The impact of mispricing and growth on UK M&As*

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Abstract

This paper investigates the impact of mispricing and growth on salient aspects of 434 UK merger and acquisition (M&A) deals over the 1990-2009 period. Mispricing is proxied by both the 26-week high price and misvaluation given the deviation of target price from its estimated fundamental value. One or both of these variables has a significantly pervasive influence on all aspects of M&As studied. The target 26-week high price, misvaluation and growth all have a significant effect on both the offer premium and whether bidders pay with cash or stock for the full sample. The 26-week high price is the main driver for the overvalued (price exceeds value) target sub-sample and growth prospects for the undervalued target sub-sample. Short run abnormal returns around the announcement are driven by misvaluation only while offers in excess of the 26-week high and of fundamental value increase the probability of deal success.

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1. Introduction

Behavioural finance has introduced novel concepts in recent years to enhance our understanding of different aspects of mergers and acquisitions (M&As).[1] Recent research has suggested that mispricing can complement growth in explaining salient aspects of merger activity where mispricing is proxied by both the 26 week high price and misvaluation given the deviation of target price from its estimated fundamental value. Neo-classical theories, in contrast, stress the importance of industry and liquidity shocks. The implication is that shocks to fundamentals, such as regulation or technology, are the primary means by which capital is transferred to higher-valued use. These transfers occur via increases in merger activities that are contemporaneous with the shocks.

Two recent behavioural finance approaches deserve special mention. On the one hand, Baker, Pan and Wurgler (2012) introduce a key role for psychological reference points – proxied by recent peak prices such as the 26- or 52-week high price – in the M&A process. They establish that using past peak prices in valuing a target has a significant effect on several salient aspects of merger activity in the USA. Bidders that offered the targets' recent peak price instead of current market valuations could more easily justify the deal and those targets' shareholders were more likely to be satisfied with such peak prices than other prices.

On the other hand, several studies find that misvaluation or the short run difference between the stock market value and the fundamental value of targets and of bidders is the key to understanding M&As in the USA. The most influential amongst these is Rhodes-Kroph, Robinson and Viswanathan (2005) (RKRV hereafter).[2] They find overvalued bidders buy undervalued (or less overvalued) targets and pay for targets with bidders' overvalued stock.

[1] Once could argue that this literature started with Roll's (1986) concept of hubris.

[2] Interestingly, RKRV give a rational interpretation of misvaluation based on correlated misinformation but their methodology can also be given a behavioural interpretation.

They report evidence that merger waves are driven by excessively high equity market valuations of corporate stock. Since in situations involving high market valuations, there is a window of opportunity within which firms' managers must complete their deal before the temporary misvaluation is corrected, market timing is crucial to the misvaluation approach.[3]

The principal contribution of this paper is that it is the first to investigate the joint impact of misvaluation and peak prices as well as growth for a sample of 434 UK merger and acquisition deals where the announcement date was between January 1, 1990 and December 31, 2009. The two mispricing approaches are linked. Both view mispricing (albeit in different forms) as playing a crucial role in M&As. Moreover, targets will expect peak price offers that bidders can more readily to match in overvalued markets. In such circumstances, paying above the market price for a target (for example, valuing it at its past year's peak price) might come easier than it would for a bidder whose equity is fairly valued. Equally, in undervalued markets, it would be unrealistic for targets to expect offers around their recent peak prices. The implication that peak prices are likely to play a more influential role in overvalued markets and this requires joint testing of these effects.

The paper's second contribution is that it proposes a unique interpretation based on the various differences in the regulatory frameworks and the market functioning in the US and UK markets which result in the differences in their approaches towards M&A offer price setting.[4] The major difference stems from the fact that the UK takeover market is more informally regulated than the US market. The US takeover regulation is the domain of courts and is regulated by the Securities and Exchange Commission. By contrast, UK takeover

[3] For the USA, Dong Hirshleifer Richardson and Teoh (2006) also find empirical evidence in support of this behavioral finance perspective. Coakley, Fu and Thomas (2010) establish that misvaluation has significant effects on UK merger activity.

[4] See Petmezas (2009).

regulations save on litigation costs by not involving lawyers or courts. The Takeover Panel has representatives from the Stock Exchange, the Bank of England, the major investment banks, and institutional investors and meets several times a year (Armour and Skeel, 2007). The means of payment in M&As is another difference. The payment method is usually cash in the UK (Chatterjee and Kuenzi 2001; Sudarsnam and Mahate 2003) suggesting that investor confidence is high. This means that post-announcement abnormal returns are greater when the payment is made mostly in cash. In the USA, most payments are made in shares or debentures, diluting the shareholders' control. The post-announcement stock prices underline this through very limited returns.

The above differences mean that the time period between the merger announcement date and the deal closing is much shorter in the UK than in the USA (Faccio and Masulis, 2005). The average time for completion of a contested UK merger is 156 trading days, three times longer than that for a single bidder situation, which is about 53 trading days observed from 15,917 merger deals. By contrast, the average time in a contested US merger is 285 trading days (see Malmendier et al., 2012), and it is three times longer than the average time in single bidder mergers, which is 65 trading days observed from 25,166 merger deals (see Betton et al., 2008). The upshot is that we focus on the 26-week high price rather than the Baker et al. (2012) 52-week high price. As a result of these differences, we expect UK bidders to be less prone to offering prices anchored or tied to psychological reference points than US bidders.

Our findings uncover novel links when the RKRV (2005) misvaluation and the Baker et al. (2012) reference point approaches are jointly considered and tested. First, the target's peak price (26-week high price) matters in valuing overvalued targets in UK M&As.[5]

[5] We found as well a significant impact for the 78-, 91- and 104-week high on the offer premium when targets were overvalued.

Bidders take advantage of the temporary windows of misvaluation and offer high premia when targets are undervalued and low premia for overvalued targets as in Dong et al. (2006). Moreover, while we confirm that bidders acquire those targets with high growth prospects to offset their own low growth prospects as in RKRV (2005), we find that such bidders also offer high premia. Second, the findings concerning the method of payment indicate that bidders employing stock offer lower premia than those employing cash. For a given level of target undervaluation, cash bidders pay a lower offer premium than non-cash bidders. Similarly, for a given level of target overvaluation, stock bidders pay a lower offer premium than do non-stock bidders.

