Received: 2 January 2019 | Revised: 29 May 2020 | Accepted: 18 June 2020

DOI: 10.1002/ijfe.1969

RESEARCH ARTICLE

WILEY

Effect of leverage deviation on choices and outcomes of public versus non-public acquisitions

Yousry Ahmed[1,2] | **Tamer Elshandidy**[3]

[1]Accounting and Finance, Newcastle University, Newcastle upon Tyne, UK

[2]Zagazig University, Zagazig, Egypt

[3]College of Business Administration, Ajman University, Ajman, United Arab Emirates

Correspondence
Yousry Ahmed, Newcastle University Business School, Room 3.11, 5 Barrack Road, Newcastle upon Tyne, NE1 4SE, UK.
Email: yousry.ahmed@newcastle.ac.uk

Abstract

This paper examines whether firms' deviation from target leverage may predict types and outcomes of mergers and acquisitions (M&A) deals. We find that over-levered firms are more inclined to be involved in public acquisitions than non-public acquisitions. Consistent with the proposition of information economics theory, our findings suggest that information asymmetry is the main motive behind over-levered firms' preference for public targets. Specifically, we observe that over-levered acquirers not only prefer public targets, but also pick those with less information asymmetry. We find that, in the short term, the market reacts negatively to the announcement of public acquisitions by over-levered firms. However, in the long term these acquirers experience better operating synergies and values, measured by changes in return on assets and Tobin's *q*, respectively. Our results are robust after controlling for M&A deals-, firm-, industry-characteristics and endogeneity concerns using both propensity score matching and Heckman two stage methods. Overall, our findings support the premises of agency theory and Uysal, *Journal of Financial Economics* (2011), **102**, 602–620 view that over-levered firms have a high tendency to pursue most value-enhancing acquisition deals due to the high pressure of holding high levels of debt.

KEYWORDS

information asymmetry, long-term performance, long-term value, market reaction, operating synergy, over-levered firms

1 | INTRODUCTION

Trade-off theory holds that a firm's target leverage is determined by balancing tax shield benefits and bankruptcy frictions (Bradley, Jarrell, & Kim, 1984; Miller, 1977). Agency theory advocates that target leverage level is set to mitigate agency costs between managers and shareholders (Jensen & Meckling, 1976; Myers, 1977;

We are grateful to Professor Mark Taylor (The Editor) and the two anonymous reviewers for constructive comments and suggestions. We would like to thank Andrey Golubov, Jarrad Harford, Kirak Kim, Sandy Klasa, Piotr Korczak, Nick Taylor, Jon Temple and Jon Tucker and participants at EFMA conference and the Annual Global Finance Conference for their insightful comments, constructive advice.

Stulz, 1990). Brounen, De Jong, and Koedijk (2006) report that 67% of the chief financial officers from the UK, the Netherlands and Germany seek to keep their leverage level around target.[1] Nevertheless, many firms deviate from their targets as a result of various factors, including information asymmetries, market inefficiencies and transaction costs (Bradley et al., 1984; Leary & Roberts, 2005; Miller, 1977).

According to Morellec and Zhdanov (2008) the connection between a firm's leverage deviation as a source of new finance and subsequent mergers and acquisitions (M&A) investment decisions is clear, but few studies have investigated this link.[2] In particular, firms that hold leverage above their target (henceforth "over-levered firms") are exposed to high financial distress costs that generally impede their ability to raise capital and to issue new debt (Dang, Kim, & Shin, 2012; Kayhan & Titman, 2007). The debt constraints of over-levered firms restrict their ability to finance large acquisitions with debt (Harford, Klasa, & Walcott, 2009). These firms also lose takeover bidding contests due to their unfavourable financial conditions (Morellec & Zhdanov, 2008). Uysal (2011) documents that the high costs associated with raising finance from external capital markets reduce over-levered firms' intentions to engage in acquisition deals. Thus, this paper extends previous literature by investigating over-levered firms' choices between public and non-public acquisitions. It further explores the motives and outcomes for such choices.

Over-levered firms' choice between public and non-public acquisitions can be explained by the premises of information economics theory, which views information asymmetry as a risk (Barney, 1986; Capron & Shen, 2007; Makadok & Barney, 2001). Non-public acquisitions are exposed to substantially greater information asymmetry regarding their value than public acquisition deals are (Officer, Poulsen, & Stegemoller, 2009). The relaxed disclosure requirements of non-public firms trigger substantial increases in information asymmetry about the fairness their values (Officer et al., 2009). Furthermore, the UK Companies Act 2006 exempts small and medium-sized non-public firms from filing audited accounts and from reporting their cash flows. In contrast, the IPO process, stringent regulatory disclosure requirements, analysts, the stock market and press coverage increase the quality and quantity of information on public targets that is available (Officer et al., 2009). In brief, consistent with information economics theory, over-levered firms that face higher financial risk are motivated to engage in public acquisitions in order to avoid any additional risk of information asymmetry about the fair values of non-public targets.

We further examine the short- and long-term effects of these acquisition deals on over-levered acquirers. Consistent with the efficient market hypothesis, we expect that the market perception of the quality of public acquisitions by over-levered firms depends on whether the main motive is only to avoid information asymmetry regarding non-public targets or further to include post-acquisition synergies and values. According to agency theory, over-levered firms are heavily committed to future interest payments; thus, they are motivated to improve future performance due to the fear of losing their jobs in case of default (Berger & Di Patti, 2006). Further, if they are willing to make an acquisition, they are likely to be selective and choose the best wealth-gain deals (Uysal, 2011; Ahmed & Elshandidy, 2018). Hence, this paper addresses the gap in the literature by examining the effect of public acquisition on over-levered firms' performance and values in a sample of all the completed M&A deals by UK public acquirers from 1987 to 2016.[3]

We observe that over-levered firms are more often involved than non-public acquisitions in public acquisitions. Additionally, over-levered firms prefer the public targets with less risk of information asymmetry. We show, using short-event windows of 3 and 5 days, that the market perceives the announcement of public acquisitions by over-levered firms as bad investments. In particular, we find that over-levered acquirers of public targets experience negative cumulative abnormal returns (CARs) around the announcement of these deals. However, using changes in the operating performance in the 3 years' before and 3 years after the effective year of public acquisition, we find that public acquisitions induce better operating synergies for over-levered firms. Similarly, we find that in the long run public acquisitions enhance over-levered firms' values measured by changes in Tobin's q in the 3 years' post and pre the effective year of completed deals. Our results are robust after controlling for self-selection bias and endogeneity concerns using both propensity score matching (PSM) and Heckman-two stage methods.

Our empirical results contribute to a strand of literature on the interaction between capital structure and acquisition decisions (i.e., Harford et al., 2009; Uysal, 2011) by exploring the link between the position of corporate leverage deviation and some types of acquisition. This paper is thought to be one of the first to present the interesting insight that firms take into account their target leverage when they choose between public and non-public acquisitions. Specifically, we provide novel evidence that over-levered firms prefer not only to pursue public acquisitions, but also to choose those with less risk of information asymmetry. Lending support to information economics theory, these findings suggest that information asymmetry avoidance can be one of the motives

behind decisions by over-levered firms to acquire public targets.

This paper further articulates the link between leverage deviation and the outcomes of acquisition deals. In particular, it adds to the literature by investigating market participants' short-term reactions to the announcement by over-levered firms of pubic and non-public acquisitions. It notes that over-levered acquirers of public targets experience a negative market reaction. This suggests that the market reaction to the announcement of an acquisition may be affected by external investors' perception of the main motive beyond the deal. Arguably, the market may view the announcement of public acquisitions by over-levered firms as a decision that is inspired only by the firms' incentive to avoid information asymmetry and not so much by a concern to maximize shareholders' wealth.

Contradicting our empirical findings of market reaction and the conventional view that public acquisitions destroy the value of shareholders' wealth with respect to non-public acquisitions (i.e., Faccio, McConnell, & Stolin, 2006; Fuller, Netter, & Stegemoller, 2002), our findings provide novel evidence that over-levered firms experience value creation and better performance in the long run following the acquisition of public targets. These findings confirm that the leverage deviation position of an acquirer is a core determinant of long-term post-acquisition value and performance. Overall, these findings support the premises of the agency theory and Uysal's (2011) view that over-levered firms that are more heavily committed to meet debt-payment terms are likely to be involved in wealth-gain acquisition decisions. Specifically, we provide novel evidence that over-levered firms carefully choose public acquisitions deals that induce better operating synergies and value maximization in the long run.

In addition to previous contributions to knowledge, this paper has direct implications for both theory and practise. First, with regard to theory, our contradictory results concerning short-term market reaction and the long-term effect of public acquisitions on the value of over-levered firms, assume that it may be a questionable notion that the UK stock market is rational in pricing new information such as announcements of acquisitions. However, these findings support the premises of the agency theory, that holding leverage above target leverage can be an effective means of reducing the agency cost between managers and shareholders. Second, from the practitioners' point of view, and contrary to findings in the prior literature (i.e., Erel et al., 2015; Moeller, Schlingemann, & Stulz, 2004; Uysal, 2011) which have treated all acquisitions as a single homogeneous group, the results of this paper suggest that distinguishing between public and non-public acquisitions is essential, since each type has its own characteristics, drivers and economic consequences. Similarly, as regards heterogeneity in firms' leverage deviations, it may be crucial to determine if they have leverage above the target. Specifically, our findings confirm that over-levered firms have special characteristics that not only drive their acquisition choices, but also significantly affect the economic gains from such investment deals. Identifying the economic gains of over-levered firms following public versus non-public acquisitions will enable managers to develop strategic plans for better acquisition decisions. It also may enable policy makers to develop codes of best practise by which to assess whether managers are behaving in compliance with their fiduciary responsibilities, as defined in company laws.

The rest of this paper is organized as follows. Section 2 reviews the literature Section 3 describes our sample, main independent variables and empirical models. Section 4 presents our empirical findings, Section 5 describes further robustness tests, and Section 6 outlines our conclusions.

2 | LITERATURE REVIEW

2.1 | Over-levered firms' choice between public and non-public acquisitions

Both trade-off and agency theories assume that firms have target leverage that they are striving to maintain (Jensen & Meckling, 1976; Myers, 1977; Stulz, 1990). Previous studies (i.e., Hovakimian et al., 2001; Morellec & Zhdanov, 2008; Uysal, 2011) document that deviation from target leverage significantly affects firms' behaviours, choices and decisions. Specifically, leverage deviation influences corporate behaviours and decisions, including those on issuing debt (Hovakimian et al., 2001), financing acquisitions (Uysal, 2011) and setting bidding limits in takeover contests (Morellec & Zhdanov, 2008). These studies also confirm that the leverage deviation effect on corporate behaviours and decisions is mainly driven by over-levered firms. Agency theory argues that over-levered firms suffer from a high risk of liquidation and high pressure to service their debt (Jensen & Meckling, 1976). Accordingly, over-levered firms' choices between public or non-public acquisitions can be explained by over-levered firms' appetite for the risk of information asymmetry.

