The Roles of Arbitrageurs – UK evidence

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ABSTRACT

The UK context with its distinct regulation on information disclosure during the takeover period provides an excellent setting to examine how the regulation can affect the roles that arbitrageurs can play in the takeover game. Using a manually-collected dataset and a variety of methods to tackle the endogeneity problem, we find supporting evidence on the importance of disclosure regulation. The UK strict disclosure rule makes it hard for arbitrageurs to outperform the average investors in the market. Furthermore, being forced to reveal their identity too soon, the presence of arbitrageurs actually reduces bid premium. There is little evidence that arbitrageurs can exert influence on the chance that the bid can go through.

1. Introduction

Merger arbitrage or risk arbitrage is the strategy designed to profit from the uncertainty surrounding the outcome of a takeover bid. It is widely documented that the strategy can generate substantial returns on risk-adjusted basis in several markets. Table 1 summarizes the results about the risk-adjusted or abnormal returns to the strategy from 10 studies. For the US market where most studies are conducted (7 out of 10), the return in excess of risk is positive ranging from 7% in Baker and Savasoglu (2002) to more than 172% in Dukes et al. (1992). The huge variation in the reported returns can be attributed to the differences in the way the returns to the strategy are calculated. On 37 Canadian cash tender offers, Karolyi and Shannon (1999) report merger arbitrage abnormal returns of 33.90%. Maheswaran and Yeoh (2005) also find risk-adjusted returns of 9.90%-10.69% on the merger arbitrage portfolio consisting of 193 Australian cash mergers[1]. More recently, Sudarsanam and Nguyen (2009) document that the UK merger arbitrage portfolios produce annualized abnormal returns ranging from 6.17% to 7.44%.

In addition to the similar results about the returns to the strategy, these studies implicitly assume that arbitrageurs act like the average investors in the market. The way that takeover bids are selected for the arbitrage portfolio is mainly based on the availability of data. Obviously, such portfolio is accessible to all investors in the market. Larcker and Lys (1987) suggest that arbitrageurs might engage in costly information acquisition, hence they can select the best bids for their portfolios. Hsieh and Walkling (2005) go a step further by reporting that arbitrageurs not only are better than the average investors at selecting bids, but also have the ability to alter the course of the takeover process. The authors find that the presence of arbitrageurs is associated with higher bid premium and higher probability that the bid will finally succeed.

Hsieh and Walkling's (2005) finding is consistent with the prediction from the theoretical models propounded by Cornelli and Li (2002) and Gomes (2001). One of the important premises of the models is that the arbitrageurs are able to hide their

[1] All reported returns are annualized returns.

identity during the takeover process. The anonymity gives arbitrageurs an edge in trading with other investors in the market enabling them to earn abnormal returns. The strict UK disclosure rule during the takeover period makes the anonymity assumption rather tenuous. As argued later in section 3, as the disclosure rule during the takeover period is much stricter in the UK than in the US, where Hsieh and Walkling's (2005) study is conducted, we would expect different results on the UK arbitrageurs' ability to select best bids for their portfolios and to influence the bid outcome.

Using a manually collected dataset and a range of methods to mitigate the possible endogeneity problem, we find that the disclosure rule has significant impact on the interaction between the presence of arbitrageurs and the outcome of the takeover as well as the arbitrageurs' ability to select the best bids for their portfolios. Our result shows only a weak relationship between arbitrage returns and the presence of arbitrageurs. This indicates that arbitrageurs are not much better than the average investors in the market in picking the best bids for the arbitrage portfolios.

In contrast to Hsieh and Walkling's (2005) finding, we report a significant negative relationship between the presence of arbitrageurs and bid premium. The fact that the UK arbitrageurs are forced to reveal their trading position too soon contributes to this relationship. If the bidder knows that the short-term arbitrageurs are already in the game, it would have no incentive to raise the offer price ex ante or revised the bid upward ex post to attract more arbitrageurs into the contests as predicted by Cornelli and Li (2002). In fact, the bid premia in those bids, where the arbitrageurs have to reveal themselves before the bid announcement date, are significantly lower than the premia in those bids, where the arbitrageurs do not have to. Finally, we find no relationship between the presence of arbitrageurs and the probability of bid success. These findings demonstrate the impact of the disclosure rules.

The paper is organized as followings. Section 2 reviews the literature about the roles of arbitrageurs in takeover contests. Section 3 develops empirical hypotheses. Section 4 describes the data and sample selection process. Section 5 discusses the methodology for the empirical tests. Section 6 presents the empirical results. Section 7 concludes the paper.

2. Theoretical Framework

2.1. Categorization of Arbitrageurs' Roles

In this section, we will describe different roles that arbitrageurs can play in the takeover contest. We focus on the information sets that arbitrageurs possess to classify the arbitrageurs' roles. Information is the epicentre of our classification because the information asymmetry between the arbitrageurs and the market is the sources of their abnormal returns. Assuming market is efficient at semi-strong form, arbitrageurs can expect to have positive abnormal profits when they have some information about the bid that is not publicly available. When information asymmetry exists, arbitrageurs play the role of *informed investors.* In the event that no information asymmetry exists, arbitrageurs play the role of *uninformed investors.* When arbitrageurs are informed investors, they can be either *passive* or *active*. The arbitrageurs are active in the sense that they have the ex ante expectation that they could influence the bid outcome. The passive arbitrageurs do not harbour such expectation.

We compare the roles that arbitrageurs can play in the takeover process on three dimensions: their ability to select the best deals to invest in, their ability to influence the bid outcome and their expectation to influence the bid outcome. Figure 1 visualizes the comparison process. On each dimension, the roles that arbitrageurs can play are placed at "high" or "low" position. The "high" positions indicate that arbitrageurs have the ability to select deals, the ability and the expectation to influence the bid outcome, whereas the "low" positions indicate otherwise.

The uninformed arbitrageurs have low scores all three dimensions. As they possess no private information about the bid outcome, they are unable to identify which are the best deals for their investment. The best strategy for these uninformed investors should be to hold a diversified portfolio of merger bids. Thus, the uninformed arbitrageurs usually have small stake in the target firms and should have neither the ability nor the expectation to influence the bid outcome. In an efficient market, the uninformed arbitrageurs should earn zero abnormal returns on average. If they can instead make positive abnormal returns from the arbitrage investment, this would constitute evidence against efficient market hypotheses.

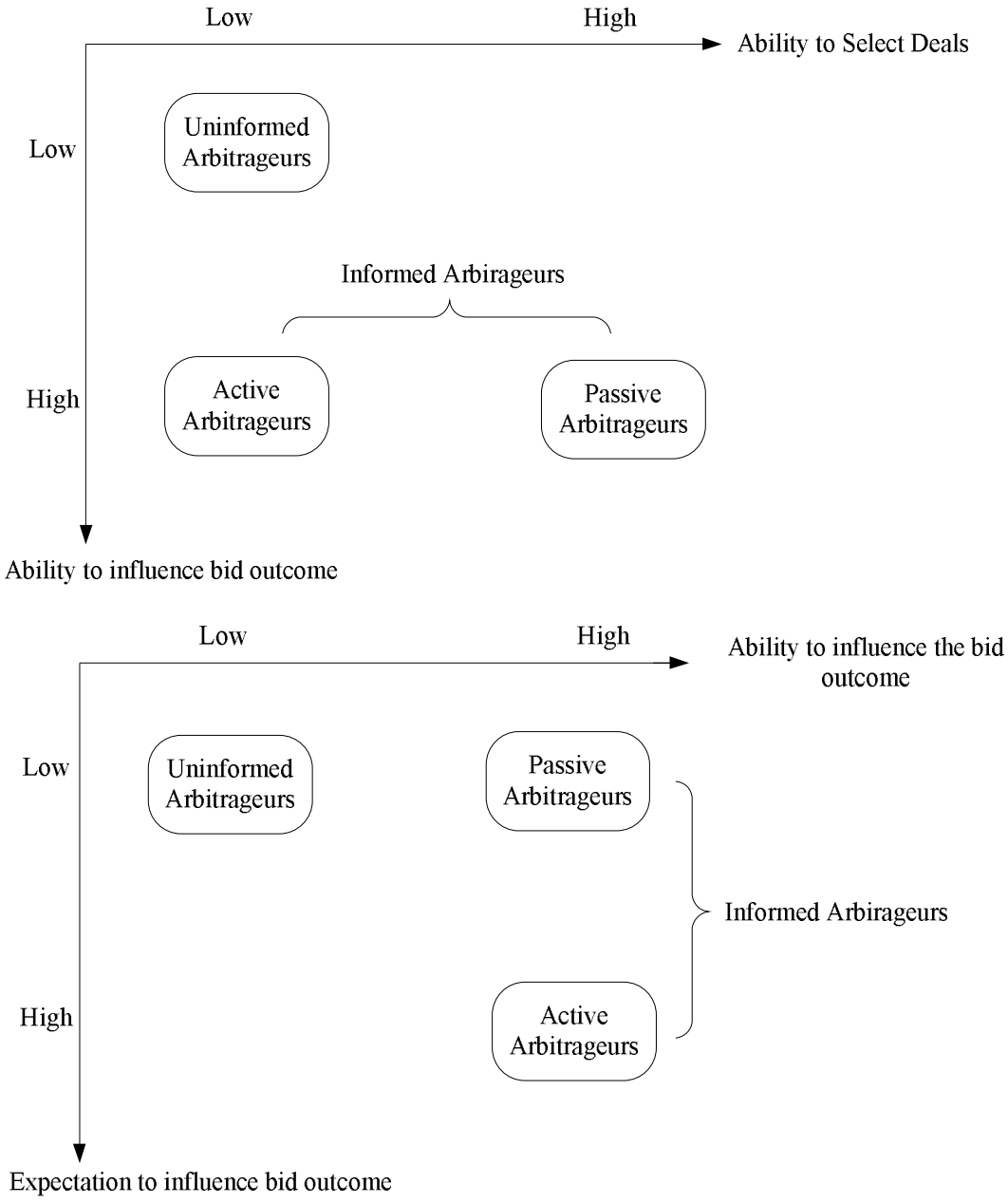

Figure 1: Comparison of different arbitrageurs' role on three dimensions: ability to select deals, ability to influence bid outcome and expectation to influence bid outcome.

As far as the informed arbitrageurs are concerned, their scores of each dimension depend on whether they play the role of passive or active investors. The passive investors, by our definition, have no expectation to influence the bid outcome. As informed investors, the passive arbitrageurs possess superior knowledge about the bid outcome, thereby having the ability to select the best deals for their portfolios. On the sample of 111 US cash tender offers from 1977 to 1983, Larcker and Lys (1987) find that the success rates of the offers in which arbitrageurs invest are significantly higher than the expected probability of success implied in the market prices. They postulate that arbitrageurs must have engaged in costly information acquisitions enabling them to obtain such superior knowledge. In the event that arbitrageurs incur substantial information costs, usually fixed costs, they may have to take large stakes in the target company so that the expected profits from the arbitrage position are sufficient to compensate for the information cost. In this scenario, the passive arbitrageurs become temporary large shareholders in the target firms; hence, they can influence the bid outcome. The mechanism for arbitrageurs to influence the bid outcome will be discussed later in section 2.2. In summary, the informed arbitrageurs in their passive role have no expectation to influence the bid outcome; due to their ex ante private knowledge about the bid outcome, they can select the best merger bids for their investments; and finally, when they acquire large stakes in the target firm, they have the ability to influence the course of the takeover bid.

The active arbitrageurs, by contrast, have ex ante expectation that they can influence the bid outcome. With such expectation, the arbitrageurs come to the game to purchase large blocks of target shares in order to be able to influence the bid outcome. As long as, the arbitrageurs can conceal their trading position, they become the only one who knows their presence. Because their presence can potentially affect the bid outcome, the knowledge about their own trading positions gives arbitrageurs an edge in trading with other investors in the market. As theoretically modelled by Cornelli and Li (2002), in contrast to the passive arbitrageurs, the active arbitrageurs do not possess prior private information about the outcome of the takeover; hence their abnormal returns do not come from their ability to select bids. Instead, the active arbitrageurs obtain the information advantage endogenously through their own action. Both the passive and the active arbitrageurs decide to get involved in the takeover

contest because they expect to earn positive abnormal returns. However, for passive arbitrageurs, the expectation to earn abnormal returns comes from their ex ante private knowledge about the bid outcome. The passive arbitrageurs will not come into the game if they do not have such knowledge in advance. For the active arbitrageurs, the expectation to earn positive abnormal returns interestingly is grounded upon the expectation to influence the bid. The active arbitrageurs take part in the game as long as they expect that they are able to influence the bid. This is the crucial point that differentiates the active arbitrageurs from the passive ones.

The way we characterize passive and active arbitrageurs is different from the approach suggested by Hsieh and Walkling (2005). Under their approach, arbitrageurs are active in the sense that they can influence the bid outcome, whereas the passive arbitrageurs cannot. As we argue earlier, if the passive but informed arbitrageurs can take large stakes in the target firm, they can as well be able to alter the course of the takeover bid. This leads to the inconsistency in Hsieh and Walkling's (2005) approach of categorizing arbitrageurs. In our approach, such inconsistency is corrected. Specifically, the active arbitrageurs differ from the passive ones in their expectation to influence the bid outcome; both the active and passive arbitrageurs have the ability to influence the bid outcome.

