On the determinants of the dynamic choice between mergers and tender offers*

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Abstract

This paper builds on recent advances in the domain of dynamic M&A option games under uncertainty and looks closer at the determinants that drive the strategic choice between mergers and tender offers. In particular, our model sheds new light in understanding the effects of uncertainty and relative size of firms on the choice of the M&A strategy. We not only show that uncertainty and relative size do impact the choice of the strategy, but we also show that this impact is non-monotonic. In fact, tender offers are more likely in a context of relatively low/high volatility, or when firms are more asymmetric in size. For intermediate values, mergers become more likely. Additionally, our model also shows that the tender offer payoff is larger than the merger payoff, suggesting that larger combined CARs should be observed for tender offers. Our empirical study gives support to these results.

Keywords: Mergers; Tender offers; Real Options; Cooperative and Non-cooperative Bargaining
JEL codes: C73; D81; G34.

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1 Introduction

Research on Mergers and Acquisitions (M&As) strategies, their performance and important determinants have received considerable attention in finance literature. To date, there is great consensus regarding some empirical features of M&A activity. Firstly, M&As occur in waves where periods of low takeover activity are followed by periods of high takeover activity, and secondly, merger activity within a wave is considerably clustered by industries (see e.g. Andrade et al. (2001); Rhodes-Kropf and Viswanathan (2004); Martynova and Renneboog (2008); Betton et al. (2008), among others). Alike, M&A activity happens in response to major shocks and is procyclical, i.e. the number of deals is higher in economics booms than in recessions. Yet, however, there is much about the M&A process we do not fully understand.

One prominent issue is the choice between tender offers and mergers. Both types usually coexist within a merger wave but their importance varies from one merger wave to the other. Exemplary, while hostile takeovers triggered the M&A wave in 1980s their number dropped significantly during the subsequent M&A wave in the 1990s. Although this trend has continued worldwide, it does not necessarily imply that hostile takeovers are becoming less important. Rather, examples like the €190 billion takeover of the German firm Mannesmann by the British mobile operator Vodafone in early 2000 or the $162 billion takeover of US-media giant TimeWarner by America Online (AOL) the same year shows that despite their low numbers hostile takeovers account for the majority stake when comparing M&A activity by deal volume. In addition, hostile takeovers serve as credible threats in friendly merger negotiations and often induce managers to end up accepting friendly mergers (Browne and Rosengren, 1987). For example, the German steelmaker Krupp-Hoesch announcement in 1997 that it would seek to buy its far larger German rival Thyssen either friendly or unfriendly lead to a *David* versus *Goliath* battle in which Thyssen finally agreed to merge with the smaller contender. A similar M&A battle started when Xerox's $33 billion friendly merger bid was rejected by its larger US rival HP in November 2019 thereby prompting for a hostile bid directed to HP shareholders.[1] Finally, Continental Europe and Japan are recent examples where the number of hostile takeovers is rising against the overall worldwide trend, thereby stoking fears of losing competitiveness to foreign bidders.

While previous literature in the domain of theoretical corporate finance has predominantly looked at the effect of uncertainty, synergies, means of payment, and debt level, among others, on the outcome of M&As, less attention has been given on the firms' strategic choice between tender offers and mergers, as well as on negotiation tactics and outside options, and their impact on M&A process. In particular, under what circumstances are tender offers superior over mergers? How does uncertainty and relative sizes of the firms

[1]See *Forbes*, Jan 6, 2020: Xerox secures $24 Billion for hostile takeover bid of HP.

impact the choice between these two M&A strategies?

Our paper contributes to the literature on dynamic M&A option games and offers a new theoretical explanation about the effects of uncertainty and relative size on the choice between tender offers and mergers. Our model allows us to posit some testable predictions which find support in the empirical study conducted. In summary, we not only show that both uncertainty and relative size do impact the choice of the M&A strategy, but we also provide theoretical and empirical contributions revealing that their impact is non-monotonic.

The paper unfolds as follows. Section 2 provides a brief overview of recent literature while Section 3 presents the derivation of the model. Section 4 analyses the main parameters driving the optimal strategy choices and presents the testable predictions of the model. Section 5 shows the empirical results. Finally, Section 6 concludes.

2 Literature review

Even though the issue whether firms should choose to merge friendly or to accept/launch a tender offer has gained less attention, when compared to other issues in M&A, it is not completely ignored in the literature. In particular, corporate finance research has revealed some empirical features that affect the choice. For example, Betton et al. (2009) and Browne and Rosengren (1987), among others, find that targets of tender offers tend to be larger than those subject of mergers.

Empirical studies also reveal that takeovers become more likely when target firms perform poorly (Hasbrouck, 1985; Palepu, 1986; Morck et al., 1989; Mitchell and Lehn, 1990), confirming the view that takeovers act as a mean to discipline management. While achieving synergies due to increases in market power, economies of scale and scope, among others, is at the core of every merger attempt, disciplinary takeovers indicate the bidder's preferences to replace the target's management because of their incapacity of maximizing shareholder wealth. This alternative view on M&A has emanated from the market for corporate control theory where, according to Jensen and Ruback (1983), managers compete for the rights to control and manage corporate resources. Obviously, when such firms operate sub-optimally they signal upside potential in profitability, and hostile takeovers are an efficient means to capitalize on these efficiency gains, due to a complete replacement of the target's management team.

Naturally, expected synergies and transaction costs are important drivers for the M&A strategy choice. While average synergies achieved in hostile takeovers tend to be larger than those in friendly mergers (Jensen and Ruback, 1983; Sudarsanam and Mahate, 2006; Offenberg et al., 2014), they are obtained at a higher price, as transaction costs are generally greater for hostile takeovers than for mergers (Schnitzer, 1996; McSweeney, 2012).

Only a few theoretical models look at these issues from a classical microeconomic perspective. For example, Berkovitch and Khanna (1991), Betton et al. (2009), Aktas et al. (2010), and Calcagno and Falconieri (2014), among others, present models of merger negotiations in which the outside option is a tender offer. The central assumption within this domain of literature is that merger negotiations take place privately while hostile takeover bids are announced publicly, and signal synergy gains to outsiders that might become potential additional bidders. Their findings reveal that under such a threat a unique level of synergies exist in equilibrium that motivate bidders to refrain from attempting to take over the target by means of a hostile takeovers, should replacing the management generate lower synergies. All of these papers, however, have in common that uncertainty and flexibility is neglected.

The literature on investment under uncertainty and flexibility has acknowledged that bargaining and negotiation are pivotal pieces of M&As and has analyzed how uncertainty affects dynamic decision making of the party's involved. In particular, several papers have used the real options approach to advance the analysis of contract design under uncertainty (Lambrecht, 2004; Morellec and Zhdanov, 2005; Alvarez and Stenbacka, 2006; Lambrecht and Myers, 2007; Thijssen, 2008; Lukas and Welling, 2012). Their results have provided answers with respect to how hostile takeover negotiation and merger negotiation, respectively, have an impact on takeover timing and surplus sharing under uncertainty. Exemplary, Morellec and Zhdanov (2005) and Lambrecht (2004) model a friendly merger of two firms where the timing and terms of takeovers are endogenous and result from value-maximizing decisions. Their findings reveal that M&As are usually timed in periods of economic expansion and that competition among heterogeneous firms speeds up the acquisition process.

Recent papers have furthermore stressed the importance of M&A strategy, i.e. friendly merger or hostile takeover, on timing and wealth distribution. Their results indicate that takeovers occur inefficiently late when compared with the merger as being the first-best. However, the bidder can claim a majority stake in the new entity due to its first-mover advantage and thus improve his bargaining position (see e.g. Lambrecht, 2004; Lukas and Welling, 2012).