Officer (2007) argues that the information asymmetry problem is associated with M&A deals of all types; however, this problem is substantially more severe for non-public targets than public targets. In particular, the

relaxed disclosure requirements of non-public firms may reduce the quality and quantity of information which, in turn, limits the breadth of a bidder's search and increases the uncertainties in the proper evaluation of these kinds of investment (Officer et al., 2009; Reuer & Ragozzino, 2008). Furthermore, according to the UK Companies Act 2006, small and medium-sized non-public firms are exempted from filing audited accounts and from reporting their cash flows. It also allows them to lodge abbreviated accounts. Thus, non-public targets are more opaque than publicly-traded targets. However, the regulatory disclosure requirements, auditors' and analysts' coverage and associations with investment banks enhance the visibility of public targets and minimize uncertainties about their fair value. Those targets are also priced by the stock market (Capron & Shen, 2007). Thus, consistent with the information economics theory, information asymmetry around non-public acquisitions can be viewed as a friction in the factor markets that increases uncertainty about their value and makes them more opaque than public targets (Capron & Shen, 2007).

Based on this discussion, our assumption is that, motivated by risk of information asymmetry, over-levered firms that are exposed to higher risks of default will prefer public acquisitions in order to avoid any additional risk arising from acquiring mis-evaluated non-public targets. This leads to the following two sub-hypotheses:

H1 *Over-levered firms are likely to acquire public targets rather than non-public targets.*

H2 *Over-levered firms are likely to acquire public targets with lower information asymmetry.*

2.2 | Market reaction to over-levered firms' announcement of public versus non-public acquisitions

Motivated by information economics, our previous expectations suggest that over-levered firms are more likely to choose public targets than non-public targets, and among those public targets, over-levered firms are more inclined to select those with less information asymmetry. According to the efficient market theory, stock investors respond accurately and instantaneously to new information, including announcements of acquisitions deals (Fama, 1991). Thus, this section develops the discussion to question whether the market is going to react either positively or negatively to the announcement of public and non-public acquisitions by over-levered firms.

Prior literature documents that non-public acquisitions experience superior gains to those of public acquisitions (i.e., Faccio et al., 2006; Fuller et al., 2002; Moeller et al., 2004). Arguably, the efficient market theory advocates that no bidder can gain above-normal returns from the market by trading on publicly-available information (Fama, 1991). In particular, bidders acquire similar information on public targets that ultimately drives them to invest in and compete for the same ones. This competition for the same public target would increase prices and reduce bidders' returns to zero (Capron & Shen, 2007).

However, strategic factor market theory argues that information heterogeneity among potential bidders for non-public targets can be viewed as a source of value creation to the bidders (Makadok & Barney, 2001). Specifically, the non-public acquisition process may allow the release of private information between bidder and target, which is impossible in contested public acquisitions (Conn, Cosh, Guest, & Hughes, 2005). Fuller et al. (2002) report that firms experience, on average, 2.08 and 2.75% abnormal returns when buying private or subsidiary targets, respectively. They also experience a 1% stock loss when acquiring a public target. Faccio et al. (2006) find that, on average, bidders earn 1.48% CARs when undertaking non-public acquisitions and an insignificant −0.38% CAR when making public acquisitions. Furthermore, a liquidation effect provides another explanation of acquirers' gains from non-public acquisitions. Specifically, non-public targets cannot be traded as easily as public targets, and the latter also have the alternative of cashing out their shares in the market rather than being acquired (Capron & Shen, 2007). Officer (2007) reports that non-public firms are sold with an average discount of 15% to 30% compared to their public counterparts, owing to the value of providing liquidity to owners of non-public targets: "*Here, the acquirer pays a lower acquisition premium to compensate for the illiquidity of the asset, to compensate for the opacity of the target, and because the unlisted target takes liquidity as a form of nonpecuniary payment*" (Harford, Humphery-Jenner, & Powell, 2012, p.249).

In brief, prior literature documents that public acquisitions entail wealth loss. However, motivated by information economics theory, over-levered firms are more likely to choose public acquisitions to avoid the high information asymmetry associated with pursuing non-public acquisitions. Thus, we expect market participants to view the announcements of public acquisitions by over-levered firms as bad investments, if these participants believe that over-levered firms, rather than receiving potential post-acquisition synergies and value, engage in such acquisitions merely to avoid the risk of information asymmetry.

The other competing argument, which stems from the agency theory perspective, posits that firms should

increase their leverage level in order to minimize conflict between shareholders and managers by restricting managerial discretion over future free cash flows (FCFs) (Jensen & Meckling, 1976; Myers, 1977; Stulz, 1990). Accordingly, over-levered firms are more heavily committed to future interest and principal payments. They are exposed to high pressures arising from a high risk of default. Thus, managers of over-levered firms are motivated to improve the future performance of their firms due to the fear of losing their jobs in case of default (Berger & Di Patti, 2006). Consistently, Uysal (2011) provides empirical evidence that over-levered firms are more likely to be selective and choose the most value-creating acquisition deal. He reports that over-levered firms have positive and significant CAR around the announcement of an acquisition transaction. In brief, we expect that the market is likely to react positively to the announcement of public acquisitions, since over-levered firms normally experience high pressure from inherent risks. Thus, it is expected that these firms are likely to select the best public targets, and, therefore, the market will recognize their selection by pricing these deals.

Based on the previous discussion and given the two competing arguments, we formulate the following unidirectional hypothesis:

H3 *The market is likely to react (either positively or negatively) to the announcement of public acquisitions by over-levered firms.*

2.3 | The impact of public versus non-public acquisitions on the long-term performance and value of over-levered firms

After exploring the market reaction to over-levered firms' decision to make public acquisitions, we should next investigate the impact of these deals on their long-term performance and value. The market reaction to the announcement of M&A deals is observed within a short period, and thus the market may misprice deals, as opposed to its value-added within a longer time horizon. Thus, our paper observes the long-term operating performance and value of over-levered firms that acquire public targets. If these deals carry a real value to shareholders, then the rationale behind over-levered firms' decisions to have public acquisitions can be justified. In contrast, if these deals diminish the operating performance and value of over-levered firms, this may reflect the immaturity of over-levered firms in deciding whether to choose between public and non-public targets.

Consistent with information economics theory, over-levered firms' choice of public acquisitions over non-public acquisitions may be motivated by their preference for avoiding any additional risk of information asymmetry. However, imperfect information around non-public acquisitions can be viewed as a source of value creation to acquiring firms (Makadok & Barney, 2001). Agency theory advocates that holding leverage above the target can minimize agency costs and encourage managers to act more in the interests of shareholders by investing in acquisition deals that gain wealth (Jensen & Meckling, 1976). In particular, over-levered firms are exposed to a higher risk of liquidation that provides managerial discipline through the threat of losing a manager's reputation and job in case of default (William & Michael, 1976). Over-levered firms are also under great pressure to make value-enhancing investments that generate enough cash flow to cover the payment of interest (Jensen, 1986). Empirically, Margaritis and Psillaki (2010) find that firms with leverage above the target take investment decisions that maximize firms' value and performance. Uysal (2011) and Maloney, McCormick, and Mitchell (1993) show that over-levered firms outperform others players in the acquisition market.

Based on the previous discussion and following assumptions of both agency and information economics theories, we formulate the following hypotheses:

H4 *Public acquisitions enhance over-levered firms' long-term performance.*

H5 *Public acquisitions enhance over-levered firms' long-term value.*

3 | METHODOLOGY

3.1 | Sample

Our sample comprises all completed M&A deals by UK public firms, downloaded from the Thomson One database for the period January 1, 1987 to December 31, 2016. According to Antoniou, Petmezas, and Zhao (2007), data coverage on UK M&A deals before 1987 was very limited. The sample period ends in 2016, since our analysis requires at least 3 years of post-merger performance data from the effective year of M&A deals (i.e., Bhaumik & Selarka, 2012; Dutta & Jog, 2009). Thus, financial data of all UK listed firms are downloaded from the Eikon database between 1984 and 2019.

Following Barbopoulos, Paudyal, and Pescetto (2012), Harford et al. (2009), Ahmed and Elshandidy (2016) and Conn et al. (2005), our sample includes all M&A deals

that meet the following criteria: deals are completed; the acquirer is a public UK firm; the acquirer is not from a financial (SIC 6,000–6,999) or utilities (SIC 4,900–4,999) industry, since they are different in nature from other industries and are subject to different regulatory and accounting requirements (Ozkan, 2001); the target can be a public, private or subsidiary firm; the target can be either a domestic or a foreign firm[4]; acquirers should take over absolute control of more than 50% of the targets; the payment method should be cash, stock or a combination of these; a cut-off point of a minimum deal value of one million dollars is employed, to avoid the results being affected by very small deals (Uysal, 2011); and all deals labelled minority stake purchases, acquisitions of remaining interest, privatizations, leveraged buyouts, spinoffs, recapitalisations, self-tenders or exchange offers and repurchases are excluded (Alexandridis, Fuller, Terhaar, & Travlos, 2013). Accordingly, the final sample comprises 6,182 successful acquisition deals.

3.2 | Estimation of leverage deviation and over-levered firms

Following Uysal (2011), leverage deviation is measured as actual market leverage minus target leverage. Actual market leverage ratio is total debt divided by the sum of total debt plus the market value of equity (Harford et al., 2009). Target leverage is estimated using all the financial data of UK listed firms from 1984 to 2019.[5] Specifically, we run yearly-industry regressions of market leverage ratios on lagged values of the main determinants of capital structure (Harford et al., 2009; Uysal, 2011). We employ ROA (return on assets) ratio, firm size, non-debt tax shield (NDTS), market to book (MTB) ratio, asset tangibility, liquidity ratio, research and development (R&D) over total assets, R&D missing and selling expenses over sales as the main determinants of capital structure (Céspedes, González, & Molina, 2010; Dang, 2013; Ozkan, 2001; Rajan & Zingales, 1995; Uysal, 2011).[6]

The ROA variable is a proxy for a firm's past profitability. Myers and Majluf (1984) argue that firms would rather raise capital from retained earnings than from external sources of finance. Thus, profitable firms with sufficient retained earnings will rely less on issuing debt to finance future projects (Dang, 2013; Fama & French, 2002). However, trade-off theory expects that profitable firms may increase their leverage to maximize their debt induced tax shield (Antoniou, Guney, & Paudyal, 2008). The firm size variable is included because large firms are more diversified and may have more stable cash flows than small firms (Titman & Wessels, 1988). Accordingly, consistent with trade-off theory, large firms are exposed to a lower risk of default and can expand their leverage level at more favourable interest rates than small firms can (Ozkan, 2001). MTB controls for firm growth opportunities, which are intangible in nature and valuable as long as a firm exists; however, they have limited collateral value if the firm becomes insolvent (Titman & Wessels, 1988). Thus, following both trade-off and agency theories, lenders view firms with more growth options as risky investments and seek higher compensation (Harris & Raviv, 1991). In contrast, tangible assets may preserve their market value more than intangible assets, and thus may be used as collateral for debt in case of liquidation (Antoniou et al., 2008). Collateral debt may also restrict a firm's ability to engage in asset substitution and risk-shifting activities, thus reducing the agency costs of debt (Titman & Wessels, 1988; Harris & Raviv, 1991; Jensen & Meckling, 1976). Accordingly, creditors accept lower premiums from firms with high tangible assets. Trade-off theory states that most firms use debt in order to reap tax deduction advantages (Miller, 1977). NDTS, such as depreciation, amortiszation and investment tax credits, may replace the tax deduction benefits associated with using debt which, in turn, reduce a firm's motivation to acquire more debt (DeAngelo & Masulis, 1980). Furthermore, firms with a high liquidity ratio may employ liquid assets such as accumulated cash to fund their investments, rather than issuing further debt (Ozkan, 2001). Harford et al. (2009) employ the R&D over sales ratio to account for firms' growth opportunities. They also control for product uniqueness using a variable of selling expenses over sales. Uysal (2011) creates a binary variable that equals one for any missing observations of the R&D variable and zero otherwise.

