# Reference Point Prices in Mergers and Acquisitions and the Influence of Information Asymmetry: Evidence From the UK

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**Abstract**

This thesis examines the role of past peaks in target share prices as reference points in mergers and acquisitions in the UK, with a focus on target 52-week high share prices. The results indicate that there is a positive, non-linear relationship between past peak share prices and offer prices. The relationship is robust to the inclusion of a range of control variables and across subsamples. The effect of 52-week high prices on offer prices is stronger in deals with all-cash consideration and in deals with multiple bidders competing for the same target. However, 52-week high prices do not affect the probability of deal success or the bidders' announcement period return. The thesis also introduces proxies to examine whether the relationship between 52-week high prices and offer prices is affected by information asymmetry between target insiders and bidders. Consistent with the hypothesis that higher information asymmetry leads to a stronger reliance on reference point prices, the relationship between 52-week high prices and offer prices is stronger in cross-border deals. However, no consistent effect is found when analyst coverage, public firm age, target volatility, bidder toehold or target average bid-ask spread are used as proxies for information asymmetry.

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## 1 Introduction

The price that a bidding firm offers to the target's shareholders in a corporate takeover is generally based on a negotiation with the target's board of directors. The traditional view of pricing in Mergers and Acquisitions (M&A) emphasizes that the offer price that the negotiating parties finally agree on is based on fundamental valuation of the target company, taking expected synergies into account (e.g. Goedhart, Koller, & Wessels, 2015; Jovanovic & Rousseau, 2002). The textbook story holds that the target's value, including expected synergies, is then divided between the bidder and the target's shareholders depending on their relative bargain power. However, determining an appropriate offer price is a complex and difficult task in practice since fundamental valuation depends on many assumptions and relative bargaining power is difficult to establish. Therefore, a precise and objective price generally cannot be determined but only estimated within a range. Due to the difficulty of determining an appropriate price, there are other factors in addition to fundamental valuation and negotiation that play a role in determining the bids that acquiring firms place and how those bids are received by the target's shareholders.

A vast body of literature provides evidence that psychological biases influence managers, boards of directors and shareholders in M&A transactions. A well-documented psychological bias is the tendency of people to rely on salient reference points to simplify financial decision-making. The seminal paper by Tversky and Kahneman (1974) provides experimental evidence that people tend to evaluate an outcome in terms of gains or losses relative to a salient reference point, which influences their behavior. Reference points have been shown to play a role in many different situations, such as consumers' purchase decisions (Xia, Monroe, & Cox, 2004), listing prices in the housing market (Genesove & Mayer, 2001), and prices in art auctions (Beggs & Graddy, 2009).

Baker, Pan, and Wurgler (2012) extend the reference point literature by examining the effects of past peak prices on M&A transactions. The authors find that past target stock price peaks act as reference points to the parties involved in an M&A transaction. These reference points are used to simplify valuation and negotiation. The authors find a positive relationship between target 52-week high stock prices and offer prices. The authors also find that the probability of deal completion increases discontinuously when the bid is higher than the target's 52-week high stock price. Further, the authors find that the portion of offer prices that is driven by the 52-week high leads to a more negative bidder announcement return. Several subsequent studies provide evidence that reference points play an important role in public M&A (e.g. Chira & Madura, 2015; Ma, Whidbee, & Zhang, 2019; Ramoška, 2012; Smith, Coy, & Spieler, 2019)

Recent evidence indicates that reference points play a role in M&A in a cross-border context as well. Smith et al. (2019) find a positive relationship between target 52-week high prices and offer prices in cross-border M&A transactions in an international sample. Further, the authors posit that increased deal complexity and information asymmetry in cross-border M&A could lead negotiators to rely more heavily on the reference point. On the other hand, the authors argue, increased complexity could lead to reduced reliance on reference points due to increased due diligence and more thorough analyses in cross-border M&A. Their results indicate that the role of reference points is reduced in cross-border M&A and argue that this is due to increased due diligence and scrutiny.

Although Smith et al. (2019) did not find support for their hypothesis regarding information asymmetry, other studies have found that information asymmetry can influence M&A transactions in several ways. Borochin, Ghosh, and Huang (2019) find that M&A announcement period wealth gains are significantly affected by the target's level of information asymmetry. The authors further find that information asymmetry is an important factor in target selection and deal closure time. Dionne, La Haye, and Bergerès (2015) argue that bidders that have established a toehold position in the target company prior to submitting a bid experience a lower degree of information asymmetry than other bidders. The authors argue that other bidders may fear suffering from the winner's curse since they are less informed. This may prompt less informed bidders to not participate or withdraw from the process early, allowing bidders with a toehold position to pay a lower premium. Consistently, the authors find that bidders with a toehold position pay a significantly lower acquisition premium than other bidders.

Although the effects of reference points in public M&A have been documented by previous studies in the US market (e.g. Baker et al., 2012; Ma et al., 2019), there is a lack of studies in other markets. Therefore, this study examines the effects of reference point prices on M&A transactions in the United Kingdom (the UK). Building on the findings of previous studies (e.g. Borochin et al., 2019; Smith et al., 2019), I also extend the literature by examining whether information asymmetry influences the effects of reference points prices on M&A transactions. A higher degree of information asymmetry between target insiders and bidders is hypothesized to lead to a stronger effect of past peak prices on offer premiums.

I study the effects of peak prices over different intervals of time, going from the target 13-week high stock price to the 78-week high stock price. I find that peak prices that have occurred farther in the past have a diminishing marginal effect. However, following previous studies (e.g. Baker et al., 2012; Chira & Madura, 2015; Smith et al., 2019), I focus on target 52-week high stock prices for the majority of the paper.

Consistent with the previous literature, the results of this paper indicate that there is a positive, non-linear relationship between target 52-week high prices and offer prices. The relationship is robust to a battery of controls and across a range of specifications and subsamples. However, in contrast to the findings of Baker et al. (2012), I find that the effect of 52-week high prices on offer prices fails to survive a falsification test which aims to test whether negotiators are specifically using the 52-week high as a reference point. Further, in contrast to Baker et al. (2012), I do not find that the probability of deal completion increases discontinuously when the bid surpasses the target 52-week high and I find no influence of the 52-week high on bidders' announcement period return. These findings may indicate that negotiators in M&A transactions rely specifically on the target 52-week high to a lesser extent in the UK market than in the US market.

I continue by examining whether the effect of 52-week high prices on offer prices is stronger in the presence of information asymmetry between target insiders and bidders. In contrast to Smith et al. (2019), I find that the effect of 52-week high prices is significantly stronger in cross-border deals. This supports the hypothesis that information asymmetry leads negotiators to rely more heavily on past peak prices as reference points. However, I find no consistent results when analyst coverage, public firm age, bidder toehold, target volatility or target average bid-ask spread are used as proxies for information asymmetry.

The remainder of this paper is organized as follows: Section 2 introduces a review of relevant literature. Section 3 describes the sample, the main variables of interest and the proxies used for information asymmetry. Section 4 presents the methodology used in the paper. In section 5, the results and robustness checks are presented and discussed. Section 6 concludes.

## 2 Literature Review and Hypotheses

This section provides a review of relevant literature. Section 2.1 describes the anchoring bias of Tversky and Kahneman (1974) and Prospect Theory of Tversky and Kahneman (1979). Section 2.2. reviews empirical evidence of the effects of reference point dependency on financial decision-making. Section 2.3 reviews evidence of the effects of reference point dependency on M&A transactions and section 2.4 reviews literature on the effects of information asymmetry in M&A.

### 2.1 Anchoring and Adjustment

Anchoring is a well-established phenomenon that was first examined in the ground-breaking paper by Tversky and Kahneman (1974). The authors find evidence of the anchoring-and-adjustment bias in an experimental setting. Their results indicate that people often make estimates by starting from an initial value that is adjusted to arrive at the final answer. The adjustments that people make are typically insufficient, which means that different starting points produce different estimates. The initial reference point carries an unreasonably high weight in people's decision making process, leading the final answer to be biased towards the reference point. Thus, people tend to "anchor" on initial salient reference points. Tversky and Kahneman (1979) argue that people choose their reference points based on the situation at hand. The most common reference point is the status quo. However, in some circumstances, people tend to use an aspiration or expectation level as a reference point. Decision-making can also be influenced by whether the situation is framed as a gain or a loss.

Anchoring has been used to explain several different phenomena in previous research. For example, Genesove and Mayer (2001) find that listing prices in the housing market depends on the purchase price paid by sellers. In this case, the purchase price paid by sellers is a salient reference point that is used to evaluate offers. Similarly, Beggs and Graddy (2009) find that sales prices of paintings in art auctions are affected by previous sales prices. More recently, Dougal, Engelberg, Parsons, and Van Wesep (2015) document that terms in loan agreements are influenced by the path of credit spreads since a firm's last loan. They find that firms are charged a higher interest rate than is implied by their fundamentals if credit spreads have declined and that firms are charged a lower interest rate than is justified by their fundamentals if spreads have increased. The authors argue that the most plausible explanation is that borrowers and/or lenders are affected by anchoring and use past loan terms as reference points.

### 2.1.1 Prospect Theory

Tversky and Kahneman (1979) develop Prospect Theory, which emphasizes that gains and losses are evaluated relative to a reference point. The authors find that people generally are loss averse, meaning that a loss carries a much greater negative utility than a commensurate gain carries a positive utility. According to Prospect Theory, the utility function is convex in the loss region and concave in the gain region and people tend to overweight low probability events.

Prospect Theory has been widely applied in the literature. For instance, it has been discussed as an explanation of "the disposition effect" (Kliger & Kudryavtsev, 2008). The disposition effect refers to the tendency to hold on to assets that are in the loss region and sell assets that are in the gain region (see section 2.2.1 below). Barberis, Huang, and Santos (2001) draw on prospect theory to extend the traditional asset pricing framework. The authors develop a model that incorporates loss aversion that changes over time due to prior portfolio performance. This model can explain several phenomena that have long been at the focus of asset pricing research, such as the equity premium puzzle and the low correlation of stock returns with consumption growth.

## 2.2 Empirical Evidence of Reference Point Dependency

This section reviews evidence of reference point dependency in financial markets and its implications.

### 2.2.1 The Disposition Effect

Shefrin and Statman (1985) were the first to document that investors are often affected by the "disposition effect", the tendency to hold on to stocks that have depreciated and sell stocks that have appreciated. People thus use the prices at which they bought stocks as a reference point and evaluate their holdings relative to that reference point. The results are consistent with Prospect Theory and cannot be explained by tax considerations. In most jurisdictions, it would be more tax-efficient to realize losses early and delay the realization of profits. Several authors have subsequently found evidence of the disposition effect among retail investors as well as institutional investors, using data on individual investors' accounts (e.g. Odean, 1998; Grinblatt & Keloharju, 2001), experimental designs (e.g. Weber & Camerer, 1998) and market-wide data (e.g. Bremer & Kato, 1996). The disposition effect has been shown to be detrimental to investors' portfolio performance. Grinblatt and Han (2005) find that investors who are affected by the disposition effect on average hurt their own wealth since the poorly performing stocks that investors hold on to tend to underperform the market whereas the stocks that investors sell tend to outperform the market.

Ye (2014) study whether the disposition effect influences corporate takeovers. The author finds that institutional investors of target companies are reluctant to realize losses. The author finds that institutional investors' reluctance to realize losses affects both pricing and the probability of deal success. The effect is most pronounced for targets whose shareholders have a strong tendency to hold on to loser stocks. Further, the disposition effect has been linked to several asset pricing phenomena, such as stock-level momentum and post-earnings-announcement drift (Barberis & Xiong, 2009).

### 2.2.2 Past Stock Price Peaks as Reference Points

The majority of the literature on the disposition effect assumes that investors use their purchase prices as reference points. Indeed, the purchase price is a salient reference point to stock market investors against which they evaluate portfolio holdings. However, researchers have found that investors may update their reference points as they receive new information. Brown, Chappel, da Silva Rosa, and Walter (2006) find that the disposition effect tends to fade away after investors have held a stock for more than 200 days. Kliger and Kudryavtsev (2008) study the mechanism of reference point formation and find that salient events that take place during the holding period of a stock affects investors' perceptions and make them update their reference points. In particular, earnings announcements that deviate from expectations were found to play a role in reference point formation. After unexpected earnings are announced, investors tend to view the stock as having new attributes and evaluate their holdings relative to the post-announcement stock price instead of their purchase price.

Several studies have found that the previous 52-week high stock price is a particularly prominent reference point in financial markets. Heath, Huddart, and Lang (1999) study option exercise decisions by over 50,000 employees at seven corporations. The authors find that option exercises by employees roughly doubles when the stock price exceeds the 52-week high. Huddart, Lang, and Yetman (2009) find that trading volumes increase significantly once a stock surpasses its 52-week high. George and

Hwang (2004) find that a large part of the profits from momentum investing can be explained by investors anchoring on the 52-week high. More recently, Lee and Piqueira (2019) document that insiders are affected by anchoring associated with the 52-week high. The authors find that insiders are reluctant to buy stock but willing to sell when the stock price is close to the 52-week high. It is also shown that insiders are more willing to buy and less willing to sell once the stock price is far from the 52-week high.

Baker et al. (2012) argue that past peak prices are important reference point for several reasons. First, past peak prices are salient to investors, boards and executives since they are readily available and often reported in the financial press. The 52-week high is a particularly commonly cited past peak price. Second, past peak prices are often used by practitioners in negotiations. Target boards that are against the deal often argue that a bid is too low compared to a certain peak price, while those that encourage the deal often note when a bid is above a certain peak price. Third, the management and the board of the target may face shareholder litigation if they recommend a bid that could be considered as too low. In such a situation, not having recommended a bid that is below a certain peak price may provide some protection. Importantly, past peak prices are reference points that are common for all stakeholders, unlike investors' individual cost bases. Therefore, past peak prices can be used as salient reference points in negotiations. In addition, Baker et al. (2012) find that a large proportion of bids tend to collect slightly above past peak prices, which implies that the respective parties in an M&A transaction indeed take peak prices into account in their negotiations. It is possible that bidders who were considering a bid close to the 52-week high, for example, tend to raise the bid to slightly above the 52-week high to raise the probability of deal success. This action may be rational since Baker et al. (2012) find that the probability of success increases discontinuously when the bid surpasses the 52-week high.

## 2.3 Pricing in M&A and the Influence of Reference Point Dependency

This section discusses factors that influence pricing in M&A and reviews evidence of reliance on past peak prices as reference points in M&A.

### 2.3.1 The Conventional Approach to Pricing in M&A

Determining an appropriate bid price is arguably one of the most critical elements in an M&A transaction. The textbook story of pricing in M&A focuses on fundamental valuation of the target and on synergies that can be attained by combining the two entities. Common valuation methods used in M&A include discounted cash flow valuation, valuation based on trading multiples of comparable listed companies, and valuation based on multiples in recent comparable transactions (e.g. Goedhart et al., 2015; Aydin, 2017)

On average, bidders pay substantial premiums above the market price of companies' stock. Fralich and Papadopoulos (2018) study a sample of acquisitions by S&P listed companies around the financial crisis of 2008. Their sample spans the period 2005-2010 and the authors find an average acquisition premium of 47.7% compared to the stock price one day prior to the bid. The authors find that premiums were significantly higher during the financial crisis than before the crisis. They argue that the higher premiums during the financial crisis are due to higher competition for distressed targets at discounted prices and higher information asymmetry between targets and bidders. During the crisis, it was more difficult for bidders to judge the quality of the targets. However, bidders assumed that target valuations were depressed, leading to higher premiums. Bertrand, Betschinger, and Settles (2016) study a sample of cross-border deals between 1990 and 2008 and find similar results as Fralich and Papadopoulos (2018). The authors calculate the acquisition premium as the bid price divided by the target stock price four weeks prior to the bid to account for any stock-price run-up due to information leakage (e.g. Schwert, 1996; Keown & Pinkerton, 1981). Their results show an average premium of 44.8%.

The premiums paid in M&A are often rationalized by focusing on expected synergies. Goedhart et al. (2015) describe that M&A transactions can only create value if there are synergies that make the cash flows of the combined entity greater than the sum of what the cash flows of the standalone firms would have been if the entities had not been combined. Synergies are defined by the authors as the revenue, cost and capital improvements that occur as a result of the combination of two businesses.

The authors note that acquirers are on average better at capturing cost synergies than realizing revenue synergies and that synergy estimates are often overoptimistic. Similarly, Fiorentino and Garzella (2015) argue that there are three common pitfalls regarding synergies: managers tend to overestimate potential synergies, underestimate the difficulties in synergy realization and exhibit a lack of attention to synergy realization.

Although acquisition premiums are normally explained through expected synergies, researchers have found that behavioral biases may affect the premiums that acquirers pay. Roll (1986) was one of the first to present empirical evidence that individual behavioural biases play a role in corporate takeovers. His hubris hypothesis focuses on bidding managers' overconfidence. He finds that hubris on the part of the individual decision makers leads to overpayment by bidding firms. However, bidders' overconfidence is not the only bias that plays a role in M&A.

Malhotra, Zhu, and Reus (2015) find evidence that decisions on acquisition premiums are often anchored on premiums that other firms have paid in similar preceding transactions. The authors find that the anchoring effect is particularly strong when similar preceding transactions have happened recently and were similar in size as the focal transaction, when the focal transaction is a cross-border deal and when the acquirer lacks acquisition experience.

Any anticipated gains from a business combination need to be divided between the shareholders of the target and the bidder to arrive at a bid price. In practice, the price in an acquisition is normally determined through a negotiation process between the parties in the transaction. Therefore, the division of perceived gains from the deal will be dependent on the relative bargaining power of the parties. Furthermore, there are several variables that complicate the negotiation process. For example, the parties have to agree on the type of consideration (e.g. cash, shares or other types), the covenants and the structure of the deal, and what roles specific managers will have post-closing. This implies that an appropriate target price can be influenced by many factors. The outcome of the negotiations is to a great extent dependent on the parties' relative bargaining power, which is difficult to establish in practice. The negotiators can bluff, other bidder could emerge and information asymmetry may exist. These issues complicate the process of determining an appropriate bid price.

