 1,137 addition events. Of

these, we are able to match 1,076 with Bloomberg data, of which, in turn, we are able to match 732 to COMPUSTAT GLOBAL. The loss of addition events is due to our COMPUSTAT GLOBAL data not covering REITs and ETFs. As our study focuses on common stocks, the effective loss in observations is minimal. Of the remaining 732 addition events, 25 lack the accounting and stock return data we need for our analysis. In the end, we arrive at our final sample of 707 common-stock additions between 2001 and 2012. These 707 addition events cover 444 distinct firms (some firms are added to the list only to be removed later and then to be added again).

Figure 1  
 Cumulative Abnormal Returns after Additions to the Hong Kong Short-Sale List

This figure reports cumulative abnormal returns around additions of stocks to the short-sale list in Hong Kong. Our sample starts in January 2001 and ends in August 2012 and encompasses a total of 707 addition events. An addition event is specified as one in which an individual stock is added to the list (=Hedge Stock) and, therefore, can be sold short from the event day, denoted as day  $t=0$ . *Industry Peers* are defined as stocks that are (1) in the same four-digit-GICS industry as the *Hedge Stock*, and (2) themselves not being added to the short-sale list on the event day. We plot the average cumulative abnormal returns, along with the 95% confidence interval, of *Industry Peers* that are in the bottom industry market-to-book-ratio half (Panel A)/quintile (Panel B); we do so over various holding periods after the addition event: [0,1], [0,5], [0,10], [0,60], [0,240]. To compute abnormal returns for *Industry Peers*, each *Industry Peer* is matched with a stock in the same size decile having the closest market-to-book ratio that is itself not affected by the addition event.

**Panel A: Bottom Market-to-Book-Ratio Half Industry Peers**



**Panel B: Bottom Market-to-Book-Ratio Quintile Industry Peers**

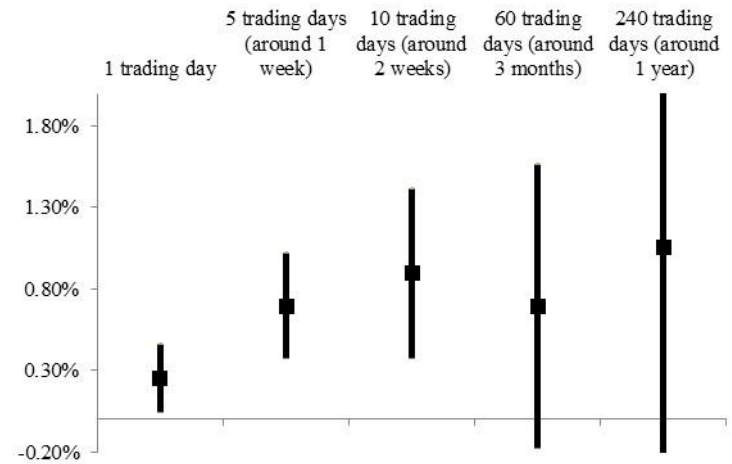


Table 1  
Hong Kong Evidence: Descriptive Statistics

This table reports summary statistics for our Hong Kong sample of 707 addition events from January 2001 through August 2012. An addition event is specified as one in which an individual stock is added to the Hong Kong short-sale list (=Hedge Stock) and, therefore, can be sold short from the event day, denoted as day  $t=0$ . There are a total of 707 hedge stocks and a total of 42,640 industry peers (i.e., 60.31 industry peers per hedge stock). *Industry Peers* are defined as stocks that are (1) in the same four-digit-GICS industry as the *Hedge Stock*, and (2) themselves not being added to the short-sale list on the event day. We separate *Industry Peers* by whether they are in the bottom industry market-to-book-ratio half (Panel C) or bottom industry market-to-book ratio quintile (Panel D). *Market Capitalization* is the number of shares outstanding multiplied by the stock price as of  $t=0$ . *MB* is the market capitalization as of the most recent fiscal year's end divided by the book value of equity. *Daily Volatility* is the average daily return squared in the month prior to the addition event. *Daily Volume* is the average daily HK\$-value of shares traded in the month prior to the addition event.