Third, our results suggest that bids generate abnormal returns when offer premia are positively associated with target overvaluation. This short-run positive relationship indicates that bidders are in fact not overpaying for their targets which is consistent with Shleifer and Vishny (2003) (SV hereafter) but not Baker et al. (2012). The latter find the bidder's announcement effect dropped by 2.45% when the component of the offer premium that reflects the target's 52-week high increases by 10%. In this regard Fu et al. (2013) also report results inconsistent with SV (2003). Finally, the probability of a successful deal increases when offer prices exceed the target's 26-week high price and fundamental value. Baker et al. (2012) also find that when the offer price exceeds the market price, the likelihood that target shareholders will accept the deal increases.

The reminder of the paper is organised as follows. Section 2 reports the methodology employed, develops the hypotheses as well as describes sample construction and the data. Section 3 provides the empirical results while Section 4 concludes.

2. Methodology and hypotheses

Misvaluation of a firm is defined as the difference between its market and fundamental values. As the true fundamental value of a firm is unknown, it is necessary to estimate this using a financial model.

2.1 Estimating fundamental value

Different models can be used to calculate a proxy for the fundamental value of a firm such as one relying on book value, a residual income model, dividend discount models and models using earnings per share. Previous studies, such as those of SV (2003) and Jovanovic and Rousseau (2001), used book value as the relevant proxy while Daniel et al. (2001) and Barberies and Huang (2001) both support book value as a valuation proxy. A firm's book value is, however, susceptible to some manipulation through managerial choice of accounting policies. While Frankel and Lee (1998) argued that the book value only reflected a firm's backward-looking accounting information (historical value), others have interpreted the market-to-book ratio (M/B) as a proxy for a firm's growth opportunities. Researchers in the investment literature in economics widely use Tobin's *q* as a proxy for growth options.[6]

Recently, Ang and Chen (2006) and Dong et al. (2006) use the residual income model to estimate a proxy for fundamental value. While Dong et al. (2006) also employ the book-to-price ratio, they suggest a preference for the residual income model because it is less sensitive to accounting treatments and combines backward-looking information with future earnings forecasts. Nevertheless, since the residual income model depends on the accuracy of a firm's accounting information, one needs to make the strong assumption that the principles of clean-surplus accounting hold at all times. While analysts' forecasts are available for UK firms, they are not as comprehensive as those for US firms in the International Brokers' Estimate System (I/B/E/S) and typically these forecasts are not available beyond three years.

[6] See Fazzari, Hubbard and Petersen (198), Baker Stein and Wurgler (2003) and Campello and Graham (2013).

Furthermore, as Capstaff et al. (1995) and Bulkley and Harris (1997) have shown, forecasts are not only difficult to apply as an investment strategy in the UK but they are also biased.

Given the above, we chose to employ a variant of the RKRV (2005) approach to estimate fundamental value. RKRV (2005) pioneered an approach to estimating fundamental value that decomposes the M/B ratio into misvaluation (or mispricing) components and a growth component. They decompose misvaluation into short and long run components. Versions of their methodology have been implemented in several studies such as those of Hertzel and Li (2010) and Fu et al. (2013). RKRV (2005) originally suggested three models linking market value and accounting information (θ_{it}) - where the latter included book value, net income and leverage - to estimate fundamental value, $v(\theta_{it};\alpha_j)$. However, in discussing their results, they focus on the model with book value only. Employing equity book values and market values of equity for firms in sector *j* in year *t*, RKRV (2005) disaggregate the M/B ratio into three separate components.

First, for firm *i* in sector *j* in year *t*, they estimate yearly ordinary least squares (OLS) sector-level cross-sectional regressions for the population (merger and non-merger firms) for each of 12 Fama-French industry classifications.

$$m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \varepsilon_{it} \qquad (1)$$

where m_{it} and b_{it} are logarithms of equity market value and equity book value respectively, and α_{0jt} and α_{1jt} denote a constant term (interpreted as intangibles) and the multiple of book value, respectively, for industry *j* and year *t* and σ_{ε}^2 the variance of the error term is assumed constant within sector *j* and year *t*.[7] Then the estimated regression coefficients and accounting

[7] Logarithms of the book and market values are employed to mitigate right skewness issues associated with accounting information.

information (b_{it}) are used to define a firms's short run fundamental value $v(b_{it};\alpha_{jt})$. From this, firm-specific error or short run misvaluation for firm *i* is given as:

$$m_{it} - v(b_{it};\alpha_{jt}) = m_{it} - \hat{\alpha}_{0jt} - \hat{\alpha}_{ijt} b_{it} \qquad (2)$$

Second, RKRV (2005) average the estimated regression coefficients over the full sample period within each industry *j*: $\bar{\alpha}_j = \left(\frac{1}{T}\sum \hat{\alpha}_{jt}\right)$ where *T* is the sample period and $\bar{\alpha}_j$ is the time series industry *j* average. Replacing the time-*t* accounting multiples by these averages and using book value gives the long run fundamental value of firm *i* in industry *j* as $v(b_{it};\alpha_j) = \bar{\alpha}_{0j} + \bar{\alpha}_{ij} b_{it}$. They calculate time series sector error or the long run misvaluation component as the deviation between time-*t* fundamental value and long-run value or $v(b_{it};\alpha_{jt}) - v(b_{it};\alpha_j)$.

Finally, RKRV (2005) arrive at the third component of their M/B decomposition. They define long run value to book or long growth prospects as the residual between long run fundamental value and book value: $v(b_{it};\alpha_j) - b_{it}$.

Our methodology departs from the RKRV (2005) approach in two respects. First, it avoids the inconsistency in the RKRV (2005) definition of long-run fundamental value first pointed out by Coakley et al. (2010). The definition suffers from look ahead bias since is based on mainly forward-looking information in all but the final year of the sample period. We thus follow the Coakley et al. (2010) time-varying, business cycle approach to mitigate this problem:

$$\bar{\alpha}_j = \frac{1}{5}\sum_{k=0}^{4} \hat{\alpha}_{jt-k} \qquad (3)$$

where *t* is the year of the original merger announcement date and *k* indicates the business cycle for industry *j*. The method relies on the observation that the cycles in the macro-economy in different industries impact a firm's long-run fundamental value over time. Thus, they propose a backward-looking, five-year (equally-weighted) moving average where the

appropriate coefficients applicable to each merger depend on the information current at the time of that merger (*t*=0) and on the set of coefficients from the 4 years prior to that of the particular merger.