In practice, most of the value created in an M&A deal tends to go to the target shareholders. There is substantial empirical evidence on the post-announcement period returns to bidders and targets in M&A transactions. Several authors have found that gains from M&A are positive on average and that most of the value created through M&A is allocated to the target shareholders. Ruback and Jensen (1983) find that corporate takeovers create positive gains and that target shareholders receive significant positive abnormal returns of 20% in mergers and 30% in tender offers whereas the abnormal returns to bidders are approximately 0% in mergers and 4% in tender offers. This evidence is supported by Bruner (2002) who summarizes evidence from 130 studies from 1971 to 2001. The author finds that that the target shareholders earn sizeable abnormal returns and that M&A creates value in aggregate. Regarding bidder returns, the author finds that about one third of bidders show value destruction, one third show value conservation and one third are able to achieve value creation through M&A. In aggregate, the author finds, bidders earn approximately zero abnormal returns.

#### 2.3.2 The Influence of Reference Points on M&A Transactions

As described in section 2.1 and 2.2 above, there is substantial evidence that reference points affect people's behavior in a range of situations. Researchers have also found that reference points play a role in negotiations. Kahneman (1992) describe that negotiators may try to anchor their counterparties at certain reference points to arrive at a desirable outcome. Making low offers or high claims may affect the other party's reference point and communicate one's own reference point. Kristensen and Gärling (2000) find evidence in an experimental setting that people do indeed tend to generate counteroffers in negotiations through an anchoring-and-adjustment process. Thus, using reference points in a negotiation may be rational for a negotiator if it leads the counterparty to accept a desired outcome.

Several previous studies provide evidence that reference point dependency influences M&A transactions. The seminal paper by Baker et al. (2012) focuses on the target 52-week high stock price as a salient reference point in M&A. The authors study a sample of 7,020 deals in the US market between 1984 and 2007 and find that the 52-week high influences M&A transactions in several ways.

First, the authors find that the 52-week high has a statistically and economically significant effect on offer prices. Using piecewise linear regression, the authors find that a 10% higher 52-week high leads to an increase in the offer price of about 3.3% as long as the 52-week high is less than 25% higher than the pre-offer stock price. When the 52-week high is between 25% and 75% higher than the pre-offer bid, the effect is noisier and statistically and economically weaker. In this range, every 10% increase in the 52-week high leads to an increase in the offer price by roughly 1%. When the

52-week high is more than 75% higher than the pre-bid price, it is intuitive that it would carry less weight in the determination of the offer price. In this range, a 10% increase in the 52-week high leads to roughly a 0.7% increase in the offer price. This pattern is consistent with the S-shaped value function of Prospect Theory, which holds that the marginal perceived loss is smaller the further away the offer price is from the reference point. The results are robust to the inclusion of control variables for bidder-, target- and deal characteristics.

Second, Baker et al. (2012) find that the bidders' announcement return becomes worse with the target's distance from its 52-week high. For each 10% increase in the component of the offer premium that is explained by the 52-week high, the bidder announcement return becomes 2.45% worse. A plausible explanation, given the strong relationship between 52-week high prices and offer prices, is that investors may view the bidder as more likely to be overpaying when the target has fallen below this reference point.

Third, the authors find that the probability of deal completion increases by 4.4-6.4% discontinuously when the offer price surpasses the 52-week high target stock price. Similarly, Chira and Madura (2015) find an inverse relationship between the probability of deal completion and the target's distance to its 52-week high at the time of bid announcement. Thus, if a firm's stock price has fallen sharply from its 52-week high, the shareholders of the firm are less likely to accept an offer for the firm. The authors argue that the shareholders are likely to perceive the firm as undervalued relative to the reference point which would make them less likely to accept a bid for the firm. Gerritsen and Weitzel (2017) provide further evidence that reference points matter to deal completion. The authors posit that analyst target prices for takeover targets act as reference points for target shareholders. The results indicate that there is a negative relationship between analyst target prices for a takeover target and the probability of deal completion.

Fourth, Baker et al. (2012) study the effects of the 52-week high on aggregate merger activity. A well-documented fact about mergers and acquisitions is that they come in waves (e.g. Harford, 2005; Rhodes-Kropf & Viswanathan, 2004). Merger waves coincide with periods of high recent returns and relatively high stock market valuations. Baker et al. (2012) hypothesize that reference point dependency contributes to the merger wave phenomenon. Higher market valuations mean that more targets are trading closer to their peak prices. Therefore, the authors argue, these peak prices are easier to satisfy (from the target perspective) and to justify (from the bidder perspective). This implies that

M&A activity will be higher when market valuations are high. Consistently, the authors find that the market's 52-week high relative to its current value is inversely related to the level of merger activity.

Chira and Madura (2015) extend the literature by investigating the joint and separate effects of target and bidder reference points based on a sample of US deals between 1992 and 2011. The authors test whether the probability that a firm will receive a bid is influenced by its 52-week high stock price. Their results indicate that a target whose stock price is more distant from its 52-week high is less likely to attract bids but is more likely to be acquired by its own management. Further, they find that bidders are more likely to submit a bid if its stock price is closer to its 52-week high. The authors also find that target and bidder reference points jointly affect the likelihood of a hostile bid.

Ma et al. (2019) study a comprehensive sample of over 19,000 US M&A deals between 1981 and 2014, involving both private and public targets, and find evidence that investors use the 52-week high as a measure of acquirer valuation. The authors focus on the effects of reference point dependency on the announcement period returns of bidders. They find that bidders earn higher announcement-period returns when the bidders' pre-announcement stock prices are well below their 52-week highs and that announcement period returns are lower when the bidders' stock prices are near their 52-week highs. Further, the reference point effect is stronger if the target is a private company, if there is greater uncertainty regarding deal specifics or if the acquirer has greater individual ownership.

Target and bidder reference point prices have also been found to influence the consideration sought by targets and the consideration offered by bidders. Chira and Madura (2018) investigate whether reference points affect the method of payment in a sample of deals involving US targets between 1992 and 2011. The authors find that targets whose stock prices are far from their 52-week highs prefer to receive cash rather than bidder stock as payment. The authors argue that the target may be in a better negotiating position, and may insist on cash payment when the stock price has fallen and the target may be viewed as undervalued. Further, bidders with a shorter distance to their respective 52-week highs prefer to offer their own stock as consideration. The authors argue that bidders' whose stock prices are close to their 52-week highs may perceive their own stock as overvalued and thus a suitable means of payment.

Li, Guo, and Andrikopoulos (2019) develop a measure of relative reference points (RRP) and examine its effects on M&A, using a sample of US deals between 1985 and 2014. RRP is defined as the difference between the target reference point and the bidder reference point. The target and bidder reference points are defined as the difference between their 52-week highs and their pre-announcement stock prices, respectively. Similarly to Chira and Madura (2018), the authors' results indicate that bidders prefer stock payment when the RRP increases. Thus, bidders prefer to use stock payment when their own stock price has risen towards its 52-week high and/or the target's stock price has fallen compared to its 52-week high. The bidders are likely to view their own stock as overvalued in such a situation. The RRP is positively related to the acquisition premium and the target announcement period return. The RRP is negatively related to bidder announcement period return but positively related to the long-run performance of bidders. The authors argue that this may indicate that bidders are able to successfully make acquisitions with overvalued stock.

All the studies mentioned above in this section focus on the US M&A market, but there are a few studies that focus on other markets as well. Stepanova, Savelyev, and Shaikhutdinova (2018) study whether a reference point effect exists in the Russian M&A market, which the authors describe as a relatively inefficient market with highly concentrated ownership. The authors find a significant negative relationship between the bidder's announcement period return and the proximity of its pre-announcement share price to the 52-week high. The effect is found to be stronger in deals with higher levels of information uncertainty. An anchoring effect on the 52-week high is found even for targets with a large shareholder that has a blocking (>10%) or controlling (>25%) stake. Ranganathan and Singh (2015) study the Indian M&A market to investigate whether the reference point effect is different in a vastly different regulatory environment. Indian takeover regulation mandates a minimum offer price, which is calculated based on a formula that includes the 60-day target high share price. The results indicate that the 52-week high influences offer prices in India even after regulation-induced anchoring is controlled for.

### 2.4 The Influence of Information Asymmetry on M&A Transactions

There is a wide body of literature that documents the effects of information asymmetry in M&A. The definition of information asymmetry adopted in this thesis is that the insiders of the target company have more or better information about the target than bidders do. Borochin et al. (2019) argue that M&A involving publicly listed companies is an ideal setting for studying the effects of information asymmetry on corporate decision-making for a number of reasons. First, a public offer causes a shock to both the target's and the bidder's information environment. The bidder normally performs a thorough due diligence process prior to the bid, gathering both public and private information about the target. Second, the announcement of the bid triggers an increase in attention from market participants who are incentivized to gather and analyze information about the firms. For example, investors who attempt to profit from so called "merger arbitrage" are highly incentivized to scrutinize the firms and the deal.

Although an M&A deal generally leads to a higher level of disclosure by the target, the level of disclosure is likely to vary across deals. The increase in information availability from public sources is also likely to differ depending on the target. Further, it may not be in the target's best interest to disclose valuable private information in case the deal falls through. Thus, some degree of information asymmetry is likely to persist between target insiders and bidders despite the increased scrutiny that follows an M&A deal. Additionally, shareholders who must ultimately accept or reject the offer may not be privy to the same level of disclosure as bidders.

Borochin et al. (2019) study the relationship between information asymmetry and firm value around M&A-transactions. To investigate the relationship between firm value and information asymmetry, the authors construct novel proxy for information asymmetry consisting of ten variables that have been used as proxies by previous researchers. Based on this proxy, the authors find a significant positive relationship between bidder announcement-period wealth gains and target information asymmetry. This finding indicates that greater target information asymmetry leads to greater value generation because bidders capture an information asymmetry discount. Further, the authors are the first to find evidence that information asymmetry is an important factor in target selection. The authors find that targets with a higher degree of information asymmetry are more likely to become takeover targets because bidders aim to capture the information asymmetry valuation discount.

Consistent with Borochin et al. (2019), prior studies provide evidence that information asymmetry is negatively related to firm value and positively related to a firm's cost of capital. Fu, Kraft, and Zhang (2012) find that increased reporting frequency decreases information asymmetry and the cost of equity. Similarly, Shroff, Sun, White, and Zhang (2013) find that following the US Securities Offering Reform, enacted in 2005, firms voluntarily provide more information disclosure before equity offerings. The authors find that the increased disclosures leads to reduced information asymmetry and a reduction in the cost of raising equity capital.

Officer, Poulsen, and Stegemoller (2009) argue that target firm information asymmetry in M&A-transactions causes difficulties in valuation and affects the consideration paid in the transaction and bidder returns. The authors measure information asymmetry by R&D intensity and idiosyncratic return volatility. The findings indicate that stock-swap transactions for targets that are difficult to value leads to significantly higher bidder returns.

Dionne et al. (2015) study the effect of information asymmetry on premiums paid in acquisitions. The authors hypothesize that informed bidders may pay a lower acquisition premium. This prediction is tested by assuming that blockholders of the target's shares are better informed than other bidders. The findings indicate that blockholders on average pay a significantly lower acquisition premium than other bidders.

Fralich and Papadopoulos (2018) note that the financial crisis of 2008 led to a period of high information uncertainty in the financial markets and increased information asymmetry between bidders and target firms in mergers and acquisitions. The authors find that the increase in information asymmetry between targets and bidders led to significantly higher average acquisition premiums. Further, the authors find that the effect of information asymmetry on premiums can be moderated through bidder CEO characteristics. More experienced CEOs with higher expertise and better networks tend to pay smaller premiums because they are better equipped to deal with an increase in information asymmetry.

Smith et al. (2019) focus on the influence of reference points in cross-border M&A. The authors argue that higher information asymmetry between negotiators in cross-border M&A deals could make the target more difficult to value. The authors posit that increased information asymmetry could thereby lead these negotiators to rely on reference points to a greater extent. However, the authors find that the role of reference points is reduced in cross-border M&A deals and attributes this to more due diligence and more intensive scrutiny in cross-border deals.

## 2.5 Hypothesis Development

The studies reviewed above have found that reference point dependency affects M&A in several ways. The 52-week high stock price has been used extensively in prior literature as a reference point measure. It is a suitable reference point measure since it is commonly cited in the financial press and it is readily available to all market participants. Further, the 52-week high is a reference point that all stakeholders have in common, unlike investors' purchase prices for example.

The success or failure of an acquisition offer ultimately lies in the hands of the target shareholders, who have to decide whether to accept the offer. Investors are often loss averse, meaning that they are reluctant to realize a loss relative to their reference point. Given that target shareholders use the 52-week high as a reference point, they will evaluate gains and losses relative to that reference point. Thus, shareholders are more likely to look favorably upon a bid that is above the 52-week high.

The target board of directors and the bidder may also be affected by reference points. Both the sell-side party and the buy-side party in an M&A transaction commonly hire financial advisers to assist them in matters such as valuation, due diligence and negotiation. These advisers normally conduct a fundamental valuation of the target company and estimate synergies that may result from the deal. However, fundamental valuation is not an exact science and an appropriate bid price can only be estimated within a range, which leaves room for reference points to play a role. Boards may reason that a bid above the 52-week high is unlikely to be considered too low and may be more inclined to recommend such a bid to shareholders. Furthermore, advisers and bidders are likely to be aware of reference point dependency, which may bias their bids towards the 52-week high. Additionally, the 52-week high may be used in negotiations in order to anchor the other party to a favorable level. Thus, there are several reasons why the 52-week high may affect offer prices.

Prior studies have found evidence that the 52-week high positively affects offer prices. I expect to find this pattern in the UK M&A market as well.

**Hypothesis 1:** There is a positive relationship between target 52-week high stock prices and offer prices.

Although the 52-week high is the most commonly used peak price in the literature, peak prices that have occurred more recently or farther away may also affect offer prices. It is plausible that investors are influenced by recent reference points to a greater extent than reference points that are in the distant past. Baker et al. (2012) find that the effects of price peaks that are more distant in the past than 65 weeks prior to the announcement date are generally insignificant. Thus, investors may update their reference points over time as new information reaches the market. More recent reference points are probably also more salient to investors as past reference points easily fade from memory and become less relevant. Therefore, I hypothesize that price peaks that have occurred more recently will have a stronger marginal effect on offer prices than price peaks that have occurred farther in the past.

**Hypothesis 2:** The marginal effect of past peak prices on offer prices is lower the farther in the past the peak prices have occurred.

Baker et al. (2012) find that the likelihood that an offer is accepted jumps discontinuously when the bid price surpasses the target 52-week high. This finding is in line with Prospect Theory, which holds that shareholders should be much more inclined to accept an offer when it represents a gain relative to their reference point instead of a loss.

**Hypothesis 3:** The probability of deal success increases discontinuously when the bid is above the 52-week high.

Baker et al. (2012) further find that bidders' announcement returns are affected by anchoring on the 52-week target high stock prices. The authors utilize a two-stage least squares approach and find that the portion of the offer price that is driven by the 52-week high leads to significantly worse announcement period abnormal returns for bidders. The results indicate that market participants may view the 52-week high effect on offer prices as overpayment.

**Hypothesis 4:** Anchoring on the 52-week high leads to more negative bidder cumulative abnormal announcement returns.

Prior studies have found that information asymmetry may influence mergers and acquisitions in several ways. The acquisition premium, the cost of equity capital, announcement period returns, acquisition financing and firm valuation have all been shown to be affected by information asymmetry. There is also evidence that information asymmetry influences the target selection process. Several authors argue that information asymmetry leads to difficulties in target valuation in M&A (e.g. Borochin et al., 2019; Officer et al., 2009). Higher uncertainty regarding the fundamental value of the target could in turn lead to greater reference point dependency. Thus, I propose the following hypothesis:

**Hypothesis 5:** The effect of target 52-week high stock prices on offer prices is stronger in deals with a higher degree of information asymmetry between target insiders and bidders.

# 3 Data and Key Variables

This section describes the sample used in this study and the variables of interest. The proxies used for information asymmetry are also motivated and discussed.

## 3.1 Sample Selection

The sample of transactions is collected from Securities Data Corporation (SDC) Platinum M&A database and Thomson Reuters Datastream. The selection criteria largely follows previous studies in the field (e.g. Baker et al., 2012; Borochin et al., 2019; Chira & Madura, 2015; Smith et al., 2019) The following selection criteria were applied to collect the initial sample:

1. The targets are denoted as UK domiciled firms in SDC Platinum. The UK market is chosen for this study because it is a large and well-developed market for public M&A. Furthermore, there is a lack of studies focusing on reference point dependency in the UK M&A market.

2. The announcement date is between January $1^{st}$, 1990 and December $31^{st}$, 2018. This sample period was chosen because data availability is more limited prior to 1990. Further, the sample period includes a sufficient number of deals and covers both booms and busts in the M&A market.

3. The deal value is at least £1 million.

4. The target is a publicly traded company.

5. The deal is not classified as a spin-off, a recapitalization, a rumored deal or a share repurchase.

6. The deal status is reported by SDC as completed, unconditional, intent withdrawn, or withdrawn. The sample thus includes both deals that have been successfully completed and withdrawn bids.

7. The bidder was seeking to acquire at least 50% of the target's common shares in the transaction. The 50% limit was chosen to only include deals in which the bidder is attempting a takeover rather than just buying a stake in the target.

8. The offer price per common share in the transaction is available from SDC.

9. Stock price data for the target is available from Datastream for the 335 calendar days preceding 30 calendar days before the bid. This data is required in order to calculate the 52-week high.

Following Baker et al. (2012), the 30 day lag is included to eliminate bias that may be introduced due to the target stock price runups that often occur prior to announcement. Such runups may occur due to information leakage or anticipation of an acquisition (e.g. Schwert, 1996; Keown & Pinkerton, 1981).