	Pctl 25	Pctl 50	Pctl 75	Mean	SD
<i>Panel A: Hedge Stocks</i>					
Market Capitalization (in HK\$ millions)	1,208	1,859	3,378	3,204	6,885
MB	0.75	1.35	2.51	2.46	3.63
Daily Volatility (*1000)	0.41	0.81	1.44	1.39	2.02
Daily Volume (in HK\$ millions)	0.80	2.73	9.35	13.43	44.85
<i>Panel B: Industry Peers of Hedge Stocks (All)</i>					
Market Capitalization (in HK\$ millions)	337	897	3,062	6,208	35,299
MB	0.53	1.01	2.08	1.97	5.77
Daily Volatility (*1000)	0.42	0.90	1.96	2.09	5.09
Daily Volume (in HK\$ millions)	0.38	1.53	5.85	9.14	39.80
<i>Panel C: Industry Peers of Hedge Stocks (Bottom Half - MB)</i>					
Market Capitalization (in HK\$ millions)	260	565	1,570	2,892	14,532
MB	0.35	0.55	0.80	0.61	0.35
Daily Volatility (*1000)	0.43	0.95	2.12	2.20	5.05
Daily Volume (in HK\$ millions)	0.29	1.13	4.78	8.57	43.01
<i>Panel D: Industry Peers of Hedge Stocks (Bottom Quintile - MB: "Seemingly Underpriced Stocks")</i>					
Market Capitalization (in HK\$ millions)	213	404	1,044	1,892	8,828
MB	0.24	0.32	0.44	0.35	0.16
Daily Volatility (*1000)	0.50	1.08	2.49	2.41	5.22
Daily Volume (in HK\$ millions)	0.30	1.15	5.03	8.81	33.76

Table 2  
Cumulative Abnormal Returns and Changes in Hedge Fund Holdings around Additions to the Hong Kong Short-Sale List

This table reports cumulative abnormal returns as well as levels of and changes in hedge fund holdings around additions of stocks to the short-sale list in Hong Kong. Our sample starts in January 2001 and ends in August 2012 and contains 707 addition events. An addition event is specified as one in which an individual stock is added to the short-sale list ( $\equiv$  *Hedge Stock*) and, therefore, can be sold short from event day  $t=0$ . *Stocks in the same Industry as Hedge Stock* are stocks that are (1) in the same four-digit-GICS industry as the *Hedge Stock*, and (2) themselves not being added to the short-sale list. For both *Hedge Stocks* and *Stocks in the same Industry as Hedge Stock*, we report cumulative abnormal returns over five trading days before the event date and five trading days after the event date (including the event date); we report results separately for industry peers that are in the top half based on their industry's market-to-book-ratio distribution as of the event day, in the bottom half and in the bottom quintile ( $\equiv$  *Seemingly Underpriced Stocks*). To compute abnormal returns, we match each stock with a matching stock that is in the same size decile, that is itself not being affected by the addition event and that has the closest market-to-book ratio. In addition to cumulative abnormal returns, we report levels of and changes in hedge fund holdings, *HFH*, in *Seemingly Underpriced Stocks* around the event day. Changes are based on the most recent reported holdings prior to the addition event and the most recent reported holdings after the addition event. We compare  $\Delta$  *HFH* to the corresponding change in holdings of long-only investors,  $\Delta$  *LIH*, and we report the difference-in-difference,  $\Delta\Delta$ . *T*-statistics are reported in parentheses. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Cumulative Abnormal Returns [%]					Hedge Fund Holdings (HFH) and Long-Only Investor Holdings (LIH) in Seemingly Underpriced Stocks [%]				
Hedge Stock	Stocks in same Industry as Hedge Stock				HFH Before Addition	HFH After Addition	$\Delta$ HFH	$\Delta$ LIH	$\Delta\Delta$
	Top Half MB	Bottom Half MB	Bottom Quintile MB ( $\equiv$ Seemingly Underpriced Stocks)						
[-5,-1]	-1.10*** (-2.83)	-0.10 (-0.88)	0.07 (0.46)	0.01 (0.07)	1.71				
[0,+5]	-0.14 (-0.35)	0.18 (0.66)	0.48*** (4.68)	0.64*** (4.17)		2.22	0.51*** (15.18)	0.18 (1.59)	0.33*** (9.95)