Appendix B reports the time series means of coefficient estimates of yearly-industry regressions employed to predict target leverage of UK non-financial public firms. It finds, consistent with the prior literature (Dang, 2013; Ozkan, 2001), that ROA, MTB, NDTS, R&D expenses/total assets and liquidity variables have negative association with target market leverage. In contrast, firm size, asset tangibility and R&D missing variables have a positive significant association with the estimated target leverage. These results are in line with the prior literature in the UK context (e.g., Dang, 2013; Ozkan, 2001).

The fitted value of previous recursive regressions across each industry-year subgroup represents the target leverage ratio. We deduct the target leverage ratio of each firm from its actual leverage ratio to calculate its leverage deviation proxy. Then, we rank all firms in each year by their leverage deviation and select the top quintile as a proxy of over-levered firms.

3.3 | Empirical models

We use an over-levered variable estimated in the previous section to examine its effect on the probability of pursuing public acquisitions. To address this question, we run the following logit model [Equation (1)] and tobit model [Equation (2)] to test H1.

$$P(\text{public acquisition}=1) = \Phi\left(\beta_0+\beta_1\text{over}-\text{levered}_{i,t-1}+\sum\beta_i\text{Controls}_{i,t-1}\right) \quad (1)$$

$$\text{Public value/TA}=\beta_0+\beta\text{over}-\text{levered}_{i,t-1}+\sum\beta_i\text{controls}_{i,t-1}+\varepsilon_{i,t} \quad (2)$$

We employ a logit model in Equation (1), since the dependent variable (public acquisition) is a dummy variable that takes the value one if a firm makes a public acquisition and zero if it makes a non-public acquisition. Following Officer (2007), both private and subsidiary targets are classified as non-public acquisitions. According to Thomson One database, 'subsidiary' represents acquiring firms that are subsidiaries of target firms. Since there is no public information available about both private and subsidiary targets, these deals are classified as non-public M&A deals (Fuller et al., 2002). We adopt a tobit model in Equation (2) because the dependent variable, being the ratio of public M&A deals value to acquirers' total assets, is censored at zero (Uysal, 2011).

Over-levered and other explanatory variables in both models are estimated a year before the announcement year of firms' M&A deals. In Equations (1) and (2), we control for firm size, MTB, ROA, stock return, asset tangibility, liquidity, sales growth, FCF, firm life cycle and market leverage (Roll, 1986; Harford et al., 2009; Owen & Yawson, 2010; Uysal, 2011). Consistent with Harford et al. (2009), it is essential to control for market leverage in order to ease interpretation and disentangle its effect from that of the over-levered variable. Controlling for market leverage also confirms that the over-levered variable is not a proxy for pre-acquisition market leverage but simply estimates the deviation effect. We also control for industry concentration using Herfindahl index (Uysal, 2011). We use the industry M&A liquidity index to capture corporate asset liquidity in each industry (Schlingemann, Stulz, & Walkling, 2002). Fama and French's 12-industry classification is also employed to account for the industry effect. Finally, the year fixed effect is used to capture macroeconomic changes in the time series.

Then, we extend our analysis to see whether over-levered firms are more inclined to acquire public targets with lower information asymmetry, using the following logit model.

$$P(\text{public target with lower information asymmetry}=1) = \Phi\left(\beta_0+\beta_1\text{over}-\text{levered}_{i,t-1}+\sum\beta_i\text{Controls}_{i,t-1}\right) \quad (3)$$

Borochin, Ghosh, and Huang (2019) argue that one key reason for the divergence in information asymmetry findings in the M&A literature is that most empirical papers use one proxy to capture the level of information asymmetry. For this reason, in Equation (3), we employ four different binary dependent variables to test H2.

Karpoff, Lee, and Masulis (2013) and Frankel and Li (2004) argue that large firms receive more attention from the external market, which minimizes the risk of information asymmetry. Thus, our first dependent variable is the large public target variable that takes the value one if a firm acquires a public target with a size above the yearly average of all targets in the sample, and zero otherwise. Leary and Roberts (2010) show that firms with higher tangible assets are much easier to value, which in turn reduces the information asymmetry between insider and outsider players. Thus, the second dependent variable, public targets with higher tangible assets, takes the value one if a firm acquires a public target with tangible assets above the yearly-average of all targets in the sample, and zero otherwise. Coles, Daniel, and Naveen (2006) and Karpoff et al. (2013) find that firms with less return volatility are likely to have less noisy information about their values and performance. Return volatility is defined as the standard deviation of daily stock returns over the year before the announcement year of an acquisition (Karpoff et al., 2013). Consequently, the third dependent variable, which takes the value one if a firm acquires a public target with return volatility below the yearly-average of all targets in the sample, and zero otherwise, is public targets with lower return volatility. Amihud (2002) defends the view that firms with more frequently traded stocks will face less information asymmetry about their fair values. He measures the frequency of traded stock in his Amihud index, which equals the average of absolute value of the daily stock return divided by trading volume over the year before the announcement year of an acquisition. Therefore, our fourth dependent variable in capturing information asymmetry is public targets with more frequently traded stocks'; it takes the value one if a firm acquires a public target under the Amihud index below the yearly average of all the targets in the sample, and zero otherwise.

Next, we run an event study to investigate how the market reacts to the announcement of public acquisitions by over-levered firms using an interaction variable, namely, Over-levered× Public acquisitions. Then, we employ the following ordinary least squares (OLS) regression model to test H3.

$$\mathrm{CAR} = \beta_0 + \beta_1 \mathrm{Over-levered} \times \mathrm{Public\ acquisitions}_{i,j,t-1} + \sum \beta_i \mathrm{Controls}_{i,j,t-1} + \varepsilon_{i,j,t} \quad (4)$$

CAR is cumulative abnormal returns over a 3-day event window (from 1 day before to 1 day after the announcement date) and over a 5-day event window (2 days before and 2 days after the announcement date).[7] CAR is estimated using the market adjusted model (MAM) and the market model (MM). The benchmark return is the Financial Times Stock Exchange (FTSE) all shares index of firms listed in the London Stock of Exchange. MM parameters are estimated over a 255-day window that ends 46 trading days before the announcement date of M&A transactions (Jansen, 2015).

In addition to the control variables that we used in the previous three equations, we add M&A deal characteristics variables, namely, deals' relative size, competed deals, hostile deals, stock acquisition deals and cash acquisition deals (Officer, 2003; Uysal, 2011).

Finally, we run the following OLS models to explore the effect of public acquisitions on long-term performance and value of over-levered acquirers to test H4 and H5.

$$\Delta\mathrm{ROA} = \beta_0 + \beta_1 \mathrm{Over-levered} \times \mathrm{Public\ acquisitions}_{i,j,t-1} + \sum \beta_i \mathrm{controls}_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

$$\Delta\mathrm{Tobin's}q = \beta_0 + \beta_1 \mathrm{Over-levered} \times \mathrm{Public\ acquisitions}_{i,j,t-1} + \sum \beta_i \mathrm{controls}_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

Following Ma, Sun, Waisman, and Zhu (2016), the change in ROA variable in Equation (5) is measured as the acquirer's average ROA in the 3-year post-acquisitions period minus average ROA in the 3-year pre-acquisition period from the effective year of a completed deal. The change in Tobin's q variable in Equation (6) is measured as the acquirer's average Tobin's q in the 3-year post-acquisitions period minus average Tobin's q in 3-year pre-acquisition period from the effective year of a completed deal.[8]

Before running the previous empirical models, we examine the issue of multicollinearity between the explanatory variables. We run the mean variance inflation factor (VIF) test for each regression model. The results reveal that the mean VIF for our explanatory variables range between 1.08 and 2.28, indicating that multicollinearity does not exist (Gujarati & Porter, 2009). Furthermore, to avoid the impact of outliers, all continuous variables in the empirical models are winsorised at the first and 99th percentiles (Ahmed & Elshandidy, 2016; Uysal, 2011).

4 | EMPIRICAL FINDINGS

4.1 | Descriptive statistics

Panel A of Table 1 presents summary statistics for main variables of the empirical models that are discussed in the previous section. It shows that, over the sample period of 30 years from 1987 to 2016, around 8% of UK public firms were involved in public acquisitions and around 92% engaged in non-public acquisitions (differences on deal characteristics between these targets are given in Panel B of Table 1). Over the same period of study, 13.2% were classified as over-levered firms. This supports the view of Davydenko and Franks (2008) that strict UK bankruptcy codes UK firms to hold a market leverage ratio near the target. Consistent with Antoniou et al. (2008), market leverage constitutes on average 15.6% of UK firms' capital structure mix. The ROA shows that UK public firms generate on average 10.3% profit before tax and interest on their total assets. The average firm size of UK non-financial acquirers equals 11.8, measured as the natural logarithm of sales. The MTB, consistent with Guney, Ozkan, and Ozkan (2007), indicates that, on average, the market value of UK public firms exceeds 1.5 times their book value. The variables that indicate the economic consequences of acquisition deals reveal that UK public firms, after engaging in an acquisition, experience on average, a 0.5% increase in the changes of ROA, as a measure of operating performance. However, these firms have a 0.004 reduction, on average, in the mean value of the changes in Tobin's q around their acquisition deals.