While our approach is conceptually sound in differentiating between the active and the passive arbitrageurs, it is difficult to implement because the expectation of the arbitrageurs is usually unobservable. Since arbitrageurs are likely to play both the active and the passive role at the same time (Hsieh and Walkling, 2005), in practice it might be better to consider these arbitrageurs in a common category: *'informed arbitrageurs'* as described in our approach. The informed arbitrageurs have the ability to select the best merger bids for their investment; also they can alter the bid outcome when they participate in the takeover game. The following table summarizes different arbitrageurs' roles along three dimensions and the sources of their abnormal returns in each role.

	Ability to select deals	Ability to influence bid outcome	Expectation to influence bid outcome	Source of abnormal return
Uninformed arbitrageurs	Low	Low	Low	Market inefficiency
Passive Arbitrageurs	High	High	Low	Ex ante private information about the bid outcome
Active arbitrageurs	Low	High	High	Knowledge about their own presence, which can influence the bid outcome

2.2. The Mechanisms for Arbitrageurs to Influence the Bid Outcome

In our classification of arbitrageurs' roles, the arbitrageurs as the informed investors, which can be either passive or active, have the ability to influence the terms and the outcome of the bid. The informed arbitrageurs have such ability as long as the arbitrage community can acquire large stakes in the target firm. There are two ways that arbitrageurs can affect the bid outcome. First, as modelled by Cornelli and Li (2002), the arbitrageurs help to solve the free-rider problem in takeover contest, thereby facilitating the takeovers. Second, as in Gomes' (2001) model, the arbitrageurs can exert influence on the bid because they can hold out the bid until the bidder offers good terms.

Cornelli and Li's (2002) model:

The presence of arbitrageurs in the takeover contest provides a solution to the classic free-rider problem propounded by Grossman and Hart (1980). To illustrate Cornelli and Li's (2002) model, we first discuss the free-rider problem.

In a value-enhancing takeover, the bidder perceives the equity value of the target as $V + r$, where V is the equity value of the target firm under the incumbent management and r is the additional value that bidder can obtain if it can control the target firm. To make a profit, the bidder will make an offer of $V + \pi$ to the target's

shareholders, where π is the bid premium and π is strictly less than r. Consider an individual shareholder, who holds a fraction α of the target's equity shares. Let call him *D*. He decides whether or not to tender based on the payoffs from his decisions. Let's look at *D*'s payoff matrix.

	Bid succeeds	Bid fails
Tender	$\alpha(V + \pi)$	αV
Not tender	$\alpha(V + r)$	αV

If we de note λ_1 and λ_2 as the probability that the bid would succeed in case *D* chooses to tender and chooses not to tender respectively, the expected payoff from each decision is:

When he chooses to tender:

$$\lambda_1\alpha(V + \pi) + (1 - \lambda_1)\alpha V = \alpha(V + \lambda_1\pi) \quad (1)$$

When he chooses not to tender:

$$\lambda_2\alpha(V + r) + (1 - \lambda_2)\alpha V = \alpha(V + \lambda_2 r) \quad (2)$$

D decides to tender only if the payoff in (1), the case he tender, is larger than the payoff in (2), the case he does not tender. Mathematically, the condition for *D* to tender is:

$$\lambda_1\pi > \lambda_2 r \quad (3)$$

When *D* is a small shareholder, i.e. α is very small, his tendering decision has very little impact on the probability that bid will go through. In other words, for small shareholders: $\lambda_1 \approx \lambda_2$. In this case, (3) is equivalent to:

$$\pi > r \quad (4)$$

This condition cannot be met because the bidder only offers bid premium π that is strictly smaller than the additional value r that he can bring to the target firm. Thus, when D is a small shareholder, his optimal choice is not to tender. Intuitively, since D knows that his tendering decision has no impact on the bid outcome, he would be better off if he chooses not to tender. By delaying his tendering decision, in the event that the bid succeed, D can share part of the enhancement value r, instead of receiving part of bid premium π, which is lower. In other words, D decides to 'free-ride' on the bidder's effort to enhance the target value. If the majority of the shareholders in the target are small shareholders like D, a value-enhancing bid can never succeed as those small shareholders will choose to free-ride. Thus, bidder faces the free-rider problem in its attempt to acquire the target.

According to Cornelli and Li (2002), the presence of arbitrageurs can help solve the free-rider problem because arbitrageurs play the role of the large shareholders. As argued before, the informed arbitragers, either passive or active, tend to take large stakes in the target firm. The passive arbitrageurs need to make big investments in order to compensate for their high fixed information costs. The active arbitrageurs derive their information advantage endogenously through their expectation to influence the bid outcome. To fulfil such expectation, the active arbitrageurs also need to obtain material stakes in the target firm.

To elucidate why large shareholder can be a solution to the free-rider problem, we analyze the tendering condition (3). In the event that D instead is a large shareholder, his tendering decision can have significant impact on the probability of bid success. If D chooses to tender, the bid has higher chance of going through. In other words, λ_1 can be substantially greater than λ_2. Thus, bidder can always choose some level of bid premium π less than the enhancement value r so that the tendering condition (3) can be satisfied. In such case, D*'s* optimal choice is to tender his shares. If the large shareholders control the majority of the target shares, the bid will succeed and the bidder can make a positive profit.

Cornelli and Li (2002) argue that thanks to arbitrageurs, even when only small shareholders constitute the target's pre-bid ownership structure, the bid still have the positive chance of success. After the bid announcement, arbitrageurs can accumulate shares and become the temporary large shareholders. As our analysis shows, the

arbitrageurs' optimal choice in this case is to tender their shares, thereby facilitating the takeover. However one question arises naturally from this line of argument. If the pre-bid ownership structure of the target firms already consists of several large shareholders, does the presence of arbitrageurs make any difference?

The answer is 'Yes' on two counts. First, if the number of shares controlled by the large shareholders is less than what needed for the bidder to take over the target, the free-rider problem is still inherent. Arbitrageurs can come in and make up for the shortage. Second, the large shareholders do not always facilitate the takeover process. Gaspar et al. (2005) report empirical evidence that whether the large shareholders favour the takeover bid is conditional on their investment horizons. In particular, short-term investors tend to sell their holdings and walk away, and therefore, speed up the takeover, whereas long-term investors tend to exert their power on the negotiating table and, contingent on the offer terms can deter or facilitate the bid. Thus, the impact of the large share ownerships on bid outcome is indeterminate at best (Sudarsanam, 1995). As long as arbitrageurs are concerned, owing to the fact that they only come to takeover game for the quick profits, it is likely that they are short term investors. Arbitrageurs' short-termism enables them to facilitate the takeover bid.

In Cornelli and Li's (2002) model, the arbitrageurs, as the short-term large shareholders in the target firm, help solve the free-rider problem and facilitate the takeover bid. Aware of such role of arbitrageurs, the bidder will increase the bid premium ex ante or revise the bid upward ex post to attract more arbitrageurs into the game. Thus, the model predicts positive relations between the presence of arbitrageurs and bid premium and the probability of bid success.

Gomes's (2001) model:

Gomes (2001) argues that arbitrageurs' role in the takeover game is not to solve the free-rider problem but to hold-out the bid until the bidder can offer more favourable terms. In his model, the bidder can overcome the free-rider problem via freezeout mechanism. In particular, the bidder makes an offer conditioned on the receipt of shares representing f percentage of the target equity, where f is the freezeout threshold, above which the bidder can compulsorily acquires the remaining shares at the offer price. Thus, if the bid succeeds, those small shareholders, who

choose to free-ride, are frozen-out and forced to convey their shares to the bidder. The value of f varies across jurisdictions. In the UK, under Section 428 to 430F (inclusive) of the Company Act 1985[2], f is equal 90% of the target equity. According to Gomes (2001), more than 90% of tender offers in the UK and in the US are freezeout-style offers.

To illustrate why the freeze-out offers can solve the free-rider problem, we come back to the shareholder *D*. In the context of a freezeout offer, if the bid succeeds, the remaining shareholders are forced to "enjoy" the bid premium and, as the result, will tender their shares. The payoff matrix is as followings:

	Bid succeeds	Bid fails
Tender	$\alpha(V + \pi)$	αV
Not tender	$\alpha(V + \pi)$	αV

It is clear that *D* receives the same payoffs regardless of his tendering decision; hence there is no room for *D* to free-ride on this freezeout-style bid. As suggested by Shleifer and Vishny (1986), *D*'s best response is to tender his shares because such action will enhance the chance that the bid will go through, even very slightly in case *D* is a small shareholder. When the bid succeeds, *D*'s wealth increases by the bid premium whereas his wealth remains unchanged if the bid fails. The reason for *D* to tender is even more compelling if the bidder is allowed to employ coercive bidding tactics[3] in this freezeout-style offer. For instance, the bidder can employ two-tiered offer, in which the minority shareholders, who choose not to tender, will receive a back-end price lower than the front-end offer price. Under such circumstances, the small shareholders will stampede to tender their shares.

[2] See Kenyon-Slade (2004)

[3] The coercive bidding tactics are generally prohibited by the UK City Code. See Comment and Jarrell (1987) for more detail about coercive bidding tactics in the US context.

Although the freezeout-style offer can solve the free-rider problem, there arises a paradox. Tendering is always a better choice for the target's small shareholders even if the bidder offers a small premium. This runs counter to the large amount of empirical evidence suggesting that the target shareholders on average receive substantial premium. According to Gomes (2001), bidder can only succeed with a low premium if the target ownership structure only consists of small shareholders. Due to the lack of co-ordination, these small shareholders' optimal choice is to tender even when the premium is not adequate.

The paradox can be resolved with the presence of arbitrageurs as the target's large shareholders. Thanks to their large stakes, one arbitrageur, in case he control sufficient shares, or a group of arbitrageurs can hold out the bid. In the UK market, where the bidder needs to obtain at least of 90% of the target's equity shares to conduct a freezeout merger, the arbitrage community only needs to accumulate 10% of target shares to be able to prevent the bidder from freezing out the remaining shareholders. The bidder, in anticipation of the arbitrageurs' hold-out power, will offer high pre-emptive bid or revise the bid upward to ensure that the arbitrageurs will tender their shares. Thus, Gomes' (2001) model also predicts a positive relationship between the presence of arbitrageurs and the bid premium. The relationship between the presence of arbitrageurs and the probability of bid success is not clear in Gomes' (2001) model.

As arbitrageurs can influence the bid outcome merely by playing the role of large shareholders, a similar question as in the case of Cornelli and Li (2002) arises. If the pre-bid ownership structure of the target firm already includes large shareholders, can arbitrageurs' hold-out power make any difference? Though the answer is 'Yes' in Cornelli and Li's (2002) model, it is a big 'No' in Gomes' (2001) model. The fundamental feature that makes arbitrageurs stand out as a good candidate to solve the free-rider problem in Cornelli and Li's (2002) model is their short-termism. However, in the hold-out context in Gomes' (2001) model, short-termism turns out to be a bad thing. If the bidder knows that those short-term investors are likely to hold out the bid,

it might not even care to offer high pre-emptive bid or revise the bid upward[4]. In the event that the bidder walks away, it is the short-term arbitrageurs that burn their fingers[5]. In fact, other larger shareholders are better than the arbitrageurs in playing the hold-out game because they are more likely to have longer investment horizon. This can be seen as a major weakness of Gomes' (2001) model. Due to this weakness, we will derive most of empirical implication for the paper based on Cornelli and Li's (2002) model.

2.3. Empirical Evidence

In our categorization, merger arbitrageurs play two major roles in the takeover game either as *uninformed investors* or as *informed investors*. In practice, as arbitrageurs are often the professional money managers, who invest on behalf of other investors for a hefty fee, it is likely that arbitrageurs play the role of the informed investors. Almost all the extant empirical studies, which focus on the profitability of the merger arbitrage strategy, nevertheless, implicitly assume that merger arbitrageurs are *uninformed investors.* The common feature of these studies is the way the arbitrage portfolio is formed. A takeover bid is added to portfolio whenever data necessary for computing arbitrage returns are available. Obviously such arbitrage portfolio is also accessible to the average uninformed investors in the market.

The real-world arbitrageurs are expected to be better than, at least different from, the average investors. When the informed arbitrageurs play the passive role, they possess superior knowledge about the bid outcome, thereby having the ability to select the best bids for their investment. What is more, they have the ability to influence the bid outcome as the target's large shareholders in the event that they play either passive or active role. The evidence about this type of arbitrageurs is nonetheless scant. We are aware of only two empirical studies on this subject.

First, Larcker and Lys (1987) examine 111 US cash tender offers, in which arbitrageurs have investment positions. The arbitrageurs are identified through 13-D

[4] This may explain the negative relationship between arbitrage holding and bid premium

[5] We would like to thank the PhD third review panel for suggesting this possibility.

filings. In the US, when an investor owns more than 5% of the outstanding shares, he must file a 13-D form, which clearly states the purpose of the investment. Larcker and Lys (1987) define arbitrageurs as those whose stated purpose in the 13-D filings is "arbitrage or other business activities". In their studies, the success rates of these 111 cash tender offers are significantly higher than the expected probability of success implied in the market prices. Furthermore, the arbitrage positions generate substantial annualized abnormal returns of 14.51%. According to Larcker and Lys (1987), the arbitrageurs engage in costly information acquisitions, as the result, are better informed about the bid outcome. The abnormal returns from the arbitrage position compensate the arbitrageurs for the information costs. The evidence provides support for the passive role of the arbitrageurs in the takeover process.

The second and more comprehensive study by Hsieh and Walkling (2005) investigates arbitrageurs' ability to influence the outcome and the terms of the bid on a sample of 608 US acquisition bids from 1992 to 1999. The study tests the common prediction of the two theoretical models proposed by Conelli and Li (2002) and Gomes (2001) that the presence of the arbitrageurs can have impact on the bid premium and the probability of bid success. Hsieh and Walkling (2005) recognized the passive role and the active role are not mutually exclusive. The arbitrageurs have the ability to choose better bids to invest in, and the presence of arbitrageurs is also influenced by the bid premium and the probability of bid success. As the result, these variables are likely to be jointly determined; in other words, they might be endogenously related.