Second, since both Fu et al. (2013) and Coakley et al. (2010) find short-term misvaluation per se adds little of economic significance to their studies, we decompose the M/B ratio into just two components specified as:

$$m_{it} - b_{it} = \{m_{it} - v(b_{it}; \alpha_j) + (v(b_{it}; \alpha_j) - b_{it})\} \qquad (4)$$

The components are defined as:

(a) The misvaluation component, $m_{it} - v(b_{it}; \alpha_j)$, is the difference between a stock's market value (*m*) and its long run fundamental value $v(b_{it}; \alpha_j)$ computed using 5-year moving average multiples, α_j of its industry *j* and where b_{it} is book value of equity for firm *i* in year *t*.

(b) The growth prospects component, $(v(b_{it}; \alpha_j) - b_{it})$, is the difference between the long run fundamental $v(b_{it}; \alpha_j)$ and book value, b_{it}.

2.2 Hypotheses

We examine the impact that misvaluation, and long run growth and the 26-weekhigh price have on the offer premium employing by the following pooled OLS regression:

$$Offer_{it} = a_1 + b_1\, 26WeekHigh_{it} + b_2\, Misvaluation_{it} + b_3\, Growth_{it} + e_{it} \qquad (5)$$

where $Offer$ is the offer premium, or the offer price divided by the target stock price 30 days before the announcement date (P_{t-30}). The peak stock price over the 150 trading days ending 30 days prior to the announcement date is $26WeekHigh$ which is also normalised by (P_{t-30}).

Misvaluation is the ratio of the market price and fundamental value, while *Growth* is the ratio of the fundamental value and the book value per share, both expressed in levels.

(i) Offer premium

Baker et al. (2012) argue that target shareholders, who are typically loss-averse, will quite likely reject offers below the most recent peak price and are more likely to accept a bid if the offer price meets or exceeds past peak prices. In negotiations, one would expect the offer price to be anchored to a reference point price or even exceed it to increase the probability of acceptance by target shareholders. This suggests the following hypothesis for the peak price over the prior 26 week high price, $26WeekHigh_{it}$ in regression (5):

Hypothesis 1A: *There is a positive relationship* $(b_1 > 0)$ *between the offer premium and the target 26-week high price.*

The SV (2003) and Rhodes-Kroph and Viswanathan (2004) theories suggest that market misvaluation motivates overvalued bidders to buy target firms that are either less overvalued or undervalued absolutely.[8] Dong et al. (2006) found a negative relation between target valuation and offer premium. Bidder managers are expected to either offer high premia when targets are undervalued to help close a deal or to offer low premia to avoid overpaying when targets are overvalued. This line of reasoning leads us to the following hypothesis for the level of misvaluation, $Misvaluation_{it}$ in regression (5):

Hypothesis 1B: *There is a negative relationship* $(b_2 < 0)$ *between the offer premium and the target misvaluation level.*

RKRV (2005) established that overvalued bidders in the US tended to have much poorer long run growth prospects than their targets and admitted that this result was a puzzle as it ran contrary to *q* theory. In such situations, bidders will quite likely seek to acquire target

[8] Absolute undervaluation implies that a firm's market price is below its estimated fundamental value.

firms with superior long-term growth prospects to help offset the bidder's growth prospect deficit. As a result, they can be expected to offer higher premia to persuade the target shareholders to sell. This line of argument suggests the following hypothesis for $Growth_{it}$ in regression (5):

Hypothesis 1C: *There is a positive relationship* $(b_3 > 0)$ *between the offer premium and the long run growth prospects of the target.*

(ii) Method of payment

An indicator variable DMP_{it}^{m} is added to regression (5) to test the hypotheses below:

$$Offer_{it} = a_1 + b_1\, 26WeekHigh_{it} + b_2\, Misvaluation_{it} + b_3\, Growth_{it} + c_3 DMP_{it}^{m} + e_{it} \quad (5`)$$

DMP_{it}^{m} is a means of payment indicator variable.[9] For *m = cash*, it is a cash indicator equal to 1 when the method of payment is only cash and 0 otherwise and for *m = stock*, a stock indicator equal to 1 when the method of payment is only stock and 0 otherwise.

The issue underlying the following hypotheses is whether the method of payment (cash or stock) for misvalued (overvalued or undervalued) targets affects the premium offered. Both SV (2003) and Rhodes-Kroph and Viswanathan (2004) propose that overvalued bidders would employ their overvalued stock as currency to acquire less overvalued targets, but they have different interpretations of why target managers would agree to accept an overvalued currency. SV (2003) argued that target managers would aim to cash out their shares soon after merger and maximise their short run private gain. Rhodes-Kroph and Viswanathan (2004) show theoretically that target managers accept stock as they overestimate

[9] This scenario need not imply that a high offer premium is necessarily an indication of overpayment since a higher offer premium could also result from synergies between the target and bidder firms.

synergies resulting from merger and their overestimation error is correlated with overall firm valuation.

The misvaluation driver links neatly with the notion of peak-price reference points. Baker et al. (2012) claim that a bidder will likely anchor on the target's 52-week high price in a regime of overvaluation and in the context of psychological reference points. We, therefore, propose the following hypotheses concerning the method of payment chosen by bidders. Since deal times are shorter in the UK than the USA, we use the 26-week high price as the peak reference point price.

Hypothesis 2A: *Stock bidders will pay a lower offer premium than the non-stock bidders in the full sample.*

Hypothesis 2B: Stock *bidders will pay a lower offer premium than the non-stock bidders when the targets are undervalued absolutely on average.*

Hypothesis 2C: *Stock bidders will pay a lower offer premium than the non-stock bidders when the targets are overvalued absolutely on average.*

(iii) Market reaction to offer announcement

Although early researchers like Servaes (1991) argued that corporate takeovers generate positive gains that benefit the target firm as well as the bidding firm, the recent literature finds that bidders tends to lose. If the recent peak price (target's highest achieved price in the prior 26 weeks) has a significantly positive effect on the offer price and were the target's price to fall below its 26-week high price, an offer price that was close to the target peak price would be perceived by the market as overpayment by the bidder.