Panel B shows the main differences on deal characteristics between public targets (472 deals) and non-public targets (5,710 deals). The results, based on a t-test, show that there are significant differences in CARs, deal relative size, completed deals, hostile deals, and pure stock deals, at the 1% level. The panel shows that while the market reaction to acquisition deals for public targets is negative, the observed reaction to non-public targets is positive, and there is a significant difference between these two target types in this reaction. It shows also that public targets have significantly higher deal relative sizes,

TABLE 1 Summary statistics

Panel A: Descriptive statistics of full sample.						
Variables	**N.**	**Mean**	**Median**	**SD**	**Min.**	**Max.**
Public acquisitions	6,182	0.076	0.000	0.266	0.000	1.000
Over-levered	6,182	0.132	0.000	0.339	0.000	1.000
ROA	6,182	0.103	0.135	0.249	−2.629	0.453
Firm size	6,182	11.763	11.681	2.006	4.787	16.503
MTB	6,182	1.500	1.014	1.849	0.054	16.715
Market leverage	6,182	0.156	0.129	0.146	0.000	0.625
Stock return	6,182	17.763	13.720	41.953	−68.01	105.71
Herfindahl index	6,182	0.116	0.072	0.144	0.019	0.861
Industry liquidity	6,182	0.054	0.026	0.135	0.000	2.009
Public value/TA	6,182	0.001	0.000	0.004	0.000	0.013
Asset tangibility	5,773	0.248	0.197	0.219	0.000	0.936
Liquidity	5,773	1.677	1.324	2.007	0.070	56.800
Firm growth	5,773	0.282	0.151	0.442	−0.573	1.598
FCF	5,773	0.063	0.039	1.225	−11.688	1.735
Firm life cycle	5,773	0.117	0.411	2.993	−26.280	17.826
Δ ROA	3,279	0.005	−0.004	0.147	−0.284	0.298
Δ Tobin's q	3,008	−0.044	0.144	1.604	−4.718	3.509
Public targets with						
Large size	5,596	0.041	0.000	0.199	0.000	1.000
Higher fixed assets	5,596	0.038	0.000	0.191	0.000	1.000
Lower return volatility	5,596	0.026	0.000	0.160	0.000	1.000
More freq. Traded stocks	5,596	0.007	0.000	0.058	0.000	1.000

Panel B: Difference in means between public and non-public targets			
Variables	**Public targets Mean**	**Non-public targets Mean**	**Difference t-value**
CARMM (−1,+1)	−0.006	0.013	−0.019***
CARMM (−2,+2)	−0.007	0.014	−0.021***
CARMAM (−1,+1)	−0.004	0.015	−0.019***
CARMAM (−2,+2)	−0.003	0.017	−0.020***
Deal relative size	0.386	0.167	0.219***
Competed deals	0.074	0.001	0.073***
Hostile deals	0.028	0.000	0.028***
Pure stock deals	0.273	0.050	0.223***
Pure cash deals	0.479	0.486	−0.007
N	472	5,710	

Note: This table gives descriptive statistics of the sample as follows. Panel A reports summary statistics of the main variables used in the paper. Panel B reports t-tests on the statistical difference in means for deal characteristics between public and non-public targets. It also shows the t-values of the differences that are statistically significant at the (*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

completed deals, and hostile deals than non-public targets. The panel reports that public targets use pure stock to finance acquisition deals (27.3%) significantly higher than non-public targets (5%). However, both target types rely similarly (there no statistical difference) on pure cash to finance these acquisition deals.

4.2 | Does leverage deviation influence public acquisitions decisions?

This section examines over-levered firms' choice between public and non-public acquisitions using both logit and tobit models. Table 2 reports the average marginal effect of logit models (Columns 1 and 2) and tobit models (Columns 3 and 4).[9] Columns 1 and 2 find that over-levered firms are significantly more inclined to be involved in making public acquisitions than non-public acquisitions. These findings are significant when controlled for firm characteristics, especially stock return and MTB ratios. This provides clear evidence that the effect of the over-levered variable is driven by neither an

TABLE 2 Over-levered firms and the likelihood of public acquisitions

	Public acquisition		Public value/TA	
	(1)	(2)	(3)	(4)
Over-levered	0.030**	0.026**	0.003**	0.002*
	(2.34)	(2.00)	(2.43)	(1.81)
Firm size	0.017***	0.018***	0.002***	0.002***
	(8.94)	(8.97)	(9.07)	(8.60)
MTB	−0.000	−0.001	−0.000	−0.000
	(−0.68)	(−1.32)	(−0.86)	(−1.28)
ROA	−0.026*	−0.005	−0.003**	−0.001
	(−1.80)	(−0.26)	(−2.01)	(−0.44)
Market leverage	−0.087**	−0.054	−0.000	−0.000
	(−2.54)	(−1.54)	(−1.05)	(−1.27)
Stock return	−0.000	−0.0001	−0.009***	−0.006
	(−1.50)	(−1.42)	(−2.96)	(−1.58)
Herfindahl	0.114***	0.093***	0.012***	0.011***
	(6.11)	(4.86)	(6.10)	(4.88)
Industry M&A liquidity	0.038*	0.034*	0.004**	0.004*
	(1.92)	(1.73)	(2.08)	(1.93)
Asset tangibility		0.006		0.001
		(0.36)		(0.48)
Liquidity		0.005***		0.001***
		(4.14)		(4.04)
Firm growth		0.0002***		0.0001***
		(2.58)		(2.63)
FCF		−0.005*		−0.0002
		(−1.84)		(−1.41)
Firm life cycle		−0.002*		−0.0003*
		(−1.80)		(−1.73)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	6,182	5.773	6,182	5.773

Note: This table reports the average marginal effects of logit analysis (Columns 1 and 2) and tobit analysis (Columns 3 and 4). The dependent variable in the logit models takes the value one if the firm makes a public acquisition and zero if the firm makes a non-public acquisition. The tobit analysis estimates the ratio of the sum of the public acquisitions value to the acquirer's total assets. *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

overpricing effect nor the growth opportunities of a firm. However, it confirms the view that firms' deviation from the target leverage specifically when over-levered is a core determinant of firms' decisions whether to engage in public acquisitions. The marginal effect of the over-levered variable also shows that our results are not only statistically significant, but also economically significant. In particular, Column 1 reports that over-levered firms are 3% more likely to acquire public targets, an increase of 39.5% (0.03/public acquisition sample mean of 0.076) over the sample average. Further, Columns 3 and 4 of tobit analysis, which estimates the ratio of public acquisitions value to the acquirer's total assets, confirm the previous results. They show that over-levered firms invest more in public acquisitions than in non-public acquisitions. Overall, these empirical findings are in line with the premises of information economics theory that over-levered firms may prefer public targets to avoid the uncertainty associated with mis-evaluation of non-public targets (Fuller et al., 2002; Officer et al., 2009). Accordingly, we accept H1 that that over-levered firms are more likely to pursue public acquisitions than non-public acquisitions.

For the other control variables, Table 2 shows that large firms have a higher likelihood of acquiring public targets than non-public targets. It also shows that firms with higher ROA are less likely to acquire public targets. We observe that Herfindal, industry M&A variables have a significant positive impact on firms' decisions to make public acquisitions. We document that firms with higher liquidity and growth are more inclined to make public acquisitions. We find that firm life cycle variable reduces the probability of pursuing public acquisitions.

4.3 | Does leverage deviation influence acquirers' preference for public targets with lower information asymmetry?

This section extends our analysis to examine whether information asymmetry is the main motive behind over-levered firms' preference for public targets. We run the following logit models to test whether over-levered firms prefer to acquire public targets with lower information asymmetry.

Table 3 presents the average marginal effect of logit models. Column 1 reveals that over-levered firms are 1.6% more likely to acquire large public targets. This result supports Frankel and Li's (2004) finding that large public firms have less risk of information asymmetry, since they receive more coverage by the press, analysts and the stock market than small firms do. Column 2 reports that over-levered firms have a 2.5% higher likelihood of acquiring public targets with higher tangible assets than the yearly average of all targets in the sample. This confirms Karpoff et al.'s (2013) notion that acquiring targets with higher tangible assets reduces the uncertainties around the fair value of these firms. Column 3 indicates that over-levered firms have a 1.5% higher propensity to choose public targets with lower return volatility than the yearly average of all the targets in the sample. This finding is in line with Borochin et al.'s (2019) view that firms with lower return are less exposed to risk of information asymmetry. Column 4 reports that over-levered firms are 0.4% more inclined to buy public targets with more frequently traded stocks. Our empirical results document the fact that over-levered firms prefer not only to pursue public acquisitions, but also to choose those with less risk of information asymmetry. Overall, these findings confirm the notion of information economics theory that avoidance of risk of information asymmetry is the main motive behind over-levered firms' preference for public acquisitions. Accordingly, we accept H2: that over-levered firms are more inclined to acquire public targets with lower information asymmetry.

For the other control variables, Table 3 shows that firm size has a positive significant influence on the likelihood of making public acquisitions with lower risk of information asymmetry. It also finds that acquirers with higher liquidity, Herfindhal and firm growth ratios are more inclined to acquire public targets with lower risk of information asymmetry.

4.4 | How does the market react to over-levered firms' announcement of public versus non-public acquisitions?

This section investigates over-levered firms' wealth around the announcement of public versus non-public acquisitions. The efficient market theory states that stock investors respond instantaneously and without bias to news releases such as announcements of acquisitions (Fama, 1991). Therefore, we run an event study to estimate CAR using short-event windows of 3 and 5 days.

Table 4 presents coefficient estimates of acquirers' CAR that are estimated using market models (MMs) (Columns 1 and 2) and MAMs (Columns 3 and 4). Our main independent variable "Over-levered× Public acquisitions" shows that the market perceives public acquisition deals by over-levered firms as bad investment decisions. Specifically, Column 1 reports that over-levered acquirers of public targets experience a 2.2% decline in CAR around the announcement of these acquisition deals. Similarly, all the other columns (Columns 2 to 4) document that the market significantly reacts

TABLE 3 Over-levered firms and the likelihood of acquiring public targets with lower information asymmetry

	Public targets with			
	Large size (1)	Higher fixed assets (2)	Lower return volatility (3)	More freq. Traded stocks (4)
Over-levered	0.016*	0.025***	0.015*	0.004*
	(1.73)	(3.83)	(1.84)	(1.76)
ROA	−0.005	−0.039*	−0.027	−0.006
	(−0.19)	(−1.82)	(−1.31)	(−1.60)
Firm size	0.016***	0.009***	0.009***	0.001**
	(9.59)	(6.08)	(6.54)	(2.57)
MTB1	−0.0001	−0.0002	−0.0001	−0.0002
	(−0.04)	(−0.89)	(−1.37)	(−1.34)
Market leverage	−0.032	−0.047*	−0.037	−0.008
	(−1.25)	(−1.95)	(−1.64)	(−0.91)
Stock return	−0.0003	−0.0003	−0.0003	−0.0002
	(−0.22)	(−0.58)	(−0.51)	(−1.35)
Herfindahl	0.073***	0.057***	0.024*	0.009**
	(5.57)	(4.24)	(1.96)	(2.17)
Industry M&A	0.020	0.003	0.015	0.002
Liquidity	(1.62)	(0.21)	(1.33)	(0.81)
Asset tangibility	0.004	0.068***	0.030***	0.002
	(0.33)	(5.55)	(2.65)	(0.36)
Liquidity	0.001***	0.001***	0.001*	0.0001*
	(3.13)	(3.07)	(1.92)	(1.77)
Firm growth	0.0001*	0.0002*	0.001**	0.001*
	(1.80)	(1.84)	(2.28)	(1.83)
FCF	−0.011	−0.0002	−0.002	−0.007*
	(−0.83)	(−0.02)	(−0.15)	(−1.80)
Firm life cycle	−0.001	−0.002	−0.000	−0.0001**
	(−1.04)	(−0.59)	(−0.46)	(−2.41)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
N	5,596	5,596	5,596	5,596

Note: This table reports the average marginal effects of logit models. The dependent variable in column (1) takes the value one if the firm acquires public targets with size above the sample mean per year and zero otherwise. The dependent variable in column (2) takes the value one if the firm acquires public targets that have tangible assets above the sample mean per year and zero otherwise. The dependent variable in column (3) takes the value one if the firm acquires public targets with return volatility below the sample mean per year and zero otherwise. The dependent variable in column (4) takes the value one if the firm acquires public targets with ratio of absolute value of daily stock return to daily trading volume over the year prior to the acquisition announcement that lies below the sample mean per year and zero otherwise. *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

negatively to the announcement of public acquisitions by over-levered firms. These findings confirm that external investors may view announcements by over-levered firms of public acquisitions as a decision that is inspired only by the firms' incentive to avoid information asymmetry rather than the incentive to maximize shareholders' wealth.