To our best knowledge, the paper by Offenberg and Pirinsky (2015) is the only one in the domain of real options and M&A that − albeit in a more qualitative way − focus on the choice between both M&A deal forms. The authors argue that the choice is driven by a trade-off between the benefits of faster completion, i.e. friendly mergers take more time than tender offers and the higher cost of hostile takeovers due to higher premiums. Their findings reveal that tender offers are completed faster than mergers but are associated with higher premiums and targets in more volatile product markets are more likely acquired by means of a tender offer. Although the authors address real options reasoning as a viable tool to investigate the factors that drive these results, their model, however, falls short to account for a rigorous dynamic decision model under uncertainty that accounts for game-theoretic elements certainly immanent in M&A deal tactics. In particular, the model neither considers the positive value of waiting for new information when choosing an optimal deal form, nor are the optimal choices impacted by any strategic behavior of the players, i.e. neither non-cooperative or cooperative bargaining are considered and thus the fraction of surpluses assigned to each entity is given endogenously. Consequently, our goal is to provide a modeling framework that links the choice between takeovers and mergers to the parties' strategic behavior during deal negotiations. Furthermore, we believe that, among other factors, credible threats, as depicted by real world M&A cases of ThyssenKrupp and HP and Xerox, have a prominent impact on the optimal deal form choice as uncertainty and synergies.

Our aim is to bridge these two strands of literature, i.e. the real options view on M&A with the literature on market for corporate control. Hence, we build on the literature that hostile takeovers are efficient means to replace target management and take advantage of upside potential. In particular, while we allow the takeover to generate synergies, we add to this the possibility for the bidder to profit from additional gains whenever the synergies due to replacing target's management are higher than conjoint control in a friendly merger. In contrast to the aforementioned literature, however, we deviate from the assumption that hostile takeovers occur in the shadow of an auction. Neglecting competitive bidding, however, seems reasonable as empirical data indicates that only a few hostile takeovers suffer from bidding contests and the majority of hostile takeovers are single-bid deals (Betton et al., 2008). In bargaining process the raider has two options. It may either make a hostile bid to acquire the target firm, or start negotiating a friendly merger in the first round knowing that, if negotiations fail, subsequent hostile takeovers are still possible.

Our paper offers several important contributions, both theoretical as well as empirical. Firstly, we develop a model suitable addressing the choice between tender offers and mergers, and we endogenously derive the synergy level that sets optimally the M&A strategy. In particular, our model leads to solutions where tender offers can optimally occur early or late, when compared to the (optimal) timing of friendly mergers. Secondly, our model reveals that volatility and relative size of firms play a relevant role on the choice of the M&A strategy. Specifically, it suggests that, for sufficiently large extra synergies provided by tender offers (when compared to those of mergers), a non-linear (U-shaped) relationship between volatility and the choice of the strategy occurs. Furthermore, a similar non-linear relationship is observed also for the relative size of firms. In fact, our model shows that, for a given level of synergies, tender offers are more likely in a context of relatively low/high volatility, or when firms are more asymmetric in size. In-between (i.e., for a context of moderate volatility or when firms are of similar sizes), mergers are optimally chosen. We perform an empirical study which shows that these theoretical implications find support in empirical evidence. Finally, our model endogenously suggests that the net payoff of tenders offers are larger than that of friendly mergers (in line with Jensen and Ruback, 1983; Sudarsanam and Mahate, 2006; Offenberg et al., 2014), suggesting that the observed merger combined CARs should be larger. We also find empirical support in this respect.

3 The Model

We model a situation where two firms, labeled as B and T, share an option to form a new entity M by combining their assets and to profit from synergies. We assume that the stand-alone value of each firm is proportional to its capital stock K_i with $i \in \{B, T\}$, i.e.

$$V_i(t) = K_i x(t) \quad \text{with } i \in \{B, T\} \tag{1}$$

where $x(t)$ captures the randomness of $V_i(t)$ due to industry wide shocks. For the sake of simplicity, we assume that $x(t)$ follows a geometric Brownian motion, i.e.:

$$dx(t) = \alpha x(t)dt + \sigma x(t)dz \tag{2}$$

where $\alpha \in \mathbb{R}$ stands for the instantaneous drift under the risk-neutral measure, $\sigma \in \mathbb{R}^+$ denotes the instantaneous volatility, dz denotes the standard Wiener increment, and r is the risk-free interest rate ($r > \alpha$).

We allow two possible strategies by which both firms can combine their assets. First, a new entity can be formed by means of a tender offer (labelled with o). Here, one firm takes on the active role and offers a premium to the shareholders of the other firm which in reaction have to choose when and whether to accept the offer. We pre-assign the roles, by assuming that firm B acts as a bidder and firm T acts as a target in such a case and follow previous literature that has suggested to model tender offers as a non-cooperative game *à la* Stackelberg (e.g., Lambrecht, 2004; Lukas and Welling, 2012; Lukas et al., 2019). Second, both firms can agree to jointly negotiate a merger (labelled with m). Here, we rely on cooperative game theory to determine each firm's stake in the new entity M. As opposed to other literature in the domain of M&A and real options, however, we do not assume a null threat (e.g., see Thijssen, 2008), but rather account for each player's outside option, should negotiations fail. In particular, firm B credibly threats to take the role of a bidder, while T may end-up as a target in a tender offer, if no agreement is achieved in the negotiations.

Since the primarily motive of our M&A activity is to profit from synergies, it is reasonable to assume that the new entity's firm value is affected by the type of deal, i.e. tender offer or merger, via the potential level of synergies. In particular, one may argue that the synergies produced in a tender offer are not smaller than those of a merger (i.e., $\omega_o > \omega_m$), for instance, due to the acquirer's power to substitute target's managers for a more efficient management team. These changes typically do not occur in mergers, where the incumbent managers normally stay in office, along with new managers designated by the acquirer.[2] Hence, upon merging, the value of the new entity M is given by:

$$V_{o,m}(t) = K_{o,m}x(t) = (\omega_{o,m} + K_B + K_T)x(t) \tag{3}$$

where $\omega_{o,m} > 0$ denotes synergies arising from the transaction.

3.1 The tender offer decision

Let us consider the dynamics of the tender offer. First, the bidder (firm B) offers a premium to acquire the target (firm T) which, in turn, sets the timing conditions for which the offer is accepted. In other words, considering B's offer, firm T defines whether and when to accept it. Notice, however, that the bidder is able to anticipate the reaction of the target optimizing the premium to be offered. The problem is solved backwards in a sequential optimization procedure, starting with the target firm.

Accordingly, firm T incorporates the offer (ψ) and maximizes its position defining the timing of the deal:

$$\max_{x_o(\psi)} \left[((\psi - 1)K_T x_o(\psi) - (1 - \epsilon_B)Y_o) \left(\frac{x(t)}{x_o(\psi)} \right)^{\beta_1} \right] \tag{4}$$

Solving the maximization problem (4), the threshold of the tender offer, for any given premium ($x_o^*(\psi)$) is obtained. Additionally,

$$\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left(-\frac{1}{2} + \frac{\alpha}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}} > 1$$

is the positive root of the standard fundamental quadratic equation (see Dixit and Pindyck, 1994). Equation (4) indicates that at the threshold, i.e. when $x(t) = x_o^*$ for the first time, the target firm T will give control over the assets worth $K_T x_o^*$, by partially incurring the transaction cost, i.e. $(1 - \epsilon_B)Y_o$. In exchange, firm T is compensated by a lump sum payment with net value $(\psi - 1)K_T x_o^*$.

The bidder's problem consists of maximizing its acquisition option by choosing an optimal premium taking into account the target's reaction function $x_o^*(\psi)$. Consequently, B's objective function is given by:

$$\max_{\psi} \left[((K_o - K_B - \psi K_T)\, x_o^*(\psi) - \epsilon_B Y_o) \left(\frac{x(t)}{x_o^*(\psi)} \right)^{\beta_1} \right] \tag{5}$$

[2] The market for control literature refers to such takeovers as disciplinary takeovers. Here, bidder opt to replace the target's management because of their incapacity of maximizing shareholder wealth (Jensen and Ruback (1983); Morck et al. (1989)).

where $K_o = \omega_o + K_B + K_T$ denotes the new entity's capital stock after the tender offer. The intuition follows analogously. Upon taking over the target at the optimal threshold, i.e. x_o^*, the bidder receives an asset worth $K_o x_o^*$ in exchange for compensating the shareholder of T and partially bearing the transaction cost of size $\epsilon_B Y_o$.