The selection based on the criteria 1-7 above resulted in a sample of 2,410 transactions. The offer price in the transaction was unavailable from SDC for 281 of these transactions and the sample thus consisted of 2,129 transactions once these had been removed.

The stock price data for the targets was downloaded from Thomson Datastream based on the target Datastream codes from SDC. However, codes were not available for a fraction of the transactions. Having removed deals for which target Datastream codes were unavailable, the sample consisted of 1,958 transactions. Further, requiring that the target's primary stock exchange is in the UK narrowed the sample down to 1,824 transactions. The targets were listed on one of the following UK exchanges: London Stock Exchange, London AIM, London Unl, OFEX, or PLUS. Eliminating observations for which the available target stock price data was insufficient for calculating the target 52-week high stock price narrowed the sample down to 1,674 transactions. Eliminating deals in which the target's share price was only available in a different currency than GBP (£) due to cross-listing or dual-listing narrowed the sample down to 1,636 deals, which is my main sample.

The distribution of the sample over time as well as deal characteristics are presented in Table 1 and Figure 1. The cyclicality of M&A activity is evident in Figure 1. There are clear drops in deal volume during the economic downturns that took place in the beginning of the 1990s, after the dot-com bubble burst in the beginning of the 2000s and after the financial crisis of 2008. The median offer premium in the entire sample, expressed as the percentage difference between the offer price and the closing share price 30 calendar days prior to the announcement of the bid, is 33.1%. However, there is considerable variation in median premiums across years. Tender offers constitute 70.8% of the deals in the sample. The most common type of consideration is all cash, with 50.5% of all deals having an all cash consideration. Hostile deals are uncommon, with only 7.8% of all deals being hostile. 16.5% of all the deals in the sample have been withdrawn and the remainder have been completed. 10.9% of the deals in the sample are leveraged buyouts (LBOs). Cross-border deals are common, constituting 43.0% of the sample.

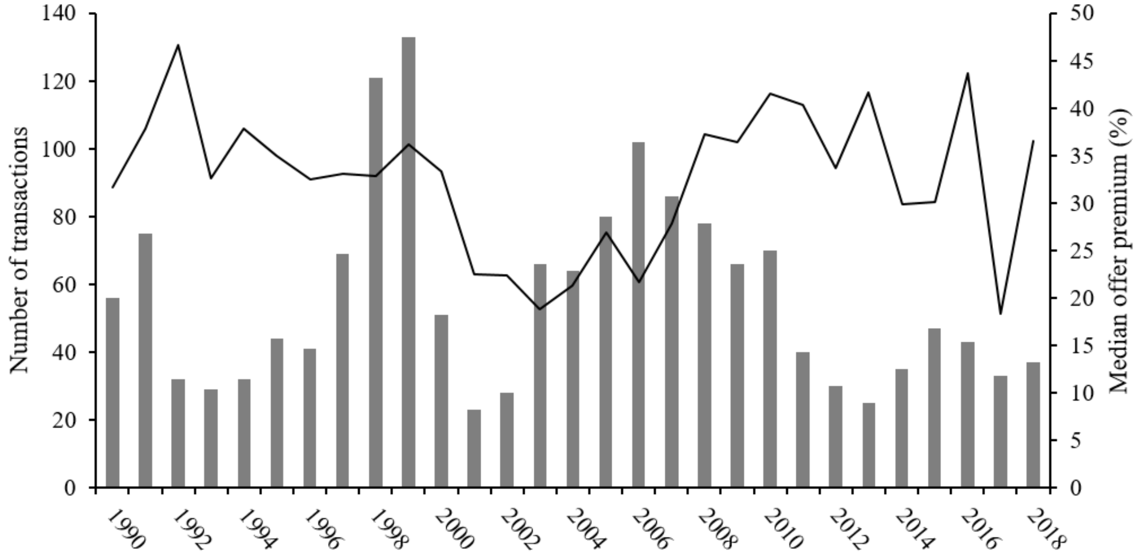
Table 1: Sample Deal Characteristics

The table shows the distribution of the sample over time and deal characteristics. Definitions of all variables can be found in Appendix A.

| Year | N | Median offer premium (%) | Median deal value (£m) | Tender | Consideration | | | Attitude | | Deal success | | LBO | Cross-border |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cash | Stock | Other | Friendly | Hostile | Completed | Withdrawn | | |
| 1990 | 56 | 31.64 | 46.42 | 35 | 24 | 11 | 21 | 51 | 3 | 46 | 10 | 6 | 32 |
| 1991 | 75 | 37.84 | 92.90 | 49 | 34 | 11 | 30 | 68 | 4 | 64 | 11 | 9 | 32 |
| 1992 | 32 | 46.58 | 63.24 | 27 | 16 | 4 | 12 | 29 | 2 | 28 | 4 | 4 | 14 |
| 1993 | 29 | 32.65 | 57.84 | 19 | 15 | 4 | 10 | 26 | 3 | 28 | 1 | 1 | 12 |
| 1994 | 32 | 37.79 | 101.76 | 21 | 13 | 5 | 14 | 26 | 3 | 26 | 6 | 5 | 13 |
| 1995 | 44 | 35.00 | 63.79 | 37 | 19 | 8 | 17 | 41 | 3 | 38 | 6 | 4 | 16 |
| 1996 | 41 | 32.53 | 77.17 | 31 | 22 | 5 | 14 | 32 | 5 | 36 | 5 | 5 | 17 |
| 1997 | 69 | 33.12 | 50.37 | 50 | 34 | 3 | 32 | 62 | 3 | 62 | 7 | 12 | 28 |
| 1998 | 121 | 32.78 | 70.45 | 84 | 57 | 13 | 51 | 103 | 11 | 103 | 18 | 14 | 53 |
| 1999 | 133 | 36.13 | 48.31 | 95 | 69 | 19 | 45 | 114 | 13 | 111 | 22 | 10 | 67 |
| 2000 | 51 | 33.33 | 72.66 | 34 | 25 | 5 | 21 | 43 | 4 | 39 | 12 | 6 | 15 |
| 2001 | 23 | 22.45 | 49.54 | 18 | 11 | 2 | 10 | 22 | 0 | 20 | 3 | 2 | 14 |
| 2002 | 28 | 22.42 | 103.92 | 19 | 10 | 3 | 15 | 24 | 0 | 25 | 3 | 2 | 7 |
| 2003 | 66 | 18.84 | 53.22 | 45 | 43 | 11 | 12 | 58 | 2 | 55 | 11 | 12 | 27 |
| 2004 | 64 | 21.24 | 46.95 | 44 | 28 | 10 | 26 | 57 | 3 | 53 | 11 | 7 | 20 |
| 2005 | 80 | 26.85 | 96.19 | 58 | 40 | 14 | 26 | 66 | 9 | 54 | 26 | 0 | 40 |
| 2006 | 102 | 21.64 | 79.03 | 65 | 51 | 14 | 37 | 89 | 7 | 82 | 20 | 7 | 45 |
| 2007 | 86 | 27.86 | 58.95 | 65 | 44 | 10 | 32 | 77 | 8 | 72 | 14 | 13 | 34 |
| 2008 | 78 | 37.24 | 42.81 | 52 | 51 | 5 | 22 | 71 | 3 | 69 | 9 | 11 | 42 |
| 2009 | 66 | 36.45 | 51.80 | 50 | 30 | 7 | 29 | 55 | 8 | 54 | 12 | 8 | 31 |
| 2010 | 70 | 41.51 | 69.23 | 53 | 43 | 4 | 23 | 58 | 7 | 57 | 13 | 10 | 28 |
| 2011 | 40 | 40.28 | 34.70 | 29 | 17 | 4 | 19 | 38 | 1 | 37 | 3 | 3 | 11 |
| 2012 | 30 | 33.71 | 78.91 | 20 | 17 | 2 | 11 | 27 | 1 | 24 | 6 | 2 | 20 |
| 2013 | 25 | 41.64 | 39.72 | 18 | 9 | 3 | 13 | 19 | 5 | 20 | 5 | 1 | 6 |
| 2014 | 35 | 29.80 | 61.27 | 28 | 19 | 5 | 11 | 30 | 5 | 33 | 2 | 3 | 16 |
| 2015 | 47 | 30.10 | 29.22 | 34 | 23 | 6 | 18 | 42 | 3 | 40 | 7 | 7 | 17 |
| 2016 | 43 | 43.70 | 74.46 | 31 | 24 | 3 | 16 | 37 | 5 | 36 | 7 | 7 | 22 |
| 2017 | 33 | 18.34 | 74.55 | 24 | 17 | 3 | 13 | 28 | 5 | 23 | 10 | 3 | 10 |
| 2018 | 37 | 36.47 | 89.13 | 23 | 22 | 4 | 11 | 34 | 1 | 31 | 6 | 5 | 15 |
| **Total** | **1636** | **33.12** | **63.24** | **1158** | **827** | **198** | **611** | **1427** | **127** | **1366** | **270** | **179** | **704** |

Figure 1: Distribution of Sample

The figure shows the number of transactions in each year in the sample (left axis) and the median offer premium for each year (right axis).




### 3.2 Summary Statistics

Summary statistics are presented in Table 2 below. Most of the continuous variables have been winsorized to remove bias that could be introduced by outliers. Since there were large outliers in the offer premium data, the log offer premium variable has been winsorized on the 5% and 95% levels. Other variables have been winsorized on the 1% and 99% levels.

Target- and bidder characteristics are presented in panels C and D of Table 2. The bidders in the sample have been classified as publicly listed in 829 deals by SDC Platinum. However, sufficient data to calculate bidder characteristics was only available for a fraction of these bidders. As presented in Panel B, the bidders on average earn negative cumulative abnormal announcement returns. Panel E shows deal characteristics, similarly to Table 1 above. Panel F of shows summary statistics for the information asymmetry variables that have been employed in this study. The selection of these variables is motivated in section 3.3 below. The summary statistics are generally similar to the ones found in previous studies (see e.g. Baker et al., 2012; Smith et al., 2019). However, a noticeable difference is that tender offers are more common in my sample than in previous studies. 71% of the deals in the sample are tender offers whereas only 17% are tender offers in Baker et al. (2012)'s sample. In the sample of Smith et al. (2019), 53% of the deals are tender offers.

Table 2: Summary Statistics

The table presents summary statistics for the main variables of interest and controls. All variable definitions are available in Appendix A. Panel A displays the offer premium, the target stock price highs over the 13, 26, 39, 52, 65 and 78 weeks ending 30 calendar days prior to the announcement of the deal, and the 52-week market index high. The offer premium is defined as the log percentage difference between the offer price from SDC Platinum and the closing stock price 30 calendar days prior to the bid. The target (market) high prices are defined as the log percentage difference between the maximum stock price (index value) over the period and the closing stock price (index value) 30 calendar days prior to announcement. Stock price data has been collected from Thomson Datastream. Panel B shows whether the deal is recorded as completed by SDC Platinum and the cumulative abnormal bidder returns over the 3 days centered on the announcement date. Panels C and D show target and bidder characteristics; market capitalization, earnings-to-price ratios, book-to-market equity, and return on assets. Panel E shows deal characteristics and panel F shows the proxies for target information asymmetry that are used in this study. The offer premium is winsorized on the 5% and 95% levels and the other continuous variables marked as wisorized in the table have been winsorized at the 1% and 99% levels.

| | N | Mean | SD | 5% | Median | 95% | Winsorized |
|---|---|---|---|---|---|---|---|
| *Panel A: Deal pricing* | | | | | | | |
| Log offer premium (%) | 1636 | 29.21 | 23.85 | -15.42 | 27.91 | 80.78 | Yes |
| Log 13-week target high (%) | 1636 | 11.02 | 14.01 | 0.00 | 2.07 | 38.68 | Yes |
| Log 26-week target high (%) | 1636 | 21.33 | 26.06 | 0.00 | 12.29 | 76.27 | Yes |
| Log 39-week target high (%) | 1636 | 30.13 | 34.77 | 0.80 | 17.86 | 104.15 | Yes |
| Log 52-week target high (%) | 1636 | 37.57 | 41.49 | 1.40 | 23.23 | 131.20 | Yes |
| Log 65-week target high (%) | 1636 | 43.91 | 47.43 | 1.77 | 28.21 | 151.63 | Yes |
| Log 78-week target high (%) | 1636 | 48.81 | 51.98 | 2.07 | 31.57 | 166.18 | Yes |
| Log 52-week market index high (%) | 1636 | 6.92 | 8.76 | 0.00 | 3.61 | 25.75 | Yes |
| *Panel B: Deal outcome variables* | | | | | | | |
| Completed (%) | 1636 | 0.83 | 0.37 | 0.00 | 1.00 | 1.00 | No |
| Bidder 3-day CAR (%) | 747 | -0.75 | 7.08 | -13.21 | -0.49 | 11.73 | Yes |
| *Panel C: Target characteristics* | | | | | | | |
| Log target market capitalization | 1628 | 4.05 | 1.93 | 1.19 | 3.84 | 7.50 | Yes |
| Log target E/P (%) | 1509 | 6.90 | 31.78 | -24.25 | 8.67 | 31.95 | Yes |
| Log target B/M (%) | 1589 | 58.63 | 47.82 | 5.20 | 54.03 | 133.33 | Yes |
| Log target ROA (%) | 1583 | -1.33 | 23.57 | -32.44 | 3.26 | 14.28 | Yes |
| *Panel D: Bidder characteristics* | | | | | | | |
| Log bidder market capitalization | 602 | 6.14 | 2.26 | 2.75 | 6.06 | 9.70 | Yes |
| Log bidder E/P (%) | 501 | 23.00 | 58.35 | -4.46 | 8.23 | 93.80 | Yes |
| Log bidder B/M (%) | 508 | 66.03 | 89.45 | 1.59 | 42.10 | 221.51 | Yes |
| Log bidder ROA (%) | 715 | 3.75 | 18.59 | -11.46 | 4.91 | 17.35 | Yes |
| *Panel E: Deal characteristics* | | | | | | | |
| Cash | 1636 | 0.51 | 0.50 | 0.00 | 1.00 | 1.00 | No |
| Shares | 1636 | 0.12 | 0.33 | 0.00 | 0.00 | 1.00 | No |
| Tender | 1636 | 0.71 | 0.45 | 0.00 | 1.00 | 1.00 | No |
| Hostile | 1636 | 0.08 | 0.27 | 0.00 | 0.00 | 1.00 | No |
| Financial bidder | 1636 | 0.11 | 0.31 | 0.00 | 0.00 | 1.00 | No |
| Cross-border | 1636 | 0.43 | 0.50 | 0.00 | 0.00 | 1.00 | No |
| *Panel F: Information asymmetry* | | | | | | | |
| Public firm age (years) | 1636 | 14.76 | 12.09 | 1.67 | 10.75 | 38.99 | No |
| Analyst coverage (N) | 1257 | 8.61 | 9.32 | 1.00 | 5.00 | 30.00 | No |
| Bid-ask spread (%) | 1609 | 5.91 | 8.16 | 0.23 | 3.67 | 17.15 | No |
| Toehold (%) | 373 | 20.53 | 13.93 | 0.90 | 21.80 | 46.00 | No |
| Target return volatility (%) | 1632 | 2.55 | 1.49 | 0.90 | 2.18 | 5.46 | Yes |

Table 3 below presents summary statistics divided based on whether the offer price is above or below the target 52-week high stock price. The offer price is higher than the 52-week high in 880 deals and lower than the 52-week high in 756 deals. The fraction of deals that have been completed is 81.9% when the offer price is below the 52-week high and 84.9% when the offer price is above the 52-week high. However, as I show in Appendix C, the probability of deal completion does not increase discontinuously when the offer price surpasses the 52-week high.

The fraction of deals with all-cash consideration is somewhat higher above the 52-week high than below. Noticeably, the fraction of deals with all-shares consideration is considerable lower when the offer price is above the 52-week high. The fraction of hostile bids is higher below the 52-week high and the fraction of LBOs is higher above the 52-week high. The fraction of cross-border deals is also higher when the offer price is above the 52-week high.

Panel B of Table 3 shows that targets on average have a higher market capitalization, higher earnings-to-price ratio, lower book-to-market ratio and higher return on assets when the offer price is above the 52-week high. A similar pattern can be seen for bidders in panel C, except that bidders have higher book-to-market values when the offer price is above the 52-week high.

Panel D shows summary statistics for target information asymmetry variables for deals in which the offer price is below/above the 52-week high. Targets that receive an offer price above the 52-week high have been publicly listed longer, have higher median analyst coverage, lower bid-ask spread and lower volatility. All these results suggest that targets that receive a bid above the 52-week high are associated with less asymmetric information.

Bidders that place an offer above the target 52-week high have smaller toehold positions on average. Although lower toehold positions would be associated with more target asymmetric information, it is intuitive that bidders with an established toehold position pay less since they are likely to face less competition for the target.