For the control variables, we find similar to Faccio et al. (2006), that public acquisitions cause a decline in

TABLE 4 Over-levered firms' wealth around the announcement of public acquisitions

	CARMM (−1,+1) (1)	CARMM (−2,+2) (2)	CARMAM (−1,+1) (3)	CARMAM (−2,+2) (4)
Over-levered	−0.003	−0.004	−0.0003	−0.003
	(−0.89)	(−0.93)	(−0.06)	(−0.62)
Over-levered × public acquisitions	−0.022**	−0.033**	−0.027**	−0.031**
	(−2.18)	(−2.53)	(−2.17)	(−2.30)
Firm size	−0.003***	−0.003***	−0.003***	−0.004***
	(−4.96)	(−3.41)	(−4.36)	(−4.02)
MTB	−0.0002	−0.0002	−0.0001	−0.0001
	(−0.98)	(−1.42)	(−1.54)	(−1.26)
ROA	0.005	−0.008	−0.011	−0.004
	(0.69)	(−0.35)	(−0.54)	(−0.20)
Market leverage	0.004	0.010	0.011	0.018
	(0.38)	(0.57)	(0.73)	(1.15)
Stock return	−0.0001	−0.0001	−0.0002	−0.0002
	(−0.15)	(−1.10)	(−0.85)	(−0.95)
Herfindahl	−0.003	0.054	0.056	0.071
	(−0.14)	(0.87)	(0.96)	(1.16)
Industry M&A liquidity	−0.001	−0.003	−0.004	−0.007
	(−0.13)	(−0.32)	(−0.45)	(−0.76)
Asset tangibility	0.004	0.010	0.004	0.007
	(0.83)	(1.17)	(0.52)	(0.79)
Liquidity	−0.001	−0.002	−0.002**	−0.002*
	(−1.42)	(−1.57)	(−2.43)	(−1.94)
Firm growth	−0.0002***	−0.0001***	−0.0002***	−0.0001***
	(−5.52)	(−3.11)	(−5.35)	(−3.67)
FCF	0.001	0.001	0.004**	0.001
	(1.05)	(0.28)	(2.14)	(0.35)
Firm life cycle	−0.000	−0.001	−0.001	−0.001
	(−0.69)	(−0.87)	(−0.70)	(−0.81)
Public acquisitions	−0.018***	−0.022***	−0.023***	−0.022***
	(−4.07)	(−3.81)	(−4.38)	(−3.82)
Deal relative size	0.006	0.009	0.017**	0.014
	(1.27)	(1.07)	(2.24)	(1.64)
Competed deals	0.006	0.015	0.012	0.019*
	(0.66)	(1.39)	(1.12)	(1.66)
Hostile deals	−0.046*	−0.038	−0.046	−0.044
	(−1.90)	(−1.18)	(−1.64)	(−1.26)
Pure cash deals	0.004**	0.006**	0.004**	0.006**
	(2.23)	(2.53)	(2.14)	(2.45)
Pure stock deals	0.006	0.016	0.014	0.014
	(1.08)	(1.47)	(1.35)	(1.33)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

TABLE 4 (Continued)

	CARMM (−1,+1) (1)	CARMM (−2,+2) (2)	CARMAM (−1,+1) (3)	CARMAM (−2,+2) (4)
R^2	0.043	0.037	0.051	0.039
N	5,489	5,489	5,489	5,489

Note: This table reports the coefficient estimates of acquirers' cumulative abnormal returns (CARs) which are estimated using market models (columns 1 and 2) and market adjusted models (columns 3 and 4). CARs are calculated over a 3-day event window (from 1 day before to 1 day after the announcement date) and over a 5-day event window (2 days before and 2 days after the announcement date). The benchmark return is the FTSE all shares index of UK quoted firms. *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

the acquirers' stock returns around the announcement of these deals. Consistent with the hubris hypothesis, large firms may undertake acquisitions due to overconfidence in their ability rather than the prospect of economic gain from these acquisitions (Roll, 1986; Moeller et al., 2004). Thus, we find that large firms experience a negative reaction around the announcement of acquisition deals. Following the view that cash acquisitions feed a positive signal to the market about the expected future gains from acquisition deals (Fuller et al., 2002), we find that stock investors respond in favour of pure cash acquisition deals. Table 4 shows that firms with a high growth rate face poor CAR around the announcement of acquisition transactions.

4.5 | Do public acquisitions influence the long-term performance of over-levered firms'?

This section investigates operating synergies of over-levered acquirers of public targets to test whether the market reaction observed in the previous section still holds in the long run. In particular, it examines changes in the operating performance of over-levered firms in 3 years' post and pre the effective year of public acquisitions.

Table 5 presents the regression analysis of ROA changes after undertaking both public and non-public targets. Using the interaction variable, Column 1 finds that over-levered firms that make public acquisitions experience significant positive changes in ROA. Column 2, after controlling for deal characteristics, shows a significant improvement in the operating performance of over-levered acquirers of public targets. Accordingly, we accept H4 that public acquisitions have a significant positive effect on the long-term performance of over-levered firms. These findings support the premises of agency theory and Uysal's (2011) view that over-levered firms are more likely to be selective and to choose the most value-enhancing public acquisition deals due to the high pressure of holding high levels of debt. Our empirical findings also suggest that the previous section's negative market reaction around the announcement of public acquisitions by over-levered firms may be biased and such acquirers experience better long-term operating synergies.

For the control variables, we find that the coefficient of the over-levered variable that accounts for over-levered acquirers of non-public targets is insignificant. This may confirm that over-levered acquirers of public firms outperform those who acquire non-public targets. According to the hubris effect, we find that large firms experience negative changes in ROA after making M&A deals. Table 5 shows that liquidity ratio and firms' life cycle variables have negative association with the changes in ROA after M&A transactions. It provides evidence that firms with high stock returns experience better operation synergies after completing their acquisition decisions. From deal characteristics, Table 5 documents that firms which have made hostile deals experience negative long-term operating performance. It documents that pure cash acquisitions have long-term operating gains. This supports our empirical market reaction results in the previous section that pure cash acquisitions feed a positive signal to the market.

4.6 | Do public acquisitions influence over-levered firms' long-term value?

This section explores the economic consequences of public acquisitions when they are made by over-levered firms. In particular, it gauges the changes in Tobin's q of over-levered firms in 3 years' post and pre the effective year of public and non-public acquisitions.

Table 6 presents the regression analysis of changes in Tobin's q after making an acquisition. The coefficient of the interaction between over-levered and public

TABLE 5 Effect of public acquisitions in the long-term performance of over-levered firms

	ΔROA (1)	(2)
Over-levered	0.002	0.002
	(0.20)	(0.15)
Over-levered × public acquisitions	0.061**	0.070**
	(2.01)	(2.31)
Firm size	−0.009***	−0.010***
	(−5.87)	(−6.43)
MTB	−0.001	−0.001
	(−1.48)	(−1.48)
ROA	−0.078***	−0.083***
	(−3.32)	(−3.39)
Market leverage	0.043*	0.046*
	(1.69)	(1.78)
Stock return	0.0003***	0.0003***
	(7.00)	(7.09)
Herfindahl	0.035**	0.037**
	(2.01)	(2.12)
Industry M&A liquidity	−0.075	−0.077
	(−0.84)	(−0.87)
Asset tangibility	−0.018	−0.024*
	(−1.31)	(−1.70)
Liquidity	−0.005***	−0.006***
	(−2.87)	(−3.00)
Firm growth	0.0003	0.0003
	(0.83)	(0.93)
FCF	−0.0002	−0.0002
	(−0.01)	(−0.12)
Firm life cycle	−0.005***	−0.005***
	(−4.46)	(−4.45)
Public acquisitions	−0.010	−0.006
	(−0.97)	(−0.58)
Deal relative size		−0.0001
		(−0.18)
Competed deals		0.025
		(0.83)
Hostile deals		−0.125**
		(−1.96)
Pure cash deals		0.013**
		(2.49)
Pure stock deals		−0.018
		(−1.41)
Year FE	Yes	Yes
Industry FE	Yes	Yes
R^2	0.116	0.119
N	3,279	3,279

Note: This table reports the coefficient estimates of OLS analyses using public and non-public M&A sample. The dependent variable is ROA 3 years after the effective year of an acquisition minus ROA 3 years before the effective year of an acquisition. *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

acquisitions in Column 1 reveals that over-levered firms experience significant positive changes in Tobin's *q* after pursuing public acquisitions. This finding suggests that the previous section's observed operating synergy of public acquisitions on over-levered firms may be the reason behind the enhanced value of these firms. Column 2, after controlling for deal characteristics, shows that the coefficients of the "public acquisitions" variable is negative and significant, which prove that public acquisition deals in general are wealth-loss decisions. However, the coefficient of the "over-levered × public acquisitions" variable is positive and significant, confirming that public acquisitions by over-levered firms are wealth maximizing investment decisions. These findings are in line with Uysal's (2011) view that over-levered firms which are more heavily committed to future interest and principal payments are more likely to be involved in wealth-gaining acquisition decisions. Collectively, the effect of public acquisition deals on over-levered firms' long-term value does not support the negative market reaction around these decisions noted in Section 4.4. However, we accept H5 that in the long run public acquisitions are value-creating decisions for over-levered firms.