Hypothesis 3A: *There is a negative relationship between bidders' cumulative abnormal returns (CAR) and an offer premium conditioned on the target's 26-week high price.*

When targets are overvalued, bidders are encouraged to offer low premia, and, for those bidders who are unwilling to overpay, the market reaction at announcement would be positive. Nevertheless, when such targets have high growth prospects also, bidders may be tempted to pay a higher premium to acquire and, therefore, to overpay the target's shareholders. We predict that in such cases the market will react negatively as measured by cumulative abnormal returns (CAR).

Hypothesis 3B: *There is a positive relationship between bidders' CAR and the offer premium conditioned on target misvaluation.*

Hypothesis 3C: *There is a negative relationship between bidders' CAR and the offer premium conditioned on target growth prospects.*

Following Baker et al. (2012), who distinguish between two methodologies when examining this issue, we employ an ordinary least squares (OLS) regression as well as a two-stage least squares (2SLS hereafter) regression. The 2SLS method employs instrumental variables to examine the market reaction to that component of the offer premium that is correlated with a target's 26-week high, the level of its misvaluation and its growth prospects. The first stage S1, involves a separate regression of the offer premium on the target's 26-week high price or misvaluation or growth prospects. The estimated coefficients from the S1 regression are employed to predict the offer premium, which is used as an independent variable in the second stage regression, S2. The $CAR_x$is defined as the cumulative sum, over a window *x*, of the differences, on each day in the window, between the stock return and the benchmark return (i.e. the market return).[10]

S1: $Offer_{it} = \alpha_0 + \beta_1 \, Component_{it} + \epsilon_{it}$ (6)

S2: $CAR_x{}^* = a + bOffer_{it}{}^* + \varepsilon_{it}$ (6)*

[10] $CAR_{-x;+x} = \sum_{t=-x}^{+x}(R_t - R_{mt})$, where x = 5 or 7 days, R_t is the return for acquirers on day *t* relative to the announcement day 0, and R_{mt} is the return on the benchmark index.

where $Offer$ is the offer premium, *Component* is a conditioning variable (26 week high price, misvaluation, or growth), and $Offer_{it}^{*}$ is the S1 fitted offer premium.

(iv) Deal success

Finally we investigate whether the likelihood of deal success is driven by either a behavioural or a fundamental measure. In general, offering the target more than their current market price increases the probability of a deal being completed. Bidders may be tempted to offer the target at least the target's 26-week high price as a psychological reference point or even to exceed that peak price to ensure that loss-averse target shareholders will sell their shares. The alternative efficiency view is that an offer in excess of the fundamental value (or a proxy such as book value) of the shares increases the probability of deal success in those cases where market misvaluation prevails.

Hypothesis 4A: *Deal success increases when the offer price exceeds the target* 26-week high price.

Hypothesis 4B: *Deal success increases when the offer price exceeds the target fundamental value.*

Hypothesis 4C: *Deal success increases when the offer price exceeds the target book value.*

A probit regression approach is employed to examine the impact of a target's 26-week high price, controlling for level of misvaluation of the target and its growth prospects, on the probability of an offer being successful. Separate probit regressions are estimated to evaluate whether exceeding the scaled fundamental value (V/P_{t-30}) or scaled book value (B/P_{t-30}) impacts the probability of deal success, again with the same two control variables. The dataset is limited to only those deals classified by SDC as either completed or withdrawn. The following probit model is estimated:

$$\Pr(S_i = 1 | \boldsymbol{\beta}' \, \boldsymbol{x}_i \,) = \frac{e^{(\boldsymbol{\beta}' \, x_i \,)}}{1+e^{\boldsymbol{\beta}' \, x_i}} + \, \varepsilon_{it}; \qquad (7)$$

where S is a binary variable which distinguishes completed deals from failed deals and is equal to 1 if a deal is completed and 0 otherwise.[11] $\boldsymbol{\beta}'$ is the vector of parameters to be estimated and $\boldsymbol{x}_i'$ $(Offer_{it}, Misvaluation_{it}, Growth_{it})$ is a vector of explanatory variables.

3. Data and empirical results

3.1 Data

The data on deals were collected from the Thomson Reuters Security Data Corporation (SDC) M&As database. The selected bids had announcement dates between January 1, 1990 and December 31, 2009 and so were mostly pre-financial crisis. They satisfy the following criteria:

- Both the acquirer and target firms were UK public firms.
- The target's market value 4 weeks prior to announcement was at least £0.625 million.[12]
- Deals are excluded if they have been classified by Thomson as recapitalisation, repurchased, rumoured and target solicitation.
- The offer price of a deal must be available.

Imposing the above criteria yielded a total sample of 804 M&A deals. This was filtered depending on the availability of matching data. Table 1 illustrates the process.

[Table 1 around here]

[11] The sub-sample included 382 deals: 323 completed and 59 withdrawn.

[12] Target market values are filtered on Thomson Reuters, using a minimum size of US$1 million.

The data for these 804 transactions were matched with corresponding accounting information and stock prices data obtained from Datastream using the stock exchange daily official list (SEDOL). This resulted in a reduction of the final sample: 243 deals have either no SEDOL codes or no Datastream codes for the required data, the data for 12 of the remaining 561 deals were not available in Datastream, and a few firms with negative book value were excluded. This filtering process resulted in a final sample of 434 takeover bids.

The UK population (non-merger and merger firms) observations are used to investigate the link between market value and book value. We include dead and active firms to mitigate survivorship bias and new listing bias, and, for each firm, only their primary quotation on the London Stock Exchange, to avoid repetition of firms in the data. We exclude firms that were not classified from Datastream as major securities.

The following conventions are employed to merge the accounting data on book values b_{it} with time-series data on market values, m_{it}. In the merger observations, the relevant stock market value one month prior to the announcement date of a merger (m_{t-30}) was chosen, as a clean period that would be likely to be free of information leakage, rumours and other similar contemporaneous factors. These market values were matched with the latest available financial year-end reports of merger firms prior to the announcement date after allowing for a three-month publication lag. If an SDC merger announcement occurred before the market had received a firm's financial year-end accounting information, we associated that merger's announcement with the firm's accounting information from the previous financial year. Each firm in each year was treated as a separate observation. A firm may be counted multiple times in the merger sample if the same bidder takes over more than one target but in a different year. There are some 33,815 non-merger firms and 868 sample merger firms (434 acquirers and 434 targets).