Table 3: Summary Statistics Above/Below the 52-Week High

The table presents summary statistics for deals in which the offer price is above/below the target 52-week high stock price. All variable definitions are available in Appendix A.

| | Below 52-week high | | | | Above or equal to 52-week high | | | |
|---|---|---|---|---|---|---|---|---|
| Total number of deals | 756 | | | | 880 | | | |
| | N | Fraction (%) | | | N | Fraction (%) | | |
| *Panel A: Deal characteristics* | | | | | | | | |
| Completed | 619 | 81.88 | | | 747 | 84.89 | | |
| All cash consideration | 376 | 49.74 | | | 451 | 51.25 | | |
| All share consideration | 148 | 19.58 | | | 50 | 5.68 | | |
| Tender | 521 | 68.92 | | | 637 | 72.39 | | |
| Hostile | 68 | 8.99 | | | 59 | 6.70 | | |
| Financial bidder | 80 | 10.58 | | | 99 | 11.25 | | |
| Cross-border | 296 | 39.15 | | | 408 | 46.36 | | |
| | N | Mean | Median | SD | N | Mean | Median | SD |
| *Panel B: Target characteristics* | | | | | | | | |
| Log target market capitalization | 751 | 3.81 | 3.49 | 2.02 | 877 | 4.26 | 4.11 | 1.83 |
| Log target E/P (%) | 671 | 3.71 | 7.91 | 42.84 | 838 | 9.45 | 9.42 | 18.33 |
| Log target B/M (%) | 727 | 66.56 | 61.35 | 50.00 | 862 | 51.95 | 46.55 | 44.84 |
| Log target ROA (%) | 720 | -6.11 | 1.53 | 30.78 | 863 | 2.66 | 4.45 | 13.93 |
| *Panel C: Bidder characteristics* | | | | | | | | |
| Log bidder market capitalization | 282 | 5.84 | 5.82 | 2.29 | 320 | 6.40 | 6.27 | 2.20 |
| Log bidder E/P (%) | 235 | 15.68 | 7.37 | 44.85 | 266 | 29.46 | 9.31 | 67.52 |
| Log bidder B/M (%) | 239 | 58.86 | 40.44 | 69.96 | 269 | 72.39 | 44.40 | 103.46 |
| Log bidder ROA (%) | 346 | 3.88 | 4.67 | 14.31 | 369 | 3.62 | 5.22 | 21.87 |
| Bidder 3-day CAR (%) | 347 | -0.96 | -0.75 | 7.64 | 371 | -0.55 | -0.34 | 6.52 |
| *Panel D: Information asymmetry* | | | | | | | | |
| Public firm age (years) | 756 | 13.47 | 9.06 | 11.93 | 880 | 15.87 | 11.90 | 12.13 |
| Analyst coverage (N) | 550 | 8.67 | 4.00 | 9.53 | 707 | 8.55 | 5.00 | 9.15 |
| Bid-ask spread (%) | 741 | 6.94 | 4.61 | 8.67 | 868 | 5.04 | 3.27 | 7.59 |
| Toehold (%) | 730 | 5.54 | 0.00 | 11.88 | 868 | 4.16 | 0.00 | 10.13 |
| Target return volatility (%) | 755 | 3.10 | 2.74 | 1.69 | 877 | 2.08 | 1.85 | 1.08 |

### 3.3 Variables

This section describes and discusses the main variables of interest in this study. Definitions of all variables used in the study are presented in Appendix A.

#### 3.3.1 The Reference Point Measure

The main independent variable in this study is the target 52-week high stock price, which may serve as a reference point to bidders and target shareholders. Following Baker et al. (2012), I define the target 52-week high as the highest closing stock price over the 335 calendar days ending 30 days prior to the announcement date of the deal, scaled by the closing price on the day 30 days prior to the announcement. The reason for the 30 day lag is to account for any stock price runup that may occur before the deal is announced. Studies have found that stock prices on average start rising before the announcement of a deal due to information leakage, rumors or because the market anticipates that a deal will take place (e.g. Schwert, 1996; Keown & Pinkerton, 1981).

Following Baker et al. (2012), I also employ other peak prices that may serve as reference points. I test whether peak prices over different time periods have incremental effects, starting with the 13-week high and adding peak prices over 13-week increments until I reach the 78-week high.

#### 3.3.2 Proxies for Information Asymmetry

This section describes and discusses the proxies for target information asymmetry that are used in this study. Measuring information asymmetry is challenging since it cannot be directly observed. Researchers must instead rely on proxies for this variable. Two alternative approaches have been used in prior studies. First, researchers have included relevant proxies separately into the analyses. The shortcomings of this approach is that it may induce multicollinearity or attenuation bias. Second, some researchers have constructed a weighted index based on relevant proxies. This approach also has drawbacks since the weights assigned to each proxy are arbitrary and the units of measurement of each proxy may affect the results. The former approach is utilized in this study and the proxies have been chosen based on the results in previous studies.

To measure the information asymmetry between target insiders and bidders, the following proxies have been used in this study: (i) the number of equity research analysts covering the stock, (ii) the volatility of target daily returns, (iii) the average daily target bid-ask spread, (iv) the target firm public age (i.e. the number of years since the firm became listed), (v) whether the bidder had an equity ownership position in the target ("toehold") prior to the bid and (vi) whether the deal is a cross-border deal. These six proxies for information asymmetry have been used by several authors in different applications as described below.

**Analyst Coverage** Analyst coverage is an important source of information for many investors. Equity research provides market participants with analyses of the historical performance of firms, estimates about the intrinsic value of shares and estimates about the future prospects of firms. Karpoff, Lee, and Masulis (2013) argue that transparency and visibility are increased when a firm has a strong analyst following. Thus, higher analyst coverage should lead to lower information asymmetry between targets and bidders. This proxy is used by Autore, Hutton, and Kovacs (2011) and Chen, Dai, and Schatzberg (2010) in the context of equity issues. Karpoff et al. (2013) utilizes this proxy in a study of SEO lockups. It is also used by Borochin et al. (2019) as a proxy for information asymmetry between targets and bidders in M&A. Following Karpoff et al. (2013), I measure analyst coverage as the average number of equity analysts providing an earnings per share (EPS) forecast for the next quarter for target firms over the year prior to the announcement date. The data has been collected from the I/B/E/S database, accessed through Thomson Datastream.

**Return Volatility** Karpoff et al. (2013) argue that higher return volatility indicates that the firm's information environment is noisy, which makes it more difficult for investors to assess the performance of the firm. Similarly, Officer et al. (2009) use target idiosyncratic return volatility as a proxy for information asymmetry and argue that higher volatility indicates that the target is more difficult to value. Baker et al. (2012) include the volatility of the target returns as a control. Following Baker et al. (2012) I define target return volatility as the standard deviation of daily total returns for the 335 calendar days ending 30 days prior to the announcement date.

**Average Bid-Ask Spread** The average bid ask-spread can be viewed as an indirect measure of trading liquidity since lower liquidity leads to a higher bid-ask spread. Karpoff et al. (2013) argue that a higher bid-ask spread is indicative of higher information asymmetry between insiders and outside investors because the higher spread compensates the less informed market makers and investors for the risk that they bear in trading in the stock. Further, a smaller spread indicates that more buyers and sellers take part in the price-building process, which may result in less uncertainty about the value of the firm. Following Borochin et al. (2019), I define the average bid-ask spread as the average daily spread between bid and ask prices divided by the closing price in each day over the year prior to the announcement of the acquisition.

**Firm Age** Companies that have been publicly listed for a longer time are more well-known by market participants. According to Karpoff et al. (2013), investors tend to have more information about older firms. Thus, information asymmetry between insiders and outside investors is normally lower in older firms. Following Borochin et al. (2019), I define firm age as the number of years that has passed since the firm's IPO.

**Toehold** Dionne et al. (2015) assume that large shareholders ("blockholders") of the target may be better informed about the target than other bidders in mergers and acquisitions. The monitoring activities of blockholders may give them preferred access to managers and board members, and thus an informational advantage to evaluate the target's performance and value. The authors argue that better informed bidders may be able to deter other bidders from entering the bidding process for the target. Thus, the authors use this variable as a proxy for information asymmetry and find that blockholders on average pay a significantly lower acquisition premium than other bidders. Consistent with this evidence, Aintablian, El Khoury, and M'Chirgui (2017) find a negative relationship between the size of bidders' toehold positions in the target prior to the bid and the number of competing bidders. The authors also find that bidders are more likely to purchase a toehold position prior to the bid as a means of reducing information asymmetry. Specifically, the authors find that bidders tend to purchase toehold positions when the target's intangible assets are higher in value, when the target is in another industry and/or incorporated in a foreign nation.

**Cross-Border** Smith et al. (2019) argue that cross-border M&A involves a high degree of deal complexity and information asymmetry due to possible changes in legal environment, regulatory hurdles and physical and cultural distance between the bidder and the target. The authors posit that the increased complexity and information asymmetry may lead negotiators in cross-border deals to rely more heavily on a readily available reference point that is observed in the market, namely the target 52-week high stock price. However, the authors also raise the point that cross-border M&A generally involves more scrutiny, which may reduce the negotiators' reliance on the reference point. Consistent with the latter explanation, the authors find that the influence of 52-week high prices on offer prices is lower in cross-border deals.

# 4 Methodology

This section describes the methods used to test the hypotheses. The main econometric methods used in the study are ordinary least squares (OLS) regression and piecewise linear regression. I also use Gaussian kernel regression, density discontinuity analysis, probit regression, instrumental variables (two-stage least squares regression) and an event study methodology.

## 4.1 Gaussian Kernel Regression

Previous studies have found that the relationship between past peak prices and offer prices is not linear (e.g. Baker et al., 2012; Smith et al., 2019). Therefore, a non-parametric examination of the relationship is appropriate. Non-parametric regression is useful for graphically estimating the shape of the relationship without imposing a specific parametric form. Kernel regression is a type of locally weighted smoothing technique. This means that the location of each predicted value is calculated based on the observations within a certain bandwidth. The observations within the bandwidth are weighted based on the kernel chosen (e.g. triangular, Epanechnikov or Gaussian). With a Gaussian kernel, the error terms are assumed to be normally distributed. A detailed description of the methodology can be found in Härdle (1990). Following Baker et al. (2012), I fit a Gaussian kernel regression with a bandwidth of 10 and 40 bins. The result is presented in Figure 4 in section 5.1 below.

## 4.2 Ordinary Least Squares and Piecewise Linear Regression

Ordinary least squares (OLS) regression is one of the most commonly used empirical techniques. This method estimates a linear relationship between the dependent and one or several independent variables by minimizing the sum of the squared residuals between observed and predicted values of the dependent variables.

Piecewise linear regression is similar to the ordinary least squares methodology but it allows different linear models to be fitted over different ranges of the independent variable. It is useful when a simple linear regression cannot provide an adequate estimation. The different linear relationships are separated by breakpoints, which are values of the independent variable where the slope changes. As shown in Figure 4 in section 5.1 below, the relationship between the 52-week high and offer prices is clearly not linear. Following Baker et al. (2012) I use piecewise linear regression to allow for the effect of past peak prices to have a diminishing marginal effect on offer prices the farther away from the pre-bid stock price they are.

### 4.3 Instrumental Variables

An instrumental variables methodology is useful in situations in which an OLS estimator may be endogenous, meaning that the independent variable is correlated with the error term. This bias can occur due to omitted variable bias, simultaneity, measurement error or other reasons (Angrist & Pischke, 2008). In this paper, I utilize two-stage least squares regressions to investigate a possible non-psychological explanation of the 52-week high effect in section 5.2.1 below and to examine the effect of the target 52-week high on bidder wealth in Appendix B.

### 4.4 Probit Regression

Probit regression is useful when the dependent variable is a dichotomous variable (i.e. a 1/0 variable) and the researcher is interested in the probability of a certain outcome. I employ probit regressions to examine whether the probability of deal success increases discontinuously when the offer price exceeds the 52-week high. The results are presented in Appendix C.

### 4.5 Event Study Methodology

I utilize an event study methodology and an instrumental variables approach to examine the effect of reference point dependency on bidder wealth. To estimate the effect of M&A transactions on bidder wealth, it is necessary to market-adjust the bidders' announcement return to isolate the part that is attributable to the M&A deal. I do this by following a standard event study methodology based on the paper by MacKinlay (1997).

To calculate the abnormal returns to bidders during the announcement period, I need an estimate of the expected return if no deal had taken place. To estimate the expected returns to bidders, I use the market model. The parameters are estimated by regressing each bidder's daily returns on their benchmark market index returns for a period of 250 trading days, ending 30 days prior to the announcement of the deal. Since the bidders in my sample are from different countries, the local market all share index for each bidder was collected from Thomson Datastream. The market model is presented in equation 1 below.

$$r_{i,t} = a_i + b_i * r_{m,t} \tag{1}$$

The variable $r_{i,t}$ is the realized total return for bidder i on trading day t and $r_{m,t}$ is the total return on the local market all share index for day t. The parameters $a_i$ and $b_i$ are used to calculate the abnormal return for each bidder during the event window as shown in equation 2 below.

$$AR_{i,t} = r_{i,t} - (a_i + b_i * r_{m,t}) \tag{2}$$

The abnormal returns are then cumulated over the event window centered on the announcement date. The purpose of calculating cumulative abnormal returns (CAR) over a window rather than focusing solely on the announcement date is to account for any information leakage or slow price adjustment that may occur around announcement. I calculate abnormal returns for a three day event window and confirm the results with a seven day event window. The abnormal returns are aggregated across bidders and through time as shown in equation 3 below. The bidder CAR is negative on average as shown in the summary statistics in Table 2 in section 3.2 above.

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t} \tag{3}$$

# 5 Results

This section presents the empirical results. Section 5.1 focuses on the effect of peak prices over different time intervals on offer prices. Thereafter, the study focuses exclusively on the 52-week high.

## 5.1 The Effect of Past Peak Prices on Offer Prices

To test hypothesis 1, I apply the methodology of Baker et al. (2012). Specifically, I use Gaussian kernel regression, OLS regression and piecewise linear regression to test whether there is a relationship between offer premiums and past target stock price peaks in the UK M&A market. Figure 2 below presents histograms of the density of offer prices around peak prices over 13-week intervals, starting at the 13-week high and ending at the 78-week high. It can clearly be seen in the histograms that offer prices tend to collect slightly above past peak prices. However, in contrast to Baker et al. (2012) I find no clear spikes at the peak prices. If negotiators anchored on the past peak price to such an extent that the offer price equalled the past peak price in a substantial number of cases, one would expect to see clear spikes at 0 in the histograms.

To formally investigate whether the density of offer prices is higher above the 52-week high, I conduct a discontinuity analysis, which is presented in Figure 3 below. Although the density is higher slightly above the peak price, there is no statistically significant discontinuity.

Figure 2: Density of Offer Prices

The histograms show the difference between the offer price and the x-week target high price. The offer price per common share is collected from SDC Platinum and the stock price data is collected from Thomson Datastream. The x-week high is defined as the maximum stock price over the x weeks prior to the announcement ending 30 calendar days prior to announcement (e.g. the 52-week high is defined as the maximum price over the 335 calendar days ending 30 calendar days prior to announcement). Both the offer price and the x-week high are scaled by the closing target stock price 30 calendar days prior to announcement.

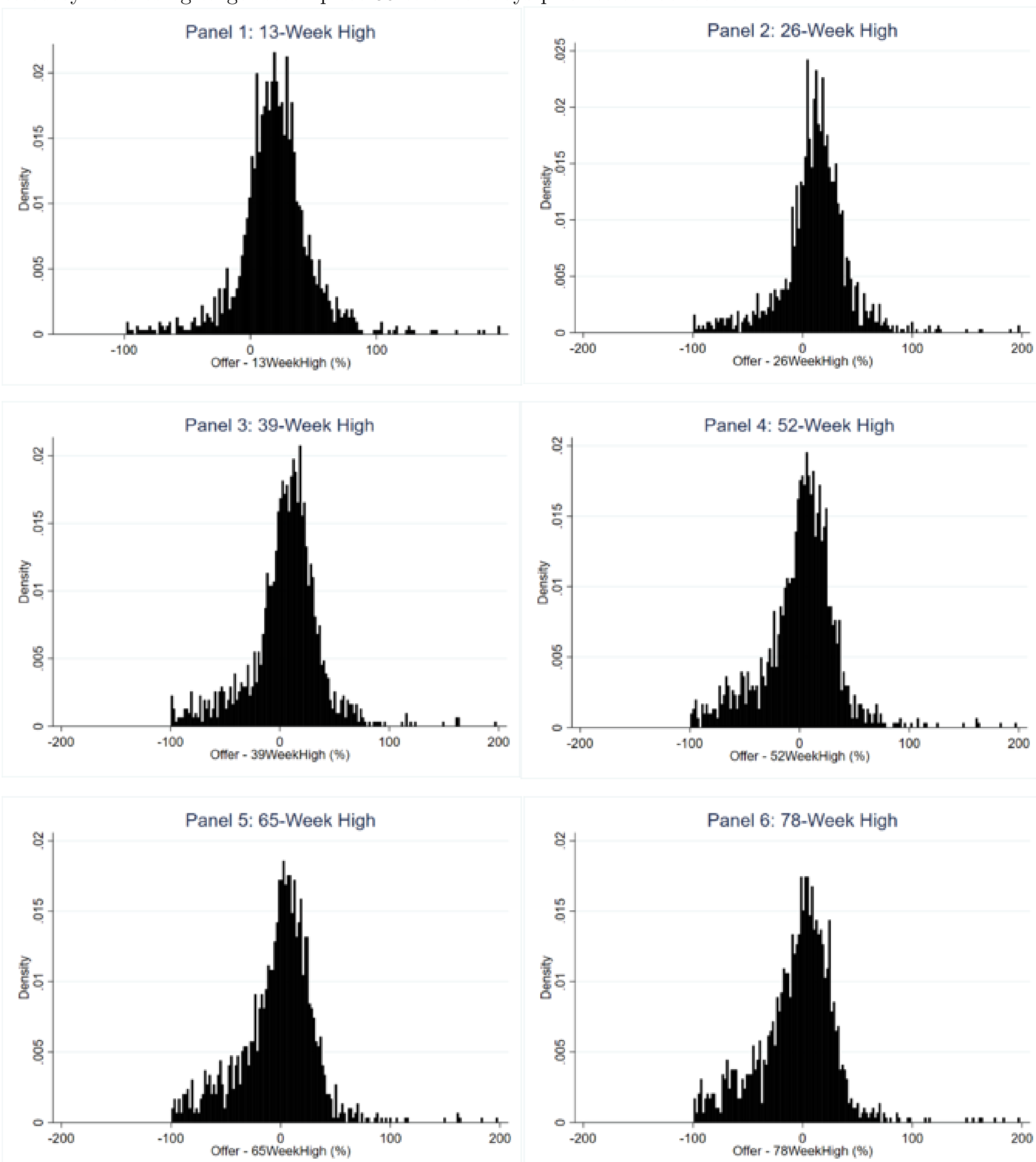
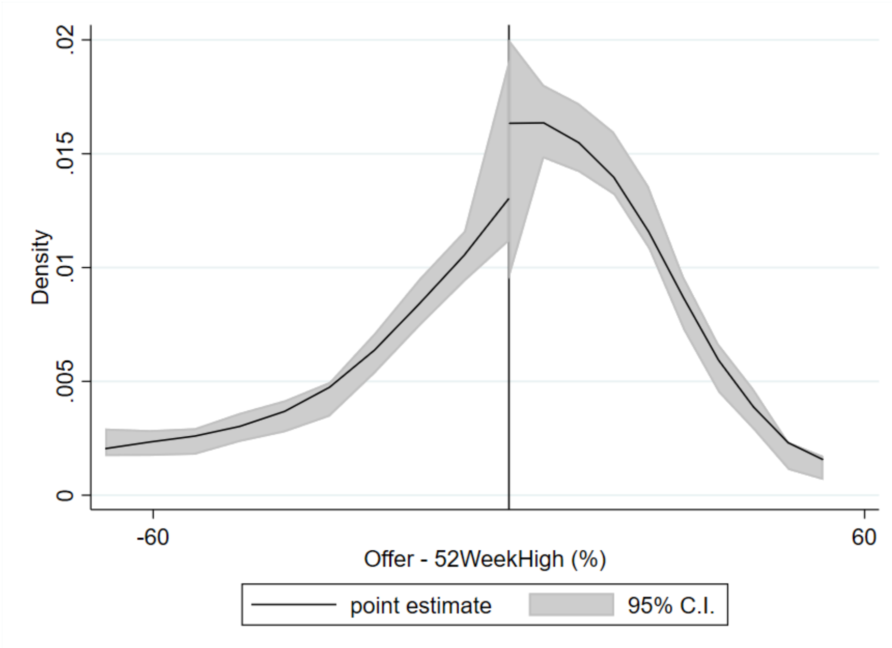


Figure 3: Discontinuity Analysis

The discontinuity analysis tests for a discontinuity in offer prices at the 52-week high target share price. The unrestricted model uses a comb banwidth method, a triangular kernel and jackknife standard errors. The robust t-statistic is -0.1130 (p-value of 0.9101). No statistically significant discontinuity is found.