Solving objective functions (4) and (5) recursively leads to the following results for the threshold, premium and firms' option values:

Proposition 1. *The tender offer takes place at the threshold:*

$$x_o^* \equiv x_o^*(\psi^*) = \frac{\beta_1}{(\beta_1 - 1)^2} \frac{(\beta_1 - \epsilon_B) Y_o}{\omega_o} \tag{6}$$

as a result of the optimal premium offered by B:

$$\psi^* = 1 + \frac{(\beta_1 - 1)(1 - \epsilon_B)}{\beta_1 - \epsilon_B} \frac{\omega_o}{K_T} \tag{7}$$

The tender offer option values, i.e. when $x(t) < x_o^*$, for B and T are, respectively:

$$A_B x^{\beta_1} = \frac{(\beta_1 - \epsilon_B) Y_o}{(\beta_1 - 1)^2} \left(\frac{x}{x_o^*} \right)^{\beta_1} \tag{8}$$

$$A_T x^{\beta_1} = \frac{(1 - \epsilon_B) Y_o}{\beta_1 - 1} \left(\frac{x}{x_o^*} \right)^{\beta_1} \tag{9}$$

Proof. See Appendix. □

3.2 The merger decision

Should the firms pursue a merger, we assume that after the deal, each firm holds a equity stake γ_i with $i \in \{B, T\}$ of the new entity's equity value $K_m = \omega_m + K_B + K_T$. In exchange, both firms have to give up their pre-merger stand-alone values $V_i = K_i x(t)$ with $i \in \{B, T\}$. Analogous to the tender offer, we furthermore assume that merging is not costless and that both firms share the transactions cost Y_m, i.e. B bears ξ_B while T has to incur a fraction $1 - \xi_B$ of the total cost. Consequently, each party's net gain in the merger amounts to:

$$(\gamma_B K_m - K_B)\, x(t) - \xi_B Y_m \tag{10}$$

for firm B shareholders, and

$$((1 - \gamma_B) K_m - K_T)\, x(t) - (1 - \xi_B) Y_m \tag{11}$$

for those of firm T, where $K_m = \omega_m + K_B + K_T$ denotes the size of M after incorporating the proper synergies arising from the merger.

It is important to note that we allow for strategic alternatives if both parties do not come to an agreement. Hence, should a merger fail, firm B has still an option to acquire the target T by means of a tender offer. Consequently, we assume that the previous derived tender offer policy serves as a credible threat when negotiating the merger. Hence, each firm possesses a certain disagreement point when bargaining with the partner that is given by the parties' tender offer option value as stated in Equation (9). For simplicity reasons, we again endogenously fix the roles of the firms, i.e. B threatens to be a (credible) bidder, while T ends-up as a target.

We apply the asymmetric Nash bargaining solution to solve for the firm's optimal shares in the new venture, represented by the following optimization problem:[3]

$$\max_{0<\gamma_B<1} \Bigg[\Big((\gamma_B K_m - K_B)\, x(t) - \xi_B Y_m - A_B x(t)^{\beta_1} \Big)^{\eta_B} \Big(((1-\gamma_B) K_m - K_T)\, x(t) - (1-\xi_B) Y_m - A_T x(t)^{\beta_1} \Big)^{1-\eta_B} \Bigg] \tag{12}$$

where η_B and $(1-\eta_B)$ represent the bargaining power of firm B and T, respectively. The terms $A_B x^{\beta_1}$ and $A_T x^{\beta_1}$ represent each firm's disagreement point, which corresponds to the outside option available to B and T, respectively. The following proposition summarizes the optimal merger policy:

Proposition 2. *The merger materializes when $x(t)$ hits the optimal timing threshold x_m^* from below:*

$$x_m^* = \frac{\beta_1}{\beta_1 - 1} \frac{Y_m}{\omega_m} \tag{13}$$

Firm B's optimal equity stake γ_B^* in the new entity upon merging amounts to:

$$\gamma_B^* = \frac{K_B}{K_m} + \frac{\omega_m}{K_m} \frac{((\beta_1 - 1)\xi_B + \eta_B)}{\beta_1} + \left(\frac{(1-\eta_B)A_B - \eta_B A_T}{Y_m} \right) \times \left(\frac{\beta_1}{\beta_1 - 1} \frac{Y_m}{\omega_m} \right)^{\beta_1} \tag{14}$$

and, naturally, $\gamma_T^* = 1 - \gamma_B^*$. Both firms' ex-ante option values result to:

$$F_B(x) = ((\gamma_B^* K_m - K_B)\, x_m^* - \xi_B Y_m) \left(\frac{x}{x_m^*} \right)^{\beta_1} \tag{15}$$

and:

$$F_T(x) = (((1-\gamma_B^*) K_m - K_T)\, x_m^* - (1-\xi_B) Y_m) \left(\frac{x}{x_m^*} \right)^{\beta_1} \tag{16}$$

Proof. See Appendix. □

From the above derived results, we can conclude that the timing of the merger is not affected by the firms' threat values. Rather, the threat values have an impact on the

[3]This approach has been previously used by Alvarez and Stenbacka (2006) and Margsiri et al. (2008), among others.

sharing rule ($\gamma^*_{B,T}$) and option values $F_{B,T}(x)$, respectively. In particular, the higher a firm's threat value, the larger the share it captures from the overall equity value of the new formed entity, which raises the attractiveness of merging expressed by the corresponding option value.

3.3 When do tender offer bids take place?

We now study the conditions under which one M&A strategy is preferable over the other, i.e. when mergers or tender offers dominate as a first best alternative.

Let us begin by analyzing one extreme scenario: if $\omega_o = \omega_m = \omega$ and $Y_o = Y_m = Y$ it is straightforward to show that the results reflect common knowledge in the domain of game theory, i.e. the inefficiency of a non-cooperative game induced outcome, when compared to that of a cooperative game. In particular, the inefficiency in our setting is related to the timing policy of both alternatives, as mergers occur sooner than tender offers (i.e. $x^*_m(\omega, Y) < x^*_o(\omega, Y)$).[4] If, however, the level of synergies is asymmetric, such that $\omega_o > \omega_m$, tender offers can be optimally accepted, either earlier or later than mergers. Thus, we differentiate between early and late tender offers.

Early tender offers

A closer look at Equations (6) and (13) reveals that high synergies of a tender offer may lead to a reversed order of the corresponding timing thresholds. Hence, the following proposition summarizes the conditions under which early tender offers materialize.

Proposition 3. *If the synergy level associated with a tender offer is larger than a critical synergy level (ω_t) early tender offers are conceivable, i.e. $x^*_o < x^*_m$:*

$$\omega_o > \omega_t = \frac{\beta_1 - \epsilon_B}{\beta_1 - 1} \frac{Y_o}{Y_m} \omega_m > \omega_m \tag{17}$$

where $Y_o > Y_m$ ensures that $\omega_t > \omega_m$.

Proof. See Appendix. □

However, a lower threshold could be not sufficient to motivate the bidder to place an optimal bid. In fact, the synergies associated with the tender offer must assure that, at the timing of the tender offer, the bidder's intrinsic value has to be greater than the foregone option value associated with the merger alternative. Hence, the following proposition states the condition under which a tender offer is a dominant strategy for the bidder.

[4] This timing inefficiency of tender offer bids as already been discussed extensively in the literature (see Lukas et al., 2019, among others).

Proposition 4. *If the synergy level associated with a tender offer ω_o is larger than ω_t and surpasses a critical synergy level (ω_{e_B}) early tender offers are optimal for the bidder:*

$$\omega_o > \omega_{e_B} = \left(\frac{(\beta_1 - 1)\eta_B}{\beta_1 - \epsilon_B} \frac{Y_m}{Y_o} \right)^{1/\beta_1} \omega_t < \omega_t \tag{18}$$

Proof. See Appendix. □

Since $\omega_{e_B} < \omega_t$, an early takeover timing ensures that the value of the tender offer dominates always the value of the merger for the bidder.

While these results provide information when tender offers can be considered earlier than mergers and under which conditions they become valuable for the bidder inducing him to place a tender offer bid, we have to analyzed the target's reaction in order to conclude whether early tender offers finally materialize. In particular, given the structure of our non-cooperative game, should $x(t)$ hit $x_o^*|_{\omega_o > \omega_t}$, the bidder firm offers the optimal premium $\psi^*(\omega_o)$ (see Equation (7)) to the shareholders of the target firm, which, in turn, decide on their own best interest. Two outcomes are possible. First, the target's shareholders accept the bid and the game ends. Second, the target's shareholder refuse the bid and wait for $x(t)$ to hit $x(t) = x_m^*$ which will trigger a subsequent merger. Accordingly, the shareholders of T will only accept the bid if the tender offer synergies (which will impact the offered premium) lead to an intrinsic value that is larger than the option to wait for a later merger. Thus, the following proposition shows the critical synergy that induces both firms to commit to early tender offers.