By using the arbitrageurs' holdings of the target shares after the bid announcement as the proxy for their presence and employing a system of simultaneous equations to control for the endogeneity, the study find support for the active role of arbitrageurs. In particular, arbitrage holdings increase in the bids that are more likely to consummate even controlling for the market's assessment of the bid success. The authors use the changes in the arbitrage spreads over different time period after the bid announcement as the proxy for the market's assessment of the bid success. When the spread widens, the market would perceive that the bid is less likely to success and vice versa. At the same time, the changes in arbitrageurs' holdings are positively related to the bid premium, the probability of bid success, the probability of

bid revision, and the probability of the target firm receiving subsequent bids if the initial bid fails controlling for other factors that also affect the outcome of the bid.

To sum up, the extant empirical evidence points to the fact that arbitrageurs are more likely to be informed investors. The arbitrageurs have superior knowledge about the bid outcome; hence they can choose the best bids for their arbitrage positions. This illustrates the passive role of arbitrageurs. Furthermore, the presence of arbitrageurs is also reported to have significant impact on the outcome of the bid. According to our discussion in section 1.1, arbitrageurs, in their passive role or active role, can have the ability to influence the bid outcome. Thus, the evidence so far provides support for either role.

3. Hypotheses Development

3.1. Arbitrageurs as informed investors

As the main purpose of the paper is to perform empirical investigation into how the roles of arbitrageurs can explain the sources of merger arbitrage abnormal returns, we will first derive the hypothesis that link the presence of arbitrageurs with arbitrage returns.

The first hypothesis is predicated on the presumption that arbitrageurs are *informed investors.* As we argue earlier, the presumption is justified by the fact that the real-world arbitrageurs are often professional money managers. Thus, they have both the resources and the ability to be informed about the outcome of the takeover bids. In our categorization, the informed arbitrageurs can be either passive or active. The passive arbitrageurs become *'informed'* through their external or internal research; hence they incur information costs. The active arbitrageurs, on the other hand, acquire private knowledge about the bid outcome through their own action. In practice, it is likely that the arbitrageurs play both the active role and the passive role at the same time. The arbitrageurs decide to become a player in the takeover game because they possess the ex ante private information about the bid outcome and also have the expectation to influence the bid outcome.

Given the presumption about informed arbitrageurs, we should expect a positive relationship between the presence of arbitrageurs and arbitrage returns. The fact that

arbitrageurs are better informed than the average investor in the market is supported if the positive relationship holds when we control for other public information about the bid. Cornelli and Li (2002) also suggest that the relationship between the presence of arbitrageurs and arbitrage returns may be non-linear. The competition among a large number of arbitrageurs during the takeover bid may drive up the price and therefore reduce profits. Thus, if arbitrageurs play either the passive role or the active role, there may be a non-linear relationship between returns and the presence of arbitrageurs. Below some level of arbitrageurs' presence, the relationship is positive. The relationship turns negative above that level. There comes the first hypothesis

Hypothesis 1*: arbitrage return is increasing with the presence of arbitrageurs when the level of arbitrageurs' presence is below a certain threshold but is decreasing with the presence of arbitrageurs when the level of arbitrageurs' presence is above that threshold.*

It is noted that we do not assert any causal link between arbitrage returns and the presence of arbitrageurs. As will be discussed in greater detail in section 4.1, arbitrage returns may be endogenously related to the presence of arbitrageurs. When arbitrageurs are informed about the bid outcome, they adjust their investment accordingly. However, the arbitrage investment can affect the bid outcome variables, which also can influence arbitrage returns.

3.2. The impact of UK takeover regulations

The second hypothesis tests the theoretical prediction in Cornelli and Li's (2002) model about the condition for the informed arbitrageurs to influence the bid outcome. As the discussion in section 2.2 points out, arbitrageurs have the ability to alter the course of the takeover process because they become the temporary large shareholders in the target firm after the bid announcement. Thus, the prerequisite for arbitrageurs to affect the bid outcome is that they can acquire large stakes in the target firm. As arbitrageurs come to the takeover game not to influence the bid outcome but to make profits, the condition should be stated such that the arbitrageurs expect to earn positive abnormal returns via their participation in the game. Cornelli and Li's (2002) argue that the condition can be fulfilled only if arbitrageurs can hide their presence.

As long as the informed arbitrageurs can conceal their presence in the process of becoming the target's large shareholders, their information advantage give them an edge in trading with other target shareholders, thereby enabling them to earn positive abnormal returns. If the arbitrageurs have to reveal their position too soon, the prevailing market price will reflect, at least some part of, their private information. In this scenario, the information advantage may disappear before they can obtain large stake in the target firms. Consequently, arbitrageurs have little room to influence the bid outcome.

According to Cornelli and Li (2002), arbitrageurs can hide their position via two channels. First, noise traders, as in the trading models propounded by Kyle (1985) and Kyle and Vila (1991), may provide camouflage for the arbitrage community. Hsieh and Walkling (2005) report that in those bids, where the abnormal trading volumes of the target shares are high, the empirical evidence about the arbitrageurs' ability to influence the bid outcome become more pronounced. Abnormal trading volume is the proxy for the amount of noise trading in target shares. The higher the noise trading is, the easier arbitrageurs are able to hide their trades. Second, each arbitrageur only acquires the target shares up to the threshold that triggers disclosure obligation (e.g. in US, UK, it is 5%, 1% of the target shares respectively[6]).

The disclosure rule is of great importance in enabling the arbitrageurs to affect the bid outcome because the noise traders can only provide camouflage for arbitrageurs as long as they own less target shares than the disclosure threshold. Empirical testing about the impact of disclosure rule on the arbitrageurs' ability to influence the bid outcome is generally a thorny issue. As disclosure rules are set at country level, the test must involve cross-country studies with significant differences in the rules. As the evidence for the US market is already available, it is imperative to perform empirical tests in other country with different disclosure rules.

In this paper, we argue that the UK context neatly fits such profile. The UK disclosure rules are remarkably different from those in the US. More importantly, the

[6] The maximum amount of target shares that trigger disclosure obligation varies among countries. In the US, the threshold is 5%; in the UK it is 1%. Please see Kenyon-Slade (2004) for more details.

difference is one-directional. As will be articulated later, the UK disclosure rules during the merger period are much stricter than their US counterpart. Thus, by empirically examining the arbitrageurs' ability to influence the bid outcome in the UK and compare the result with the US study by Hsieh and Walkling (2005), we can see the impact of disclosure rules on the arbitrageurs' ability to affect the outcome of the takeover bid.

The disclosure rules during the takeover period are the regulatory response to secretive stake building. The rationale behind the rules is to allow the current shareholders of a potential target firm to be informed about any possible imminent takeover offer. If the bidder is not required to disclose their share ownership, it can secretly acquire a large stake at the current, possibly undervalued market price and then announce the offer. In this way the acquiror can reduce the acquisition cost and may be able to coerce the remaining shareholders to tender their shares at a lower price.

In the US, section 13(D) of the Securities Exchange Act and Rule 13D-1(a) of Regulation 13D provide that any person who, directly or indirectly, acquires "beneficial ownership" of 5% or more of any class of equity security that is subject to the provisions of Section 13(D) shall file a disclosure statement on Schedule 13D with the SEC within 10 days after the acquisition. In the UK, under rule 8 of the UK City Code on takeovers, during an offer period a party has to disclose its all trading as long as having interest in more than 1% of the target share and the disclosure has to be made on the next business after the date on which the trading occurs.

It is quite clear that the UK the disclosure is much stricter on two accounts. First the disclosure threshold is considerably lower (1% in the UK versus 5% in the US). Second, the timetable for disclosure is very lax in the US. In the UK because the disclosure must be made on the next business, there is little chance for arbitrageurs to accumulate more than 1% of target shares in secrecy. If they start buying too many shares in one day, their presence will be uncovered from a surge in trading volume. In the US, the arbitrageurs have 10 days to accumulate more shares in excess of 5% threshold. As the result, it is considerably easier for US arbitrageurs to become a large shareholder of the target firm before having to reveal their identity. Mikkelson and Ruback (1985) find that the average size of the investment recorded in 479 13-D

filings is 21.38 percent of the target outstanding shares, which is more than 4 times larger than the threshold.

The lax disclosure rule in the US may help explain the significant empirical support for the active role of arbitrageurs reported by Hsieh and Walkling (2005). However if the impact of the disclosure rule is true, we should expect a much less active role on the part of UK arbitrageurs due to their difficulty in hiding their position. There comes our second hypothesis:

Hypothesis 2: *In the UK market, arbitrageurs' presence during the takeover has little impact on the outcome and the terms of the bid. More specifically, arbitrageurs' presence has little impact on bid premium and the probability of bid success.*

Cornelli and Li's (2002) theoretical model is predicated on the assumption that arbitrageurs can effectively hide their presence and predict that there is a positive relationship between the presence of arbitrageurs and bid premium and the probability of bid success. The above argument indicates that due to the UK's strict disclosure rule it is very difficult for arbitrageurs to hide their position. Thus we would expect a different relationship between arbitrage holding and those bid outcome variables. As the model predict a positive relationship, we should expect that the relationship turn to zero or statistically insignificant.

4. Methodology

4.1. Empirical Tests

The first hypothesis examines the relationship between the presence of arbitrageurs and arbitrage returns. To test the hypothesis, the following equation needs to be estimated

$$R_i^A = \alpha_0 + \alpha_1 holding_i + \alpha_2 holding_i^2 + \sum_{j=3,k} \alpha_j X_{ij} + \epsilon_i \qquad (5)$$

where R_i^A is annualized arbitrage returns, $holding_i$ is the percentage of the target's equity shares purchased by the arbitrage community, X_{ij} is the set of control variables, ϵ_i is the error terms in the equation, and the subscript i denotes the takeover bid i in the

sample. As will be discussed in the next section, the set of control variables in X_{ij} represent the public information at the time the bid is announced. Under the presumption of the first hypothesis, arbitrageurs are informed investors. As the result, the first hypothesis would indicate a positive relation between arbitrage holding and arbitrage returns when X_{ij} are controlled for. A significant positive α_1 would provide evidence supporting the fact that arbitrageurs are better informed than the general market. The variable $holding_i^2$ is included to control for the possible non-linear relationship between arbitrage returns and arbitrage holdings. As more arbitrageurs entering the game, the heightened competition will increase the price and reduce returns. If the non-linear pattern exists, we would expect $\alpha_2 < 0$.

To test the second hypothesis about the arbitrageurs' ability to alter the course of the takeover process, we estimate the following equations:

$$Premium_i = \beta_0 + \beta_1 holding_i + \sum_{j=2,k} \beta_j X_{ij} + u_i \quad (6)$$

$$Prob(Success_i) = \gamma_0 + \gamma_1 holding_i + \sum_{j=2,k} \gamma_j X_{ij} + v_i \quad (7)$$

where $Premium_i$ is the bid premium, $Prob(Sucess_i)$ is the probability of bid success, X_{ij} is the set of control variables, and u_i and v_i are the error terms in these equations. According to the second hypothesis, due to the strict UK disclosure rules, the UK arbitrageurs have little chance to exert influence on the bid outcome. In other words, when other variables that can affect the outcome of the bid are taken into account, arbitrage holdings should have no impact on the probability of bid success and bid premium. Thus, we expect that β_1 and γ_1 are all equal to zero.

Estimation:

Before discussing the methods to estimate the set of equations from (5) to (7), we first examine whether or not these equations are sufficient in capturing the relations between arbitrage return, bid outcome variables, i.e. bid premium and probability of the bid success, and arbitrage holding. As the common structure of equation (5)-(7), arbitrage holding is placed at the right hand side of the equation as the explanatory

variable. Thus, if we presume that these equations can model the true relationships between these variables, we impose another implicit assumption such that arbitrage holding is exogenous variable, that is, it is determined outside these models. This assumption seems tenuous, nevertheless. As argued in section 3.1, since arbitrageurs are likely to be informed investors, their decision to enter the game, hence arbitrage holding, is influenced by arbitrage returns and bid outcome variables. For instance, arbitrageurs might increase their purchase of target shares in those bids with higher expected returns, higher bid premium and higher probability of bid success. If this is true, the set of equations from (5) to (7) are inadequate in modelling the relationship between arbitrage returns, bid outcome variables and arbitrage holding. We need to add the following equation that shows the determinants of arbitrage holdings into the system:

$$holding_i = \varphi_0 + \varphi_1 R_i^A + \varphi_2 Premium_i + \varphi_3 Prob(Success_i) + \sum_{j=3,k} \alpha_j X_{ij} + e_i \qquad (8)$$

All variables in equation (8) are described in equation (5)-(7) except for e_i, which is the error term of the equation.

The system of the equations from (5) to (8) seems to be general enough to model the relationship between arbitrage holding and arbitrage return and bid outcome variables. Conditional on the true value of the parameters in equation (8), different estimation methods can be applied. There are two main scenarios:

Scenario 1

Arbitrage holding is not influenced by arbitrage returns and bid outcome variables ($\varphi_i = 0$, for all $i = \overline{1,3}$). In this scenario, we can discard equation (8) from the system. The initial set of equations from (5) to (7) is sufficient to model the relationship among the variables of interest.