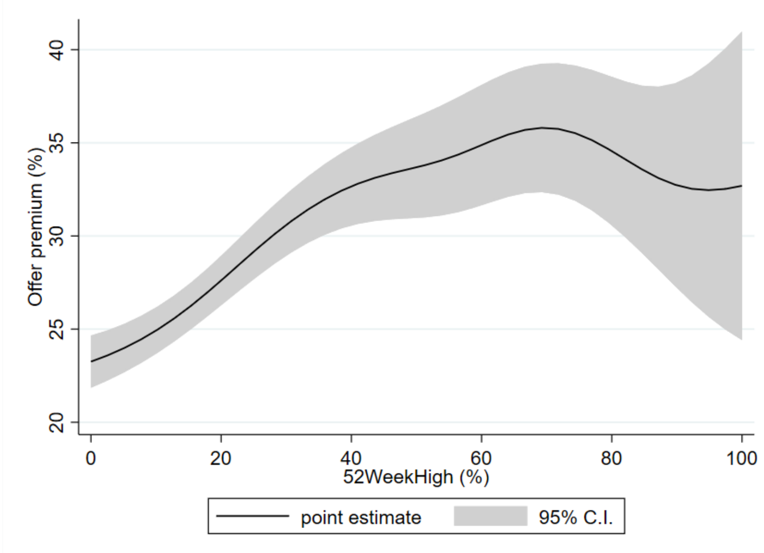


Previous studies have found that the relationship between past peak prices and offer premiums is non-linear. Following Baker et al. (2012), I examine the relationship non-parametrically through a Gaussian kernel regression, presented in Figure 4 below. The graph shows that the relationship between 52-week high prices and offer prices is positive when the 52-week high is close to the pre-bid share price. When the 52-week high premium is higher, the relationship becomes nosier and less positive. It is consistent with Prospect Theory that reference points that are further away have a diminishing marginal effect since the Prospect Theory value function is convex in the loss region. As the loss relative to the reference point grows bigger, the marginal decrese in value from additional loss decreses.

Consider for example a company that is trading at it's 52-week high 30 calendar days prior to the bid, corresponding to a 52-week premium of 0%. The shareholders of this company would likely feel a strong sense of loss from a bid slightly below the 52-week high. On the other hand, if the company's stock was trading at only half of its 52-week high 30 calendar days prior to the bid (a 52-week high premium of 100%), the shareholders would probably not experience as strong a feeling of loss if the offer price was below the 52-week high. Thus, shareholders may be more inclined to anchor on the 52-week high if it is closer to the pre-bid share price. Furthermore, it may be difficult for negotiators to convince their conterparty that the past peak price is relevant to the valuation of the company if the stock price has fallen precipitously from its 52-week high.

Figure 4: Gaussian Kernel Regression

The figure estimates the relationship between offer prices and 52-week high prices non-parametrically with a Gaussian kernel, a bandwidth of 10 and 40 bins. The graph shows that the effect of 52-week high prices on offer prices is stronger and less noisy when the 52-week high is closer to the stock price 30 calendar days prior to the announcement of the bid (i.e. when the 52WeekHigh (%) is closer to 0).




The graphical analyses above provide a sense of the shape of the relationship between the variables of interest. I continue by running an OLS regression of the offer premium on the 52-week high target stock price as shown in equation 4 below. The result is presented in column 1 of Table 4 below. The coefficient on the 52-week high is statistically significant on the 1%-level but the economic significance is low. The coefficient of 0.085 means that for every 10% increase in the 52-week high, the offer premium rises by 0.85%. The result is in line with Baker et al. (2012) who find a coefficient of 0.096 in their sample. However, the relationship between offer prices and 52-week high prices is non-linear and the effect is stronger for peak prices that are closer to the pre-bid share price.

$$Offer_{i,t} = a + b_1 * 52WeekHigh_{i,t-30} + e_{i,t} \tag{4}$$

A piecewise linear specification, shown in equation 5 below, is used to account for non-linearity in the relationship between offer prices and 52-week high prices. Consistent with Prospect Theory, Baker et al. (2012) note that reference point that are far away are likely affect the offer premium to a lesser extent since the shareholders' perceived loss diminishes. Therefore, the piecewise specification provides estimates for 52-week high premia for the following ranges: up to 25% ($b_1$), between 25% and

75% ($b_2$) and above 75% ($b_3$). The 52-week high premium is defined as the log percentage difference between the 52-week high stock price and the closing stock price 30 calendar days prior to the bid. The piecewise linear regression approach creates three new variables that take values according to the specification in equation 5 below. For example, if the 52-week high premium in a certain deal was 20%, then the variable corresponding to $b_1$ will take a value of 20 whereas the variables corresponding to $b_2$ and $b_3$ will both take a value of 0. If the 52-week high premium is instead 80%, for example, the first variable will take a value of 25, the second will take a value of 50 and the third will take a value of 5. Thereby, the specification provides a means to distinguish between the effects of the 52-week high over different ranges of the 52-week high premium.

$$
\begin{aligned}
Offer_{i,t} &= a + b_1 * min(52WeekHigh_{i,t-30}, 25) \\
&+ b_2 * max(0, min(52WeekHigh_{i,t-30} - 25, 50)) \\
&+ b_3 * max(0, 52WeekHigh_{i,t-30} - 75) + e_{i,t}
\end{aligned}
\tag{5}
$$

Both the offer price and the 52-week high are scaled by the target's closing stock price 30 days prior to the announcement date of the bid in order to reduce heteroscedasticity. However, Baker et al. (2012) note that this may lead to measurement error if boards and investors do not consider the offer price and the 52-week high relative to the stock price 30 days prior to the bid. Such a measurement error may induce a spurious positive correlation if it is not controlled for. Therefore, the inverse of the lagged 30-day price is included as a control in all regressions.

The piecewise specification in column 2 of Table 4 shows that the effect of the 52-week high on offer premiums is statistically and economically significant when the 52-week high premium is between 0% and 25%. In this range, the coefficient of 0.435 indicates that a 10% increase in the 52-week high leads to an increase in the offer price by 4.35% on average. Similarly, Baker et al. (2012) find that the effect is strongest for the 0% to 25% range with a coefficient of 0.329. However, in contrast to previous studies, I find no significant relationship between offer prices and 52-week high prices when the 52-week high premium is between 25% and 75% or above 75%. Both Baker et al. (2012) and Smith et al. (2019) find that the effect is gradually lower but still significantly positive in the higher ranges of the 52-week high. The loss in significance that I observe is unlikely to be explained by the size of the sample. Although my sample is significantly smaller than that in Baker et al. (2012), it is somewhat larger than the sample in Smith et al. (2019).

Following Baker et al. (2012), I also study whether there are incremental effects of peak prices over different periods of time. I start with the 13-week high and add incremental peak prices over 13-week intervals until I reach back 78 weeks ending 30 calendar days prior to the announcement of the bid. Specifically, I estimate the incremental effect of past peak prices by adding piecewise residuals for high prices over periods greater than 13 weeks. For example, to estimate the incremental effect of the 26-week high, I take the residuals of piecewise linear regressions of the 26-week high on the 13-week high. This regression is run three times for cases in which the 26-week premium is below 25%, between 25% and 75% and above 75%. This methodology allows the past peak prices to have a diminishing marginal effect in case it is far away from the stock price 30 calendar days prior to the bid. For example, the residuals $e_{1j}$ are estimated through the piecewise linear regression specification below. The residuals $e_{2j}$ and $e_{3j}$ are estimated by switching the dependent variable in the regression to the second or third part of the piecewise breakdown of the JWeekHigh.

$$\begin{aligned} min(JWeekHigh_{i,t-30}, 25) = c + \sum_{j=13,26,\ldots}^{J-13} & d_{1,j} * min(jWeekHigh_{i,t-30}, 25) \\ & + d_{2,j} * max(0, min(jWeekHigh_{i,t-30} - 25, 50)) \\ & + d_{3,j} * max(jWeekHigh_{i,t-30} - 75, 0) + e_{1J,i,t-30} \end{aligned} \tag{6}$$

The results of these analyses are presented in Table 4 below. The coefficients, $b_{1j}$, $b_{2j}$ and $b_{3j}$ show the marginal effect of adding the residuals $e_{1j}$, $e_{2j}$ and $e_{3j}$ to the regression of the offer premium on the piecewise 13-week high. I find that peak prices over periods longer than 13-weeks indeed have incremental explanatory ability. First, consider a target whose 13-week high is 10% higher than the closing price 30 calendar days prior to announcement. The coefficient $b_{1,13}$ indicates that the offer price for this target will be about 4.4% higher on average than if the 13-week high had been 0% higher than the closing price 30 calendar days prior to announcement. Second, imagine that the target's 26-week high is 10% higher than one would expect given its 13-week high and the statistical relationship between the 13-week high and the 26-week high. Then, the $b_{1,26}$ coefficient indicates that the offer price would be higher by a further 3.86%.

The results further show that long past price peaks on average have a lower incremental effect, with lower statistical and economic significance. This evidence supports hypothesis 2. It is intuitive that long-past price peaks carry less importance than more recent ones. Price peaks that are far away in the past may seem less relevant to market participants as new information reaches the market. However, I find that the incremental effect of the 52-week high is stronger than peak prices over other intervals. This could indicate that the 52-week high has a special role as a reference point in M&A. As discussed in section 2.2.2, the 52-week high has received strong academic attention and it may be a particularly salient reference point as it is commonly cited in the media and by practitioners. Having confirmed that price peaks over different time periods have incremental effects, I choose to focus on the 52-week high for the remainder of this paper to enable comparisons with prior literature on reference points.

Table 4: Incremental Effects of Past Peak Prices

Column 1 shows an OLS regression of the offer premium on the target 52-week high. Column 2 shows a piecewise linear regression of the offer premium on the 52-week high. The dependent variable is the offer premium. Offer prices have been collected from SDC Platinum. The 52-week high is the maximum target stock price from Datastream over the 335 days ending 30 days prior to the announcement of the bid. Both the offer premium and the 52-week high are expressed as a log difference from the target's closing stock price 30 calendar days prior to the announcement of the bid. Columns 3 and 4 show a piecewise linear regression of the offer premium on the 13-week high and piecewise residuals for high prices over time periods that are longer than 13 weeks in 13-week intervals. The residuals show the incremental effects of high prices over longer periods. The method for calculating the residuals is described in the text above (see equation 3). The inverse of the closing share price 30 calendar days prior to the bid is included as a control in all regressions. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | | OLS | Piecewise | Piecewise | Piecewise |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 52-week high (%) $b$ | | 0.085*** | | | |
| | | (3.45) | | | |
| 52-week high (%) $b_1$ | | | 0.435*** | | |
| | | | (4.23) | | |
| 52-week high (%) $b_2$ | | | 0.083 | | |
| | | | (1.72) | | |
| 52-week high (%) $b_3$ | | | -0.028 | | |
| | | | (-0.55) | | |
| Inverse (1/Pt-30) | | 0.085 | 0.109* | 0.119** | 0.104* |
| | | (1.55) | (2.12) | (2.49) | (2.09) |
| 13-week target high price (%) | $b_{1,13}$ | | | 0.441*** | 0.443*** |
| | $b_{2,13}$ | | | -0.029 | -0.025 |
| | $b_{3,13}$ | | | -2.932 | -2.894 |
| Incremental 26-week target high price (%) | $b_{1,26}$ | | | 0.385*** | 0.386*** |
| | $b_{2,26}$ | | | 0.073 | 0.075 |
| | $b_{3,26}$ | | | 0.107 | 0.108 |
| Incremental 39-week target high price (%) | $b_{1,39}$ | | | 0.290** | 0.291** |
| | $b_{2,39}$ | | | 0.032 | 0.034 |
| | $b_{3,39}$ | | | -0.014 | -0.011 |
| Incremental 52-week target high price (%) | $b_{1,52}$ | | | 0.474** | 0.476** |
| | $b_{2,52}$ | | | 0.058 | 0.059 |
| | $b_{3,52}$ | | | -0.109 | -0.108 |
| Incremental 65-week target high price (%) | $b_{1,65}$ | | | | 0.283* |
| | $b_{2,65}$ | | | | -0.002 |
| | $b_{3,65}$ | | | | 0.097 |
| Incremental 78-week target high price (%) | $b_{1,78}$ | | | | -0.207 |
| | $b_{2,78}$ | | | | 0.238** |
| | $b_{3,78}$ | | | | 0.072 |
| Constant | | 0.257*** | 0.203*** | 0.249*** | 0.250*** |
| | | (27.54) | (12.69) | (21.28) | (20.21) |
| Year fixed effects | | No | No | No | No |
| N | | 1636 | 1636 | 1636 | 1636 |
| Adjusted $R^2$ | | 0.027 | 0.047 | 0.049 | 0.052 |

### 5.2 The Effects of Target 52-Week High Prices

#### 5.2.1 The Target 52-Week High and the Market Index 52-Week High

This section provides further evidence of the effect of 52-week high prices on offer prices and introduces the market index 52-week high. Further, I show that the 52-week high effect does not simply arise as a result of target firm returns over the months leading up to the deal. The results are presented in Table 5 below.

Target monthly returns for the 11 months ending one month prior to the announcement of the bid are included as controls in columns 1 and 2 of Table 5. The aim is to control for any effect of run-ups in target share price on offer premiums (e.g Schwert, 1996; Keown & Pinkerton, 1981). The coefficients on returns in months $t-2$ and $t-3$ are significantly negative, which suggests that high returns in these months lead to lower offer premiums. Comparing the results with column 2 of Table 4, the introduction of past monthly returns lowers the effect of the 52-week high somewhat. Column 2 of Table 5 also includes year fixed effects which lowers the effect of the 52-week high further. However, the effect is still statistically and economically significant.

The 52-week market high also has a significant effect on offer prices. The OLS regression in column 3 of Table 5 shows a highly significant coefficient of 0.179 for the market index 52-week high. This means that for every 10% increase in the market index 52-week high, the offer price increases by about 1.8%. This indicates that offer premiums tend to be higher when the market index has fallen from its 52-week high. It is plausible that higher offer premiums are required when the market has fallen if targets consider themselves undervalued after a fall in stock prices.

### 5.2.2 A Non-Behavioral Explanation of the 52-Week High Effect

The two-stage least squares specification in column 4 of Table 5 sheds light on an alternative, non-behavioral, explanation of the 52-week high effect on offer prices. Baker et al. (2012) describe that the 52-week high may be considered relevant because it represents a valuation that the bidder could achieve by optimizing firm management, even in the absence of any synergies. Optimal firm management is defined here as the policies that prevailed at the time the 52-week high was reached. If this alternative explanation holds, an omitted and unobservable variable in the regression of offer prices on 52-week high prices would be firm-specific mismanagement, which would make the 52-week high endogenous. The specification in column 4 of Table 5 deals with the potential omitted variable bias by using the market 52-week high as an instrumental variable (IV) for the target 52-week high. The market 52-week high is highly correlated with the target 52-week high, so it is a relevant IV. Further, the market 52-week high is uncorrelated with firm-specific mismanagement. Thus, it also fulfils the IV exclusion restriction.

The results of the two-stage estimation shows that the target 52-week high price still has a significantly positive effect on offer prices after the omitted variable bias has been controlled for. The coefficient of 0.132 indicates that that the offer premium rises by 1.32% for every 10% increase in the component of the target 52-week high that is driven by the market 52-week high. The fact that the market component of the 52-week high also has a statistically and economically significant effect on offer prices casts doubt on the alternative explanation since the bidder naturally cannot hope to capture the market-component of the target 52-week high by correcting mismanagement of the target firm. Thus, the 52-week high effect appears to be a psychological bias rather than a rational expectation of a specific valuation that could be achieved.