Table 2 give selected M&A bid characteristic over the sample period.

[Table 2 around here]

The mean annual number of M&As is 22. Mergers peaked in the 1997-1999 (dotcom boom) and 2004-2006 (pre-financial crisis) periods. Cash dominates stock as the means of payment. Some 46% of completed M&As were cash funded while the corresponding proportion for stock is 26%. This confirms one main difference between the UK and US M&A markets. The vast majority (86%) of completed deals were friendly.

Table 3 reports the means, median, standard deviation, maximum and minimum for the main target variables (Panel A) and bidder variables (Panel B).

[Table 3 around here]

The mean offer premium was 28% while the median was 22%. Interestingly, the mean 26-week high premium of just under 28% is almost identical to the mean offer premium. However, the median 26-week high premium of 11% is only half the median offer premium, suggesting a bunching of offer premia at the high end.

Table 4 presents the disaggregation of the M/B into misvaluation and growth components.

[Table 4 around here]

It shows for the full sample that both bidders and targets are absolutely overvalued ($M/V>1$) but that bidders are substantially more overvalued relative to targets. However targets enjoy greater growth prospects. These properties continue to hold when the sample is divided into a absolutely undervalued ($M/V<1$) and overvalued target sub-samples. The main difference is that the scale of misvaluation is much higher in the case of overvalued targets. For instance, the mean M/V is only 0.55 for undervalued targets but that for overvalued targets is more than four times that level at 2.47. The corresponding misvaluation figures are 1.34 and 3.37, respectively for the corresponding bidders. Since the growth prospects remain very similar

across both sub-samples, this indicates that most variation in the M/B ratios are driven by misvaluation.

3.2 Offer premium

We estimate model (5) using the full target sample as well as two sub-subsamples based on whether the target is absolutely undervalued ($M/V<1$) or overvalued ($M/V>1$). These comprise 63% and 37%, respectively, of the full sample. Table 5 reports the results.

[Table 5 around here]

Column 1 reports the results for the full sample. The coefficients on misvaluation and long-term growth prospects are significantly negative and positive, respectively. These results support Hypotheses 1B and 1C. The target's 26-week high price coefficient is statistically insignificant which indicates that it has no significant impact on the offer premium after controlling for misvaluation and growth variables. This result rejects Hypothesis 1A. While it contrasts with the Baker et al. (2012) finding for the USA that the psychological reference point positively impacts the offer premium, including control variables imposes a higher burden of proof on the 26-week high price.[13] The coefficient on the 26-week high price is also insignificant for the undervalued sub-sample.

The 26-week high price is significantly negative at the 5% level in the smaller overvalued target sub-sample results reported in column 3. Moreover, it has the most strongly economically significant impact of all the variables in any of the regressions. A 1% increase in the 26-week high price reduces the offer premium by some 0.26%, thus supporting Hypothesis 1A for the overvalued targets sub-sample. The negative coefficient could be

[13] In unreported results, the 26-week high price is statistically insignificant in a univariate regression with no controls for the full sample contrary to Baker et al. (2012) US result.

justified by bidders tending to offer low premiums when they know that targets are already overvalued (see discussion of Hypothesis 1B below).

Table 5 shows that the coefficient on target misvaluation is significantly negative at the 1% level for the full sample and at the 5% level for the overvalued sub-sample. These results support Hypothesis 1B and imply that when a target's misvaluation rises by 1%, the offer premium decreases by close to 0.03% in the full sample as well as the overvalued sub-sample. These results imply that it is rational for bidders offer a lower premium when they know that targets are overvalued. A similar result is reported for the USA by Dong et al. (2006) who find a negative relationship between offer premium and target valuation.[14]

The coefficient on target growth prospects is significantly positive at the 5% level for the full sample and undervalued sub-sample but is insignificant for the overvalued sub-sample. The positive coefficients support Hypothesis 1C that there is a positive relationship between the offer premium and a target's long-run growth prospects. The offer premium increases by 0.06% and 0.1% for the full sample and undervalued sub-sample, respectively, for a 1% increase in the target's growth prospects. Offering a relatively higher premium on undervalued targets is a rational response by bidders. The overall results indicate that bidders pay a higher offer premium for better long-term growth prospects both to increase the probability of target shareholder acceptance and to enhance their own growth prospects as argued by RKRV (2005).

The results show interesting contrasts depending on whether the target is absolutely undervalued or overvalued. The results for the larger undervalued target sub-sample indicate that behavioural or mispricing factors do not matter but growth prospects drive offer premium increases. The overvalued sub-sample results indicate that the two mispricing factors, the 26-

[14] Although their valuation approach uses the residual income model, their conclusions parallel those we find.

week high price and misvaluation, are both significantly negative while growth prospects are statistically insignificant. These are consistent with the hot merger market concept of Rosen (2006). These are novel insights in the M&A literature and suggest that joint consideration of explanatory variables is important. The overall message is that mispricing measures (misvaluation and peak prices) matter most for the offer premium when targets are overvalued whilst only growth matters when targets are undervalued.

3.3 Method of payment

We next investigate whether the premium offered to the target firm is affected by the method of payment controlling for its mispricing and growth prospects. Table 6 reports the results.

[Table 6 around here]

For both cash and stock bids in the full sample, the misvaluation coefficients are significantly negative, those on growth are significantly positive and those on the 26-week high price are insignificant. However, the economic impact of growth is double that of misvaluation. The marginal effect of a cash bid (given by the DMP^{Cash} coefficient) on the offer premium is significant at -0.06 whilst that of a stock bid (DMP^{Stock} coefficient) is statistically significant at -0.11. These results indicate that, ceteris paribus, the stock bidder offers a lower premium than the cash bidder in the regressions controlling for mispricing and growth variables. They support Hypothesis 2A.

The undervalued target sub-sample results are broadly similar to those for the full sample. The coefficient on target misvaluation is significantly negative for cash bids only while those on growth prospects are significantly positive in both cases and economically stronger than in the full sample. The marginal net effect of a cash bid on the offer premium is now insignificant but that of a stock bid is -0.14 and significant in support of Hypothesis 2B.