Proposition 5. *If the synergy level associated with a tender offer ω_o is larger than ω_t and surpasses a critical synergy level (ω_e) the shareholders of the target will accept the bid and early tender offers materialize:*

$$\omega_o > \omega_e = \max \left[\left(\frac{1 - \eta_B}{1 - \epsilon_B} \frac{Y_m}{Y_o} \right)^{1/\beta_1}, 1 \right] \omega_t \tag{19}$$

Proof. See Appendix. □

Against this background, a second result becomes obvious. If synergies are not high enough to stimulate T's shareholders to accept the bid, i.e. if $\omega_t < \omega_o < \omega_e$, then it is still possible for both firms to reach an agreement. In particular, since $x = x_m^* > x_o^*|_{\omega_m < \omega_t < \omega_o < \omega_e}$ firm B and T optimally opt for a merger with lower synergies in the future, as soon as $x(t)$ hits x_m^* from below. Notice that no threat values are considered in the case of this subsequent negotiation, as the threshold for the tender offer has already been achieved.

Late tender offers

Finally, we need to consider that timing efficient mergers, i.e. that occur earlier than takeovers, may be less valuable than late tender offers as the continuation value of the tender offer reveals to be more valuable ($A_B {x_m^*}^{\beta_1} > F_B(x_m^*), A_T {x_m^*}^{\beta_1} > F_T(x_m^*)$) for both parties. Again, we can define a critical synergy level that indicates when such a scenario materializes.

Proposition 6. *If the synergy level associated with a tender offer ω_o is larger than ω_l i.e.,:*

$$\omega_o > \omega_l = \left(\frac{\beta_1 - 1}{(\beta_1 - 1) + \beta_1(1 - \epsilon_B)} \frac{Y_m}{Y_o} \right)^{1/\beta_1} \omega_t < \omega_t \tag{20}$$

but smaller than ω_t both firms will leave the merger option unexercised and opt for a late tender offer strategy.

Proof. See Appendix. □

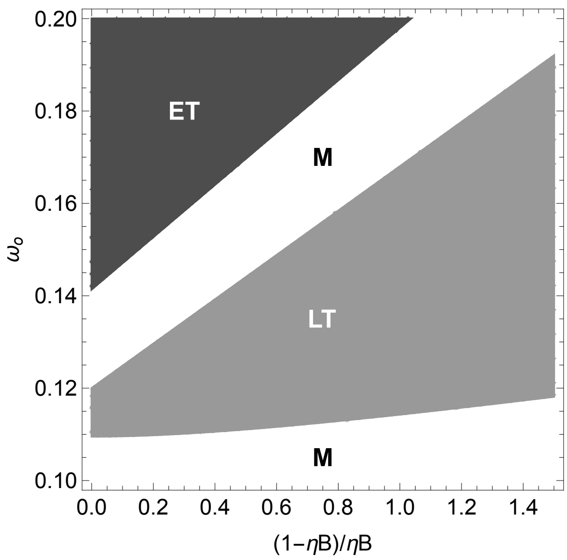
It is possible to show that the condition ω_l applies both for bidder and target firms, as natural result of the Nash bargaining solution.

4 Comparative statics and empirical predictions

In this section we present a comparative statics for two main drivers of M&A strategies. We study how volatility and firms' relative size affect the choice between tender offers and mergers. For low levels of tender offer synergies, the merger is always the best choice for the firms, regardless the relative size or the volatility (see Figures 1 and 2).

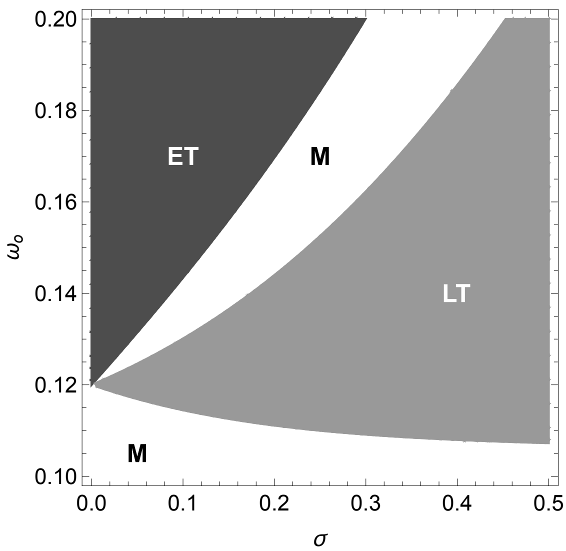
We focus our analysis in the region where tender offers become a viable strategy, i.e. in the region where the synergy of a tender offer is sufficiently larger than that of a merger ($\omega_o > \omega_t$). In that region we can observe a U-shaped effect of relative size (Figure 1) and uncertainty (Figure 2) on the choice of tender offers over mergers. Early tender offers are the best strategy for a small relative size of the target and low uncertainty, and late takeovers become optimal for a large relative size of the target and high uncertainty. Mergers should be chosen for intermediate relative sizes and uncertainty levels. The boundaries between these three regions are ω_e (Proposition 5) and ω_t (Proposition 3), respectively. The U-shaped relationship between the strategy choice exists if both boundaries increase with respect to the parameter of interest.

We study the effect of relative size by assuming that the bargaining power of the bidder is proportional to the its size ($\eta_B = K_B/(K_B + K_T)$), and that, in a merger, the bidder's transaction cost is proportional to its size ($\xi_B = K_B/(K_B + K_T)$), whereas that cost is larger in the case of a tender offer ($\epsilon_B > \xi_B$). Under this setting, the effect of the firms' size on the M&A strategy can be studied as the effect of the bargaining power η_B, and



$\omega_m = 0.1$, $Y_o = 0.12$, $Y_m = 0.1$, $\xi_B = \eta_B$, $\epsilon_B = \eta_B + 0.4(1 - \eta_B)$, $r = 0.04$, $\alpha = 0$, and $\sigma = 0.2$. ET = Early tender offer; LT = Late tender offer; M = Merger.

Figure 1: Optimal M&A strategy: sensitivity to the relative size.



$\omega_m = 0.1$, $Y_o = 0.12$, $Y_m = 0.1$, $\eta_B = 2/3$, $\xi_B = \eta_B$, $\epsilon_B = \eta_B + 0.4(1 - \eta_B)$, $r = 0.04$, $\alpha = 0$. ET = Early tender offer; LT = Late tender offer; M = Merger.

Figure 2: Optimal M&A strategy: sensitivity to uncertainty

the effect of target's relative size ($\theta = (1 - \eta_B)/\eta_B$), as the effect of the target's relative bargaining power. Accordingly, the following corollary holds:

Corollary 1. *As the target's relative size increases, early tender offers require even higher synergies to be preferable to mergers ($\partial\omega_e/\partial\theta > 0$), while late tender offers require not so high synergies to be preferable to mergers ($\partial\omega_t/\partial\theta > 0$).*

Figure 1 illustrates effects presented in Corollary 1. In fact, we see that, for a wide range of sufficiently large and meaningful tender offer synergies the non-monotonic effect is shown. Based on this analysis, the following testable hypothesis can be formulated:

Hypothesis 1. *For sufficiently large (and meaningful) tender offer synergies, the likelihood of tender offers has a U-shaped relationship with firms' relative sizes.*

Regarding the effect of uncertainty, the following corollary holds:

Corollary 2. *As the market uncertainty increases, early tender offers require even higher synergies to be preferable to mergers ($\partial\omega_e/\partial\sigma > 0$), while late tender offers require not so high synergies to be preferable to mergers ($\partial\omega_t/\partial\sigma > 0$).*

Figure 2 illustrates this corollary. Firms operating in moderate volatile industries (or in periods of moderate volatility) will be more prone to enter in mergers deals, while preferring tender offers for low and high levels of volatility. Accordingly to this analysis, the following testable hypothesis can be formulated:

Hypothesis 2. *For sufficiently large (and meaningful) tender offer synergies, the likelihood of tender offers has a U-shaped relationship with uncertainty.*

We started by assuming that the synergy of a tender offer is larger than that of a merger, which allowed us to study the conditions under which costly tender offers may occur. In addition, however, our model allows also to relate the synergies with the overall net payoff for the firms at the threshold (when the deal takes place), subject to the chosen strategy. Notice that the announcement of the deal reveals two important pieces of information: the threshold of the deal and the strategy chosen by the firms.