Table 3  
Cumulative Abnormal Returns and Changes in Hedge Fund Holdings around Additions to the Hong Kong Short-Sale List:  
Difficulty to Hedge Industry Risk prior to Addition

This table mirrors Table 2, but separates observations into those where it was less difficult to hedge industry risk prior to the addition event (Panel A) and those where it was more difficult to hedge industry risk prior to the addition event (Panel B). For every year and each four-digit-GICS industry, we compute the fraction of stocks with nonzero short-selling volume. An observation is categorized as coming from a more-difficult-to-short industry if it resides in an industry that is in the bottom decile based on the industry's fraction of shorted stocks in the year prior to the addition event, and as coming from a less-difficult-to-short industry otherwise. *T*-statistics are reported in parentheses. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Cumulative Abnormal Returns [%]		Hedge Fund Holdings (HFH) and Long-Only Investor Holdings (LIH) in Seemingly Underpriced Stocks [%]				
	Hedge Stock	Seemingly Underpriced Stocks	HFH Before Addition	HFH After Addition	Δ HFH	Δ LIH	ΔΔ
<i>Panel A: Industry Less-Difficult-to-Short Prior to Addition (→ Less Hedging Demand)</i>							
[-5,-1]	-1.06** (2.17)	0.04 (0.27)	1.75				
[0,+5]	-0.16 (-0.38)	0.56*** (3.56)		2.24	0.49*** (13.86)	0.18 (1.54)	0.31*** (9.27)
<i>Panel B: Industry More-Difficult-to-Short Prior to Addition (→ More Hedging Demand)</i>							
[-5,-1]	-1.25*** (-2.98)	0.43 (0.63)	1.20				
[0,+5]	0.01 (0.01)	1.65*** (2.48)		1.93	0.73*** (8.06)	0.03 (0.63)	0.70*** (3.88)



Table 4  
 Cumulative Abnormal Returns and Changes in Hedge Fund Holdings around Additions to the Hong Kong Short-Sale List:  
 Industry Risk Exposure of Seemingly Underpriced Stocks

This table mirrors Table 2, but separates observations into those where *Seemingly Underpriced Stocks* have low industry risk exposure (Panel A) and those where *Seemingly Underpriced Stocks* have high industry risk exposure (Panel B). We compute the industry beta for each *Seemingly Underpriced Stock* using daily stock-return data over a one-year period prior to the addition event (we exclude data from two calendar weeks prior to the addition event). We also compute the standard deviation of daily industry-return data over the same pre-addition period. An observation is categorized as having high industry risk exposure if it is in the top decile based on its product of industry beta and industry volatility, and as having low industry risk exposure otherwise. *T*-statistics are reported in parentheses. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Cumulative Abnormal Returns [%]		Hedge Fund Holdings (HFH) and Long-Only Investor Holdings (LIH) in Seemingly Underpriced Stocks [%]				
	Hedge Stock	Seemingly Underpriced Stocks	HFH Before Addition	HFH After Addition	Δ HFH	Δ LIH	ΔΔ
<i>Panel A: Low Industry Risk Exposure (→ Less Hedging Demand)</i>							
[-5,-1]	-1.05*** (-2.71)	0.06 (0.37)	1.64				
[0,+5]	-0.13 (-0.20)	0.49*** (3.04)		2.10	0.46*** (12.76)	0.19 (1.52)	0.27*** (7.65)
<i>Panel B: High Industry Risk Exposure (→ More Hedging Demand)</i>							
[-5,-1]	-1.79** (-2.53)	0.20 (0.36)	2.10				
[0,+5]	-0.22 (-0.33)	1.85*** (3.24)		2.86	0.76*** (8.44)	0.12 (0.48)	0.64*** (7.50)

Table 5  
Cumulative Abnormal Returns and Changes in Hedge Fund Holdings around Additions to the Hong Kong Short-Sale List:  
Industry Exposure of Hedge Stock