5 | ROBUSTNESS

5.1 | Propensity score matching to address endogeneity concerns

Testing the effect of public acquisitions on over-levered firms' long-term performance and value using the OLS method may entail a self-selection bias. Specifically, a potential bias from using this method is that a firm's decision to choose between public and non-public acquisitions is unlikely to be exogenous. To address possible

TABLE 6 Effect of public acquisitions in the long-term value of over-levered firms

	ΔTobin's *q* (1)	(2)
Over-levered	0.098	0.130
	(0.14)	(0.19)
Over-levered × public acquisitions	1.496*	1.678*
	(1.82)	(1.71)
Firm size	−0.016	−0.029
	(−0.09)	(−0.14)
MTB	−0.061	−0.061
	(−1.24)	(−1.24)
ROA	0.858	0.591
	(0.16)	(0.13)
Market leverage	−1.374	−1.422
	(−0.94)	(−1.05)
Stock return	0.010***	0.010***
	(3.43)	(3.02)
Herfindahl	−1.116	−1.067
	(−1.15)	(−1.08)
Industry M&A liquidity	−0.998	−1.138
	(−0.12)	(−0.13)
Asset tangibility	0.338	0.345
	(0.39)	(0.39)
Liquidity	−0.229	−0.228
	(−0.83)	(−0.83)
Firm growth	0.0003	0.002
	(−0.02)	(0.12)
FCF	−0.179	−0.182
	(−0.60)	(−0.55)
Firm life cycle	−0.054	−0.054
	(−0.37)	(−0.37)
Public acquisitions	−0.931***	−0.840**
	(−3.02)	(−2.18)
Deal relative size		−0.078
		(−0.09)
Competed deals		0.467
		(1.03)
Hostile deals		1.139
		(1.63)
Pure cash deals		−0.174
		(−0.68)
Pure stock deals		−0.730
		(−0.58)
Year FE	Yes	Yes
Industry FE	Yes	Yes
R^2	0.021	0.021
N	3,008	3,008

Note: This table reports the coefficient estimates of OLS analyses using public and non-public M&A sample. The dependent variable is Tobin's *q* 3 years after the effective year of an acquisition minus Tobin's *q* 3 years before the effective year of an acquisition. *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

endogeneity concerns, we use PSM by constructing a subsample of public acquirers (the treatment group) that is matched to a sample of non-acquirers (the control group) (Rosenbaum & Rubin, 1983; Saunders & Steffen, 2011). In particular, we calculate each observation's propensity score using a logit model that predicted the likelihood of public acquisition (the likelihood of being treated) as a function of firm-level characteristics (over-levered, firms size, ROA, MTB and market leverage).[10] Second, each public acquirer is matched with non-acquiring firms that have the closest propensity score to the treated firm. We employ three matching techniques, namely, the 5 nearest neighbours, Caliper and kernel (Minton, Taillard, & Williamson, 2014).[11] We apply these matching methods with replacements, which means that a single non-acquirer can match more than one public acquirer. We employ the common support to exclude the extreme boundaries by dropping non-acquirers in the control group whose propensity score is higher than the maximum or lower than the minimum propensity score among public acquirers in the treatment group and vice versa (Harris & O'Brien, 2018).

Table 7 presents results of assessing effect of public acquisitions on over-levered firms' long-term performance and value, using a multivariate propensity score methodology. In Columns 1 and 4, we match treated and control firms using the 5 nearest neighbours. Following Simintzi, Vig, and Volpin (2015), in Columns 2 and 4, we select the control group within a predefined propensity score distance with a caliper of 0.001.[12] In Columns 3 and 6, we adopt the kernel matching estimator.[13]

Columns 1 to 3 confirm our previous results that over-levered acquirers of public targets experience significant improvement in their operating performance after addressing selection bias concerns. Column 3 shows that

TABLE 7 Effect of public acquisitions on over-levered firms' performance and value using PSM

	ΔROA			ΔTobin's *q*		
	5-neighbours (1)	**Caliper (2)**	**Kernel (3)**	**5-neighbours (4)**	**Caliper (5)**	**Kernel (6)**
Over-levered	0.009	0.008	0.020***	−0.095	−0.107	0.246***
	(0.55)	(0.52)	(3.57)	(−0.49)	(−0.54)	(2.67)
Over-levered × public acquisitions	0.099**	0.097**	0.073**	0.862***	0.831***	0.414*
	(2.58)	(2.55)	(2.21)	(3.04)	(2.94)	(1.65)
Firm size	−0.001	−0.001	−0.005***	−0.068*	−0.063*	−0.024
	(−0.51)	(−0.60)	(−5.90)	(−1.79)	(−1.66)	(−1.12)
MTB	−0.0002	−0.0002	−0.002***	−0.003	−0.005	−0.226***
	(−0.35)	(−0.37)	(−3.54)	(−0.03)	(−0.05)	(−4.80)
ROA	−0.044	−0.045	−0.010	−0.620	−0.613	−1.712***
	(−0.79)	(−0.81)	(−0.76)	(−0.61)	(−0.60)	(−6.47)
Market leverage	0.005	0.009	0.006	−1.642***	−1.586***	−0.719**
	(0.14)	(0.22)	(0.40)	(−2.87)	(−2.77)	(−2.28)
Stock return	0.001***	0.001***	0.0001***	0.001	0.002	0.004***
	(5.25)	(5.24)	(12.81)	(1.03)	(1.14)	(5.75)
Herfindahl	−0.031	−0.032	0.015	0.926	0.858	0.786
	(−1.12)	(−1.13)	(1.33)	(0.52)	(0.48)	(1.14)
Industry M&A liquidity	0.007	−0.004	0.125**	−1.235	−1.646*	−1.234***
	(0.04)	(−0.02)	(2.08)	(−1.40)	(−1.90)	(−3.03)
Asset tangibility	0.010	0.011	−0.002	0.680**	0.667**	0.028
	(0.50)	(0.53)	(−0.29)	(2.33)	(2.29)	(0.16)
Liquidity	0.002	0.002	−0.002**	−0.033	−0.033	−0.019
	(0.74)	(0.76)	(−2.01)	(−1.07)	(−1.05)	(−1.43)
Firm growth	0.0001	0.0001	0.0005***	0.003**	0.003*	0.002***
	(0.00)	(0.01)	(3.72)	(1.99)	(1.94)	(2.73)
FCF	0.013***	0.013***	0.010***	0.322	0.274	0.619***
	(2.72)	(2.71)	(5.66)	(0.90)	(0.77)	(3.13)
Firm life cycle	−0.004*	−0.004*	−0.004***	−0.037	−0.037	−0.006
	(−1.73)	(−1.72)	(−5.91)	(−1.02)	(−1.01)	(−0.42)
Public acquisitions	0.000	0.002	−0.001	−0.506***	−0.478***	−0.390**
	(0.03)	(0.13)	(−0.07)	(−3.25)	(−3.11)	(−2.50)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.125	0.126	0.090	0.150	0.153	0.118
N	1,638	1,628	17,558	1,569	1,559	16,725

Note: This table reports the coefficient estimates of OLS analyses using matched propensity scores sample of public acquiring firms and non-acquiring firms. The dependent variables are changes in ROA (Columns 1, 2, and 3) and changes in Tobin's *q* (Columns 4, 5, and 6). *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

the coefficient of the over-levered variable that account for non-acquiring of over-levered firms is positive and significant. However, comparing coefficients of both the "over-levered" variable and the "over-levered× public acquisitions" variable leads to the conclusion that over-levered acquirers of public firms outperform non-

TABLE 8 Long-term outcomes of public acquisitions on over-levered firms' performance and value after controlling for self-selection bias

	ΔROA		ΔTobin's *q*	
	(1)	(2)	(3)	(4)
Over-levered	0.001	0.002	0.071	0.121
	(0.06)	(0.12)	(0.12)	(0.21)
Over-levered × public acquisitions	0.061*	0.072**	1.494*	1.565*
	(1.84)	(2.36)	(1.76)	(1.80)
Firm size	−0.001	−0.002	−0.083	−0.062
	(−0.09)	(−0.24)	(−0.13)	(−0.09)
MTB	−0.002	−0.002	−0.075	−0.071
	(−1.38)	(−1.46)	(−0.78)	(−0.74)
ROA	−0.078*	−0.086*	0.889	0.909
	(−1.68)	(−1.81)	(0.17)	(0.20)
Market leverage	0.039	0.040	−1.482	−1.426
	(0.92)	(0.94)	(−0.95)	(−1.01)
Stock return	0.001***	0.001***	0.013	0.012
	(2.80)	(3.03)	(0.89)	(0.80)
Herfindahl	0.036	0.038	−1.108	−1.094
	(1.32)	(1.41)	(−1.11)	(−1.06)
Industry M&A liquidity	0.061	0.069	−0.561	−0.155
	(0.37)	(0.42)	(−0.04)	(−0.01)
Asset tangibility	−0.015	−0.020	0.381	0.370
	(−0.80)	(−1.09)	(0.40)	(0.37)
Liquidity	−0.004	−0.004	−0.213	−0.217
	(−1.32)	(−1.37)	(−0.67)	(−0.67)
Firm growth	0.000	0.001	0.001	0.001
	(0.53)	(0.63)	(0.10)	(0.06)
FCF	−0.0001	−0.0001	−0.192	−0.179
	(−0.03)	(−0.02)	(−0.64)	(−0.52)
Firm life cycle	−0.004**	−0.004**	−0.054	−0.056
	(−2.47)	(−2.43)	(−0.37)	(−0.38)
Public acquisitions	−0.009	−0.004	−0.919***	−0.910*
	(−0.80)	(−0.38)	(−3.10)	(−1.95)
Deal relative size		−0.009		−0.378
		(−0.45)		(−0.13)
Competed deals		0.029		0.441
		(0.83)		(1.05)
Hostile deals		−0.124*		1.234*
		(−1.68)		(1.74)
Pure cash deals		0.013**		−0.155
		(2.21)		(−0.64)
Pure stock deals		−0.016		−0.738
		(−0.79)		(−0.56)
Inverse-Mills ratio	0.311	0.336	3.753	2.504

(Continues)

TABLE 8 (Continued)

	ΔROA		ΔTobin's *q*	
	(1)	(2)	(3)	(4)
	(1.35)	(1.52)	(0.20)	(0.14)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
R^2	0.116	0.120	0.021	0.021
N	3,279	3,279	3,008	3,008

Note: This table reportse the coefficient estimates of OLS analyses after controlling for self-selection bias using Inverse Mills ratio estimated by Heckman two-stages method. The dependent variable in (Columns 1 and 2) is ROA 3 years after the effective year of an acquisition minus ROA 3 years before the effective year of an acquisition. The dependent variable in (Columns 3 and 4) is Tobin's *q* 3 years after the effective year of an acquisition minus Tobin's *q* 3 years before the effective year of an acquisition. *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.

acquirers' matched counterparts. Columns 4 to 6 find that over-levered acquirers of public targets maximize their values, after accounting for endogeneity concerns using PSM.

5.2 | Heckman two-step procedure to address self-selection bias

Arguably, if unobserved factors that influence the selection of either public or non-public acquisitions also affects the long-term outcomes of these acquisitions, then the coefficient estimated on the interaction term between over-levered and public acquisitions in Tables 5 and 6 may be biased. Following Borochin et al. (2019), we employ Heckman (1979) two-step estimation method to correct for self-selection bias arising from the fact that the choice between public and non-public acquisition is a managers' decision rather than a random choice. In the first step, we run a probit model of the likelihood of public acquisitions using the same variables as in Equation (1) of Section 3.3. In the second step, we estimate the inverse Mills ratio from the probit model in the first step and then employ it as an additional explanatory variable to test the effect of public acquisitions on performance of over-levered firms' and value, using our M&A sample. Table 8 presents the results using Heckman's two-step self-selection correction model. It finds similar to our previous results that public acquisitions enhance the long-term performance and values of over-levered firms', and hence this finding is not sensitive to self-selection bias.