The rationale for this is possibly that the small growth prospects differential (as can be gleaned from Table 4) in this case triggers lower stock offers.

For the overvalued target sub-sample, the coefficient on target misvaluation remains significantly negative for cash bids only but those on the other variables are very different. The coefficients on the 26-week high price are significantly negative and very strongly economically significant also with values of -0.26 and -0.24 for cash and stock bids, respectively. The coefficient on both means of payment indicators is statistically insignificant and this result rejects Hypothesis 2C.

3.4 Market reaction to offer announcement

We investigate the impact of the predicted offer premium on the market reaction measured by bidder's announcement period cumulative abnormal return (CAR). In the 2SLS regressions, the first stage OLS regression gives the predicted component of the offer premium associated with either the target 26-week high price, misvaluation or growth prospects. The three separate predicted offer premium values are employed in the second stage as an instrumented variable in place of the actual offer premium.[15] Table 7 presents the 2SLS results for the offer premium predicted by misvaluation (hereafter the predicted offer premium).

[Table 7 around here]

The Panel A 2SLS results in show that, in the full sample, the coefficient on the predicted (misvaluation) offer premium is significantly positive. The results imply that when this offer premium increases by 10%, bidder's returns rise by 1.54% and 1.84% in the CAR_5 and CAR_7 regressions, respectively. This suggests that bidders generate profits from the mergers and supports Hypothesis 3B that posits a positive relationship between bidder shareholders'

[15] Strictly speaking, these are recursive and not simultaneous models.

abnormal returns and the offer premium component associated with target misvaluation. The 2SLS results for the undervalued sub-sample (Panel B) yield no significant relationship between bidder CAR and the predicted offer premium. In the overvalued sub-sample (Panel C), the 2SLS coefficient on the predicted offer premium is significantly positive. The results imply that when the predicted offer premium increases by 10%, bidder's returns increases by 1.75 % and 2.45% in the CAR_5 and CAR_7 regressions, respectively, in line with Hypothesis 3B.

The other unreported second stage results for the component of the offer premium predicted by the target 26-week high price and by growth prospects were statistically insignificant and so reject Hypotheses 3A and 3C. The target's 26-week high price result contrasts with that of Baker et al. (2012) for the USA. They provide evidence that the bidder's announcement effect becomes more significantly negative (decreases) the further away a target is from its 52-week high price.

Overall, our results are consistent with SV (2003) who argued that overvalued bidders can earn short-run wealth by using their overvalued stock as a means of payment to acquire less overvalued firms. Nevertheless, Fu et al. (2013) challenge this idea since they fail to find evidence of positive synergies and found that overvalued bidders who acquired less overvalued firms are associated with lower announcement returns. They argue that bidders would benefit from paying with overvalued stock as the means of payment by negotiating a "favourable exchange ratio" that offers a low premium to target firms. This is consistent with our findings.

3.5 Deal success

Finally, we study whether the probability of deal success is driven by mispricing or fundamental criteria by an appropriate partitioning of the data. The first is based on a

behavioural criterion: this sub-sample of deals satisfies the condition that the offer premium exceeds the 26-week high premium.[16] The second sub-sample comprises only deals in which the offer premium exceeds the target scaled fundamental value (V/P_{t-30}), and the third where the offer premium is greater than scaled book value (B/P_{t-30}).

Since the outcome is binary – the deal is successful or not completed – we employ probit regressions. Table 8 reports the marginal effects for the full sample.

[Table 8 around here]

First, the results indicate that there is a significantly positive marginal impact of the offer premium on deal success when the offer price exceeds the target's 26-week high price. This finding is consistent with that of Baker et al. (2012) for the USA but is stronger in that it holds after controlling for target misvaluation and growth prospects.[17] The result implies that when the offer premium exceeds the 26-week high by 1%, the probability of deal success rises by 0.22%. This supports Hypothesis 4A that the probability of deal success increases when offer premium exceeds the 26-week high price.

Second, the impact of the offer price in excess of scaled fundamental value on the probability of deal success is significantly positive at the 5% level. The economic impact of 0.23% is very similar to that in the first regression and it supports Hypothesis 4B that the probability of deal success increases when the offer premium exceeds the scaled fundamental value. Finally, the results show that the marginal impact on the offer price in excess of scaled book value is statistically insignificant and so Hypothesis 4C is rejected.[18]

[16] 26-week high premium = Offer price – 26-week high price.

[17] Note that Baker et al. employ the 52-week high price in their US sample.

[18] Unreported results for the absolutely overvalued sub-sample were all insignificant. The coefficient on offer price exceeding the scaled book value was significantly positive for the absolutely undervalued sub-sample

The overall results indicate that the probability of deal increases with both mispricing and fundamental factors in support Hypotheses 4A and 4B.

4. Conclusions

The main contribution of this paper is that it investigates the joint impact of the 26-week high price, misvaluation and growth prospects for a sample 434 UK merger and acquisition (M&A) deals over the 1990-2009 period. It decomposes the market-to-book ratio to identify misvaluation and growth prospect components and employs the 26-week high price of the target firm's equity as the peak price. The results indicate the mispricing and growth variables have a pervasive influence on salient aspects of merger activity including the offer premium, method of payment, market reaction and the probability of offer success.

Misvaluation sheds new light on M&As as the effects of mispricing and growth differ between undervalued (price below value) and overvalued (price exceeds value) target sub-samples. Basically, for undervalued targets, growth matters more in explaining the offer premium and the means of payment. For overvalued targets, the target 26-week high price is the main driver of the offer premium ignoring the means of payment and separately for both cash and stock bids. Short run abnormal returns around the announcement date are driven the offer premium component that reflects target misvaluation only while offers in excess of the 26-week high and of fundamental value increase the probability of deal success.

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Table 1. Data filtering process

UK M&A data were obtained from Thomson Reuters which owns the Security Data Corporation (SDC). The initial dataset comprises 2251 deals for the period between January 1, 1990 and December 31, 2009 from SDC where the target and bidders are public companies in the UK market, the target market value 4 weeks prior to the announcement date is at least $1m, and deals classified by SDC as recapitalization, repurchase, rumoured and solicited by the target are excluded. It include only the deals where the offer price is known, the targets and bidders SEDOL/Datastream codes are available and the required accounting information, market value, past peak price and positive book value are available. The sample is reduced to 434 deals after imposing these filtering criteria.