Table 5: The Effect of 52-Week High Prices on Offer Prices

Columns 1 and 2 present piecewise regressions of the offer premium on the target 52-week high, with both expressed as a log difference from the closing stock price 30 calendar days prior to announcement of the bid. Column 3 presents an OLS regression of the offer premium on the market 52-week high. Column 4 reports the results of a two-stage least squares regression in which the market index 52-week high acts as an instrumental variable for the target 52-week high. The market 52-week high is the maximum local market all share index value over the 335 calendar days ending 30 calendar days prior to the announcement of the bid, expressed as a log percentage difference from the closing index value 30 calendar days prior to the announcement of the bid. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | Piecewise<br>**1** | Piecewise<br>**2** | OLS<br>**3** | 2SLS<br>**4** |
|---|---|---|---|---|
| 52-week high (%) b1 | 0.313** | 0.263* | | |
| | (2.65) | (2.12) | | |
| 52-week high (%) b2 | 0.040 | 0.032 | | |
| | (0.72) | (0.56) | | |
| 52-week high (%) b3 | -0.080 | -0.089 | | |
| | (-1.49) | (-1.55) | | |
| Market index 52-week high (%) | | | 0.179*** | |
| | | | (3.69) | |
| 52-week high (%) | | | | 0.132*** |
| | | | | (3.62) |
| Inverse (1/Pt-30) | 0.085 | 0.076 | 0.163** | 0.031 |
| | (1.28) | (1.10) | (2.51) | (0.39) |
| Target returnt-2 (%) | -0.127** | -0.155*** | | |
| | (-2.85) | (-3.18) | | |
| Target returnt-3 (%) | -0.136*** | -0.143*** | | |
| | (-3.51) | (-3.34) | | |
| Target returnt-4 (%) | 0.003 | -0.012 | | |
| | (0.04) | (-0.19) | | |
| Target returnt-5 (%) | -0.066 | -0.081 | | |
| | (-0.95) | (-1.25) | | |
| Target returnt-6 (%) | -0.082* | -0.093* | | |
| | (-1.83) | (-2.05) | | |
| Target returnt-7 (%) | -0.134* | -0.152** | | |
| | (-1.86) | (-2.34) | | |
| Target returnt-8 (%) | -0.023 | -0.022 | | |
| | (-0.30) | (-0.30) | | |
| Target returnt-9 (%) | -0.010 | -0.012 | | |
| | (-0.15) | (-0.18) | | |
| Target returnt-10 (%) | -0.022 | -0.028 | | |
| | (-0.34) | (-0.49) | | |
| Target returnt-11 (%) | -0.028 | -0.037 | | |
| | (-0.77) | (-1.23) | | |
| Target returnt-12 (%) | 0.020 | 0.024 | | |
| | (0.43) | (0.46) | | |
| Constant | 0.238*** | 0.186*** | 0.273*** | 0.241*** |
| | (9.93) | (5.51) | (36.10) | (16.67) |
| Year fixed effects | No | Yes | No | No |
| N | 1608 | 1608 | 1636 | 1636 |
| Adjusted $R^2$ | 0.055 | 0.073 | 0.012 | 0.021 |

### 5.2.3 Robustness

In this section, I introduce more control variables and conduct a falsification test to examine the robustness of the relationship between offer prices and 52-week high prices. The purpose is to test the robustness of the relationship before proceeding by studying the effect of 52-week high prices in subsamples and the influence of information asymmetry. The results are presented in Tables 6 and 7 below. I control for deal characteristics such as method of payment (e.g. cash or stock), whether the bid is hostile, whether the bid is a tender offer and whether the bidder is a financial acquirer (i.e. the deal is an LBO). Bidder and target characteristics such as firm size, return on assets, book-to-market ratio and volatility are also controlled for. All the specifications in Tables 6 and 7 also control for the past monthly returns for the target for the eleven months ending 30 calendar days prior to the announcement of the bid.

The results in Table 6 show that the 52-week high effect is robust to a battery of controls. The evidence supports hypothesis 1. The results indicate that for every 10% increase in the target 52-week high share price, the offer price rises by about 2.1% to 4.6%, depending on the specification, when the 52-week high is between 0% and 25% higher than the closing share price 30 calendar days prior to the announcement of the bid. The specification in column 5 of Table 6 includes the full range of controls as well as year fixed effects. This specification shows the strongest effect of 52-week high prices on offer prices. However, data availability limits the sample substantially when the full range of controls are included.

The results support the evidence produced by previous studies. Baker et al. (2012) find that for every 10% increase in the target 52-week high share price, the offer price rise by approximately 2.5% to 4.3%, depending on the specification, in their US sample. The authors also find that that the result is robust only for the lowest range of the 52-week high premium (0% to 25%) whereas the significance for the middle range (25% to 75%) and the top range (75% and above) drops out when controls are included. Smith et al. (2019) similarly find that the effect is strongest for the lowest range. However, the authors also find significant positive effects in the higher ranges.

Table 6: Robustness

Columns 1-5 show piecewise linear regressions of offer prices on target 52-week high share prices. The offer price is from SDC Platinum and the 52WeekHigh is the maximum target stock price from Thomson Datastream over the 335 calendar days ending 30 days prior to the announcement of the bid. Both are expressed as a log percentage difference from the target's closing stock price 30 calendar days prior to the announcement of the bid. Definitions of all the variables can be found in Appendix A. All regressions control for target returns in the months t-2 to t-12 prior to the bid and the inverse of the share price 30 calendar days prior to the bid. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | Piecewise **1** | Piecewise **2** | Piecewise **3** | Piecewise **4** | Piecewise **5** |
|---|---|---|---|---|---|
| 52-week high (%) $b_1$ | 0.313** | 0.314** | 0.212* | 0.397** | 0.455*** |
| | (2.65) | (2.88) | (1.92) | (2.43) | (3.54) |
| 52-week high (%) $b_2$ | 0.040 | 0.072 | -0.033 | -0.145 | -0.134 |
| | (0.72) | (1.17) | (-0.52) | (-1.42) | (-1.02) |
| 52-week high (%) $b_3$ | -0.080 | -0.067 | -0.123** | 0.079 | 0.127 |
| | (-1.49) | (-1.17) | (-2.50) | (1.17) | (1.35) |
| Inverse (1/Pt-30) | 0.085 | 0.087 | -0.055 | -0.093 | -0.234** |
| | (1.28) | (1.42) | (-0.88) | (-1.77) | (-2.45) |
| Cash | | -0.011 | | | -0.008 |
| | | (-1.17) | | | (-0.28) |
| Shares | | -0.157*** | | | -0.135*** |
| | | (-6.11) | | | (-3.13) |
| Hostile | | -0.012 | | | -0.006 |
| | | (-0.59) | | | (-0.17) |
| Tender | | 0.026* | | | 0.019 |
| | | (2.13) | | | (0.55) |
| Financial bidder | | -0.055*** | | | -0.080 |
| | | (-3.34) | | | (-0.43) |
| Log target ROA (%) | | | -0.043* | | 0.005 |
| | | | (-1.83) | | (0.19) |
| Log target B/M (%) | | | 0.058*** | | 0.077* |
| | | | (3.92) | | (1.93) |
| Log target market capitalization | | | -0.018*** | | -0.035** |
| | | | (-3.75) | | (-2.93) |
| Target return volatility (%) | | | 0.532 | | -0.819 |
| | | | (0.75) | | (-0.63) |
| Log bidder ROA (%) | | | | 0.021 | -0.003 |
| | | | | (0.51) | (-0.07) |
| Log bidder B/M (%) | | | | 0.027*** | 0.026** |
| | | | | (3.20) | (2.25) |
| Log bidder market capitalization | | | | -0.000 | 0.023** |
| | | | | (-0.07) | (2.36) |
| Constant | 0.238*** | 0.245*** | 0.299*** | 0.218** | 0.243*** |
| | (9.93) | (8.43) | (7.52) | (4.09) | (4.98) |
| Year fixed effects | No | No | No | No | Yes |
| N | 1608 | 1608 | 1542 | 493 | 474 |
| Adjusted $R^2$ | 0.055 | 0.101 | 0.096 | 0.045 | 0.203 |

Table 7 below presents a falsification test that examines whether market participants anchor precisely at the 52-week high. The falsification test aims to elucidate the specific effect of the 52-week high by adding the $80^{th}$, $90^{th}$, $95^{th}$ and $99^{th}$ percentile target share price over the 335 calendar days ending 30 calendar days prior to the announcement of the bid to the same piecewise specification as the 52-week high. To use the same terms, the 52-week high is the 100th percentile target share price over the 335 calendar days ending 30 calendar days prior to the announcement of the bid.

The results in Table 7 show that the 52-week high effect does not survive the falsification test. The X-percentile high share prices are of course highly correlated with the 52-week high and the anchoring effect essentially gets split up between the coefficients. The 52-week high effect is still significant when the $80^{th}$ and $90^{th}$ percentile target share price is included, but the effect disappears when the $95^{th}$ and $99^{th}$ percentile prices are included. The results differ from Baker et al. (2012) who find that the 52-week high effect is highly significant even when the $95^{th}$ and $99^{th}$ percentile target share prices are included in the specification. The differing results are consistent with the results from section 5.1 where I, in contrast to Baker et al. (2012), find no clear spikes in offer price density at the peak price and no significant discontinuity in offer price density at the 52-week high. Taken together, these results imply that the anchoring effect on the 52-week high is weaker in the UK M&A market than in the US M&A market. It is possible that the market participants in the UK market focus more on other factors, such as synergies, than past peak prices in pricing an M&A deal. Perhaps major shareholders' purchase prices are also more important reference points than the 52-week high in some cases. In other cases, peak prices that have occurred more recently or farther in the past may play a greater role than the 52-week high.

Nevertheless, the 52-week high is the most commonly applied reference point measure in the literature. Thus, it is worthwhile to continue this paper by examining whether the effect of the 52-week high is stronger in certain types of deals. This is done below by examining the 52-week high effect in subsamples and by studying whether the effect of the 52-week high is stronger in deals involving a higher degree of information asymmetry between insiders in the target firm and bidders.

Table 7: Falsification Test

The piecewise specifications in the table include the $80^{th}$, $90^{th}$, $95^{th}$, and $99^{th}$ percentile target share price during the 335 calendar days ending 30 calendar days prior to the bid. All regressions control for target returns in the months t-2 to t-12 prior to the bid and the inverse of the share price 30 calendar days prior to the bid. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | 80%<br>**6** | 90%<br>**7** | 95%<br>**8** | 99%<br>**9** |
|---|---|---|---|---|
| 52-week high (%) $b_1$ | 0.279* | 0.290* | 0.145 | 0.075 |
| | (1.86) | (1.92) | (0.81) | (0.20) |
| 52-week high (%) $b_2$ | 0.100 | 0.150 | 0.114 | 0.491 |
| | (1.03) | (1.09) | (0.73) | (1.56) |
| 52-week high (%) $b_3$ | -0.010 | 0.056 | -0.049 | -0.590 |
| | (-0.08) | (0.36) | (-0.17) | (-0.79) |
| X-percentile target high (%) | | | | |
| $c_1$ | 0.025 | 0.002 | 0.163 | 0.215 |
| | (0.17) | (0.01) | (0.87) | (0.54) |
| $c_2$ | -0.057 | -0.108 | -0.052 | -0.413 |
| | (-0.52) | (-0.81) | (-0.32) | (-1.46) |
| $c_3$ | -0.066 | -0.137 | -0.008 | 0.547 |
| | (-0.34) | (-0.67) | (-0.02) | (0.74) |
| Inverse (1/Pt-30) | 0.087 | 0.081 | 0.090 | 0.094 |
| | (1.36) | (1.24) | (1.30) | (1.46) |
| Cash | -0.011 | -0.011 | -0.011 | -0.010 |
| | (-1.14) | (-1.12) | (-1.11) | (-1.05) |
| Shares | -0.157*** | -0.157*** | -0.158*** | -0.157*** |
| | (-6.07) | (-6.05) | (-6.06) | (-6.14) |
| Hostile | -0.012 | -0.011 | -0.012 | -0.012 |
| | (-0.59) | (-0.57) | (-0.60) | (-0.58) |
| Tender | 0.026* | 0.027* | 0.025* | 0.026* |
| | (2.06) | (2.12) | (1.98) | (2.06) |
| Financial bidder | -0.055*** | -0.055*** | -0.056*** | -0.057*** |
| | (-3.33) | (-3.32) | (-3.35) | (-3.41) |
| Constant | 0.249*** | 0.249*** | 0.251*** | 0.248*** |
| | (8.57) | (8.99) | (8.84) | (8.59) |
| Year fixed effects | No | No | No | No |
| N | 1608 | 1608 | 1608 | 1608 |
| Adjusted $R^2$ | 0.100 | 0.100 | 0.100 | 0.101 |

### 5.2.4 Subsamples

Results for piecewise regressions for subsamples are presented in Table 8 and Table 9 below. The specifications include interaction terms to examine whether the 52-week high effect is stronger/weaker in certain situations. For example, the specification that focuses on whether the deal is a tender offer includes interaction terms between the 52-week high and an indicator variable that takes a value of 1 if the deal was a tender offer and 0 otherwise. The interaction category is the one on the right in each of the subsamples in Tables 8 and 9. For instance, under the Attitude header, the interaction category is "hostile", meaning that an indicator variable that takes a value of 1 if the deal is hostile is interacted with the 52-week high.

For the continuous variables in Tables 8 and 9, I include an interaction term between the 52-week high and an indicator variable that takes a value of 1 if the continuous variable takes a value that is above or equal to the $50^{th}$ percentile and 0 if the continuous variable takes a value that is below the $50^{th}$ percentile. This shows whether 52-week high prices have a stronger/weaker effect on offer prices given that the variable is in the "high" region (i.e. above the 50th percentile).

The results show that the 52-week high effect is significant across all subsamples except for the subsample in which the consideration is all shares. However, the results for the deals with all shares may be spurious since the consideration consists entirely of shares in only 12.1% of the deals. The other subsamples all show a significant positive effect, indicating that offer prices rise by about 3.4% to 5.5% for every 10% increase in the 52-week target high share price when the 52-week high is between 0% and 25% higher than the closing stock price 30 calendar days prior to the announcement of the bid. I find very little evidence that 52-week high prices have a significant effect on offer premiums when the 52-week high is more than 25% higher than the closing stock price 30 calendar days prior to the announcement of the bid. However, when the sample is split up based on whether the deal was announced in the first or the second half of the sample period, all three coefficients are significant. In the first half of the sample period, 52-week high prices have a significant positive effect on offer premiums when the 52-week high is 25% to 75% higher than the closing stock price 30 calendar days prior to the announcement of the bid. In this range, the effect is significantly lower in the second half of the sample period. The opposite pattern is found in the highest range of the 52-week high piecewise specification. The results may indicate that the behavior of anchoring on the 52-week high has changed over time in the UK M&A market. However, further investigation of this matter is beyond the scope of this paper.

In the cross-border subsample, the effect of 52-week high prices on offer prices is significantly stronger in the middle range of the piecewise specification. The result differs from Smith et al. (2019) who find that the effect of the 52-week high is significantly lower in cross-border deals than in domestic deals. The effect of the 52-week high in cross-border M&A deals is examined further in section 5.2.6 below.

The effect of the 52-week high on offer premiums is significantly stronger in deals in which there are multiple bidders competing for the target. Facing tough competition for the target, bidders may be inclined to focus more on past reference points to induce the target shareholders to acquiesce. It is also plausible that the offer price is driven up towards or beyond the 52-week target high price when there are multiple bidders who compete for the target in an auction.

I find that the effect of 52-week high prices on offer prices is lower when the bidder has a high toehold position in the target prior to making a bid. This is consistent with the asymmetric information explanation of hypothesis 5. A bidder that has already has an established ownership position in the target before launching a takeover bid is likely to face less asymmetric information because ownership provides insight into the target. For example, the bidder may have a board seat and closer ties to the target if an ownership position has been established prior to the bid. With lower information asymmetry, the valuation of the target may be less uncertain and the reference point may therefore play a lesser role. Further, with an established toehold position, the target shareholders may be less likely to oppose the bid, which may also make the reference point less relevant.

The subsample that divides the sample based on whether the average daily target bid-ask spread is high or low during the year prior to the bid shows that 52-week high prices tends to have a lower effect on offer premiums in the highest range of the piecewise specification. Similarly, I find that 52-week high prices have a significantly lower effect on offer premiums in the highest range for deals that were subsequently completed compared to deals that were subsequently withdrawn.

As shown in Tables 8 and 9, I find no significant differences in the effect of 52-week high prices on offer premiums for the subsamples based on deal attitude, whether the bidder is a financial firm, target analyst coverage, target volatility, the number of years that the target had been listed, or whether the target and bidder were in the same industry. In an unreported test, I compare deals with a publicly listed bidder against deals with a non-public bidder and find no significant difference.