Assuming there is no measurement error or omitted variable, the assumption that arbitrage holding is exogenous variable is maintained. As the result, we can estimate each equation using standard procedure. When the dependent variables are continuous, as in the case of equation (5) and (6), Ordinary Least Squares (OLS)

method can be employed. When the dependent variable is binary, as in the case of equation (7), logistic regression can be applied.

Scenario 2

Arbitrage holding is determined by arbitrage returns or at least one of the bid outcome variables ($\varphi_i \neq 0$, for at least one $i = \overline{1,3}$). To clearly illustrate this scenario, consider the simplest case where only one of the main independent variables in equation (8) is significant, say, bid premium. This means that $\varphi_2 \neq 0$, and $\varphi_1$and φ_3 are equal to 0. Because arbitrage holding is not influenced by arbitrage return and the probability of bid success, it is exogenous variable in equation (5) and (7). Hence, for these two equations, standard estimation procedures can be applied.

Turning to equation (6), the independent variable, arbitrage holding, is partially determined by the dependent variable, bid premium. In other words, arbitrage holding and bid premium are jointly determined. In such case, Wooldridge (2002) shows that arbitrage holding would correlate with the error term of the equation. Thus, it becomes endogenous independent variable. In the presence of endogeneity, the OLS methods will give biased and inconsistent estimates of equation (6). The traditional solution to the endogeneity problem is to find appropriate instrument variables (IV) for the endogenous variable and then use the IV estimators to get the consistent estimates of the coefficients. According to Larcker and Rusticus (2008), when the endogeneity problem arises from the fact that the independent variable is partially determined by the dependent variable, there are two general approaches to obtain the IV estimators. First, we can estimate equation (6) independently using 2 stages least squares (2SLS) regression. Second, we can estimate both equation (6) and (8) concurrently in a system of simultaneous equation using 3 stages least squares (3SLS). While the system estimation method with 3SLS is more efficient than the single-equation estimation with 2SLS, the former implies more effort needed in finding appropriate instrument variables. As the 3SLS method use the information of one equation in estimating other equations in the system, in order to obtain consistent estimates for one equation it would require appropriate instrument variables for the endogenous variables in all equations in the system. The 2SLS method, by contrast,

only requires the appropriate instrument variables for the endogenous variables in the equation of interest.

In this simplest case of the second scenario, to estimate equation (6) we would need to find instrument variables for both arbitrage holding and bid premium if 3SLS is employed, whereas in case 2SLS is employed, only instrument variables for arbitrage holding are needed. In a more general case where we expect that arbitrage holding is also determined by arbitrage returns and bid outcome variables, to estimate equation (5)–(7), we would need instrument variables for 4 variables – arbitrage holding, arbitrage returns bid premium, and probability of bid success – if 3SLS is chosen but only need instrument variables only for arbitrage holding if 2SLS is employed.

If finding appropriate instrument variables is an easy task, the straightforward estimation option should be 3SLS. However, it is actually a very daunting task (Maddala, 1986; Stock, et al., 2002). As pointed out by Larcker and Rusticus (2007, 2008), in most practical applications, the instrument variables are less than ideal, which means that the IV estimators are often biased and inconsistent. Such bias and inconsistency are magnified through the 3SLS procedure. Thus, Larcker and Rusticus (2008) suggest that even when the researchers choose to use 3SLS, he/she should also report the 2SLS result. The result from 3SLS is valid only if it is similar to the one from 2SLS.

Given the fact that we need to find appropriate instrument variables for much less number of endogenous variables if 2SLS is employed compared to the circumstance under which 3SLS is employed (1 versus 4), 2SLS is clearly the better method in our case. Furthermore, the dependent variable in equations (7), that is the probability of bid success, is not observed and need to be estimated by logistic regression. As logistic regression use maximum likelihood method rather than least squares method to estimate the coefficients, it is impossible to simultaneously estimate equation (7) with equation (8) using 3SLS. As will be discussed in more detail in section 6.2 , for this equation, a variation of 2SLS method can be applied to resolve the endogeneity problem. For all these reasons, in this paper, 2SLS will be the preferred method of dealing with the possible endogeneity problem.

In the first scenario, we assume that endogeneity is not present, as the result we can apply standard approach, that is, OLS and logistic regression, for estimation. In the second scenario, endogeneity is assumed and the proper estimation procedure is argued to be 2SLS. In practice, as we are often not sure which scenario will transpire, we need to perform statistical test to determine whether endogeneity is present. As suggested by Larcker and Rusticus (2008) because the IV estimators are always less efficient than OLS, in the absence of endogeneity, OLS should be the preferred option.

The common test for endogeneity is the Hausman (1978) test. As shown by Larcker and Rusticus (2008), the validity of Hausman test is contingent on the appropriateness of the instrument variables. An appropriate instrument variable has to meet two requirements. First, it is not correlated with the error term of the equation. This requirement is equivalent to the statement that the instrument variable is exogenous. Second, it has non-zero correlation with the endogenous variable. The IV estimators conducted through 2SLS are consistent as long as both of these requirements are satisfied. Thus, Larcker and Rusticus (2008) suggest the first step in the empirical procedure to deal with the endogeneity problem is to show that the instrument variables are valid. We will describe the tests for valid instrument variable in more detail in section 6.1. In the next section, we will discuss the set of control variables employed in equation (5)-(8).

4.2. Control Variables

Mood of the offer The mood of the offer refers to whether the offer is hostile or friendly. In a hostile offer, the target management oppose to the offer, whereas in a friendly one, the target management usually recommend the offer to the target shareholders. The mood of the offer is found to be the most important determinant of the bid outcome (Schwert, 2000). Walkling (1985) reports that the hostile bids have about 33% lower chance to go through compared to the friendly bids.

Managerial ownership Given that the target management's attitude toward the bid have such powerful influence on the bid outcome, it is logical that the managerial ownership should also affect the bid outcome. Significant share ownership gives managers more room to deter or facilitate the bid. The direction of the impact of the

managerial ownership on the outcome of the bid depends on the mood of the offer. In hostile bids, the impact is negative as large managerial ownership helps target managers to block the bid more effectively. The impact, by contrast, is positive in friendly bids because managers favour the bid in those situations. The existing empirical evidence on the impact on managerial ownership on bid outcome is inconclusive. Song and Walkling (1993) find that the level of managerial ownership is significantly related to the outcome of hostile bids but not to the outcome of friendly bids. Sudarsanam (1995) reports that although the managerial ownership is inversely related to the probability that a hostile bid will go through, the relationship is statistically insignificant.

Large shareholders' ownership As discussed in section 2.2, the merger arbitrageurs as the target's large shareholders can help solve the free-rider problem, thereby facilitating the takeover process. The presence of arbitrageurs enhances the probability of bid success due to arbitrageurs' short-termism. Thus, whether large share holders facilitate or block the bid is conditional on their investment horizon. According to Gaspar et al. (2005), short-term investors tend to sell their holdings walk away, and therefore, speed up the takeover; long-term ones tend to exert their power on the negotiating table and contingent on the offer terms can hold out or facilitate the deal. Thus the impact of large shareholders' ownership on the bid outcome is indeterminate at best (Sudarsanam, 1995).

Arbitrage Spread The spread is defined as the percentage difference between the initial offer price and the target stock price one day after the bid announcement date. The spread reflects the prevailing market wisdom about the bid outcome. Brown and Raymond (1986) and Samuelson and Rosenthal (1986) document that the movements of post-announcement target share price provide accurate forecast about the final outcome of the takeover bid. Jindra and Walkling (2004) perform a comprehensive study about the information content of the arbitrage spread. The study reports that while controlling for other ex ante bid characteristics, the spread yields excellent prediction about the realized terms and outcome of the bid. In particular, successful bids are associated with higher arbitrage spreads; the chance that the bid is revised upward is negatively related to the spread; and bid duration is positively related to the spread. In around 23% of the cases, the spreads become negative implying the market

perception about an imminent upward revision by the original bidder or a higher offer from other bidders.

Methods of payment An equity offer may give rise to the problem of information asymmetry between the target and the bidder shareholders (Hansen, 1987). The target shareholders may assume that the bidder chooses to use equity offer only when the bidder's stock is overvalued. Therefore, an equity offer is more likely to trigger resistance from target shareholders. The problem of information asymmetry does not associate with cash offers. Furthermore, in the case of equity offers, the process of issuing equity often require the approval of the bidder' shareholders. As the result, in stock mergers, approvals from both the bidder's and target's shareholders are required, whereas in cash mergers only approval from the target's shareholders is needed. Thus, cash offers might have higher chance of success than equity offers.

Toehold Toehold is another name for the bidder's pre-bid share ownership in the target. Hirshleifer and Titman (1990) argue that acquiring toehold can help solve the free-rider problem in a value enhancing takeover bid, hence increase the chance the bid will go through. Furthermore, toehold reduces the number of shares that the bidder needs to acquire in order to gain control of the target. Given the toehold, the bidder can bid more aggressively by raising the bid premium as the additional premium is only paid for the shares acquired during the bid not on the toehold (Singh, 1998). In a multi-bidder contest, such aggressiveness would frustrate other rival bidder, thereby enhancing the probability of success for the original bidders. Thus, it is expected that toehold has positive impact on the probability of the bid success.

Irrevocable Undertaking Irrevocable Undertaking represents the number of target shares that a shareholder or a group of shareholders of the target firm commit to tender to the bidder. The information about the irrevocable undertaking is disclosed in the offer document. For example, in its bid for Seet Plc on 21 March 2001, Cosalt Plc discloses in the offer document that it receives written irrevocable undertaking to accept the bid from directors of Seet Plc and other shareholders in respect of 9.03 million shares representing 50.3% of the issued share capital of Seet Plc. It is expected that the larger the number of shares included in the irrevocable undertaking,

the higher the chance that the bid is successful. To our best knowledge, this variable has not been used in any empirical tests about the factors influencing the bid outcome.

Scheme of Arrangement In the UK, the bidder can acquire the target via a general offer or a scheme of arrangement (Kenyon-Slade, 2004). In a general offer, the bidder makes a cash or equity offer to the target shareholders. This is the most popular form of conducting a takeover. In a scheme of arrangement, under section 425-27 of the Company Act 1985, an application is made to the court by the target firm in order for the court to direct meetings of relevant classes of shareholders. There are two reasons why a takeover conducted via a scheme of arrangement has higher chance of success. First, as the application for the scheme must be made by the target, the deal is always a friendly one. Second, in the scheme, the bidder ends up owning 100% of target's shares if it obtains the approval for the scheme from the target shareholders representing 75% of the total share ownership of those shareholders who are present and vote at the meeting. In case of a general offer, the bidder is sure that it can own all the target's shares only when it acquires 90% of the share ownership of all target's shareholders not just the ones present at the meeting.

Termination fee A target termination fee, or inducement fee[7], clause requires the target firm to pay a fixed cash sum to the bidder if specified events occur which have the effects of preventing the bid from proceeding or causing it to fail. As a typical example of such specified events, the target management recommend a higher competing bid. On a US sample of 2511 takeover bids from 1988 to 2000, Officer (2003) find that the inclusion of the termination fee term is associated with approximately 4% higher bid premium and increases the likelihood that the bid is successfully completed by almost 20%. In the UK, under Rule 21.2 of the City Code, the termination fee is capped at 1% of the offer value, while in Officer (2003) study, the average termination fee is equal 3.8% of the offer value. Thus, in the UK context, the impact of termination fee clause on the bid outcome is expected to be less pronounced than in the US context.

[7] The term 'inducement fee' is used in the UK takeover code but it has the same meaning as the term 'termination fee' or 'breakup fee' used in the US context. See Kenyon-Slade (2004, p631) for more detail.

Contested bid Contested bid refers to the situation when two or more bidders are competing to acquire one target. The situation added more uncertainty about the bid outcome. Walkling (1985) and Jennings and Mazzeo (1993) document that the emergence of new bidders in the process decreases the probability that the original bidder can successfully consummate the bid. From the arbitrageurs' perspective, though the situation increases the risk of the arbitrage position, the potential returns are higher. In a contested bid, it is more likely that the bid is revised upward by one of the bidders.

Transaction Value The probability of a successful bid may decrease with transaction value. In a horizontal merger, a large deal is likely to trigger regulatory concern about anti-trust issue. Moreover, bidder may find it more difficult to obtain sufficient funds to finance a large takeover bid. Consequently, the bidder is forced to offer a small premium, thereby lowering the chance that the bid can go through.

Bid Duration This is the only controlled variable that is unobservable at the bid announcement date. As the annualized arbitrage return is also a function of the bid duration, this variable accounts for the cross-sectional variation in arbitrage return stemming from the differences in bid duration.

4.3. Arbitrage returns calculation

To take into account the difference in the durations of takeover bids, we use the annualized returns as the measure of the returns to each arbitrage position. To come up with the annualized returns, we first compute the daily return to individual arbitrage positions. The return to the arbitrage position in a single bid on day t (day 0 is the announcement date) is the ratio of the change in the position value on day t to the position value on day $t-1$. As the particular investment tactics are dependent on the bid's form of payment, the return calculation differs between cash and stock bids.

For cash bids, because the arbitrage position includes only a long position in the target stock, the position value per one stock is the market price of the target stock. The change of the position value at day t is computed based on the changes in the target stock price and the dividend paid by the target firm. The equation to calculate the daily return to a position in a cash bid on day t is:

$$R_{it} = \frac{P_{it}^T + D_{it}^T - P_{it}^T}{P_{it-1}} \quad (9)$$

where R_{it} is the return to the investment in bid i on day t , P_{it}^T and P_{it-1}^T are the target stock price at the close of the market on day t and $t-1$ respectively (superscript T refers to "target") , D_{it}^T is the dividend paid by the target firm of deal i on day t. In case the cash bid is revised, equation (1) is still applicable. As the arbitrageurs only hold long position in the target stocks, the revision does not affect the structure of the investment in a cash bid.