Let us compare the overall net payoff of a tender offer with that of a merger at the moment when each take place. For that, we use the payoffs–component of equations (8) and (9), and (15) and (16), ignoring the respective stochastic discount factors. By computing the difference between the payoffs of both strategies (i.e. the overall payoff of tender offers minus the overall payoff of mergers) we are able set the following corollary:

Corollary 3. *The payoff of a tender offer exceeds that of a merger, when measured at time of the deal.*

From this result we can conjecture that the synergies revealed by tender offers are larger than those revealed in merger deals:

Hypothesis 3. *At the time of the deal, larger synergies are revealed when tender offers are chosen.*

5 Empirical Analysis

5.1 Data and Sample Characteristics

Our sample comprises deals of US-based bidders and targets for a 35 years period, between January 1, 1985 and December 31, 2019. The data was collected from Refinitiv's SDC Platinum M&A, WorldScope and DataStream databases. The following criteria were applied:

- Both the bidder and the target must be listed.
- The bidder must hold less than 50% (i.e., considering also the deals where the bidder holds a toehold on the target) and acquire 100% of the target firm.
- All acquisitions have to be completed.
- Transactions with insufficient data in the estimation period, as well as in the event window, were excluded.

To be consistent with the literature, we excluded heavily regulated utilities, banking, and insurance industries (i.e. Fama&French 49 industries SIC 31, SIC 45, SIC 46) (see Offenberg and Pirinsky (2015), among others). A M&A deal is classified as a tender offer as in Refinitiv's SDC Platinum M&A database. Our final sample consists of 1769 deals of which 22% (389) are classified as tender offers and the remaining 78% (1,380) are classified as mergers.

Table 1 presents the distribution of mergers and tender offers over time. As can be seen, the majority of annual takeover activity was observed between 1998 and 2007. During this period tender offers accounted for roughly one-fourth of overall deals. The highest proportion of tender offers was in 1985 (67%) and the lowest was in 2005 (6%). However, there is no gradual decline in tender offers over time. In particular, since the beginning of 2000, the percentage number of tender offers alternates between 10% and 30% in our sample, indicating their ongoing attractiveness even in recent years.

The main results of our model is that the choice of acquisition method is determined by the differences in size and the level of uncertainty. In particular, we use $RELSIZE$ measured by the ratio of the market value of total assets of the target over the market

Table 1: Number of deals per year

Year	Deals	Tender offers	Mergers	% Tender offers
1985	3	2	1	67
1986	14	9	5	64
1987	5	3	2	60
1988	17	11	6	65
1989	13	7	6	54
1990	9	1	8	11
1991	9	4	5	44
1992	11	3	8	27
1993	11	2	9	18
1994	23	7	16	30
1995	32	6	26	19
1996	29	10	19	34
1997	76	19	57	25
1998	127	22	105	17
1999	144	34	110	24
2000	116	32	84	28
2001	108	25	83	23
2002	67	21	46	31
2003	68	14	54	21
2004	78	8	70	10
2005	72	5	67	7
2006	71	6	65	8
2007	69	19	50	28
2008	53	15	38	28
2009	49	13	36	27
2010	59	15	44	25
2011	37	7	30	19
2012	46	7	39	15
2013	36	3	33	8
2014	47	11	36	23
2015	70	18	52	26
2016	56	11	45	20
2017	47	10	37	21
2018	52	4	48	8
2019	45	5	40	11

value of total assets of the bidder both at the end of the year prior to the announcement of the transaction, and uncertainty measured by the volatility, $VOLA$, of the target firm's industry returns using Fama&French portfolios. Finally, we control for a number of bidder and target, and deal characteristics in the fiscal year before the acquisition for both the target and the bidder. The bidder and target attributes that we consider are firm size, Tobin's Q, leverage and return-on-assets. Here, $BSIZE$ and $TSIZE$ denote the bidder's and the target's size as measured by the natural logarithm of market value while $BLEV$ and $TLEV$ measure both firm's leverage as estimated by the ratio of total debt to total assets. Finally, $BTOBINQ$ and $TTOBINQ$ measure the deal partner's Tobin's Q and are estimated by the ratio of market value and book value while $BROA$ and $TROA$ measure the return-on-asset for bidder and target for which we divided the firm's net income before depreciation by the book value of total assets.

The deal characteristics include deal size, industry relatedness, whether the deal was payed in cash, subject to multiple bidders or whether the bidder has previous ties to the target by means of a toehold. In particular, industry relatedness, DIV and $CASH$ are dummy variables which take the value 1 if the bidder and target belong to different industries and the deal is fully paid in cash. Alike, $TOEHOLD$ and $COMPBID$ are dummy variables which take the value 1 if the bidder holds a toehold in the target or more than one firm bid for the target. Finally, we measure $SIZE$ as the logarithm of the deal's transaction value. Table (8) in the Appendix summarizes the way we have estimated our key and control variables and provides information on the sources we used to estimate them.

As reported in Table 2 the target firm size $TSIZE$ in a tender offer is significantly smaller than in mergers in our sample. This also holds when measured relatively, i.e. the target firms' relative size ($RELSIZE$) is on average 0.239 while it is 0.474 in mergers. Moreover, tender offers tend to be performed in less volatile environments than mergers. The difference in $VOLA$ is significant at the ten percent level. As opposed to findings in the literature, we furthermore find that tender offers tend to be smaller than mergers. Average deal value ($SIZE$) of tender offers is smaller than for mergers and this difference is significant ($p < .05$). Moreover, tender offers seem to be more often a consequence of prior links. As Table 2 indicates, bidders hold toeholds more often in tender offers as opposed to mergers. The difference is statistically significant at the one percent level. The acquisition forms, however, do neither differ with respect to the performance of the bidder nor the target. Target and bidder firm's average values for $BTOBINQ$ and $TTOBINQ$ are quite similar. Finally, our sample indicates that tender offers tend to attract more than one bidder, are more diversified and are payed more likely by cash.

5.2 Results

Relative size and uncertainty

Our model demonstrates that the choice of M&A strategy is driven by relative size and uncertainty as stated in hypotheses 1 and 2. In order to validate their impact on the choice

Table 2: Sample characteristics by strategy

Variable	Tender offer	Merger	Difference
RELSIZE	0.246	0.455	-0.209^{***}
VOLA	0.221	0.229	-0.009^{*}
BROA	0.063	0.022	0.041^{***}
BLEV	0.201	0.250	-0.049^{***}
BTOBINQ	2.097	2.074	0.023
BSIZE	8.572	8.113	0.458^{***}
TROA	−0.062	−0.056	−0.006
TLEV	0.195	0.249	-0.053^{***}
TTOBINQ	1.990	2.001	−0.011
TSIZE	5.961	6.245	-0.283^{***}
TOEHOLD	0.077	0.033	0.044^{***}
DIV	0.442	0.363	0.079^{***}
COMPBID	0.090	0.028	0.062^{***}
SIZE	5.944	6.184	-0.240^{**}
CASH	0.694	0.257	0.437^{***}

*** p < .01; ** p < .05; * p < .1

of acquisition method empirically we use a logit model in which the dependent variable is the likelihood of a tender offer:

$$\begin{aligned} TENDER_j =& \alpha + \gamma_1 RELSIZE_j + \gamma_2 VOLA_j + \gamma_3 RELSIZE_j^2 \\ &+ \gamma_4 VOLA_j^2 + \sum_{c=1}^{m} \gamma_c CONTROLS_{c,j} + \epsilon_j \end{aligned} \tag{21}$$

where $TENDER_j$ denotes acquisition method used in deal j and equals one for tender offer deals, and zero otherwise. The quadratic terms are included to capture the U-shaped effects of both variables.

The first model 1 in Table 3 serves as our base model and contains only the key determinants of our theoretical model as explanatory variables while the last two models 2 and 3 include additional control variables. In particular, model 2 adds firm specific control variables while model 3 adds additional deal characteristics to the base model. Models 4-6 control for year dummies.