This table mirrors Table 2, but separates observations into those where the *Hedge Stock* has low industry exposure (Panel A) and those where the *Hedge Stock* has high industry exposure (Panel B). We compute the industry beta for each *Hedge Stock* using daily stock-return data over a one-year period prior to the addition event (we exclude data from two calendar weeks prior to the addition event). An observation is categorized as having a *Hedge Stock* with high industry exposure if the corresponding *Hedge Stock* is in the top decile based on its industry beta, and as having low industry exposure otherwise. *T*-statistics are reported in parentheses. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Cumulative Abnormal Returns [%]		Hedge Fund Holdings (HFH) and Long-Only Investor Holdings (LIH) in Seemingly Underpriced Stocks [%]				
	Hedge Stock	Seemingly Underpriced Stocks	HFH Before Addition	HFH After Addition	Δ HFH	Δ LIH	ΔΔ
<i>Panel A: Hedge Stock has low Industry Exposure (→ Worse Hedging Candidate)</i>							
[-5,-1]	-0.87** (-2.16)	0.04 (0.24)	1.77				
[0,+5]	-0.14 (0.14)	0.58*** (3.70)		2.27	0.50*** (14.12)	0.19 (1.53)	0.31*** (8.92)
<i>Panel B: Hedge Stock has high Industry Exposure (→ Better Hedging Candidate)</i>							
[-5,-1]	-3.32** (-2.44)	0.39 (0.84)	1.15				
[0,+5]	-0.02 (-1.11)	1.24** (1.99)		1.73	0.58*** (5.32)	0.05 (0.29)	0.53*** (4.91)

Table 6  
Additional Tests

This table mirrors Table 2. Panels A through D report results from a discontinuity analysis. One of the primary triggers for addition events is stocks passing the HK\$ 1 billion market capitalization and the 0.40 liquidity ratio thresholds set by Hong Kong regulators. In Panel A, we look at 77 stock/year-quarter-ends, where the stock has a liquidity ratio above 0.40, but the market capitalization falls just short of the HK\$ 1 billion market capitalization cutoff ( $0.9 \text{ billion} \leq \text{market capitalization} < 1 \text{ billion}$ ). All these stocks' market capitalizations eventually exceed HK\$ 1 billion; the average quarterly rise in market capitalization that causes these stocks to cross the threshold and, consequently, become added to the short-sale list is HK\$ 0.16 billion. Panel A reports results around this special subset of 77 eventual addition events. Panel B reports results for "pseudo addition events". Here, a pseudo addition event is one in which an individual stock has a liquidity ratio above the 0.40 threshold and experiences a quarterly rise in its market capitalization of greater than HK\$ 0.5 billion that, nevertheless, fails to cross the official HK\$ 1 billion threshold. There are 89 such events. In Panel C, we look at 152 stock/year-quarter-ends, where the stock has a market capitalization above HK\$ 1 billion, but the liquidity ratio falls just short of the 0.40 cutoff ( $0.39 \leq \text{liquidity ratio} < 0.40$ ). All these stocks' liquidity ratios eventually exceed 0.40; consequently, all these stocks are subsequently added to the short-sale list and the average quarterly rise in the liquidity ratio that leads to the eventual addition is 0.02. Panel C reports results around this special subset of 152 eventual addition events. Panel D, again, reports results for "pseudo addition events". Here, a pseudo addition event is one in which an individual stock has a market capitalization above the HK\$ 1 billion threshold and experiences a quarterly rise in its liquidity ratio of greater than 0.20 that, nevertheless, fails to cross the official 0.40 threshold. There are 292 such events. Panel E reports results around 88 addition events in which the hedge stock has a below-median market-to-book ratio and a below-median past-one-year-stock-market performance and, as such, is perhaps more likely to be shorted for hedging considerations (rather than for being overpriced).

	Cumulative Abnormal Returns [%]		Hedge Fund Holdings (HFH) and Long-Only Investor Holdings (LIH) in Seemingly Underpriced Stocks [%]				
	Hedge Stock	Seemingly Underpriced Stocks	HFH Before Addition	HFH After Addition	$\Delta$ HFH	$\Delta$ LIH	$\Delta\Delta$
<i>Panel A: Discontinuity Analysis (Small rise in market capitalization, but enough to become added to the short-sale list)</i>							
[-5,-1]	-1.57*** (-3.06)	-0.32 (-0.63)	1.26				
[0,+5]	-0.12 (-0.82)	0.85** (1.94)		1.75	0.49*** (5.74)	0.15* (1.79)	0.34*** (2.72)
<i>Panel B: Discontinuity Analysis (Large rise in market capitalization, but not enough to become added to the short-sale list)</i>							
[-5,-1]	0.42 (1.32)	0.05 (0.75)	1.44				
[0,+5]	1.29** (2.57)	-0.16 (-0.78)		1.57	0.13 (0.51)	0.42*** (6.71)	-0.29*** (-4.63)

Table 6. Continued.