The merger arbitrage position in a stock merger includes a long position in the target stock and a short position in the bidder stock. To capture the arbitrage spread, for every long position in one target stock, arbitrageurs short δ bidder stocks, where δ is the exchange ratio i.e. the number of bidder stocks in exchange for one target stock. As the arbitrage position is created in day 1, for every long position in the target stock, the arbitrageurs receive the proceeds from the short position in the bidder stock equivalent to δP_{i1}^B, where P_{i1}^B is the price of the bidder stock of bid i on day 1 (superscript B refers to "bidder"). In practice, the arbitrageurs have to put the proceeds from the short position as the cash collateral and may earn interest on the cash collateral (D'Avolio, 2002). Assuming that the rate of return on the cash collateral is the risk-free rate, cash collateral plus cumulative interests on day $t-1$ per one bidder stock being shorted is $P_{i1}^B\left(1 + r_f\right)^{t-2}$, where r_f is the daily risk-free rate for the period from day 1 to day $t-1$, and P_{t-1}^B is the bidder stock price at the close of the market on day $t-1$.

The value of the arbitrage position on day $t-1$ is the amount that arbitrageurs receive if they choose to close the position. In particular, for every long position in one target stock, the arbitrageurs receive the cash from selling the target stock (P_{it-1}^T), the cash collateral plus the cumulative interests from day 1 ($\delta P_{i1}^B\left(1 + r_f\right)^{t-2}$) ; the arbitrageurs have to pay to buy back the bidder stocks (δP_{it-1}^B). The change in the value of the arbitrage position is computed based on the movement of the bidder and target stock price, the dividend paid by the bidder firm and the target firm and the

interest on the cash collateral. The final equation to calculate the daily return to the arbitrage position in a stock deal is:

$$R_{it} = \frac{(P_{it}^{T} + D_{it}^{T} - P_{it-1}^{T}) - \delta(P_{it}^{B} + D_{it}^{B} - P_{it-1}^{B} - r_f P_{i1}^{B})}{P_{it-1}^{T} - \delta[P_{it-1}^{B} - P_{i1}^{B}(1 + r_f)^{t-2}]} \qquad (10)$$

In case the stock bid is revised, the exchange ratio δ and hence the proceeds from shorting the bidder stock change. Thus, for stock bids that subject to revision, equation (2) cannot be used to compute the arbitrage return throughout the bid period. Following Mitchell and Pulvino (2001), when a stock bid is revised, we consider the revised bid as a new bid and apply equation (2) to calculate the returns to the arbitrage position starting from the revised date to the next revised date or to the resolution date.

The compound returns to the arbitrage investment in bid *i* over the duration of the bid is:

$$R_{ci} = \prod_{t=1}^{K_i}(1 + R_{it}) - 1 \qquad (11)$$

where R_{ci} is the compound returns to the arbitrage investment in bid i, K_i is the number of trading days from announcement date to the resolution date of bid i. For successful bids, the resolution date is the date on which the bid is declared completed or unconditional as reported in SDC. For failed bids, the resolution date is one day after the date on which the bid is withdrawn.

Finally the annualized returns are obtained from the daily returns using the following equation:

$$R_i^A = \frac{R_{ci} \times N_i}{365} \qquad (12)$$

where R_i^A is the annualized returns to the arbitrage investment in bid i and N_i is the number of calendar days from the announcement date to the resolution date.

5. Data and Sample selection

5.1. Takeover sample

Data about the UK takeover bids are taken from Thomson on-line SDC database. Data about arbitrage holdings, the variables we will use as a measure of arbitrageurs' presence, are manually picked up from Perfect Filings. Our sample covers the period from 1/1/1997 to 31/12/2007.

To be included in our initial sample, the following criteria must be met:

- The bidder is seeking to control more than 50% of the target shares.

- The bid announcement date is from 01/01/1997 to 31/12/2007

- The bid's consideration structure is either pure cash or pure stock. In cash bids, the bidder offers cash in exchange for the target's shares. In stock bids, a fixed number of the bidder's shares are exchanged for each target share.

- For cash bids, the target must be a public company listed on a UK stock exchange; for stock bids, both bidder and target are required to be publicly traded companies.

- The bid duration, which is the number of days between the announcement date and the resolution date, is at least 21 days. For successful bids, the resolution date is the date on which the bid is declared to be effective or unconditional in case the effective date is not available in SDC. For failed bids, the resolution date is the day after the date the bid is withdrawn. Under Rule 31.1 of the City Code, an offer must remain open for a minimum of 21 days following the date on which the offer document is posted. This justifies the requirement.

These criteria result in the initial sample of 720 takeover bids. In several bids, the offer price is missing. After searching and reading through the offer documents downloaded from Perfect Filings to fill in the missing information, we discard 8 bids. For the remaining bids, we requires that the target share price is available in Datastream for the period starting 160 days prior to the bid announcement and ending at the bid resolution date defined above. For stock bids, we also require the

availability of bidder's share price during the offer period. These requirements further reduce the sample by 59 bids. The final sample consists of 653 UK cash and stock mergers over the period of 01/01/1997 – 31/12/2007.

Table 2 presents some descriptive statistics for the sample of the UK takeover bids. Around 80% of the bids in the sample are paid for in cash. The percentage of cash bids is similar to the typical US samples (Mitchell and Pulvino, 2001; and Baker and Savasoglu, 2002). For both stock and cash bids, the mean of transaction value is much larger than the median implying that there are a few very large deals in the sample that skew the distribution of the variable. The success rate, the percentage of the bids that finally go through, is 82% and varies considerably throughout the sample period. The success rate of cash bids is not distinguishable from that of stock bids. A paired comparison test, which is not reported for brevity, confirms this fact.

[Insert Table 2 here]

5.2. Identification of arbitrageurs and their holding

As there is no database which enumerates the identity of merger arbitrageurs, we follow the empirical procedure similar to the one adopted by Baker and Savasoglu (2002) and Hsieh and Walkling (2005) to identify arbitrageurs and their holdings of target shares. Arbitrageurs are those who actively purchase the target' shares during the offer period. We rely on the trading disclosure filings to London Stock Exchange to record the purchases of arbitrageurs.

In the UK, under rule 8 of the City Code, any party must disclose all their trades in the shares of an entity involved in mergers if the party has interest in more than 1% of the entity's share. The party has to make a filing on the next working day after the date on which the trading occurs. We collected all trading disclosure filings under rule 8 from Perfect Filings database. Because the filing has to be made the next day, each filing can typically report all the trades in only one day. If a party purchases the target share throughout the merger period, it may have to submit dozens of filings. Thus in case dozens of parties decide to buy the target's shares, hundreds of filings will be submitted in a takeover bid. To get the number of target's shares that each party purchases in a bid, we need to manually pick up the figures from each filing and

aggregate them. This is an arduous process that took us more than 7 months to complete.

After collecting the holdings of target's shares by all parties in all takeover bids in the sample, we follow the procedure suggested by Baker and Savasoglu (2002) and Hsieh and Walkling (2005) to identify the arbitrageurs. In particular, we categorize those parties who purchase the target's shares in at least 8 different bids as arbitrageurs. As arbitrageurs enter the takeover game to make a short-term bet on the outcome of the bid, we discard the parties having long-term strategic interest with the bidder or the target firm. Hence, we exclude all parties that quote the reason of submitting the filings as being the bidder's or the target's associate. After pinning down the identity of the arbitrageurs, the arbitrage holding in a bid will be the total of the holdings of all individual arbitrageurs in that bid. We will use arbitrage holding as the measure of arbitrageurs' presence in a takeover bid.

The way we collect data about arbitrage holding introduces a downward bias as we only record the purchase of those arbitrageurs who own more than 1% of target's share. Those arbitrageurs who own less than 1% of the target's shares are excluded from the sample. In other words, our sample includes the holdings of only arbitrageurs who cannot hide their arbitrage positions due to the UK strict disclosure rules. To the extent that we want to see the impact of the UK disclosure rule on arbitrageurs' capability to influence the bid outcome, this downward bias should have little impact on the empirical validity of this study. If we find that the holding of the arbitrageurs, who are forced to reveal their presence, has no impact on takeover outcome, this piece of evidence would validate the prediction. On the other hand, a significant impact would clearly invalidate the prediction about takeover regulation.

6. Empirical Result

6.1. Arbitrage returns and arbitrage holdings

In this section, we examine the relationship between arbitrage returns and arbitrage holding by estimating equation (5). As the argument in section 4.1 shows, the first step in the empirical analysis is to find the appropriate instrument variables for the suspected endogenous variables. Since we will use 2SLS to obtain the IV estimators,

we only need to find instrument variables for arbitrage holding. Following Hsieh and Walkling (2005) in this study, we use the number of arbitrageurs as the instrument for arbitrage holding.

A valid instrument variable must meet two requirements: (1) it has zero correlation with the error term of the equation (2) it has non-zero correlation with arbitrage holding. When both these requirements are satisfied, the IV estimators are consistent (Wooldridge, 2003).

The first requirement warrants that the instrument variable must be exogenous. This requirement nevertheless cannot be tested because the error term of the structural equation is not observable. According to Murray (2006), researchers can never be certain that the instrument variable is exogenous. He also suggests that since the requirement cannot be subject to empirical scrutiny, reasoning should be applied to chase away as much doubt as possible. In this study, we argue that the instrument variable for arbitrage holding, i.e. the number of arbitrageurs, should have little correlation with the error term of equation (5). Because the number of arbitrageurs can also be another proxy for the presence of arbitrageurs, this variable may affect arbitrage returns in the similar way as arbitrage holding. As the result, when arbitrage returns are controlled for, the number of arbitrage should have little impact on arbitrage returns. In other words, the number of arbitrageurs should have little correlation with the error term of the equation.

As for the second requirement, it can be directly tested with the data. Larcker and Rusticus (2008) argue that the evidence of non-zero correlation between the instrument variable and the endogenous variable is generally too weak for the 2SLS IV estimators to be superior to the OLS estimators in the presence of endogeneity problem. As we cannot be sure whether the instrument variable is truly exogenous, the second requirement should be modified to incorporate that reality. In their simulation analysis, Larcker and Rusticus (2008) report that when the instrument variable is weakly correlated with the endogenous variable, even though the correlation is different from zero, only a small correlation between the instrument variable and the model's error term will cause the 2SLS IV estimator to be more biased than the OLS one and make the hypothesis tests under 2SLS become invalid. The authors suggest that requirement (2) should be modified such that the instrument

variable should be highly correlated with the endogenous variable. Stated differently, we should find strong instrument. When the instrument variable is strong, the 2SLS estimator is still preferred to OLS even if the instrument is semi-endogenous, i.e. have some mild correlation with the error term of the model.

Following such logic, our next step is to perform statistical tests to ensure that the number of arbitrageurs is a strong instrument variable. We normalize the variable using natural logarithm. Specifically, we use $\ln(1 + Narb_i)$ as the instrument variable instead of $Narb_i$, where $Narb_i$ is the number of arbitrageurs in bid i and ln is the natural logarithm. We will use the result obtained from the first-stage regression in the 2SLS procedure to assess the strength of the instrument variable. The standard set-up for the first stage regression is to put the endogenous variable, in this case $holding_i$, as the dependent variables and the instrument variables $\ln(1 + Narb_i)$ and other control variables as the independent variables. Clearly the underlying assumption in this situation is that the endogenous variable can be projected linearly onto the set of the exogenous variables. However, as argued by Woolridge (2002), the assumption is only justified as long as the relation between the dependent variable and the endogenous regressor is linear. In case the relation is non-linear, it is impossible to derive the reduced form equation, in which the endogenous regressor is a linear function of the exogenous variables. Thus, if arbitrage returns are related with arbitrage holding in a non-linear way as stated in the first hypothesis (the coefficient of $holding_i^2$ is different from 0), the first-stage regression with the standard set-up is invalid.

As we are not sure whether the relationship between arbitrage return and arbitrage holding is linear or non-linear, it is better to consider both scenarios. In the first scenario where the relationship is assumed to be linear, we can simply estimate the first-stage regression using the standard set-up as described in the previous paragraph. The result is presented Panel A of Table 3.

The minimum requirement for $\ln(1 + Narb_i)$ to be valid instrument is that the coefficient estimate of the variable is different from 0 in the first-stage regression (Wooldridge, 2003). The result clearly shows that $\ln(1 + Narb_i)$ passes this requirement. In Panel B of Table 3, we report a series of statistical tests for the instrument variable and the endogenous variable. Another test to evaluate the validity

of the instrument is the under-identification test. As shown, the null hypothesis that the structural equation is unidentified is rejected at 1% level. This again confirms the validity of the instrument.

Although the tests show that $\ln(1 + Narb_i)$ is a valid instrument variable, this does not warrant that the variable is a strong instrument. Stock and Yogo (2005) and Stock, et al (2002) develop two formal quantitative benchmark to assess the strength of the instrument variable. The first benchmark set the minimum value for the size of the F-statistic on the instrument variable in the first-stage regression. In this case when we have one instrument, the F-statistic should be at least 8.96 so that the finite-sample bias from 2SLS is smaller than the bias from OLS. The second benchmark set the minimum threshold for the statistic of the weak identification test (Cragg-Donald Wald F statistic). In our case the weak identification test statistic should be larger than 16.38 in order for the statistical inferences under 2SLS to be valid. When the either of the test statistics falls below the benchmark, the instrument variable is considered weak.