6 | CONCLUSION

Previous work by Uysal (2011) investigates how deviations from target leverage affect the likelihood of making acquisitions. This paper goes further and explores the effect of leverage deviation on a firm's choice between public and non-public acquisitions. According to information economics, over-levered firms should avoid the uncertainty risk arising from the information asymmetry of non-public targets. Lending support to this theory, the results of the present paper reveal that over-levered firms tend to engage in public acquisitions. The paper further documents the view that searching for targets with better available information can be one of the motives of over-levered firms' preference for public acquisitions. To the best of our knowledge, this paper is one of the first to provide interesting evidence that UK firms significantly consider their target leverage when they decide the type of acquisition to undertake.

This paper further explores the economic gains and operating synergies of public versus non-public acquisitions when carried out by over-levered firms. It reveals, using short event windows, that the market perceives the announcement of public acquisitions by over-levered firms as decisions that lose wealth. However, testing the effect of these deals on over-levered acquirers' long-term performance and values reveals that public acquisitions trigger better operating synergies and value for these firms. In summary, our empirical findings imply that the position of any deviation from target leverage has essential implications for firms' acquisition policies. The paper finds that leverage deviation affects the type, value and performance of the chosen acquisition. In practise, our paper sheds light on the importance of addressing heterogeneity in firms' leverage deviations before making acquisition decision in order to involve in successful deals.

ENDNOTES

[1] Graham and Harvey (2001) report that 55% of large US firms have strict leverage targets. Beattie, Goodacre, and Thomson (2006) provide survey evidence from UK public firms that 50% of finance directors seek to keep their leverage level on target. Using a comprehensive survey of managers of 16 European countries, Bancel and Mittoo (2004) find that 59% of respondents confirm the importance of maintaining a target debt to equity ratio.

[2] Leverage deviation is defined as actual market leverage ratio minus target leverage ratio. Over-levered firms are those with leverage deviation in the highest quintile (Hovakimian, Opler, & Titman, 2001).

[3] The choice of our context is attributable to the fact that the UK is a key player in the world's M&A market, surpassing all other European Union (EU) countries (Sudarsanam, 2003). In terms of economic importance, investments in domestic acquisition deals represented around 8.5 and 2.4% of the UK's gross domestic product (GDP) in 2000 and 2008, respectively (Office for National Statistics [ONS], 2013). Furthermore, the reported total value for M&A transactions during Quarter 1 of 2016 was £49.4 billion, the highest value reported since Quarter 2 of 2007 (ONS, 2016). The distinction between non-public and public acquisitions is a key since such deals are quite pervasive and represent approximately 92% of the total volume of UK domestic acquisitions during our sample period.

[4] We obtain consistent results when we exclude foreign acquisition deals from our sample.

[5] Our data are collected from the Eikon database using a list of both "live" and "dead" UK non-financial firms, in order to avoid survivorship bias.

[6] Previous UK studies (i.e., Dang, 2013; Ozkan, 2001) exclude R&D and selling expenses variables when estimating firms' target leverage. For example, Hovakimian et al. (2001) argue that the MTB variable can capture the same effect of both R&D and selling expense variables. In an unreported table, we exclude these variables to re-estimate leverage deviation and an over-levered proxy. Then if we test our hypotheses, we still obtain similar results.

[7] Aw and Chatterjee (2004) advocate that it is essential to include days before the event in order to take into account any leakages of information into the market. Similarly, including days after the event is recommended to capture any delays or frictions in the price adjustment process by stock investors due to the time needed by them to fully grasp the impact of the deal (Amewu & Alagidede, 2018). Arnold and Parker (2007) confirm that employing a three-day event window minimizes the likelihood of encompassing abnormal returns arising from events unrelated to the acquisition itself. While, Fuller et al. (2002) confirm that employing 5-day event window capture most of the acquisition impact.

[8] We get consistent results when we run Equations (4) and (5) using non-overlapping acquisitions data in which a firm is not involved in an acquisition within 3 years of a previous acquisition.

[9] We report the average marginal effects, since it is difficult to interpret the coefficient estimates of logit and tobit models and to assess the economic significance of our findings. We add more control variables in Columns 2 and 4.

[10] In an unreported table, we predict the control group using our logit model in Equation (1) that includes over-levered, firm size, MTB, ROA, stock return, asset tangibility, liquidity, sales growth, FCF, firm life cycle, market leverage, Herfindhal index, industry M&A liquidity, industry fixed effect and year. We also try to replace the over-levered variable by a leverage deviation variable and still get consistent results.

[11] We obtain consistent results when applying the nearest neighbour matching method without replacement by selecting one non-acquirer that has the closest propensity score for each public acquirer and also when we match with the 4 nearest neighbours.

[12] We also apply a caliper of 0.01 to define the propensity score distance and still get qualitatively similar findings.

[13] We report a Gaussian kernel estimator and we get consistent results when trying the Epanechikov kernel matching estimator and local linear regression matching.

DATA AVAILABILITY STATEMENT

It is a revision paper.

ORCID

Yousry Ahmed https://orcid.org/0000-0001-7022-0912

REFERENCES

Ahmed, Y., & Elshandidy, T. (2016). The effect of bidder conservatism on M&A decisions: Text-based evidence from US 10-K filings. *International Review of Financial Analysis*, *46*, 176–190.

Ahmed, Y., & Elshandidy, T. (2018). Why do over-deviated firms from target leverage undertake foreign acquisitions?. *International Business Review*, *27*(2), 309–327.

Alexandridis, G., Fuller, K. P., Terhaar, L., & Travlos, N. G. (2013). Deal size, acquisition premia and shareholder gains. *Journal of Corporate Finance*, *20*, 1–13.

Amewu, G., & Alagidede, P. (2018). Do mergers and acquisitions announcements create value for acquirer shareholders in Africa. *International Journal of Finance & Economics*, *23*(4), 606–627.

Amihud, Y. (2002). Illiquidity and stock returns: Cross-section and time-series effects. *Journal of Financial Markets*, *5*(1), 31–56.

Antoniou, A., Guney, Y., & Paudyal, K. (2008). The determinants of capital structure: Capital market-oriented vs. bank-oriented institutions. *Journal of Financial and Quantitative Analysis*, *43* (01), 59–92.

Antoniou, A., Petmezas, D., & Zhao, H. (2007). Bidder gains and losses of firms involved in many acquisitions. *Journal of Business Finance & Accounting*, *34*(7-8), 1221–1244.

Arnold, M., & Parker, D. (2007). UKcompetition policy and shareholder value: The impact of merger inquiries. *British Journal of Management*, *18*(1), 27–43.

Aw, M. S. B., & Chatterjee, R. A. (2004). The performance of UKfirms acquiring large cross-border and domestic takeover targets. *Applied Financial Economics*, *14*(5), 337–349.

Bancel, F., & Mittoo, U. R. (2004). Cross-country determinants of capital structure choice: A survey of European firms. *Financial Management*, *33*, 103–132.

Barbopoulos, L., Paudyal, K., & Pescetto, G. (2012). Legal systems and gains from cross-border acquisitions. *Journal of Business Research*, *65*(9), 1301–1312.

Barney, J. B. (1986). Strategic factor markets: Expectations, luck, and business strategy. *Management Science*, *32*(10), 1231–1241.

Beattie, V., Goodacre, A., & Thomson, S. J. (2006). Corporate financing decisions: UKsurvey evidence. *Journal of Business Finance & Accounting*, *33*(9-10), 1402–1434.

Berger, A. N., & Di Patti, E. B. (2006). Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry. *Journal of Banking & Finance*, *30*(4), 1065–1102.

Bhaumik, S. K., & Selarka, E. (2012). Does ownership concentration improve M&a outcomes in emerging markets?: Evidence from India. *Journal of Corporate Finance*, *18*(4), 717–726.

Borochin, P., Ghosh, C., & Huang, D. (2019). Target information asymmetry and takeover strategy: Insights from a new perspective. *European Financial Management*, *25*(1), 38–79.

Bradley, M., Jarrell, G. A., & Kim, E. (1984). On the existence of an optimal capital structure: Theory and evidence. *The Journal of Finance*, *39*(3), 857–878.

Brounen, D., De Jong, A., & Koedijk, K. (2006). Capital structure policies in Europe: Survey evidence. *Journal of Banking & Finance*, *30*(5), 1409–1442.

Capron, L., & Shen, J. C. (2007). Acquisitions of private vs. public firms: Private information, target selection, and acquirer returns. *Strategic Management Journal*, *28*(9), 891–911.

Céspedes, J., González, M., & Molina, C. A. (2010). Ownership and capital structure in Latin America. *Journal of Business Research*, *63*(3), 248–254.

Coles, J. L., Daniel, N. D., & Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics*, *79*(2), 431–468.

Conn, R. L., Cosh, A., Guest, P. M., & Hughes, A. (2005). The impact on UKacquirers of domestic, cross-border, public and private acquisitions. *Journal of Business Finance & Accounting*, *32*(5-6), 815–870.

Dang, V. A. (2013). Testing capital structure theories using error correction models: Evidence from the UK, France and Germany. *Applied Economics*, *45*(2), 171–190.

Dang, V. A., Kim, M., & Shin, Y. (2012). Asymmetric capital structure adjustments: New evidence from dynamic panel threshold models. *Journal of Empirical Finance*, *19*(4), 465–482.

Davydenko, S. A., & Franks, J. R. (2008). Do bankruptcy codes matter? A study of defaults in France, Germany, and the UK. *The Journal of Finance*, *63*(2), 565–608.

DeAngelo, H., & Masulis, R. W. (1980). Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics*, *8*(1), 3–29.

Dutta, S., & Jog, V. (2009). The long-term performance of acquiring firms: A re-examination of an anomaly. *Journal of Banking & Finance*, *33*(8), 1400–1412.

Erel, I., Jang, Y., & Weisbach, M. S. (2015). Do acquisitions relieve target firms' financial constraints? *The Journal of Finance*, *70*(1), 289–328.

Faccio, M., McConnell, J. J., & Stolin, D. (2006). Returns to acquirers of listed and unlisted targets. *Journal of Financial and Quantitative Analysis*, *41*(01), 197–220.

Fama, E. F. (1991). Efficient capital markets: II. *The Journal of Finance*, *46*(5), 1575–1617.

Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. *Review of Financial Studies*, *15*(1), 1–33.

Frankel, R., & Li, X. (2004). Characteristics of a firm's information environment and the information asymmetry between insiders and outsiders. *Journal of Accounting and Economics*, *37*(2), 229–259.

Fuller, K., Netter, J., & Stegemoller, M. (2002). What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions. *The Journal of Finance*, *57*(4), 1763–1793.

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, *60*(2), 187–243.

Gujarati, D., & Porter, D. (2009). *Basic Econometrics* (5th ed.). New Yorkn, NY: McGraw-Hill.