Criteria	No. deals	No. Excluded
Target and bidder are public companies in the UK market.	2251	0
Target market value 4 weeks prior to the announcement was at least $1m.	1320	931
Deal has not been classified as recapitalization, repurchase, rumoured and solicited by the target.	951	369
The offer price is known.	804	147
Target and bidder SEDOL codes are available.	603	201
Target and bidder Datastream codes are available.	561	42
Accounting information, market value and past peak price.	438	123
Negative book value excluded.	434	4

Table 2. Characteristics of mergers

The table reports the annual distribution of UK M&A bids between January 1, 1990 and December 31, 2009. Data were obtained from the Thomson Reuters Security Data Corporation (SDC) M&A database. The filtering process required that target and bidder be public firms, offer price was available, target value 4 weeks prior to announcement date was at least £0.625 million (US$1 million) and deal was not classified as recapitalization, repurchase, rumour, or a target solicitation. Data were obtained on the method of payment, deal completion status and the merger attitude.

year	Total No.	Cash	Stock	Mixed	Friendly	Hostile	Completed	Withdrawn
1990	11	0	0	1	4	2	8	3
1991	18	4	0	3	5	7	12	6
1992	18	10	0	6	5	5	13	4
1993	14	7	1	5	9	1	14	0
1994	10	2	1	2	8	1	9	1
1995	15	4	2	5	11	1	13	1
1996	15	2	3	3	10	3	11	4
1997	26	8	5	8	21	1	20	4
1998	33	6	9	9	27	2	27	5
1999	40	9	7	13	28	7	31	9
2000	18	7	5	0	13	0	15	2
2001	11	4	3	2	6	0	7	2
2002	20	16	2	2	5	1	16	0
2003	23	8	7	2	14	1	17	1
2004	29	9	5	8	22	0	23	2
2005	36	11	9	8	28	0	25	3
2006	30	12	11	0	19	1	20	6
2007	22	9	5	5	17	0	15	4
2008	24	11	3	4	13	1	15	1
2009	21	9	6	1	14	0	12	1
Total	434	148	84	87	279	34	323	59

Table 3. Descriptive metrics

This table reports the mean, median, standard deviation, maximum and minimum values for target and bidder variables. Panel A shows the target variables: offer premium and 26-week high premium where the offer price is from SDC platinum and the 26-week high stock price from Datastream both divided by the target stock price 30 days prior the announcement date. Misvaluation is the market value divided by fundamental value and growth is the target fundamental value divided by the book value, all the target variables are expressed in levels. Panel B shows bidder cumulative abnormal returns for 3-, 5-, 7- and 11-days centred on the announcement date. All the continuous variables are winsorized at the 1% and 99% levels.

	Mean	Median	SD	Max	Min	N
Panel A: Target variables						
Offer	1.2814	1.2240	0.3925	3.0000	0.2353	434
26-week high	1.2768	1.1109	0.5012	4.2105	1.0000	434
Misvaluation	1.2565	0.7464	1.6283	9.9051	0.1183	434
Growth	1.9017	1.7633	0.6973	4.5991	0.7538	434
Panel B: Bidders variable						
CAR_3	0.0055	-0.0028	0.0694	0.2550	-0.1704	434
CAR_5	0.0043	-0.0038	0.0735	0.2595	-0.1721	434
CAR_7	0.0056	-0.0007	0.0814	0.2805	-0.1914	434
CAR_{11}	0.0076	-0.0019	0.0925	0.2864	-0.2743	432

Table 4. Disaggregation of market-to-book ratios

This presents the results of disaggregating the market-to-book (M/B) ratios into two components following a modified RKRV (2005) approach. The basic disaggregation is given by

$$M/B = M/V \times V/B$$

where M and B are the market and book values, respectively of the sample firms, and V gives their estimated fundamental values averaged over a rolling 5-year window. M/V is the misvaluation component while V/B is the growth prospects component. Absolutely undervalued targets are those with (M/V<1) and absolutely overvalued targets are those with (M/V >1) at the merger announcement date.

	Full sample		Undervalued targets	Related bidders	Overvalued targets	Related bidders	Undervalued targets		Related bidders		Overvalued targets		Related bidders	
	Bidders	*Targets*					*Cash*	*Stock*	*Cash*	*Stock*	*Cash*	*Stock*	*Cash*	*Stock*
M/B	3.684	2.605	1.023	2.369	5.342	5.955	0.912	1.065	1.856	3.053	5.655	5.272	6.354	5.637
M/V	2.086	1.257	0.553	1.344	2.474	3.369	0.536	0.514	1.146	1.561	2.498	2.550	3.206	3.251
V/B	1.725	1.902	1.867	1.730	1.962	1.715	1.739	2.042	1.647	1.881	2.137	1.844	1.824	1.582

Table 5. Offer premium

This presents the results of estimating ordinary least squares regressions of the offer premium on the target's 26-week high price, misvaluation level and long term growth prospects. Column 1 reports results for the full sample, column 2 for the absolutely undervalued (*M/V*<1) targets and column 3 for absolutely overvalued (*M/V*>1) targets. The numbers in parentheses represent robust *t*-statistics and ** and *** denote statistical significance at the 5% and 1% levels, respectively.

$$Offer_{it} = a_0 + b_1\, 26WeekHigh_{it} + b_2\, Misvaluation_{it} + b_3\, Growth_{it} + e_{it}$$

	Full target sample	Undervalued targets	Overvalued targets
	1	2	3
a_0	1.1375***	1.1352***	1.5025***
	(11.53)	(7.25)	(11.99)
26-week high	0.0480	0.0776	-0.262**
	(0.60)	(0.84)	(-2.59)
Misvaluation	-0.0288***	-0.209	-0.0251**
	(-2.79)	(-1.81)	(-2.00)
Growth	0.0624**	0.0942**	0.0558
	(2.16)	(2.59)	(1.37)
N	434	275	159
R^2	0.031	0.055	0.077