The F-statistic for $\ln(1 + Narb_i)$ in this first-stage regression and the weak identification test statistic are both 211.24, which is much higher than the benchmark value. This clearly shows that the number of arbitrageurs appears to be strong instrument variable. Another way to look at the strength of the instrument variables and evaluate whether 2SLS is preferred to OLS in the presence of endogeneity is to calculate the partial R^2 between arbitrage holding and $\ln(1 + Narb_i)$ in this first stage regression. The partial R^2 is 24.84%. According to Larcker and Rusticus (2008), the size of the partial R^2 means that 2SLS is preferable to OLS in the presence of endogeneity problem unless the square of the correlation between $\ln(1 + Narb_i)$ and the error term of the equation is more than 24.84%. As we already argued earlier, given that arbitrage holding and the number of arbitrageurs are both the proxies for the arbitrageurs' presence in the takeover contest, there should be little correlation between the $\ln(1 + Narb_i)$ and the model's error term. Thus, in the presence of endogeneity, 2SLS seems to provide more reliable estimates.

In case the relationship between arbitrage returns and arbitrage holding is assumed to be linear, a series of statistical tests confirm that $\ln(1 + Narb_i)$ seems to

be a strong and valid instrument variable for arbitrage holding. Wooldridge (2002) shows that this result can be extended to the case of non-linear relation. In particular, we can consider the non-linear part of the endogenous variable ($holding_i^2$) as an additional endogenous variable. If $\ln(1 + Narb_i)$ is a good instrument for $holding_i$, then the square of the fitted value of $holding_i$ obtained from the first-stage regression described above ($fittedholding_i^2$) can serve as the optimal instrument for the $holding_i^2$. By doing so, the endogenous variable can be projected in a non-linear way onto the set of exogenous variable (Wooldridge, 2002). A set of statistical tests for the non-linear case reported in Panel B of Table 3 show that both $\ln(1 + Narb_i)$ and $fittedholding_i^2$ are also strong instruments for $holding_i$ and $holding_i^2$ respectively.

To this stage we obtain the first step in dealing with the potential endogeneity problem by finding the appropriate instrument variables for both linear and non-linear cases. The next step is to perform the Hausman test on whether the suspected variable is truly endogenous. Larcker and Rusticus (2008) suggest that the validity of the test hinges on the appropriateness of the instrument variable. This explains our lengthy process to select the instrument for the suspected variable. The test result is shown in Panel B of Table 3

When linearity is assumed, null hypothesis that $holding_i$ is and exogenous variable can only be rejected at 10% significance level. Although the evidence of endogeneity problem is not strong, we cannot rule out the problem. As a result, in case of linear relation between arbitrage return and arbitrage holding is assumed, 2SLS estimator appears to be more reliable. In the event that non-linearity is assumed, the null hypothesis that both $holding_i$ and $holding_i^2$ are exogenous variables cannot be rejected even at 10% significant level. The endogeneity problem seems to be of much less consequential in the non-linear case. Thus, we can rely on the OLS estimator when the non-linear relationship is assumed.

The estimation of equation (5) using both 2SLS and OLS method is reported in Panel A of Table 3. First, we consider the linearity case. The two methods yield similar result. Arbitrage returns is positively related to arbitrage holding but the relation is not statistical significant. As the endogeneity is likely to present, we stick to the 2SLS result and other statistical methods that can help mitigate the potential

endogeneity problem. One major weakness of 2SLS method is that it is not very efficient, i.e. it produces larger standard errors of the coefficient estimates (Wooldridge, 2003). Thus, it might fail to reject the null hypothesis when the null is false. In this study, to ensure that the result is robust, we also perform three additional tests, the Anderson-Rubin Wald test, the Stock-Wright LM test and Moreira's (2003) conditional likelihood ratio test, on the null hypothesis that coefficient estimate of $holding_i$ is equal to 0. As these tests are robust even when instrument variable is weak, it is expected that they are more efficient than the standard test under 2SLS. Andrews, et al. (2007; 2004) show that these tests perform better than the standard test under 2SLS; and among these tests, the Moreira's (2003) conditional likelihood ratio test performs best. One shortcoming of the Moreira's (2003) test is that it only applies to the case whether the equation has only one endogenous variable. Consequently, we cannot perform this test in the non-linear case where both $holding_i$ and $holding_i^2$ are considered endogenous variables. The results for the Moreira's (2003) conditional likelihood ratio test, the Anderson-Rubin Wald test, and the Stock-Wright LM test are shown in Panel B of Table 3.

Under the Anderson-Rubin Wald test and Stock-Wright LM test, the relationship between arbitrage returns and arbitrage holding become statistically significant at 10%. Moreira's (2003) conditional likelihood ratio test also show similar result. It is noted that Moreira's (2003) test is based on Monte Carlo simulation, hence instead of producing a test statistic, the test provides a confidence interval. The 95% confidence interval for coefficient estimate of $holding_i$ is [-0.26, 4.90] indicates that the relation between arbitrage return arbitrage holding is not statistically significant at 5% level. The 90% confidence interval of [0.15, 4.47] shows that the positive relation between arbitrage return and arbitrage holding is significant at 10% level. As the Anderson-Rubin Wald test, the Stock-Wright LM test and Moreira's (2003) conditional likelihood ratio test is expected to perform better than the standard t-test under 2SLS, we can conclude that arbitrage return is positively related with the arbitrage holding. The relation is however weakly supported by the data since it is only significant at 10% level.

Turning to the non-linear case, the result under both the OLS and 2SLS show similar pattern. The coefficient estimate of $holding_i$ is positive and of $holding_i^2$ is

negative. This result is consistent with the fact that arbitrage return is related with arbitrage holding in a non-linear way as stated in the first hypothesis. Under the 2SLS, both coefficients are however not statistically different from 0. The Anderson-Rubin Wald test and the Stock-Wright LM test yield the same result. The null hypothesis that the two coefficients are both 0 cannot be rejected. Because the Moreira's (2003) conditional likelihood ratio test can only be applied in case of single endogenous variable, we do not report the test result when the non-linearity is assumed. Under the OLS result, $holding_i$ is significant at 10% level but $holding_i^2$ is not. As the Hausman test does not detect any serious endogeneity problem, we are more inclined to rely on the OLS result as the estimator is more efficient. The OLS result turns out to be very similar to the case when linear relation between arbitrage return and arbitrage holding is assumed. As $holding_i^2$ is not significant, there is no evidence of non-linearity. Arbitrage returns seem to be positively related to arbitrage holding in a linear way and the relationship is statistically significant at 10% level. Thus, the empirical conjecture stated in the first hypothesis that arbitrageurs are better than the average investors in the market is marginally supported. However, there is no evidence that competition among arbitrageurs up to some level will reduce arbitrage return.

The behaviours of some significant control variables provide interesting insight into the determinants of merger arbitrage returns. Arbitrage returns are significantly higher in hostile and contested takeover bids. As shown in the next section, the probability of bid success decreases if the bid is a hostile or a contested bid. Thus, there is greater uncertainty regarding the outcome of these bids. The risk of investing in these bid are considerably higher but the potential return is also bigger. The fact that arbitrage returns are higher in riskier bids nicely demonstrates the risk-return trade-off principle in finance. By the same token, arbitrage returns are also significantly higher for those bids with wider spread. The spread reflects the market perception about the outcome of the bid. A wide spread implies that the market perceive a lower chance that the bid can complete, hence pose greater risk for the arbitrageurs.

Among the remaining control variables, the value of the bid is significantly related to arbitrage returns. In particular, arbitrage returns are lower in high value

bids. This evidence is consistent with the fact that the marginal investors in the arbitrage game require compensation for bearing transaction costs. As the shares of large companies are usually more liquid than small firms, the transaction costs in trading large firm stock is usually smaller. Thus, the arbitrageurs require less expected return to compensate for the transaction costs. This explains the negative relation.

To sum up, we find supporting evidence about a positive relationship between the presence of arbitrageurs and arbitrage returns while controlling for other public information available at the bid announcement date. This means that arbitrageurs seem to be better than the average investors in the market in selecting takeover bids for their investment. The evidence is not very strong nevertheless as the relationship is only significant at 10% level. Furthermore, we find no evidence about the non-linear relationship between arbitrage return and arbitrage holding. The conjecture that more arbitrageurs coming into the game will heighten the competition thereby reducing arbitrage returns is not supported.

6.2. Bid outcome and arbitrage holding

The second hypothesis predicts that due to the UK's strict disclosure rule during takeover period, arbitrageurs in the UK should hardly be able to influence the outcome of the bid. Thus, we expect that arbitrage holding has little impact on bid premium and the probability of bid success.

6.2.1. Bid premium

In order to examine the impact of arbitrage holding on bid premium, we estimate equation (6). To decide between OLS and 2SLS estimation method, we need to perform the Hausman test on the presence of endogeneity problem. As we already demonstrate in section 6.1, $\ln(1 + Narb_i)$ serves as a good instrument variable for arbitrage holding. A series of tests on the strength of the instrument variable reported in Panel B of Table 4 confirm this fact. As the interpretation of these tests is similar to section 6.1, from this point onward, we will not discuss these tests in detail. We still report all result of all the tests to show that $\ln(1 + Narb_i)$ is indeed a good instrument variable.

Following the argument from Larcker and Rusticus (2008), when a strong instrument variable is available, we can proceed to the Hausman test. The test statistic reported in Panel B of Table 4 is 0.78 indicating that the null hypothesis that arbitrage holding is exogenous variable cannot be rejected, hence endogeneity does not appear to pose serious problem. Thus, OLS is the preferred method to estimate equation (6). The estimation result using both OLS and 2SLS are reported in Panel A of Table 4.

The result shows a statistically negative relationship between bid premium and arbitrage holding under both OLS and 2SLS method. With OLS, the relation is highly significant at 1% level; with 2SLS, it is significant only at 5% level. The OLS result seems to show stronger relationship because OLS estimator is generally more efficient than 2SLS estimator. The results from the Anderson-Rubin Wald test, the Stock-Wright LM test and Moreira's (2003) conditional likelihood ratio test also confirm this negative relation between bid premium and arbitrage return.

The result is in stark contrast with the prediction of Cornelli and Li's (2002) model, upon which the theoretical argument for the interaction between arbitrage holding and bid outcome variables are grounded. The model predicts that as the bidder likes to attract more arbitrageurs into the game to solve the free-rider problem, it would offer a high offer ex ante or revise the offer upward. Thus, according to the model, there should be a positive relationship between arbitrage holding and bid premium. To reconcile the contradictory empirical results, we need to look at the basic premise of the model. The model assumes that arbitrageurs can hide their identity in the takeover game. Because there is inherent uncertainty regarding whether the arbitrageurs will come into the game to solve the free-rider problem, the bidder needs to make high pre-emptive bid or revise the bid upward in order to attract more arbitrageurs so that the bid can succeed and it can make a positive profit.

The UK's strict disclosure rule makes the assumption that arbitrageurs are anonymous rather tenuous. First the disclosure threshold during the offer period is only 1% of the target's equity shares, which is much lower than the threshold of 5% in the US market where the positive relationship is documented (Hsieh and Walkling, 2005). Thus, it is quite hard for the arbitrageurs in the UK to trade in target stocks without revealing their identity. In case arbitrageurs are involved in the game and the bidder knows about that, it has no incentive to offer high bid to attract more

arbitrageurs into the game. Even worse, when he knows that all those short-term arbitrageurs are likely to involve in the game, it might even lower its offer price because if they walk away it is the arbitrageurs who burn their finger. In this case, the bidder, instead of increasing the bid to attract the arbitrageurs, may actually decrease the bid if it is aware of the presence of arbitrageurs in the game. This may help explain the observed negative relationship.

The direct corollary of this argument is that the premia in those bids where the bidder are more likely to know about the presence of arbitrageurs before the bid announcement date will be lower than the premia in other bids. A closer look at the definition of term "offer period", during which the strict disclosure threshold of 1% is applied provides a direction to empirically test this corollary. As reviewed by Kenyon-Slade (2004, p608), the offer period is defined as the period from the time when the announcement is made of a proposed or possible offer (with or without terms) until the date when the offer becomes or is declared unconditional as to acceptances or lapses. Based on this definition, it is possible that the arbitrageurs may need to reveal their identity well before the actual terms of the offer are announced. In our sample, there are 187 bids, in which the arbitrageurs need to reveal their identity before the bidder announces the offer terms. As nearly 30% of the sample bid, the bidder knows pretty well that the short-term arbitrageurs are in the game before it needs to announce the offer price, he may decide to lower the price. This helps explain the negative relationship between bid premium and the presence of arbitrageurs.

To further investigate this relationship, we compare the bid premium of those 187 bids with the rest of the sample. On average the bid premia on those bids are 6% lower than the other bids and the difference is significant at 5% level. To test whether such difference are still robust when other factors that affect bid premia are controlled for, we add a dummy variable $DiscloseBefore$, which is equal to 1 if the arbitrageurs have to disclose their trading before the official bid announcement and equal to zero otherwise, to the model. If the conjecture about the impact of the disclosure on the relationship between bid premium and arbitrage is correct, the new dummy variable should be negative. The result in Table 4 shows that this is really the case. The

variable $DiscloseBefore$ is negative and marginally significant at 5% level. Thus, the impact is robust in multivariate context.

To provide further insight into this issue, we re-estimate equation (6) in two subsamples. The first one includes 187 bids in which the arbitrageurs have to reveal their position before the bid announcement; and the second one include the rest of the sample. As shown in Table 4, in first subsample, arbitrage holding are negatively related to bid premium and the relationship is statistically significant at 5% level, while in the second subsample the relationship is not significant. This result confirms the conjecture about the impact of takeover regulation on the relationship between bid premium and arbitrage holding.