Starting with our base model first, we find that the impact of $RELSIZE$ is U-shaped (hypothesis 1), as the coefficient of $RELSIZE$ is negative and the coefficient of $RELSIZE^2$ is positive ($p < .01$)). Hence, firms are less likely to opt for a tender offer for more asymmetric sizes. Alike, our model predicts a non-monotonic effect of uncertainty on the choice of tender offer (hypothesis 2). In particular, the likelihood of tender offers initially drops as the volatility increases and then increases for higher volatility levels. Hence, we would expect a negative coefficient for $VOLA$ and a positive coefficient for the quadratic term. As can be observed in model (1), the $VOLA$ variable has a significant negative coefficient and the $VOLA^2$ variable presents a significant positive coefficient. This results supports our hypothesis that the choice of acquisition method depends non-monotonically on the magnitude of uncertainty. Adding control variables to our base model does not deter our findings. Neither the firm (model 2), the deal characteristics (model 3), nor controlling for year dummies (models 4-6) do change the signs of our key variables, nor do they change their significance.

Synergies

According to our theoretical model, another main result is that tender offers exhibit higher realized synergies at the time of completion, i.e. when comparing their combined payoffs at their timing triggers (hypothesis 1). In order to empirically test this hypothesis, we rely on an event study research design combined with a propensity score matching model to deal with endogeneity issues. In particular, event studies are based on the assumption that capital markets are semi-strong efficient, i.e. the listed share price prices in all publicly available information. In case of an M&A announcement, unexpected stock market reactions do reveal information about the economic gains arising from synergies (e.g.: Bradley et al., 1988). Consequently, against the background of our model the main conjecture is that the capital market reaction of tender offers are higher and differ significantly from those observed in mergers.

We follow Wang and Xie (2009) and Bradley et al. (1988), and use the cumulative combined abnormal returns over a certain time window to proxy for the synergies generated by the acquisition method. For each acquisition, the returns are computed for the value-weighted portfolio of the bidder and the target, with weights based on the market capitalization on the day before the event window beginning. The target weight is adjusted by subtracting from its market capitalization the value of toehold held by the bidder. The expected returns are computed using the market model with the estimation window $[-250; -21]$, and we use the CRSP return series from Kenneth French's website for the market returns. To estimate a deal's synergies, cumulative abnormal returns (CAR) are calculated over an event window of five days prior announcement to five days past announcement ($[-5; +5]$). In order to compare the synergy levels of the two different acquisition forms, we calculate the average CAR for each acquisition strategy.

As the following Table 4 presents, the average combined $CAR_{[-5,5]}$ of the whole sample is weakly positive, i.e. 0.014 but significant different from zero at the one percent level indicating that the capital market views all acquisitions as marginally value enhancing. Looking at the level of the acquisition method, we find that both acquisition method's average CARs are positive and significant. Against the background of hypothesis 3, we find

Table 3: M&A strategy

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
RELSIZE	-2.021^{***}	-1.994^{***}	-1.717^{***}	-2.177^{***}	-2.019^{***}	-1.750^{***}
	(0.300)	(0.467)	(0.481)	(0.323)	(0.488)	(0.516)
RELSIZE^2	0.512^{***}	0.509^{***}	0.416^{***}	0.562^{***}	0.534^{***}	0.443^{***}
	(0.099)	(0.129)	(0.130)	(0.104)	(0.133)	(0.137)
VOLA	-6.315^{**}	-7.385^{**}	-6.722^{**}	-10.363^{**}	-14.271^{***}	-14.833^{***}
	(3.136)	(3.218)	(3.354)	(4.047)	(4.290)	(4.685)
VOLA^2	8.832^{*}	10.423^{*}	10.738^{*}	11.963^{*}	16.420^{**}	17.963^{**}
	(5.358)	(5.554)	(5.722)	(6.396)	(6.789)	(7.420)
BROA		3.175^{***}	2.552^{***}		3.153^{***}	2.218^{***}
		(0.832)	(0.739)		(0.861)	(0.774)
BLEV		-1.362^{***}	-1.205^{***}		-1.681^{***}	-1.394^{***}
		(0.394)	(0.390)		(0.450)	(0.474)
BTOBINQ		-0.119^{**}	-0.022		-0.145^{**}	-0.072
		(0.055)	(0.055)		(0.060)	(0.066)
BSIZE		-0.034	-0.161^{**}		0.009	-0.109
		(0.059)	(0.068)		(0.064)	(0.075)
TROA		-0.522^{*}	-0.233		-0.563^{*}	-0.350
		(0.276)	(0.293)		(0.300)	(0.339)
TLEV		-0.675^{**}	-0.009		-1.081^{***}	-0.464
		(0.284)	(0.311)		(0.315)	(0.359)
TTOBINQ		-0.063	-0.020		-0.052	-0.018
		(0.052)	(0.050)		(0.053)	(0.052)
TSIZE		0.041	0.237^{**}		0.047	0.276^{**}
		(0.064)	(0.105)		(0.067)	(0.112)
TOEHOLD			0.856^{***}			0.619^{*}
			(0.275)			(0.318)
DIV			0.106			0.059
			(0.135)			(0.147)
COMPBID			1.456^{***}			1.531^{***}
			(0.277)			(0.326)
SIZE			-0.088			-0.058
			(0.089)			(0.095)
CASH			1.679^{***}			2.200^{***}
			(0.154)			(0.192)
Year dummies?	No	No	No	Yes	Yes	Yes
N	1769	1769	1769	1769	1769	1769

This table reports the coefficients from logistic regressions of the probability for a M&A deal to be structured as a tender offer. Detailed definitions of all variables are in Table 8 in appendix. Numbers between parenthesis are the coefficient standard errors, robust to heteroscedasticity. ***, ** and * indicate statistical significance at the .01, .05, and .1 level, respectively.

that tender offers exhibit higher combined abnormal returns than mergers. In particular, our findings reveal that the average $CAR_{[-5,5]}$ of tender offers is more than three times higher than for mergers, i.e. 0.031 as compared to 0.009. The difference between them is significant at the one percent level which supports our hypothesis that high synergistic deals tend to be designed as tender offers. In order to check the robustness of our findings we calculated the CARs for two alternative windows, i.e. $CAR_{[-30,5]}$ and $CAR_{[0,5]}$. For both cases, the results remain unchanged, i.e. tender offers observe significantly higher combined abnormal returns than mergers (see Table 4).

Table 4: Average Cumulative Abnormal Returns

Window	All deals (N=1769)	Tender offers (N=389)	Mergers (N=1380)	Difference
$[-5, 5]$	0.014***	0.031***	0.009***	0.021***
$[0, 5]$	0.010***	0.027***	0.006***	0.021***
$[-10, 5]$	0.018***	0.030***	0.014***	0.015**

$^{***}p < .01;^{**}p < .05;^{*}p < .1$

To further improve the quality of our empirical analysis we apply a multivariate regression with the combined abnormal returns as the dependent variable, i.e.:

$$CAR_j = \alpha + \gamma_1 TENDER_j + \sum_{c=1}^{m} \gamma_c CONTROLS_{c,j} + \epsilon_j \tag{22}$$

where CAR_j is the observed CAR of deal j. Here, we use the event window of five days prior to five days past the announcement.

Table 5 reveals that tender offers are associated with higher CARs than mergers. The dummy variable *TENDER* is positive and significant at the one percent level. This finding remains very robust once we add firm level, deal level characteristic, and year dummies.

Since we do not observe the potential synergies/payoff in the alternative M&A strategy, our analysis and results may be biased. To circumvent such a problem we performed a propensity score matching to check the robustness of our findings. In particular, we match every tender offer with an otherwise similar merger and compare the CARs of the two deals. We follow Offenberg and Pirinsky (2015) and model the choice of tender offer by means of a probit model in the first stage. The coefficients are used to estimate the probability score, i.e. the probability of a deal being structured as a tender offer. In the second stage, we match each tender offer with a merger and compare the CARs between them. The differences in CARs, i.e. the average treatment effects and its statistical significances are reported in Table 6.