	Cumulative Abnormal Returns [%]		Hedge Fund Holdings (HFH) and Long-Only Investor Holdings (LIH) in Seemingly Underpriced Stocks [%]				
	Hedge Stock	Seemingly Underpriced Stocks	HFH Before Addition	HFH After Addition	Δ HFH	Δ LIH	ΔΔ
<i>Panel C: Discontinuity Analysis (Small rise in liquidity ratio, but enough to become added to the short-sale list)</i>							
[-5,-1]	-1.78** (-2.27)	0.32 (1.38)	1.56				
[0,+5]	-0.21 (-0.30)	1.04*** (3.27)		2.01	0.45*** (5.99)	0.18 (0.79)	0.27*** (3.85)
<i>Panel D: Discontinuity Analysis (Large rise in liquidity ratio, but not enough to become added to the short-sale list)</i>							
[-5,-1]	4.37** (2.29)	-0.11 (-0.63)	1.32				
[0,+5]	0.56 (0.70)	0.15 (1.34)		1.57	0.25*** (3.48)	0.55*** (6.75)	-0.30*** (-4.48)
<i>Panel E: Hedge Stock Less Likely to be Overpriced</i>							
[-5,-1]	-1.20** (-2.14)	0.11 (0.20)	1.79				
[0,+5]	0.03 (0.08)	1.36** (2.58)		2.27	0.48** (1.96)	0.09 (0.47)	0.39* (1.85)

Table 7  
Post-Earnings Announcement Drift and the Role of Shortability: Hong Kong

We estimate regression equations of price reactions around earnings announcements on various firm and industry characteristics. Our sample spans annual earnings announcements from January 2001 through August 2012. *Earnings Surprise* is the difference between earnings-per-share in year  $t$  and earnings-per-share in year  $t-1$ , scaled by price-per-share as of five trading days prior to the announcement. We first look at the subset of negative earnings surprises and form quintile portfolios based on *Earnings Surprise*. Portfolio 1 contains the observations with the most negative earnings surprises; Portfolio 5 contains the observations with the least negative earnings surprises. Analogously, we look at the subset of positive earnings surprises and form quintile portfolios based on *Earnings Surprise*. Portfolio 7 contains the observations with the least positive earnings surprises; Portfolio 11 contains the observations with the most positive earnings surprises. Portfolio 6 contains observations that have an earnings surprise of zero. Our dependent variable, CAR [+2, +75], is the cumulative abnormal return from two trading days after the annual earnings announcement day,  $t=+2$ , to seventy-five trading days thereafter,  $t=+75$ . *% Stocks Shortable* is the fraction of stocks shorted in the industry of the earnings-announcing firm in the year prior to the earnings announcement. *High Earnings Surprise* equals one for observations that are part of Portfolio 11, and zero otherwise; *Low Earnings Surprise* equals one for observations that are part of Portfolio 1, and zero otherwise; *Standard Controls* include indicators for the year of the announcement, indicators for the month of the announcement, and the decile of the relevant stock's market capitalization. We also include industry-fixed effects. We do not report the intercept.  $T$ -statistics are reported in parentheses and are based on standard errors clustered by year of the annual earnings announcement. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

	CAR [+2,+75]
<i>% Stocks Shortable</i>	-0.069 (-1.23)
<i>High Earnings Surprise</i>	0.264*** (3.19)
<i>% Stocks Shortable * High Earnings Surprise</i>	-0.635*** (-3.48)
<i>Low Earnings Surprise</i>	-0.144** (-2.02)
<i>% Stocks Shortable * Low Earnings Surprise</i>	0.215 (1.25)
<i>Standard Controls</i>	Yes
# Obs.	1,259
Adj. $R^2$	0.15