The significance and size of some control variables are also of interest. Whether the bid is a contested bid appears to be one of the most important determinants of bid premium. The premia for contested bids are approximately 20% higher than those uncontested and the difference is significant at 1% level. This result is consistent with the large body of empirical evidence about the impact of competition among rival bidders on bid premium (Eckbo, 2009). For example, Eckbo and Langohr (1989) document that the bid premium increase substantially after the introduction of the mandatory disclosure rule and the requirement that the offer must be open for minimum 4 weeks in French context. The reason is that such regulation makes the bid more transparent and open for longer period, thereby attracting more rival bidders into the game. Schwert (1996) also document similar result in the US context.

As the discussion in section 4.2 indicates, while toehold is expected to have positive relation with bid premium, the result turns out to be negative in our sample. While the result is inconsistent with the argument that bidder can offer high premium if he has acquired large toehold in the target firm because such premium needs only be paid for the remaining shares. This can be called the toehold-related-overbidding hypothesis (Singh, 1998). However, as argued by Eckbo (2009), toehold also deters the arrival of new bidders as they may expect that it is difficult for them to win the contest. Because of such entry deterrence effect, toehold lowers bid premium. The evidence in this paper is consistent with this entry deterrence argument. Betton and Eckbo (2000) and Betton, et al. (2008) also report similar result. Since the number of shares irrevocably committed is expected to have similar impact as toehold, this

explains why this variable is negatively related to bid premium. This also supports the entry deterrence argument.

Finally, bid premium is significantly higher in cash offer than in stock offer. This result is consistent with the information-theory about the choice of payment method and the result reported by Betton, et al. (2008). Under these theories, bidder chose stock offers in case it is uncertain about the true value of the target. In this case, he can underpay the target because any value enhancement later can be shared by both parties. However, a cash offer that undervalues the target will be rejected as the target shareholders have no involvement in the post-takeover firm.

In summary, the result for those control variables appears to be consistent with the extant literature. Arbitrage holding appears to be negatively related to bid premium. The negative relationship stems from the strict UK disclosure rule applied during the offer period.

6.2.2. Probability of bid success

In this section, we examine the impact of arbitrage holding on the chance that the bid will consummate by estimating equation (7). Similar to the previous sections, our first concern is the endogeneity problem. The tests repored on Panel B of Table 5 shows that $\ln(1 + Narb_i)$ is a strong instrument for arbitrage holding, the suspected endogenous variable. As the result, we can go straight to perform the test on endogeneity. According to the Hausman test result in Panel B of Table 5, the null hypothesis that arbitrage holding is exogenous variable is rejected at 10% level. Thus, endogeneity problem is likely to be present in equation (7) and we need to tackle the problem.

To controll for the possible endogeneity issue, we first employ the least square estimation methods as shown in section 6.1 and 6.2.1. In particular, we perform the 2SLS estimation using $\ln(1 + Narb_i)$ as the instrument variable for arbitrage holding. We also report the OLS result for comparison. As the depenent variable in equation (7) is the probabilty of bid success, the major shortcoming of the least square method is that fitted value of the dependent varilabe may go beyond the [0,1] inveval. Consequently, the least square methods do not accurately model the probability of bid

success. Despite this shortcoming with the least square method, Wooldridge (2003) suggests that the coefficient estimates under the least square methods are still consistent and can be valid for inference. According to the author, in applied work, it is acceptable to present the least square analysis of a linear probability model. When comapring the least square result with the one from the logit analysis, we can see that they are verey similar.

A better way to model the probability of bid success is to estimate equation (7) using logistic regression. We report the result with and without control for the possible endogeneity problem. We follow the two-step estimation procudure suggested by suggested by Maddala (1986) to mitigate the endoneity problem. In the first step, we obtain the predicted value of arbitrage holding, the endogenous variable, from the regression of this variable on the instrument variable ln $(1 + Narb_i)$ and the set of exogenous variables that have low correlation with the probability of success. We obtain the list of these variables from the logistic regression when arbitrage holding is excluded from the equation. These variables include large shareholder ownership, managerial ownership, whether the bid has termiation term, toehold and the bid's form of payment. In the second step, we replace the arbitrage holding variable in equation (7) with the predicted value calculated in the first step and employ logit method to estimate equation (7). The idea is to purge the impact of the probabilty of bid success from arbitrage holding, the source of the endogeneity problem. It is noted that these two step estimation method is very similar to the 2SLS method. The main difference is that in the second stage, logit-type maximum likelihood estimation is performed to correctly model the probability of bid success. The result using both the logit and the least square methods is reported in Panel B of Table 5.

Both methods show similar result. In case the equation is estimated with OLS, arbitrage holding is positively related with the probability of bid success. When the 2SLS is employed, the relationship turns negative. The change in the size of the arbitrage holding is similar in case of logistic regression. When arbitrage holding is used, i.e. without controlling for the endogeneity issue, the relation is positive; when fitted holding obtained from the first-step regression is used, i.e. the endogeneity problem is taken into account, the sign changes to negative. In all cases, the

coefficient of arbitrage holding is not statistically signficant different from zero. The result from the Anderson-Rubin Wald test, the Stock-Wright LM test and Moreira's (2003) conditional likelihood ratio test reported in Panel B of Table 5 also shows no significant relationship between arbitrage holding and the probability of bid success. This finding is consistent with the second hypothesis and indicates that the UK strict disclosure rule during the offer period has substantial impacts in the interaction between the presence of arbitrageurs and the outcome of the takeover bid.

The characteristics of the control variables are gennerally consistent with the extant literature. The mood of the offer seems to be the most important determinant of the takeover outcome. The success rates of the hostile bids are around 41% on average whereas the success rates of the friendly bids are around 88%. The presence of rival bidders also reduce the chance that the initial bid can consumate. These findings are in line with most existing studies, notably Walkling (1985), Schwert (2000), and Sudarsanam (1995).

Toehold and the number of shares irrecovably committed both contribute positively to the probability of success. The finding is similar to Betton et al. (2009) In this sample, the impact of irrevocable commitment on the probability of bid success dominates the impact of toehold as only the former is statistically significant. The irrevocable commitment can offer benefits similar to toehold, that is, reduce the number of shares that the bidder needs to acquire and deter the entrance of rival bidders. And it can offer more. Wright et al (2007) argue that the irrevocable commitment is the result of the private negotiation process between the bidders and the management and the blockholders of the target firm. As a result, the presence of the irrevocable commitment sends a clear signal to the market that these informed investors approve the logic of the bid. Furthermore, as it makes sense for the bidder to negotiate mainly with those holding large number of shares, we should expect that the size of the commitment is large relatively to the size of toehold. This is actually the case. In our sample, the average size of the irrevocable commitment is 16.5% of the target equity, which is much bigger that the average size of toehold, that is, 4.6% of the target equity. Since the irrevocable commitment can offer more benefits to bidder and the size of the commitment is bigger, it dominates the impact of toehold on the probability of bid success.

Among the remaining variables, transaction value is negatively related to the probability of bid success and the relationship is statistically significant at 5% level. The relation is in line with our argument put forth in section 4.2. Large deals are more likely to trigger regulatory concern about anti-trust issue. Moreover, bidder may find it more difficult to obtain sufficient funds to finance a large takeover bid. When the bid is conducted via scheme of arrangement, the chance of success is also higher. This variable is however only marginally significant at 10% level. Interestingly, both the number of shares owned by large shareholders and target management do not contribute to the probability of success. The insignificance of these two variables stem from the indeterminacy of the blockholders and the incumbent management regarding their support for the takeover bid as argued in section 4.2. Whether the bid has a termination fee or inducement fee clause has no impact on the probability of bid success. The result can be explained by the 1% cap of the UK City Code on inducement fees.

In summary, our finding on the relationship between the presence of arbitrageurs and the probability of bid success provides support for the second hypothesis. Due to the UK strict disclosure rule, there is little chance for the arbitrageurs to exert influence on the outcome of the bid to their advantage.

7. Conclusion

Utilizing a manually collected dataset and a range of methods to tackle the possible endogeneity problem, this study examines different roles that arbitrageurs can play in the takeover process in the UK context. The study in the US context by Hsieh and Walkling (2005) document that arbitrageurs are informed investors who are superior in selecting the takeover bids for their portfolio and have the ability to alter the course of the takeover process. The authors report that the presence of arbitrageurs is associated with higher bid premium and higher chance of bid success. The findings provide a good demonstration of the theoretical prediction propounded by Cornelli and Li (2002). The theoretical model is, however, predicated on the assumptions that arbitrageurs have the ability to hide their identity during their trading with other investors.

The strict disclosure rule during the takeover period in the UK relatively to the US where previous studies are conducted, provide an excellent setting to investigate whether the role of the assumption in shaping the model's prediction. Under the UK laws, it is very difficult for the arbitrageurs to trade in the target stock without revealing their positions. If the assumption is of great importance, we would expect a very different relationship between the presence of arbitrageurs and arbitrage returns, bid premium and the probability of bid success. Our empirical result shows that it is indeed the case. The stark difference in the result, when the assumption is somewhat violated, raises the need for future theoretical models to incorporate a weaker version of the assumption.

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Table 1: Merger arbitrage abnormal returns

This table summarizes the results of 9 studies on the profitability of the merger arbitrage strategy. The Capital Asset Pricing Model (CAPM), the Fama and French (1993) three-factor model (F&F), and the contingent claim approach suggested by Glosten and Jagannathan (1994) are employed to control for risk in calculating the abnormal returns to the strategy. Two approaches are applied to calculate the merger arbitrage portfolio returns. In the event-time approach, the return to the investment in each bid is computed for the period starting one or two days after the announcement date and ending at the date, on which the bid is completed or terminated; the portfolio return is the average of the annualized returns from all bids in the sample. In the calendar-time approach, a takeover bid is included in the portfolio at one or two days after the announcement date and excluded from the portfolio at the date, on which the bid is competed or terminated. The portfolio return at each point in time is the average of the returns from all active bids in the portfolio at that time. The calendar time approach produces a time series of the merger arbitrage portfolio returns.

Studies	**Sample**	**Annualized abnormal returns**		
		CAPM	**F&F**	**Contingent Claim**
Event-time approach				
Larcker and Lys (1987)	111 US cash tender offers from 1977 to 1983	14.51%	N/A	N/A
Dukes (1992) et al.	761 US cash tender offers from 1971 to 1985	172%	N/A	N/A
Thosar and Trigeorgis (1994)	63 US cash tender offers from 1981 to 1987	42.08%	N/A	N/A
Karolyi and Shannon (1999)	37 Canadian cash tender offers in 1997	33.90%	N/A	N/A
Calendar-time approach				
Mitchell and Pulvino (2001)	4750 US cash and stock bids from 1963 to 1999	9.90%	9.25%	10.30%
Baker and Savasoglu (2002)	1901 US cash and stock bids from 1981 to 1996	9.77%	7.31%	N/A
Jindra and Walkling (2004)	362 US cash tender offers from 1981 to 1995	N/A	26.82%	N/A
Maheswaran and Yeoh (2005)	193 Australian cash bids from 1991 to 2000	10.69%	9.90%	N/A
Branch and Yang (2006)	1309 US cash and stock bids from 1990 to 2000	22.42%	N/A	N/A
Sudarsanam and Nguyen (2009)	1105 UK cash and stock bids from 1987to 2007	6.17%	7.23%	6.42%

Table 2: Sample Description

This table presents a summary of the takeover bid sample used in this paper. Only pure cash and pure stock\mergers are included. The transaction value in GBP is recorded in SDC. Success rate is the percentage of the transactions reported as "completed" or "unconditional" in SDC over total number of transactions. For transaction value, the figure in the parentheses is median, the other one is mean. The transaction values in different years are converted to 2007 value using the *UK Consumer Price Index – All Urban: All items.*

Year	Cash Mergers			Stock Mergers		
	Number of Deals	Average Value (£ millions)	Success Rate	Number of Deals	Average Value (£ millions)	Success Rate
1997	27 (64.29%)	210.95 (72.59)	92.59%	15 (35.71%)	66.16 (44.30)	86.67%
1998	42 (68.85%)	110.24 (31.29)	92.86%	19 (31.15%)	616.61 (127.16)	78.95%
1999	76 (76.77%)	204.64 (37.12)	94.74%	23 (23.23%)	356.51 (34.19)	86.96%
2000	54 (75.00%)	288.96 (70.13)	87.04%	18 (25.00%)	659.01 (71.21)	88.89%
2001	23 (74.19%)	223.80 (37.40)	100.00%	8 (25.81%)	18.89 (17.12)	87.50%
2002	24 (85.71%)	77.84 (19.71)	95.83%	4 (14.29%)	364.80 (418.57)	100.00%
2003	52 (85.25%)	172.63 (39.20)	98.08%	9 (14.75%)	60.53 (31.27)	100.00%
2004	27 (81.82%)	275.31 (83.45)	88.89%	6 (18.18%)	74.96 (23.55)	100.00%
2005	60 (88.24%)	399.57 (88.73)	90.00%	8 (11.76%)	70.15 (49.27)	75.00%
2006	91 (88.35%)	831.08 (99.95)	85.71%	12 (11.65%)	171.84 (95.55)	75.00%
2007	51 (92.73%)	716.19 (91.31)	90.20%	4 (7.27%)	1,114.45 (146.99)	75.00%
Complete Sample	527 (80.70%)	381.47 (53.40)	91.46%	126 (19.30%)	336.95 (40.08)	85.71%