Guney, Y., Ozkan, A., & Ozkan, N. (2007). International evidence on the non-linear impact of leverage on corporate cash holdings. *Journal of Multinational Financial Management*, *17*(1), 45–60.

Harford, J., Humphery-Jenner, M., & Powell, R. (2012). The sources of value destruction in acquisitions by entrenched managers. *Journal of Financial Economics*, *106*(2), 247–261.

Harford, J., Klasa, S., & Walcott, N. (2009). Do firms have leverage targets? Evidence from acquisitions. *Journal of Financial Economics*, *93*(1), 1–14.

Harris, J., & O'Brien, W. (2018). US worldwide taxation and domestic mergers and acquisitions. *Journal of Accounting and Economics*, *66*(2-3), 419–438.

Harris, M., & Raviv, A. (1991). The theory of capital structure. *The Journal of Finance*, *46*(1), 297–355.

Heckman, J. J. (1979). Sample selection as a specification error. *Econometrica*, *47*, 153–161.

Hovakimian, A., Opler, T., & Titman, S. (2001). The debt-equity choice. *Journal of Financial and Quantitative Analysis*, *36*(01), 1–24.

Jansen, I. P. (2015). Trading volume around announcements of mergers and acquisitions. *Applied Economics Letters*, *22*(15), 1204–1208.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, *76*(2), 323–329.

Karpoff, J. M., Lee, G., & Masulis, R. W. (2013). Contracting under asymmetric information: Evidence from lockup agreements in seasoned equity offerings. *Journal of Financial Economics*, *110*(3), 607–626.

Kayhan, A., & Titman, S. (2007). Firms' histories and their capital structures. *Journal of Financial Economics*, *83*(1), 1–32.

Leary, M. T., & Roberts, M. R. (2005). Do firms rebalance their capital structures? *The Journal of Finance*, *60*(6), 2575–2619.

Leary, M. T., & Roberts, M. R. (2010). The pecking order, debt capacity, and information asymmetry. *Journal of Financial Economics*, *95*(3), 332–355.

Ma, M., Sun, X., Waisman, M., & Zhu, Y. (2016). State ownership and market liberalization: Evidence from China's domestic M&a market. *Journal of International Money and Finance*, *69*, 205–223.

Makadok, R., & Barney, J. B. (2001). Strategic factor market intelligence: An application of information economics to strategy formulation and competitor intelligence. *Management Science*, *47* (12), 1621–1638.

Maloney, M. T., McCormick, R. E., & Mitchell, M. L. (1993). Managerial decision making and capital structure. *Journal of Business*, *66*, 189–217.

Margaritis, D., & Psillaki, M. (2010). Capital structure, equity ownership and firm performance. *Journal of Banking & Finance*, *34* (3), 621–632.

Miller, M. H. (1977). Debt and taxes. *The Journal of Finance*, *32*(2), 261–275.

Minton, B. A., Taillard, J. P., & Williamson, R. (2014). Financial expertise of the board, risk taking, and performance: Evidence from bank holding companies. *Journal of Financial and Quantitative Analysis*, *49*(2), 351–380.

Moeller, S. B., Schlingemann, F. P., & Stulz, R. M. (2004). Firm size and the gains from acquisitions. *Journal of Financial Economics*, *73*(2), 201–228.

Morellec, E., & Zhdanov, A. (2008). Financing and takeovers. *Journal of Financial Economics*, *87*(3), 556–581.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, *5*(2), 147–175.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, *13*(2), 187–221.

Officer, M. S. (2003). Termination fees in mergers and acquisitions. *Journal of Financial Economics*, *69*(3), 431–467.

Officer, M. S. (2007). The price of corporate liquidity: Acquisition discounts for unlisted targets. *Journal of Financial Economics*, *83*(3), 571–598.

Officer, M. S., Poulsen, A. B., & Stegemoller, M. (2009). Target-firm information asymmetry and acquirer returns. *Review of Finance*, *13*(3), 467–493.

Office for National Statistics (2016). Mergers and Acquisitions involving UK companies, Office for National Statistics. Retrieved on May 5, 2020 from https://www.ons.gov.uk/businessindustryandtrade/changestobusiness/mergersandacquisitions/bulletins/mergersandacquisitionsinvolvingukcompanies/jantomar2016

Office for National Statistics (2013). Long-Term Profile of Gross Domestic Product (GDP) in the UK, Office for National Statistics. Retrieved on May 5, 2016 from http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/elmr/explaining-economic-statistics/long-term-profile-of-gdp-in-the-uk/sty-long-term-profile-of-gdp.html

Owen, S., & Yawson, A. (2010). Corporate life cycle and M&a activity. *Journal of Banking & Finance*, *34*, 427–440.

Ozkan, A. (2001). Determinants of capital structure and adjustment to long run target: Evidence from UKcompany panel data. *Journal of Business Finance & Accounting*, *28*(1–2), 175–198.

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *The Journal of Finance*, *50*(5), 1421–1460.

Reuer, J. J., & Ragozzino, R. (2008). Adverse selection and M&A design: The roles of alliances and IPOs. *Journal of Economic Behavior & Organization*, *66*(2), 195–212.

Roll, R. (1986). The hubris hypothesis of corporate takeovers. *Journal of Business*, *59*(2), 197–216.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41–55.

Saunders, A., & Steffen, S. (2011). The costs of being private: Evidence from the loan market. *The Review of Financial Studies*, *24*(12), 4091–4122.

Schlingemann, F. P., Stulz, R. M., & Walkling, R. A. (2002). Divestitures and the liquidity of the market for corporate assets. *Journal of Financial Economics*, *64*(1), 117–144.

Simintzi, E., Vig, V., & Volpin, P. (2015). Labor protection and leverage. *The Review of Financial Studies*, *28*(2), 561–591.

Stulz, R. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics*, *26*(1), 3–27.

Sudarsanam, S. (2003). *Creating value from mergers and acquisitions: The challenges: An integrated and international perspective*, Essex, England: Pearson Education.

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. *The Journal of Finance*, *43*(1), 1–19.

Uysal, V. B. (2011). Deviation from the target capital structure and acquisition choices. *Journal of Financial Economics*, *102*(3), 602–620.

William, H., & Michael, J. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*, 305–360.

How to cite this article: Ahmed Y, Elshandidy T. Effect of leverage deviation on choices and outcomes of public versus non-public acquisitions. *Int J Fin Econ*. 2021;26:3436–3459. https://doi.org/10.1002/ijfe.1969

APPENDIX A: DEFINITIONS OF VARIABLES

Variable	Definition
Asset tangibility	Net property, plant and equipment divided by total assets.
CARMAR (−1, 1) & (−2, +2)	Cumulative abnormal returns estimated using the market adjusted model. The benchmark return is the UK FTSE all shares index on date *t*. CARs are calculated over a 3-day event window (from 1 day before to 1 day after the announcement date) and over a 5-day event window (2 days before and 2 days after the announcement date).
CARMM (−1, +1) & (−2, +2)	Cumulative abnormal returns estimated using market model. The benchmark return is the UK FTSE all shares index on date t. market model parameters are estimated over the 255-day window ending 46 trading days before the announcement. CARs are calculated over a 3-day event window (from 1 day before to 1 day after the announcement date) and over a 5-day event window (2 days before and 2 days after the announcement date).
Δ ROA	The difference between the average ROA 3 years after the deal ($t + 1$, $t + 3$) and the average 3 years ROA prior to the deal ($t - 3$ to $t - 1$), where t is the effective year of a completed M&A deal.
Δ Tobin's q	The difference between the average Tobin's q 3 years after the deal ($t + 1$, $t + 3$) and the average 3 years Tobin's q prior to the deal ($t - 3$ to $t - 1$), where t is the effective year of a completed M&A deal. Tobin's q equals (market value of equity + book value of liabilities)/(book value of equity + book value of liabilities).
Competed deals	Takes a value of one if there is more than one bidder and zero otherwise.
Deal relative size	Natural logarithm of the ratio of deal value to the acquirers' total assets prior to the announcement date.
FCF	Free cash flow ratio is (net operating cash flow – Cash dividends – Capital expenditures)/ total assets.
Firm growth	Sales growth rate the equal natural logarithm of $(\text{Sales}_{i,t}/\text{Sale}_{i,t-1})t$
Firm life cycle	Retained earnings divided by common shareholders' equity
Firm size	The natural logarithm of sales.
Herfindahl	The sum of the square of sales of a firm divided by the sum of sales of all firms sharing the same three-digit SIC.
Hostile deals	Takes a value of one if the deal is a hostile acquisition and zero otherwise.
Industry M&A Liquidity	Total acquisition value for each year and three-digit SIC code, scaled by total assets of all UK firms that share the same year and three-digit SIC.
Leverage deviation	Actual market leverage ratio minus target leverage ratio.
Liquidity	Current assets over current liabilities.
Market leverage	Total debt divided by the sum of total debt plus market-value of equity.
MTB	Market value over book value of total assets.
NDTS	Non-debt tax shields ratio is annual depreciation expenses over total assets.
Over-levered	Takes a value of one if the firm falls in the highest quintile for leverage deviation and zero otherwise.
Over-levered × public acquisitions	An interaction term between over-levered firm and public acquisitions.
Public acquisition	Takes a value of one if the firm makes a public acquisition and zero if it makes a non-public acquisition.
Public value/TA	Ratio of public deals value to the acquirers' total assets.
Pure cash deals	Takes a value of one if the whole acquisition transaction is paid with cash only and zero otherwise.
Pure stock deals	Takes a value of one if the whole acquisition transaction is paid with stock only and zero otherwise.
R&D expenses/total assets	The ratio of research and development expenses over total assets.

Variable	Definition
R&D missing	Takes a value of one for missing R&D data and zero otherwise
ROA	Income before extraordinary item divided by total assets.
Selling expenses/sales	The ratio of selling expenses over sales.
Stock return	Compounded total stock returns 1 year prior to a firm's fiscal year end.
Sum public acquisition/TA	Ratio of the sum of public acquisition value to the acquirer's total assets.

APPENDIX B: TARGET MARKET LEVERAGE ESTIMATION MODEL

	Market leverage
Firm size	0.008***
	(18.38)
MTB	−0.010***
	(−19.28)
ROA	−0.387***
	(−17.34)
Asset tangibility	0.135***
	(27.65)
Liquidity	−0.036***
	(−20.44)
NDTS	−0.517***
	(−9.57)
R&D expenses/total assets	−0.227***
	(−10.30)
R&D missing	0.019***
	(3.93)
Selling expenses/sales	−0.025
	(1.59)

Note: This table shows the time series means of coefficient estimates of yearly-industry regressions to predict target market leverage using UK data from 1984 to 2019. The dependent variable market leverage equals total debt/ (total debt plus market value of equity). *T*-statistics are reported in parenthesis. Standard errors are robust and clustered by firm. The estimates in the models are statistically significant at the 1(*)10%, (**)5%, and (***)1% levels. All continuous variables are winsorised at the first and 99th percentiles. Variable definitions are given in Appendix A.