Table 6. Method of payment

This presents the results of estimating OLS regression results of the offer premium on the target's 26-week high price, misvaluation level, growth prospects, and a means of payment indicator (DMP_{it}^{m}), where *m = cash* or *stock*. Columns 1 and 2 report results using the full sample, columns 3 and 4 for the undervalued target sub-sample, and columns 5 and 6 for the overvalued targets sub-sample. The odd-numbered columns report results when the dummy variable, DMP_{it}^{Cash} indicates cash was the method of payment while even-numbered columns report results when the dummy variable, DMP_{it}^{Stock} indicates stock was the method of payment. The figures in parentheses represent robust *t*-statistics and ** and *** denote statistical significance at the 5% and 1% levels, respectively.

$$Offer_{it} = a_0 + b_1\, 26WeekHigh_{it} + b_2\, Misvaluation_{it} + b_3\, Growth_{it} + c_1 DMP_{it}^{Cash} + e_{it}$$

$$Offer_{it} = a_0 + b_1\, 26WeekHigh_{it} + b_2\, Misvaluation_{it} + b_3\, Growth_{it} + c_1 DMP_{it}^{Stock} + \epsilon_{it}$$

	Full sample		Undervalued targets		Overvalued targets	
	Cash	Stock	Cash	Stock	Cash	Stock
	1	2	3	4	5	6
a_0	1.1679***	1.1379***	1.2137***	1.1239***	1.5089***	1.5046***
	(11.50)	(11.71)	(7.16)	(7.35)	(12.4)	(11.62)
26-week high	0.0433	0.0608	0.0662	0.0908	-0.264***	-0.241**
	(0.53)	(0.76)	(0.71)	(1.00)	(-2.62)	(-2.24)
Misvaluation	-0.0298***	-0.0278***	-0.235**	-0.214	-0.0251**	-0.0248
	(-2.85)	(-2.49)	(-1.99)	(-1.91)	(-1.98)	(-1.95)
Growth	0.0612**	0.0645**	0.0837**	0.106***	0.0581	0.0509
	(2.12)	(2.27)	(2.24)	(2.90)	(1.35)	(1.25)
DMP^{Cash}	-0.0608*		-0.0796		-0.0259	
	(-1.65)		(-1.63)		(-0.43)	
DMP^{Stock}		-0.113**		-0.136**		-0.0794
		(-2.42)		(-1.97)		(-1.59)
N	434	434	275	275	159	159
R^2	0.036	0.044	0.064	0.071	0.078	0.085

Table 7. Market reaction to the offer premium conditioned on target misvaluation

This presents the results of estimating a 2-stage least squares regression of the market reaction, CAR on predicted offer premium that was estimated from a first stage regression. In the first stage, the offer premium is conditioned on misvaluation. Panels A, B and C report results for the full sample, and for the sub-samples where the target is absolutely undervalued or overvalued, respectively. In the second stage the dependent variable is the cumulative abnormal return CAR_x centered on the offer announcement date where x = 5 or 7 days. Columns 1 and 3 give the results for the OLS regressions (without instrumenting). The second stage results are reported in columns 2 and 4 where, the predicted offer premium estimated from the first stage is employed as the instrument. The figures in parentheses represent robust standard errors and ** and *** denote statistical significance at the 5% and 1% levels, respectively.

First stage: $Offer_{it} = \alpha_0 + \beta_2\ Misvaluation_{it} + \varepsilon_{it}$

Second stage: $CAR_{it}^{*} = \alpha + \beta Offer_{it}^{*} + \varepsilon_{it}$

	CAR_5	$CAR_5{}^{*}$	CAR_7	$CAR_7{}^{*}$
	1	2	3	4
	OLS	2SLS	OLS	2SLS
Panel A: Full sample				
α_0	-0.0004	-0.1929**	-0.00537	-0.2301**
	(0.0139)	(0.0899)	(0.0155)	(0.1049)
Offer	0.00362	0.154**	0.00853	0.184**
	(0.0109)	(0.0712)	(0.0122)	(0.0829)
N	434	434	434	434
R^2	0.000	.	0.002	.
Panel B: Undervalued targets				
α_0	0.0135	-0.1250	-0.0115	-0.1091
	(0.0184)	(0.0990)	(0.0199)	(0.1048)
Offer	-0.00522	0.1014	-0.0031	0.0897
	(0.0145)	(0.0774)	(0.0158)	(0.0819)
N	275	275	275	275
R^2	0.001	.	0.000	.
Panel C: Overvalued targets				
α_0	-0.0274	-0.2190*	-0.0396**	-0.3043**
	(0.0169)	(0.1196)	(0.0199)	(0.1493)
Offer	0.0219	0.1753*	0.0335**	0.2453**
	(0.0125)	(0.0969)	(0.0149)	(0.1209)
N	159	159	159	159
R^2	0.014	.	0.025	.

Table 8. Deal success

This table presents the marginal effects on the offer premium from a probit regression where the dependent variable *S* equals 1 if a deal is completed (succeeds) and 0 otherwise, and misvaluation and growth measures are included as control variables. Only those deals classified by SDC as either completed or withdrawn are included. Column 1 report the results for observations when the offer premium exceeds the 26-week high premium ($26wh/P_{t-30}$), Column 2 when the offer premium is greater than the scaled fundamental value (V/P_{t-30}) and column 3 when the offer premium exceeds the scaled book value (B/P_{t-30}). The figures in parentheses are robust *t*-statistics and the asterisks ** and *** denote statistical significance at the 5% and 1% levels, respectively.

$$\Pr(S_i = 1 | \boldsymbol{\beta}' \, \boldsymbol{x}_i) = \frac{e^{(\boldsymbol{\beta}' \, \boldsymbol{x}_i)}}{1 + e^{\boldsymbol{\beta}' \, \boldsymbol{x}_i}} + \varepsilon_{it}$$

$$\boldsymbol{\beta}' \, \boldsymbol{x}_i = a + b_1 Offer_{it} + b_2 \, Misvaluation_{it} + b_3 \, Growth_{it}$$

	Offer>26-week high 1	Offer>Fundamental value 2	Offer>Book value 3
Offer	0.00215**	0.00231**	0.00150
	(2.15)	(2.28)	(1.66)
Misvaluation	-0.00088	0.00135	0.00293
	(0.05)	(0.31)	(0.52)
Growth	0.0185	0.00581	0.0206
	(0.54)	(0.23)	(0.79)
N	257	179	274
Pesudo R^2	0.003	0.002	0.004