For our base model we find that synergies in an average tender offer are 1.2% higher that the synergies in an average merger. The difference is statistically significant at the

Table 5: Deal Combined CARs

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TENDER	0.021^{***}	0.024^{***}	0.015^{***}	0.021^{***}	0.025^{***}	0.016^{***}
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
BROA		0.033	0.034		0.039	0.039
		(0.028)	(0.028)		(0.029)	(0.029)
BLEV		0.021	0.023		0.021	0.023
		(0.014)	(0.014)		(0.015)	(0.015)
BTOBINQ		-0.004^{*}	-0.003		-0.003	-0.002
		(0.002)	(0.002)		(0.002)	(0.002)
BSIZE		-0.007^{***}	-0.009^{***}		-0.008^{***}	-0.009^{***}
		(0.001)	(0.002)		(0.001)	(0.002)
TROA		0.0003	0.006		0.005	0.008
		(0.013)	(0.013)		(0.013)	(0.013)
TLEV		-0.010	-0.007		-0.007	-0.006
		(0.011)	(0.011)		(0.011)	(0.011)
TTOBINQ		-0.002	-0.002		-0.002	-0.002
		(0.002)	(0.002)		(0.002)	(0.002)
BSIZE		0.004^{**}	0.011^{***}		0.003	0.010^{***}
		(0.002)	(0.004)		(0.002)	(0.004)
TOEHOLD			-0.014			-0.011
			(0.010)			(0.010)
DIV			-0.005			-0.005
			(0.005)			(0.005)
COMPBID			-0.005			-0.005
			(0.010)			(0.010)
SIZE			-0.007^{*}			-0.006
			(0.004)			(0.004)
CASH			0.028^{***}			0.024^{***}
			(0.005)			(0.005)
Year dummies?	No	No	No	Yes	Yes	Yes
N	1769	1769	1769	1769	1769	1769
Adj. R-squared	0.008	0.028	0.046	0.013	0.038	0.048

This table reports the coefficients from OLS regressions of the deal's 10-days CARs. Detailed definitions of all variables are in Table 8 in appendix. Numbers between parenthesis are the coefficient standard errors, robust to heteroscedasticity. $^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

5 percentage level. When we expand the probit to include for firm characteristics, the findings remain unchanged, i.e. the average tender offer still exhibits higher synergies. Alike, adding deal characteristics does not change the results indicating that our findings seem to be robust. We furthermore analyzed the robustness of our findings by introducing year dummies. As the table reports, all three models, i.e. model (4)-(6) indicate that tender offers still exhibit higher CARs as their counterparts.

Table 6: Difference of synergies with propensity scores

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	0.012^{**}	0.018^{***}	0.012^{**}	0.023^{***}	0.022^{***}	0.018^{***}
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
N	778	778	778	778	778	778

In the first step, the propensity of the acquisition method being a tender offer is estimated with a probit model matching the models in Table 3. In the second step, the difference of the synergies between tenders offers and mergers is estimated using a propensity score matching with replacement. Numbers between parenthesis are the coefficient standard errors, robust to heteroscedasticity. ***, ** and * indicate statistical significance at the .01, .05, and .1 level, respectively.

5.3 Robustness

In order to analyze the quality of our results, we performed robustness checks. In particular, we tested whether our results change if we only consider deals from 2001 to 2019 to neglect the regulatory uncertainties around tender offers in the 1980s and 1990s. As Table 7 reports in models 1 and 2, the non-monotonic effect of size on the choice remains highly significant, however, the non-linear impact of uncertainty remains only significant once we control for year dummies. We also checked the robustness of our uncertainty measure. In particular, we estimated the volatility using a 2-years window and rerun the analysis. In model 3 the non-monotonic impact of uncertainty on the probability for a tender offer vanishes while it remains statistically significant and shows the proper signs once we control for year dummies (model 4).

6 Conclusions

Given the increasing prominence of M&A deals in today's global economy, their increasing valuation levels, and their strategic importance for firms' competitiveness it is surprising how little about their trends and in particular their dynamics has been explored in depth. The paper at hand builds on recent advances in the domain of dynamic M&A games under uncertainty and looks closer at determinants that drive the choice between mergers and tender offers.

Table 7: M&A strategy: Robustness checks

	Model 1	**Model 2**	**Model 3**	**Model 4**
RELSIZE	-2.362^{***}	-2.458^{***}	-1.687^{***}	-1.732^{***}
	(0.721)	(0.732)	(0.482)	(0.516)
RELSIZE^2	0.482^{***}	0.513^{***}	0.404^{***}	0.437^{***}
	(0.184)	(0.190)	(0.131)	(0.137)
VOLA	-6.609	-19.179^{***}	0.404	-12.726^{***}
	(4.370)	(6.295)	(3.015)	(4.264)
VOLA^2	11.895^{*}	24.163^{***}	0.357	14.601^{**}
	(7.007)	(9.135)	(4.997)	(6.349)
BROA	1.748^{**}	1.871^{**}	2.590^{***}	2.168^{***}
	(0.831)	(0.855)	(0.734)	(0.769)
BLEV	-1.089^{**}	-1.493^{**}	-1.099^{***}	-1.330^{***}
	(0.501)	(0.586)	(0.387)	(0.474)
BTOBINQ	0.062	0.015	-0.025	-0.068
	(0.061)	(0.073)	(0.055)	(0.066)
BSIZE	-0.198^{**}	-0.211^{**}	-0.168^{**}	-0.109
	(0.082)	(0.088)	(0.068)	(0.075)
TROA	-0.584^{*}	-0.530	-0.200	-0.339
	(0.350)	(0.377)	(0.294)	(0.337)
TLEV	-0.281	-0.474	0.028	-0.429
	(0.403)	(0.418)	(0.311)	(0.357)
TTOBINQ	0.021	0.015	-0.013	-0.015
	(0.059)	(0.062)	(0.049)	(0.052)
TSIZE	0.168	0.201	0.234^{**}	0.274^{**}
	(0.133)	(0.145)	(0.104)	(0.112)
TOEHOLD	0.579	0.811^{*}	0.852^{***}	0.618^{*}
	(0.423)	(0.475)	(0.275)	(0.317)
DIV	0.014	0.046	0.119	0.065
	(0.175)	(0.185)	(0.135)	(0.147)
COMPBID	1.489^{***}	1.446^{***}	1.476^{***}	1.530^{***}
	(0.346)	(0.403)	(0.279)	(0.325)
SIZE	0.052	0.072	-0.068	-0.055
	(0.119)	(0.130)	(0.088)	(0.096)
CASH	1.374^{***}	1.583^{***}	1.708^{***}	2.202^{***}
	(0.219)	(0.238)	(0.155)	(0.193)
Year dummies?	No	Yes	No	Yes
N	1130	1130	1769	1769

This table reports the coefficients from logistic regressions of the probability for a M&A deal to be structured as a tender offer. The first two models include deals from 2001 to 2019 and in the last two models volatility is estimated using a 2-years window. Detailed definitions of all variables are in Table 8 in appendix. Numbers between parenthesis are the coefficient standard errors, robust to heteroscedasticity. ***, ** and * indicate statistical significance at the .01, .05, and .1 level, respectively.

Specifically, our theoretical model sheds new light for understanding how uncertainty, as well as relative size of firms, affect the choice of the M&A strategy. It is shown that these determinants have an important impact on the choice of the strategy. However, and more importantly, it is also shown that the impact is non-monotonic. In fact, tender offers become more likely in a context of relatively low/high volatility, or when firms are more asymmetric in size. When these determinants assume intermediate values, mergers tend to be more likely. We perform an empirical study which shows that these theoretical results find support in empirical evidence. Finally, our model also establishes that the net payoff of tenders offers tend to be larger than that of friendly mergers, suggesting that synergies revealed by the CARs should be larger for the former. We also find empirical support in this respect.