Table 8: Subsamples (1/2)

This table shows the results of piecewise linear regressions of the offer price on the 52-week high for subsamples. Both the offer price and the 52-week high are expressed as a log percentage difference from the closing target share price 30 calendar days prior to the bid. The regressions include interaction terms for the respective subsamples. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | Tender | | Attitude | | Success | | Consideration | |
|---|---|---|---|---|---|---|---|---|
| | No | Yes | Friendly | Hostile | Withdrawn | Completed | Shares | Cash |
| 52-week high (%) b1 | 0.357*** | 0.109 | 0.431*** | 0.035 | 0.483** | -0.056 | -0.111 | 0.663*** |
| | (3.22) | (1.54) | (4.04) | (0.15) | (3.03) | (-0.44) | (-0.98) | (4.44) |
| 52-week high (%) b2 | -0.038 | 0.175* | 0.090 | -0.039 | -0.090 | 0.208 | 0.097 | 0.022 |
| | (-0.65) | (2.12) | (1.76) | (-0.20) | (-0.65) | (1.55) | (1.33) | (0.22) |
| 52-week high (%) b3 | 0.099 | -0.193* | -0.026 | -0.097 | 0.201* | -0.269* | -0.037 | 0.054 |
| | (1.49) | (-2.01) | (-0.48) | (-0.39) | (1.93) | (-1.82) | (-0.42) | (0.53) |
| Inverse (1/Pt-30) | 0.116** | | 0.108* | | 0.103* | | 0.147*** | |
| | (2.37) | | (2.09) | | (2.04) | | (3.72) | |
| Year fixed effects | No | | No | | No | | No | |
| N | 1636 | | 1636 | | 1636 | | 1025 | |
| Adjusted R2 | 0.054 | | 0.045 | | 0.050 | | 0.108 | |
| | **Multiple bidders** | | **Toehold** | | **Analyst coverage** | | **Target bid-ask spread** | |
| | No | Yes | Low | High | Low | High | Low | High |
| 52-week high (%) b1 | 0.363*** | 0.685*** | 0.494*** | -0.198* | 0.515*** | -0.119 | 0.380*** | 0.136 |
| | (3.88) | (4.92) | (5.25) | (-1.99) | (6.08) | (-1.12) | (3.26) | (1.44) |
| 52-week high (%) b2 | 0.098* | -0.185 | 0.054 | 0.197 | 0.056 | 0.037 | -0.011 | 0.141 |
| | (1.80) | (-1.28) | (1.14) | (1.69) | (0.75) | (0.36) | (-0.26) | (1.75) |
| 52-week high (%) b3 | -0.013 | -0.111 | -0.010 | -0.167 | 0.011 | 0.098 | 0.149* | -0.239** |
| | (-0.24) | (-0.76) | (-0.17) | (-1.37) | (0.17) | (1.15) | (1.89) | (-2.77) |
| Inverse (1/Pt-30) | 0.120** | | 0.117* | | 0.191* | | 0.085 | |
| | (2.34) | | (2.07) | | (1.82) | | (1.59) | |
| Year fixed effects | No | | No | | No | | No | |
| N | 1636 | | 1598 | | 1257 | | 1609 | |
| Adjusted $R^2$ | 0.065 | | 0.054 | | 0.070 | | 0.059 | |

Table 9: Subsamples (2/2)

This table shows the results of piecewise linear regressions of the offer price on the 52-week high for subsamples. Both the offer price and the 52-week high are expressed as a log percentage difference from the closing target share price 30 calendar days prior to the bid. The regressions include interaction terms for the respective subsamples. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | Half of sample period | | Cross-border | | Financial bidder | | Public bidder | |
|---|---|---|---|---|---|---|---|---|
| | First half | Second half | No | Yes | No | Yes | No | Yes |
| 52-week high (%) b1 | 0.432*** | 0.012 | 0.401*** | 0.067 | 0.444*** | -0.094 | 0.453*** | -0.031 |
| | (4.25) | (0.15) | (3.39) | (0.68) | (4.44) | (-0.70) | (3.61) | (-0.31) |
| 52-week high (%) b2 | 0.173** | -0.191** | -0.055 | 0.344*** | 0.095* | -0.096 | 0.119 | -0.076 |
| | (2.81) | (-2.49) | (-0.99) | (4.58) | (1.87) | (-0.61) | (1.56) | (-0.84) |
| 52-week high (%) b3 | -0.197*** | 0.357*** | -0.044 | 0.016 | -0.041 | 0.132 | -0.020 | -0.008 |
| | (-5.54) | (8.04) | (-0.80) | (0.19) | (-0.75) | (1.19) | (-0.43) | (-0.15) |
| Inverse (1/Pt-30) | 0.078 | | 0.127** | | 0.106* | | 0.106* | |
| | (1.30) | | (2.60) | | (2.09) | | (2.18) | |
| Year fixed effects | No | | No | | No | | No | |
| N | 1636 | | 1636 | | 1636 | | 1636 | |
| Adjusted R2 | 0.063 | | 0.082 | | 0.047 | | 0.047 | |
| | Target volatility | | Public firm age | | Same industry | | Target market capitalization | |
| | Low | High | Low | High | No | Yes | Low | High |
| 52-week high (%) b1 | 0.483*** | -0.101 | 0.344** | 0.172 | 0.468*** | -0.156 | 0.530*** | -0.172 |
| | (5.62) | (-1.17) | (2.87) | (1.72) | (4.50) | (-1.59) | (5.17) | (-1.75) |
| 52-week high (%) b2 | 0.167** | -0.081 | 0.114 | -0.042 | 0.073 | 0.050 | 0.107 | -0.097 |
| | (2.21) | (-1.01) | (1.44) | (-0.45) | (1.28) | (0.41) | (1.48) | (-1.06) |
| 52-week high (%) b3 | 0.036 | -0.049 | 0.011 | -0.125 | 0.004 | -0.134 | -0.025 | -0.066 |
| | (0.08) | (-0.11) | (0.19) | (-1.34) | (0.07) | (-1.48) | (-0.40) | (-0.51) |
| Inverse (1/Pt-30) | 0.114** | | 0.103* | | 0.122** | | 0.056 | |
| | (2.34) | | (1.96) | | (2.52) | | (1.08) | |
| Year fixed effects | No | | No | | No | | No | |
| N | 1632 | | 1636 | | 1636 | | 1629 | |
| Adjusted $R^2$ | 0.050 | | 0.050 | | 0.050 | | 0.058 | |

### 5.2.5 The Effect of the 52-Week High on Deal Success and Bidder Wealth

To provide further evidence on the effects of reference point prices in the UK M&A market, I examine whether the effect of 52-week target high stock prices on the probability of deal completion and bidder wealth that Baker et al. (2012) find in the US M&A market hold in my sample as well. The results are available in Appendix C and D for the interested reader. I find no support for hypotheses 3 or 4. I do not find that the probability of deal completion increases discontinuously when the offer price surpasses the 52-week high. Nor do I find that bidders' announcement period return is affected by anchoring on the targets' 52-week high stock prices.

### 5.2.6 The Effect of the 52-Week High in Cross-Border Deals

Building on the subsample results from section 5.2.4 above, I study the effect of 52-week high prices on offer premiums in cross-border deals further in this section. The sample includes 704 deals that have been flagged by SDC Platinum as cross-border deals (i.e. deals in which the bidder's ultimate parent is domiciled in a different country than the UK). The results are presented in Table 10 below. The results in section 5.2.4 differed from the evidence by Smith et al. (2019) who find that the effect of 52-week high prices on offer prices is significantly lower in cross-border deals. The opposite results warrant further investigation. Further, cross-border deals are especially relevant in this paper since they are likely to involve a higher degree of information asymmetry between target insiders and bidders, as discussed in section 3.3.2 above.

Following Smith et al. (2019) I examine the effect of 52-week high prices on offer prices in cross-border deals using interaction terms, controlling for the legal origin of the bidding firm's country of incorporation. The legal origin of a country is classified as Scandinavian civil law, German civil law, French civil law or British common law based on La Porta, Lopez-de Silanes, and Shleifer (2008). Smith et al. (2019) describe that legal origins of countries may affect M&A transactions since shareholder rights differ depending on legal origins. The legal origins of countries are controlled for using interaction terms between the piecewise 52-week high specification and dummy variables for Scandinavian-, German- and French legal origins in columns 3-4 of Table 10. The British common law category thus serves as the reference category. The bidder nations and legal origins are presented in Table 12 in Appendix B. Deal characteristics and target characteristics are also controlled for and year fixed effects are included in columns 2-4 in Table 10 below.

The results indicate that the 52-week high effect on offer prices is robust across all four specifications in Table 10. Contrary to Smith et al. (2019) I find that the effect of 52-week high prices on offer premiums is significantly higher in cross-border deals.

Table 10: The Effect of 52-Week High Prices in Cross-Border Deals

The table presents piecewise linear regressions of the offer premium on the 52-week target high, with both expressed as a log percentage difference from the closing share price 30 calendar day preceding the bid. Interaction terms and controls are included. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | Piecewise **1** | Piecewise **2** | Piecewise **3** | Piecewise **4** |
|---|---|---|---|---|
| 52-week high (%) $b_1$ | 0.435*** | 0.397** | 0.421** | 0.382*** |
| | (4.23) | (2.72) | (3.06) | (3.27) |
| 52-week high (%) $b_2$ | 0.083 | -0.059 | -0.030 | -0.083 |
| | (1.72) | (-0.97) | (-0.44) | (-1.50) |
| 52-week high (%) $b_3$ | -0.028 | -0.040 | -0.024 | -0.024 |
| | (-0.55) | (-0.70) | (-0.45) | (-0.49) |
| Inverse (1/Pt-30) | 0.109* | 0.130** | 0.123* | -0.030 |
| | (2.12) | (2.46) | (2.05) | (-0.33) |
| Cross-border | | 0.003 | 0.000 | 0.015 |
| | | (0.14) | (0.02) | (0.69) |
| Cross-border*52-week $b_1$ | | 0.032 | -0.041 | -0.040 |
| | | (0.22) | (-0.29) | (-0.30) |
| Cross-border*52-week $b_2$ | | 0.346*** | 0.327*** | 0.274*** |
| | | (3.87) | (3.83) | (3.94) |
| Cross-border*52-week $b_3$ | | 0.010 | 0.093 | 0.087 |
| | | (0.11) | (0.85) | (0.84) |
| Cash | | | -0.036*** | -0.041*** |
| | | | (-3.48) | (-4.11) |
| Shares | | | -0.151*** | -0.149*** |
| | | | (-7.02) | (-7.00) |
| Tender | | | 0.040** | 0.025* |
| | | | (2.71) | (1.89) |
| Hostile | | | -0.004 | -0.005 |
| | | | (-0.15) | (-0.29) |
| Log target ROA (%) | | | | -0.049 |
| | | | | (-1.23) |
| Log target B/M (%) | | | | 0.060** |
| | | | | (2.85) |
| Log target E/P (%) | | | | 0.064* |
| | | | | (2.13) |
| Log target market capitalization | | | | -0.017*** |
| | | | | (-3.74) |
| Constant | 0.203*** | 0.159*** | 0.136*** | 0.203*** |
| | (12.69) | (5.58) | (4.53) | (6.08) |
| Year fixed effects | No | Yes | Yes | Yes |
| Controls for legal origin | No | No | Yes | Yes |
| N | 1636 | 1636 | 1636 | 1491 |
| Adjusted $R^2$ | 0.047 | 0.092 | 0.132 | 0.158 |

### 5.2.7 The Effect of the 52-Week High in the Presence of Asymmetric Information

Preliminary results regarding the influence of information asymmetry on the relationship between 52-week high prices and offer prices are presented in the subsamples in section 5.2.4 above. In this section, I examine the effect of information asymmetry further by introducing more controls and allowing the information asymmetry variables to vary continuously rather than dividing them into high/low as in section 5.2.3. The results are presented in Table 11 below.

The effect of 52-week high prices on offer prices remains significant across all specifications in Table 11. As discussed in section 5.1, the coefficient on the 52-week high in the basic OLS regression of offer prices on 52-week high prices (column 1 of Table 11) is not economically large since a 10% increase in the 52-week high implies only a 0.85% increase in the offer premium. However, the coefficient on the 52-week high increases substantially in columns 2-5 of Table 11 when information asymmetry proxies, control variables and year fixed effects are added to the regression. This implies that 52-week high prices may have a stronger effect on offer premiums once the effects of the other variables have been controlled for.

Interaction terms are introduced in columns 3-5 to examine whether the effect of 52-week high prices is stronger in situations in which information asymmetry between target insiders and bidders is likely to be higher. The strongest result is that the 52-week high has a stronger effect on offer premiums in cross-border deals than in domestic deals, which corroborates the results in section 5.2.6 above. The coefficient on the cross-border interaction term is positive and significant on the 1% level across the specifications in columns 3-5 of Table 11. The economic impact is also meaningful. For instance, in the specification in column 5 of Table 11, the results imply that for a 10% increase in the 52-week high, the offer premium rises by 1.63% for domestic deals. However, if the deal is a cross-border deal, the offer premium rises by an additional 1.69% for an equivalent 10% increase in the 52-week high for a total of 3.32%.

The results for the other information asymmetry proxies are not robust across specifications. The interaction term for analyst coverage shows a negative and significant coefficient in columns 3-5. Higher analyst coverage should lead to less information asymmetry and thus less dependence on the 52-week high. Thus, a negative coefficient would be expected. However, the coefficients are very small. The coefficient on the target bid-ask spread is large and significant in columns 3 and 4 of Table 11. However, the coefficient is insignificant in column 5. A higher bid-ask spread should be associated with a higher degree of information asymmetry which should lead to a higher dependence on the 52-week high. Thus, a positive coefficient would have been expected. The interaction term between the 52-week high and toehold is negative in columns 4-5. A negative coefficient would be expected for toehold since a higher toehold would decrease information asymmetry and thus decrease the dependence on the 52-week high. No significant results are found for the interaction terms which include the target public firm age or the target volatility.

Borochin et al. (2019) describe that public M&A deals lead to intense due diligence, scrutiny and public interest, which alleviates target information asymmetry. It is possible that due diligence and other forms of scrutiny in domestic M&A deals effectively lowers information asymmetry, which could reduce reliance on past peak prices as reference points. However, further investigation of this matter is beyond the scope of this study.

Table 11: The Influence of Target Information Asymmetry

The table presents OLS regressions of offer prices on the target 52-week high and interaction terms with proxies for information asymmetry. The 52-week high is the maximum target stock price from Datastream over the 335 days ending 30 days prior to the announcement of the bid. Both the offer premium and the 52-week high are expressed as a log difference from the target's closing stock price 30 calendar days prior to the announcement of the bid. All variable definitions are available in Appendix A. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| | OLS **1** | OLS **2** | OLS **3** | OLS **4** | OLS **5** |
|---|---|---|---|---|---|
| Target 52-week high (%) | 0.085*** | 0.148*** | 0.254*** | 0.258*** | 0.194** |
| | (3.45) | (6.61) | (3.53) | (3.29) | (3.05) |
| Inverse (1/Pt-30) | 0.085 | 0.115 | 0.167 | 0.205 | 0.079 |
| | (1.55) | (0.89) | (0.99) | (1.25) | (0.59) |
| Analyst coverage | | -0.001 | 0.002 | 0.001 | 0.005*** |
| | | (-0.91) | (1.27) | (0.82) | (4.12) |
| Target volatility | | -1.731* | -1.061 | -1.178 | -0.195 |
| | | (-2.11) | (-1.30) | (-1.17) | (-0.22) |
| Target bid-ask spread | | 0.249 | 0.829** | 0.597 | -0.360 |
| | | (0.77) | (2.41) | (1.72) | (-1.61) |
| Target public firm age | | 0.000 | 0.001 | 0.001 | 0.000 |
| | | (1.23) | (1.22) | (1.13) | (0.91) |
| Cross-border | | 0.062*** | -0.009 | -0.010 | -0.011 |
| | | (4.75) | (-0.51) | (-0.55) | (-0.63) |
| Analyst coverage*52-week high | | | -0.007*** | -0.006** | -0.005** |
| | | | (-4.10) | (-2.78) | (-2.43) |
| Target volatility*52-week high | | | -2.259 | -2.411 | -2.573 |
| | | | (-1.34) | (-1.31) | (-1.53) |
| Target bid-ask spread*52-week high | | | -1.080** | -0.898* | -0.147 |
| | | | (-2.53) | (-2.02) | (-0.42) |
| Target public firm age*52-week high | | | -0.000 | -0.000 | 0.000 |
| | | | (-0.04) | (-0.10) | (0.17) |
| Cross-border*52-week high | | | 0.212*** | 0.205*** | 0.202*** |
| | | | (5.55) | (5.10) | (5.36) |
| Toehold | | | | -0.227*** | -0.216*** |
| | | | | (-4.34) | (-5.38) |
| Toehold*52-week high | | | | -0.161 | -0.256 |
| | | | | (-1.35) | (-1.77) |
| Cash | | | | | -0.024* |
| | | | | | (-1.81) |
| Shares | | | | | -0.150*** |
| | | | | | (-7.16) |
| Tender | | | | | 0.040** |
| | | | | | (2.38) |
| Hostile | | | | | -0.019 |
| | | | | | (-1.00) |
| Log target market capitalization | | | | | -0.040*** |
| | | | | | (-6.58) |
| Constant | 0.257*** | 0.243*** | 0.204*** | 0.218*** | 0.340*** |
| | (27.54) | (17.61) | (7.78) | (3.61) | (5.96) |
| Year fixed effects | No | No | No | Yes | Yes |
| N | 1636 | 1246 | 1246 | 1222 | 1219 |
| Adjusted $R^2$ | 0.027 | 0.077 | 0.124 | 0.156 | 0.234 |

# 6 Conclusions

The thesis examines the role of past target share price peaks as reference points in mergers and acquisitions. The effects of reference point prices have been well-documented in the US M&A market, but there is a lack of studies done in other markets. Therefore, I contribute to the literature by examining the effects of reference point prices using a sample of public M&A transactions involving a target firm domiciled in the UK. I also contribute by examining whether the effect of past peak prices is affected by asymmetric information between target insiders and bidders.

The results of the paper confirm that there is a positive, non-linear relationship between past peak prices and offer prices. I study past peak prices over several intervals, from the 13-week high to the 78-week high, and find that offer prices are affected by peaks that have occurred farther in the past and more recently as well. I also find that peak prices that have occurred farther in the past have a diminishing marginal effect on offer prices. I find that offer prices tend to collect above rather than below past peak prices. However, In contrast to Baker et al. (2012) I find no significant discontinuity in offer price density at the 52-week high.

Following previous studies, the main reference point measure employed in the study is the target 52-week high stock price. The positive relationship between 52-week high prices and offer prices is statistically and economically significant. It is robust to the inclusion of a range of control variables and across a range of specifications and subsamples. The subsamples analysis reveals that the effect of 52-week high prices on offer prices is stronger in deals with all-cash consideration and in deals with multiple bidders competing for the same target.

In contrast to Baker et al. (2012) I find that the relationship between 52-week high prices and offer prices does not survive a falsification test which aims to test whether negotiators are using specifically the 52-week high as a reference point. Further, unlike Baker et al. (2012), I do not find that the probability of deal completion increases discontinuously when the offer price surpasses the 52-week high and I do not find that anchoring on the 52-week high leads to a worse announcement period return for bidders. The findings indicate that the effect of the target 52-week high on offer prices is weaker in the UK market than in the US market. Other reference points, such as major bidders' purchase prices or peak prices that have occurred more recently or farther in the past may play a greater role in some deals. In that case, the 52-week high may simply act as a proxy for other reference points.