Table 3: The relationship between arbitrage holding and arbitrage return

This table presents the estimation result of equation (5), which shows the relationship between the presence of arbitrageurs and arbitrage returns. Arbitrageurs are defined as those who actively purchase the target shares in at least 8 different bids in the sample period. Arbitrage holding of a particular bid is the aggregate of the holdings of all arbitrageurs investing in the bid. We scale arbitrage holding by the number of target's shares outstanding. Arbitrage Spread is calculated as $(IP - P\_1)/P\_1$ where IP is the initial offer price P_1 is target stock price one day after the bid announcement. Premium is the sum of runup and markup. Runup is the cumulative abnormal return to the target shares for trading days (-40,-1) before the bid announcement date. Markup is computed as $(FP - P_{-1})/P_{-1}$ where P_{-1} is the target stock price one day prior to the bid announcement date. Hostile is the dummy variable, which is equal to 1 if the bid is a hostile bid and 0 otherwise. Deal value is the value of transaction in GBP millions record in SDC. Duration is the number of days between the bid announce date to the date on which the bid is successful or terminated. Toehold is the percentage of target shares own by the bidder prior to the announcement date. Irrevocable is the percentage of target share that the bidder gets in form of irrevocable undertaking to tender from a group of target's shareholders prior to the bid announcement. Success is the dummy variable, which is equal to 1 if the bid is successful and 0 otherwise. Competing is the dummy variable equal to one if the bid is a contested bid and 0 otherwise. Termination is a dummy variable equal to 1 if either the bidder or the target agrees to pay the other party a fee in case the bid fails, and 0 otherwise. Scheme is a dummy variable equal to 1 if the bid is conducted via Scheme of Arrangement, 0 otherwise. Block holding is the percentage of target equity shares owned by shareholders whose ownership exceeds 3% of the target equity shares. Insider holding is the percentage of target shares owned by the incumbent management and their family. Both Block holding and insider holding are taken from the most recent annual reports downloaded through Perfect Filings. Panel A reports the regression result; Panel B reports the test statistics relating to the endogenous variables. The figures in the parentheses in Panel A are the heteroskedasticity-consistent standard errors; the ones in Panel B are the p-value of the test statistics.

Panel A: Regression result					
	First stage OLS	2SLS Result		OLS Result	
		Linear	Non-linear	Linear	Non-linear
Intercept	-0.0308**	-0.0257	-0.0672	-0.1604	-0.1569
	(0.0156)	(0.4784)	(0.4270)	(0.4466)	(0.4430)
Holding		2.2727	2.9724	0.2451	3.2428*
		(1.9954)	(3.7160)	(0.7502)	(1.7397)
Holding squared			-4.5497		-10.1097**
			(13.1252)		(4.5704)
ln(1+Narb)	0.0459***				
	(0.0032)				
Block holding	0.0086	0.2419	0.2472	0.2163	0.2463
	(0.0098)	(0.2261)	(0.2214)	(0.2329)	(0.2331)
Insider Holding	0.0104	0.1346	0.1478	0.1035	0.1549
	(0.0129)	(0.2447)	(0.2329)	(0.2562)	(0.2546)
Hostile	-0.0010	0.6718***	0.6674***	0.6493***	0.6556***
	(0.0069)	(0.1765)	(0.1783)	(0.1806)	(0.1802)
Competing	0.0214***	0.5175***	0.5357***	0.5778***	0.5753***
	(0.0049)	(0.1317)	(0.1229)	(0.1150)	(0.1149)
Arbitrage spread	-0.0222	1.8218**	1.7896**	1.7338**	1.7248**
	(0.0233)	(0.7241)	(0.7480)	(0.7515)	(0.7489)
Toehold	0.0141	-0.2529	-0.2418	-0.2214	-0.2192
	(0.0158)	(0.2741)	(0.2658)	(0.2661)	(0.2660)
Irrevocable	0.0052	-0.0177	-0.0148	-0.0261	-0.0137
	(0.0078)	(0.1201)	(0.1153)	(0.1202)	(0.1183)
Scheme	0.0122**	-0.0401	-0.0440	-0.0019	-0.0376
	(0.0059)	(0.1126)	(0.1139)	(0.1062)	(0.1089)
Stock	0.000031	0.0212	0.0210	0.0336	0.0242
	(0.0043)	(0.1089)	(0.1085)	(0.1060)	(0.1068)
Termination	0.0021	0.0069	0.0148	0.0247	0.0296
	(0.0056)	(0.0783)	(0.0738)	(0.0761)	(0.0754)
ln(DealValue)	-0.0049***	-0.1185**	-0.1171**	-0.0977**	-0.1095***
	(0.0015)	(0.0503)	(0.0476)	(0.0393)	(0.0415)
ln(Duration)	0.0075**	0.0891	0.0959	0.1140	0.1113
	(0.0033)	(0.0801)	(0.0779)	(0.0808)	(0.0802)
Adjusted R^2	0.456	0.103	0.115	0.116	0.124

*, **, *** indicate significance at 10%, 5% and 1% levels, respectively

Table 3 (cont…)

Panel B: Other tests for the endogenous varaibles			
	First stage	Linear model	Non-linear model
F-statistic	211.24		
Partial R_2	0.2484		
Hausman test		3.27*	2.15
		(0.0704)	(0.3406)
Underidentification test		162.238***	71.037***
		(0000)	(0000)
Weak identification test		211.242	38.938
Critical value for weak identification test		16.38	7.03
Anderson-Rubin Wald statistic		3.17*	4.04
		(0.0748)	(0.1326)
Stock-Wright LM S statistic		3.16*	4.02
		(0.0755)	(0.1343)
Andrews, Moreira and Stock (2005) conditional likelihood ratio- 95% confidence level		[-.2563827, 4.901783]	na
Andrews, Moreira and Stock (2005) conditional likelihood ratio- 90% confidence level		[.1493077, 4.466109]	na

*, **, *** indicate significance at 10%, 5% and 1% levels, respectively

Table 4: Bid premium and arbitrage holding

This table presents the estimation result of equation (6) which shows the relationship between bid premium and arbitrage holdings. *Disclose Before* is a dummy variable equal to 1 if the one arbitrageurs need to disclose their trading positions before the bid announcement and 0 otherwise. All other variables are defined in Table 3. Panel A reports the regression result; Panel B reports the test statistics relating to the endogenous variables. The figures in the parentheses in Panel A are the heteroskedasticity-consistent standard errors; the ones in Panel B are the p-value of the test statistics.

Panel A: Regression result						
	Full sample				Sub-sample	
	2SLS (I)	2SLS (II)	OLS (I)	OLS (II)	OLS - Before	OLS after
Intercept	0.524***	0.535***	0.532***	0.534***	0.335**	0.550***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.047)	(0.000)
Holding	-1.219**	-0.590	-0.752***	-0.647**	-0.628*	-0.834**
	(0.030)	(0.326)	(0.002)	(0.011)	(0.062)	(0.026)
Disclose before		-0.0764**		-0.0754**		
		(0.019)		(0.015)		
Block holding	-0.0290	-0.0206	-0.0223	-0.0214	-0.0470	-0.00144
	(0.737)	(0.808)	(0.795)	(0.802)	(0.780)	(0.989)
Insider Holding	-0.176	-0.177	-0.167	-0.178	-0.315	-0.152
	(0.199)	(0.194)	(0.225)	(0.195)	(0.132)	(0.347)
Hostile	0.0286	0.0187	0.0326	0.0185	-0.0866	0.0356
	(0.627)	(0.752)	(0.586)	(0.758)	(0.162)	(0.618)
Competing	0.218***	0.204***	0.203***	0.206***	0.229***	0.174**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)
Toehold	-0.423***	-0.435***	-0.432***	-0.434***	-0.412**	-0.437***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.019)	(0.004)
Irrevocable	-0.130*	-0.132*	-0.127*	-0.132*	-0.0255	-0.166*
	(0.087)	(0.079)	(0.096)	(0.082)	(0.825)	(0.074)
Scheme	-0.0627	-0.0837	-0.0732	-0.0823*	-0.0632	-0.0848
	(0.210)	(0.100)	(0.125)	(0.087)	(0.361)	(0.182)
Stock	-0.104***	-0.114***	-0.107***	-0.113***	-0.0442	-0.129***
	(0.009)	(0.005)	(0.009)	(0.006)	(0.526)	(0.009)
Termination	-0.0564	-0.0528	-0.0597	-0.0526	-0.0323	-0.0684
	(0.170)	(0.191)	(0.143)	(0.198)	(0.596)	(0.218)
ln(DealValue)	-0.0153	-0.0161	-0.0205*	-0.0155	0.00612	-0.0182
	(0.213)	(0.195)	(0.067)	(0.172)	(0.787)	(0.178)
Adjusted R^2	0.061	0.070	0.065	0.070	0.107	0.048
N	653	653	653	653	187	466

Panel B: Other tests for the endogenous varaibles		
	2SLS (I)	2SLS (II)
F-statistic - *ln(1+Narb)*	219.93	207.42
Partial R_2 -*ln(1+Narb)*	0.2555	0.2448
Hausman test	0.78	0.01
	(0.3768)	(0.9164)
Underidentification test	166.811***	159.834
	(0000)	(0000)
Weak identification test	219.926	207.423
Critical value for weak identification test	16.38	16.38
Anderson-Rubin Wald statistic	4.03**	0.96
	(0.0448)	0.3279
Stock-Wright LM statistic	4.00**	0.93
	(0.0455)	0.3352
Moreira (2003) conditional likelihood ratio test- 95% confidence level	[-2.443797, -.0163836]	[-1.839501, .6632481]
Moreira (2003) conditional likelihood ratio test- 90% confidence level	[-2.242639, -.2108564]	[-1.635822, .4587055]

*, **, *** indicate significance at 10%, 5% and 1% levels, respectively

Table 5: Probability of bid success and arbitrage holding

This table presents the estimation result of equation (7) which shows the relationship between the probability of bid success and arbitrage holding. All variables are defined in Table 3. Panel A reports the regression result; Panel B reports the test statistics relating to the endogenous variables. The figures in the parentheses in Panel A are the heteroskedasticity-consistent standard errors; the ones in Panel B are the p-value of the test statistics.

	Logistic Regression - Probability of Bid Success			OLS	2SLS
	(I)	(II)	(III)		
Intercept	2.8122***	2.8358***	2.7227***	0.9681***	0.9584***
	(0.7572)	(0.7584)	(0.7646)	(0.0657)	(0.0657)
Holding		1.5657		0.1564	-0.6359
		(2.0680)		(0.2626)	(0.5219)
Fitted holding			-4.9396		
			(5.4641)		
Premium	0.6127	0.6571*	0.5637	0.0629*	0.0537
	(0.3744)	(0.3810)	(0.3777)	(0.0336)	(0.0339)
Block holding	-0.6758	-0.6588	-0.7495	-0.0482	-0.0592
	(0.7831)	(0.7825)	(0.7940)	(0.0747)	(0.0747)
Insider Holding	0.3045	0.3525	0.1309	-0.0361	-0.0531
	(1.3584)	(1.3608)	(1.3741)	(0.0983)	(0.0984)
Hostile	-2.0505***	-2.0473***	-2.0891***	-0.3883***	-0.3954***
	(0.3985)	(0.3994)	(0.4010)	(0.0531)	(0.0531)
Competing	-1.8326***	-1.8896***	-1.7855***	-0.3026***	-0.2760***
	(0.3121)	(0.3221)	(0.3158)	(0.0390)	(0.0417)
Arbitrage spread	-1.8584	-1.9054	-1.8606	-0.1954	-0.1779
	(1.6918)	(1.6926)	(1.6777)	(0.1781)	(0.1777)
Toehold	1.1351	1.1432	1.0733	0.1154	0.1253
	(1.2920)	(1.2918)	(1.2973)	(0.1223)	(0.1219)
Irrevocable	4.3935***	4.4199***	4.3602***	0.2340***	0.2293***
	(1.1169)	(1.1252)	(1.1171)	(0.0599)	(0.0597)
Scheme	0.7298	0.6993	0.8142*	0.0843*	0.1013**
	(0.4457)	(0.4455)	(0.4560)	(0.0447)	(0.0456)
Stock	0.1507	0.1275	0.1812	0.0147	0.0198
	(0.5015)	(0.4990)	(0.5040)	(0.0430)	(0.0429)
Termination	0.1507	0.1275	0.1812	0.0147	0.0198
	(0.5015)	(0.4990)	(0.5040)	(0.0430)	(0.0429)
ln(DealValue)	-0.1930**	-0.2122**	-0.1250	-0.0257***	-0.0173*
	(0.0899)	(0.0935)	(0.1167)	(0.0091)	(0.0103)
(Pseudo) R^2	0.274	0.275	0.276	0.240	0.229

Panel B: Other tests for the endogenous varaibles	
	2SLS method
F-statistic - *ln(1+Narb)*	214.31
Partial R_2 -*ln(1+Narb)*	0.2512
Hausman test	3.05*
	(0.0805)
Underidentification test	164.005
	(0000)
Weak identification test	214.315
Critical value for weak identification test	16.38
Anderson-Rubin Wald statistic	1.51
	(0.2194)
Stock-Wright LM statistic	1.5
	(0.2199)
Moreira (2003) conditional likelihood ratio test- 95% confidence level	[-1.69978,0.3892555]
Moreira (2003) conditional likelihood ratio test- 90% confidence level	[-1.523652, 0.2247127]

*, **, *** indicate significance at 10%, 5% and 1% levels, respectively