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Appendix

A Proofs

Proof of Proposition 1. Solving the maximization problem in Equation (4), T's threshold for any given ψ is obtained:

$$x_o^*(\psi) = \frac{\beta_1}{\beta_1 - 1} \frac{(1 - \epsilon_B) Y_o}{(\psi - 1) K_T} \tag{23}$$

This optimal threshold is anticipated by B. Incorporating (23) into Equation (5) and maximizing for ψ, the solution presented in Equation (7) is obtained. Finally, the threshold that incorporates the optimal premium is $x_o^* \equiv x_o^*(\psi^*)$, for which simply incorporate (7) into (23) and obtain (6). □

Proof of Proposition 2. On a cooperative game the optimal investment threshold equals the central planner's optimal investment threshold. Hence, the central planner's objective function equals:

$$\max_{x_m^*} \left[(\omega_m x_m^* - Y_m) \left(\frac{x(t)}{x_m^*} \right)^{\beta_1} \right] \tag{24}$$

Equation (13) is the solution. The solution for the optimization problem (12), for any $x(t)$ is:

$$\gamma_B^*(x(t)) = \frac{(\eta_B \omega_m + K_B)\, x(t) + ((1 - \eta_B) A_B - \eta_B A_T)\, x(t)^{\beta_1} - Y_m(\eta_B - \varepsilon_B)}{K_m x(t)} \tag{25}$$

Computing the optimal stake at the optimal threshold, i.e., setting $x(t) = x_m^*$, and rearranging we get (14). □

Proof of Proposition 3. ω_t is obtained by solving $x_o^* = x_m^*$ (Equations (6) and (13)) for ω_o^*. Since $\beta_1 > 1$ and $1 > \epsilon_B > 0$, and assuming $Y_o > Y_m$, $\omega_t > \omega_m$. □

Proof of Proposition 4. Since no threat values are considered in the case early takeovers, as the threshold for the tender offer has already been achieved, it is possible to show that the merger options values become: The option values are:

$$G_B(x) = \frac{\eta_B Y_m}{\beta_1 - 1} \left(\frac{x}{x_m^*} \right)^{\beta_1} \tag{26}$$

$$G_T(x) = \frac{(1 - \eta_B) Y_m}{\beta_1 - 1} \left(\frac{x}{x_m^*} \right)^{\beta_1} \tag{27}$$

ω_{eB} is obtained by solving $A_B x^{\beta_1} = G_B(x)$ (Equations (8) and (26)) for ω_o^*. Since $\beta_1 > 1$, $1 > \eta_B > 0$ and $1 > \epsilon_B > 0$, and assuming $Y_o > Y_m$, $\omega_{eB} < \omega_t$. □

Proof of Proposition 5. ω_e is obtained by solving $A_T x^{\beta_1} = G_T(x)$ (Equations (9) and (27)) for ω_o^*. $\square$

Proof of Proposition 6. ω_l is obtained by solving $A_B x^{\beta_1} = F_B(x)$ (Equations (8) and (15)) or $A_T x^{\beta_1} = F_T(x)$ (Equations (9) and (16)) for ω_o^*. Since $\beta_1 > 1$ and $1 > \epsilon_B > 0$, and assuming $Y_o > Y_m$, $\omega_l < \omega_t$. $\square$

Proof of Corollary 1. Let $\theta = (1 - \eta_B)/\eta_B$. Then:

$$\frac{\partial \omega_{e,t}}{\partial \theta} = -{\eta_B}^2 \frac{\partial \omega_{e,t}}{\partial \eta_B} \tag{28}$$

Assuming that ϵ_B is increasing in η_B ($\partial \epsilon_B / \partial \eta_B > 0$), given that $\beta_1 > 1$, $1 > \eta_B > 0$ and $1 > \epsilon_B > 0$, assuming $Y_o > Y_m$, and noting that:

$$\frac{\partial \omega_e}{\partial \eta_B} = -\frac{1}{1-\eta_B} \frac{\beta_1 - \epsilon_B}{\beta_1(\beta_1 - 1)} \left(\frac{1-\eta_B}{1-\epsilon_B} \frac{Y_o}{Y_m} \right)^{1/\beta_1} \frac{Y_o}{Y_m} \omega_m < 0 \tag{29}$$

$$\frac{\partial \omega_e}{\partial \epsilon_B} = \frac{\epsilon_B}{\beta_1(1-\epsilon_B)} \left(\frac{1-\eta_B}{1-\epsilon_B} \frac{Y_o}{Y_m} \right)^{1/\beta_1} \frac{Y_o}{Y_m} \omega_m < 0 \tag{30}$$

we can state that:

$$\frac{\partial \omega_e}{\partial \eta_B} = \frac{\partial \omega_e}{\partial \eta_B} + \frac{\partial \omega_e}{\partial \epsilon_B} \frac{\partial \epsilon_B}{\partial \eta_B} < 0 \tag{31}$$

Similarly for late takeovers:

$$\frac{\partial \omega_t}{\partial \eta_B} = 0 \tag{32}$$

$$\frac{\partial \omega_t}{\partial \epsilon_B} = -\frac{1}{\beta_1 - 1} \frac{Y_o}{Y_m} \omega_m < 0 \tag{33}$$

we can conclude that:

$$\frac{\partial \omega_t}{\partial \eta_B} = \frac{\partial \omega_t}{\partial \eta_B} + \frac{\partial \omega_t}{\partial \epsilon_B} \frac{\partial \epsilon_B}{\partial \eta_B} < 0 \tag{34}$$

Finally, since $\partial \omega_{e,t} / \partial \eta_B < 0$, from Equation (28) $\partial \omega_{e,t} / \partial \theta > 0$. $\square$

Proof of Corollary 2. Since $\beta_1 > 1$, $1 > \eta_B > 0$ and $1 > \epsilon_B > 0$, assuming $Y_o > Y_m$, and noting that $\frac{1-\eta_B}{1-\epsilon_B} \frac{Y_o}{Y_m} > 1$ when $\omega_e > \omega_t$, for early takeovers:

$$\frac{\partial \omega_e}{\partial \beta_1} = -\left(\frac{1-\epsilon_B}{\beta_1 - 1} + \frac{\beta_1 - \epsilon_B}{{\beta_1}^2} \ln \left(\frac{1-\eta_B}{1-\epsilon_B} \frac{Y_o}{Y_m} \right) \right) \frac{1}{\beta_1 - 1} \left(\frac{1-\eta_B}{1-\epsilon_B} \frac{Y_o}{Y_m} \right)^{1/\beta_1} \frac{Y_o}{Y_m} \omega_m < 0 \tag{35}$$

Similarly for late takeovers:

$$\frac{\partial \omega_t}{\partial \beta_1} = -\frac{1-\epsilon}{(\beta_1-1)^2}\frac{Y_o}{Y_m}\omega_m < 0 \tag{36}$$

Noting that $\partial\beta_1/\partial\sigma < 0$:

$$\frac{\partial \omega_{e,t}}{\partial \sigma} = \frac{\partial \omega_{e,t}}{\partial \beta_1}\frac{\partial \beta_1}{\partial \sigma} > 0 \tag{37}$$

□

Proof of Corollary 3. The combined payoff of the bidder and target in a tender offer is $A_B + A_T$ at the tender offer threshold (Equations (8) and (9)):

$$\Pi_o = \frac{\beta_1 - 1 + \beta_1(1-\epsilon_B)}{(\beta_1-1)^2}Y_o \tag{38}$$

The combined payoff of the bidder and target in a merger is $A_B + A_T$ at the tender offer threshold (Equations (15) and (16), for late takeovers, and Equations (26) and (27), for early takeovers):

$$\Pi_m = \frac{1}{\beta_1-1}Y_m \tag{39}$$

Since $\beta_1 > 1$ and $1 > \epsilon_B > 0$, and assuming $Y_o > Y_m$, the tender offer payoff is always greater than the merger payoff:

$$\Pi_o - \Pi_m = \frac{1}{\beta_1-1}(Y_o - Y_m) + \frac{\beta_1(1-\epsilon_B)}{(\beta_1-1)^2}Y_o > 0 \tag{40}$$

□

B Variables definition

Table 8: Variables definition

Symbol	Description	Source
Deal characteristics		
RELSIZE	Market value of Total assets of the Target / Market value of Total assets of the Bidder	WorldScope
CASH	Dummy variable; 1 if value paid in cash = 100%; 0 otherwise	SDC
TOEHOLD	Dummy variable; 1 if the Bidder holds a toehold in the Target; 0 otherwise	SDC
DIV	Dummy variable; 1 if the Bidder and Target belong to different Fama&French 49 industries; 0 otherwise	SDC
SIZE	Log(Value of transaction)	SDC
COMPBID	Dummy variable; 1 where a third party launched an offer for the target while the original bid was pending; 0 otherwise	SDC
Firm characteristics		
VOLA	Volatility of the target, using Fama&French 49 industry portfolios	K.French's website
SIZE	Log(Market value of Total assets)	WorldScope
ROA	Net Income before Extraordinary Items/Preferred Dividends / Total Assets	WorlsScope
LEV	Total Debt / Total Assets	WorlsScope
TOBINQ	Market value of Total assets / Total Assets	WorlsScope