I hypothesize that the effect of past peak prices on offer prices is stronger in the presence of asymmetric information between target insiders and bidders. Information asymmetry can lead to more uncertainty regarding target valuation, which may lead negotiators to rely on past peak prices as reference points to a greater extent. Consistent with this hypothesis, I find that the effect of 52-week high prices on offer prices is significantly stronger in cross-border deals. This result differs from the results of Smith et al. (2019) who find the opposite result, that the effect of the 52-week high is significantly weaker in cross-border deals. However, I find no consistent results when analyst coverage, target volatility, public firm age or target bid-ask spread are used as proxies for information asymmetry.

It would be interesting to further examine the roles of different reference points in future studies. Analyzing the role of major shareholders' purchase prices as reference points in the UK M&A market could be an interesting avenue for future research. Data on shareholders' purchase prices is difficult to obtain, but it would be valuable to examine whether purchase prices is a stronger reference point than past peak prices in the UK.

Future research could also delve deeper into what reference points are most important to targets and bidders. Most previous studies focus on the target 52-week high. However, I find no strong evidence that the 52-week high has any special role compared to other reference points. Future studies could examine whether other potential reference points, such as aspiration level share prices or share prices of competitors also play a role. It would also be interesting to examine what factors affect anchoring on certain reference points in M&A.

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# A Variable Definitions

This appendix provides definitions of all the variables included in this study. Share price data, index data and return data has been collected from Thomson Reuters Datastream and all other data has been collected from the SDC Platinum M&A database.

**Analyst coverage:** Analyst coverage is defined as the average number of equity analysts providing an earnings per share (EPS) forecast for the next quarter for target firms over the year prior to the announcement date. The data has been collected from the Institutional Brokers' Estimate System (I/B/E/S) database, accessed through Thomson Datastream.

**Cash:** Indicator variable equal to 1 if the final consideration in the deal is recorded as cash by SDC platinum and 0 otherwise.

**Completed:** Indicator variable equal to 1 if the deal is recorded as completed or unconditional by SDC platinum and 0 if the deal is recorded as withdrawn or intent withdrawn by SDC platinum.

**Cross-border:** Indicator variable equal to 1 if the deal is recorded as a cross-border deal by SDC platinum.

**German civil law bidder:** Indicator variable equal to 1 if the bidding firm is incorporated in a country with a German civil law legal origin and 0 otherwise. See Appendix B.

**Financial bidder:** Indicator variable equal to 1 if the deal is flagged as an LBO by SDC platinum and 0 otherwise.

**French civil law bidder:** Indicator variable equal to 1 if the bidding firm is incorporated in a country with a French civil law legal origin and 0 otherwise. See Appendix B.

**Hostile:** Indicator variable equal to 1 if the deal is recorded as hostile by SDC platinum and 0 if the deal is recorded as friendly by SDC platinum.

**Inverse of the 30-day price:** The inverse of the closing target stock price 30 calendar days prior to the announcement of the bid.

**Multiple bidders:** Indicator variable equal to 1 if the number of bidders, as reported by SDC platinum, exceeds one. The variable takes a value of 0 if the number of bidders is reported by SDC platinum as equal to one.

**Offer premium:** Offer premium is defined as the log percentage difference between the offer price per target common share and the closing target share price 30 calendar days prior to the announcement of the bid. The offer price is scaled by the price 30 calendar days prior to the bid instead of the share price on the day of the announcement to avoid bias due to so called "runups" in target share prices that frequently occur prior to announcement (e.g. Schwert, 1996; Keown & Pinkerton, 1981). The offer premium is calculated as follows:

$$Offer_{it} = log\left(\frac{Offerprice_{it}}{Targetshareprice_{i,t-30}} - 1\right)$$

**Public firm age:** The number of years since the target firm became listed on a stock exchange in the UK. The data is collected from Thomson Datastream.

**Same industry:** An indicator variable that takes the value 1 if the target and the bidder is in the same industry and 0 otherwise. The target and the bidder are considered to be in the same industry if they have the same 4-digit SIC code, as reported by SDC Platinum.

**Scandinavian civil law bidder:** Indicator variable equal to 1 if the bidding firm is incorporated in a country with a Scandinavian civil law legal origin and 0 otherwise. See Appendix B.

**Second half of sample period:** Indicator variable equal to 1 if the announcement date of the deal is on or after the $2^{nd}$ of July 2004 and 0 otherwise.

**Target bid-ask-spread:** The average daily spread between bid and ask prices divided by the closing price for each day over the 365 calendar days prior to the announcement of the acquisition.

**Target/bidder market capitalization:** The number of shares outstanding at the end of the most recent interim period prior to the bid multiplied by the closing share price 30 calendar days prior to the announcement date of the bid.

**Target/bidder earnings-to-price ratio (E/P):** log (EBIT for the last twelve months from the most recent interim period prior to the bid divided by the market capitalization).

**Target/bidder book-to-market ratio (B/M):** log (Book value of equity at the end of the most recent interim period prior to the bid divided by market capitalization).

**Target/bidder return on assets (ROA):** log (Net income for the last twelve months from the most recent interim period prior to the bid divided by total book assets at the end of the most recent interim period).

**Target volatility:** The standard deviation of daily returns for the 335 calendar days ending 30 days prior to the announcement date of the bid.

**Tender:** Indicator variable equal to 1 if the deal is recorded as a tender offer by SDC platinum and 0 otherwise.

**Toehold:** The percentage of the target's common stock owned by the bidder prior to announcement of the deal. The data has been collected from SDC platinum.

**X-Week target (market) high:** The main independent variable in this study is the 52-week high. However, high prices over 13-week intervals from the 13-week high to the 78-week high are also used. These high prices are defined as the log percentage difference between the maximum target stock price over the x-week period ending 30 days prior to the announcement of the bid and the closing target share price 30 calendar days prior to the announcement of the bid. For instance, the 52-week high is calculated as follows:

$$52WeekHigh_{i,t} = log\left(\frac{max(Targetshareprice_{i,t-365\to t-30})}{Targetshareprice_{i,t-30}} - 1\right)$$

The 52-week market index high is defined correspondingly as the log percentage difference between the maximum index value over the 335 calendar days ending 30 days prior to the announcement of the bid and the closing index value 30 calendar days prior to the announcement of the bid.

## B Bidder Nations and Legal Origins

Table 12 below presents all the nations in which the bidders' ultimate parents are domiciled. A deal is considered a cross-border deal by SDC Platinum if the bidder's ultimate parent is domiciled in different country than the target. The classification of legal origin for each nation follows La Porta et al. (2008). The legal origins of bidder nations are classified as Scandinavian civil law, German civil law, French civil law or British common law. According to Smith et al. (2019), the legal origins of bidders' home nations are important to control for since investor protection differs depending on a nation's legal origin.

Table 12: Bidder Nations

The table shows the nations in which the bidders' ultimate parents are domiciled in the sample, the number of deals for each country and the legal origins of each country. The classification of legal origin follows La Porta et al. (2008). There are 932 domestic deals and 704 cross-border deals in the sample.

| | **Bidder nation** | N | **Legal origin** | | **Bidder nation** | N | **Legal origin** |
|---|---|---|---|---|---|---|---|
| 1 | Australia | 15 | British common | 28 | Israel | 1 | British common |
| 2 | Austria | 2 | German civil | 29 | Italy | 9 | French civil |
| 3 | Bahamas | 2 | British common | 30 | Japan | 17 | German civil |
| 4 | Bahrain | 4 | British common | 31 | Jersey | 5 | British common |
| 5 | Belgium | 13 | French civil | 32 | Kuwait | 1 | French civil |
| 6 | Belize | 1 | British common | 33 | Lithuania | 1 | French civil |
| 7 | Bermuda | 14 | British common | 34 | Luxembourg | 6 | French civil |
| 8 | Brazil | 2 | French civil | 35 | Malaysia | 6 | British common |
| 9 | British Virgin Islands | 7 | British common | 36 | Malta | 1 | British common |
| 10 | Bulgaria | 1 | German civil | 37 | Mexico | 1 | French civil |
| 11 | Canada | 32 | British common | 38 | Netherlands | 13 | French civil |
| 12 | Cayman Islands | 4 | British common | 39 | New Zealand | 3 | British common |
| 13 | China | 10 | German civil | 40 | Norway | 3 | Scandinavian civil |
| 14 | Cyprus | 1 | French civil | 41 | Oman | 1 | British common |
| 15 | Denmark | 2 | Scandinavian civil | 42 | Peru | 1 | French civil |
| 16 | Finland | 3 | Scandinavian civil | 43 | Philippines | 2 | French civil |
| 17 | France | 53 | French civil | 44 | Qatar | 3 | British common |
| 18 | Germany | 28 | German civil | 45 | Russia | 4 | French civil |
| 19 | Gibraltar | 2 | British common | 46 | Singapore | 4 | British common |
| 20 | Greece | 1 | French civil | 47 | South Africa | 17 | British common |
| 21 | Guernsey | 11 | British common | 48 | South Korea | 1 | German civil |
| 22 | Hong Kong | 10 | British common | 49 | Spain | 10 | French civil |
| 23 | Iceland | 7 | Scandinavian civil | 50 | Sweden | 9 | Scandinavian civil |
| 24 | India | 8 | British common | 51 | Switzerland | 29 | German civil |
| 25 | Indonesia | 2 | French civil | 52 | Ukraine | 1 | French civil |
| 26 | Ireland | 21 | British common | 53 | United States | 287 | British common |
| 27 | Isle of Man | 8 | British common | 54 | Utd Arab Em | 4 | British common |

# C The 52-Week High and the Probability of Deal Success

I estimate the impact of 52-week high prices on the probability of deal success by running probit regressions. The results are presented in Table 13 below. The dependent variable in the probit regressions is an indicator variable that takes a value of 1 if the deal has been completed and 0 if the deal has been withdrawn. All specifications control for past monthly returns of the target firms.

The specifications include an indicator variable that takes a value of 1 if the offer price is above the 52-week high. If the likelihood of success is discontinuously higher when the offer price is higher than the 52-week high, one would expect to see a significant positive coefficient on this variable. However, the coefficient is only significant in the specification in column 1 of Table 13 and insignificant in the other three specifications. Thus, the probability of deal success does not seem to rise significantly when the offer price surpasses the 52-week high. The offer premium does not seem to have a strong impact on the probability of deal success either. Instead, whether the deal is hostile, whether the deal is a tender offer and the size of targets and bidders appear to have a much stronger effect on the probability of success. Intuitively, the probability of success is much lower if the deal is hostile. The probability is also lower the larger the bidder is. Conversely, the probability of success is higher the larger the target is and if the offer is a tender offer.

Table 13: The 52-Week High and the Probability of Deal Success

The table presents probit regressions to investigate whether deal success is more likely if the bid exceeds the 52-week high. The dependent variable is an indicator variable taking a value of 1 if the deal has been completed and 0 if the deal has been withdrawn. Columns 3-4 include a quartic polynomial of the offer premium. All variable definitions are presented in Appendix A.

| | Probit **1** | Probit **2** | Probit **3** | Probit **4** |
|---|---|---|---|---|
| Offer premium | -0.222 | -0.856** | 0.992* | 0.596 |
| | (-1.64) | (-2.40) | (1.70) | (0.64) |
| Offer premium$^2$ | | | -0.809 | 5.344 |
| | | | (-0.38) | (0.87) |
| Offer premium$^3$ | | | -4.401 | -25.604 |
| | | | (-0.63) | (-1.42) |
| Offer premium$^4$ | | | 4.219 | 21.239 |
| | | | (0.62) | (1.46) |
| Offer premium> 52-week high | 0.184* | 0.124 | 0.131 | 0.052 |
| | (1.70) | (0.94) | (1.11) | (0.38) |
| Cash | | -0.221 | | -0.202 |
| | | (-1.36) | | (-1.28) |
| Shares | | -0.051 | | -0.026 |
| | | (-0.27) | | (-0.14) |
| Hostile | | -1.162*** | | -1.143*** |
| | | (-6.15) | | (-6.07) |
| Tender | | 0.895*** | | 0.897*** |
| | | (6.93) | | (7.29) |
| Log target market capitalization | | 0.143*** | | 0.143*** |
| | | (2.90) | | (2.94) |
| Log bidder market capitalization | | -0.132*** | | -0.131*** |
| | | (-2.68) | | (-2.70) |
| Inverse (1/Pt-30) | 1.179* | 3.746* | 1.333* | 3.821* |
| | (1.80) | (1.77) | (1.87) | (1.71) |
| Constant | 0.911*** | 0.349 | 0.835*** | 0.138 |
| | (14.57) | (1.20) | (12.19) | (0.38) |
| Year fixed effects | No | No | No | No |
| Target monthly returns | Yes | Yes | Yes | Yes |
| N | 1608 | 585 | 1608 | 585 |
| Pseudo $R^2$ | 0.015 | 0.182 | 0.021 | 0.189 |

# D Bidder Wealth Effects

To estimate the effect of anchoring on the target 52-week high on bidders' wealth, I utilize a two-stage least squares regression where the 52-week high is used as an instrument for the offer premium. The results are presented in Table 14 below.

Following Baker et al. (2012) I start by running an OLS regression of the 3-day CAR on the offer premium to examine whether the market reacts more negatively to a higher premium (see column 1 of Table 14 below). A high premium could be interpreted as overpayment by the bidder. Alternatively, investors may perceive a high premium as justified if the deal is expected to produce adequate synergies. I find no significant result, indicating that investors do not simply perceive a high premium as value destructive overpayment by the bidder. I confirm the result by running the same regression on the 7-day CAR in column 2 of Table 14. Again, I find no significant result. I run OLS regressions with controls added in columns 3 and 4. The only significant result I find is that the CAR tends to be slightly higher when the consideration is all cash.

The results of the two-stage least squares approach is presented in columns 5 and 6 of Table 14. The 3-day CAR and the 7-day CAR are the dependent variables in columns 5 and 6 respectively. The positive relationship between the 52-week high and the offer premium is one of the main findings of this paper. Thus, the 52-week high is an appropriate first stage regression. The exclusion restriction is also fulfilled since it is unlikely that the 52-week high directly affects the CAR or indirectly affects it through omitted variables.

Imagine that the offer premium reflects synergies and/or overpayment. In that case, the 52-week high may be positively correlated with either component. If the 52-week high reflects overpayment, the IV estimate should be more negative than the OLS estimate. If the 52-week high instead reflects expected synergies, the IV estimate should be higher than the OLS estimate. I find no significant effect of the offer premium on the CAR in the two-stage approach, which indicates that the 52-week high effect on offer premiums does not strongly reflect overpayment or synergies.

The results differ from those of Baker et al. (2012) who find a negative relationship between the bidder CAR and the offer premium. Further, Baker et al. (2012) find that the effect is more negative when the 52-week high is used as an instrument for offer premiums. However, my results are in line with the evidence by Coakley, Gazzaz, and Thomas (2017) who study a sample of UK M&A deals. The authors use the target 26-week high as an instrument for offer premiums and find no significant second stage results for the component of offer premiums predicted by the target 26-week high.

Table 14: The 52-Week High and Bidder Wealth

The table presents OLS and two-stage least squares regressions of the bidder announcement period cumulative abnormal return on the offer premium. The 52-week high is used as an instrumental variable for offer premiums in the two-stage least squares regressions. The dependent variable in each specification is either the 3-day or the 7-day bidder cumulative abnormal return (CAR), centered on the announcement date (the dependent variable is given in the header of each column). All variable definitions are available in Appendix A. Robust t-statistics with standard errors clustered by month are in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

| Dependent variable | OLS $CAR_3$ **1** | OLS $CAR_7$ **2** | OLS $CAR_3$ **3** | OLS $CAR_7$ **4** | 2SLS $CAR_3$ **5** | 2SLS $CAR_7$ **6** |
|---|---|---|---|---|---|---|
| Offer premium | 0.002 | 0.015 | -0.002 | 0.006 | -0.044 | -0.056 |
| | (0.22) | (1.28) | (-0.18) | (0.34) | (-0.28) | (-0.42) |
| Inverse (1/Pt-30) | -0.027 | -0.059** | -0.040 | -0.067** | -0.046 | -0.075*** |
| | (-1.57) | (-2.60) | (-1.47) | (-2.93) | (-1.25) | (-2.76) |
| Cash | | | 0.026*** | 0.023*** | 0.025*** | 0.022*** |
| | | | (3.67) | (3.28) | (4.77) | (3.59) |
| Shares | | | 0.013 | 0.012 | 0.007 | 0.003 |
| | | | (1.54) | (1.25) | (0.27) | (0.14) |
| Hostile | | | 0.002 | -0.001 | 0.004 | 0.003 |
| | | | (0.22) | (-0.07) | (0.31) | (0.25) |
| Tender | | | -0.003 | -0.010 | -0.003 | -0.009 |
| | | | (-0.62) | (-1.33) | (-0.56) | (-1.33) |
| Financial | | | -0.016 | -0.012 | -0.021 | -0.020 |
| | | | (-1.12) | (-1.41) | (-0.84) | (-1.01) |
| Log target market cap | | | 0.003 | -0.001 | 0.002 | -0.003 |
| | | | (0.79) | (-0.14) | (0.27) | (-0.54) |
| Log bidder maket cap | | | -0.003 | 0.000 | -0.002 | 0.001 |
| | | | (-0.82) | (0.06) | (-0.54) | (0.38) |
| Constant | -0.007* | -0.012** | -0.009 | -0.009 | 0.007 | 0.015 |
| | (-1.84) | (-2.30) | (-1.35) | (-0.77) | (0.11) | (0.30) |
| Year fixed effects | No | No | No | No | No | No |
| Target monthly returns | No | No | Yes | Yes | Yes | Yes |
| N | 747 | 747 | 583 | 583 | 583 | 583 |
| Adjusted $R^2$ | 0.001 | 0.009 | 0.023 | 0.009 | | |