# Dynamic M&A Strategies under Uncertainty: Small Steps or a Big Leap?*

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**Abstract**

In this paper we study the entrance in a market by means of M&A when different strategies are available to the acquirer. One strategy is the big leap, where the company acquires a large incumbent; the other is the acquisition program moving in small steps, acquiring a minor company first and the larger player later on. The dynamic game-theoretic model furthermore considers alternative contract designs for the acquisition program, such as hostile, friendly or mix. We find that higher synergies between the buyer and the minor (large) incumbent will increase the chance of a mixed (pure hostile) M&A strategy, and that highly uncertain industries tend to exhibit more pure hostile acquisition programs than those with less significant uncertainties. Moreover, the model predicts that higher abnormal returns are only observed in the first acquisition, with stronger affects when the acquisition program is driven by the synergies with the large incumbent which supports recent findings in the empirical M&A literature. Moreover, abnormal returns are found to be significant when acquisition programs take place in less volatile industries. Finally, novel testable hypotheses for further empirical studies in the domain of M&A are derived from the model.

**Keywords:** M&A; Real Options; Sequential Investment; Cooperative and Non-cooperative Bargaining **JEL codes:** C73; D43; D81; D92; G31.

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## 1 Introduction

Mergers and acquisitions (M&A) are a key part of a corporate growth strategy as they allow firms to achieve economies of scale, access to new markets, or respond to economics shocks. Undoubtedly, M&As are among the largest investments that a firm will ever undertaken and thus few economic phenomenas gain as much research attention as the diverse forms of corporate takeovers, as stated by Betton et al. (2008). Exemplary, the chip manufacturer Broadcom Ltd only recently announced a $103 billion bid for the US-based Qualcomm Inc which is higher than the gross domestic product (GDP) of European countries such as Luxembourg, Slovak Republic, and Bulgaria.

While much is understood regarding the strategic motivation and economic reasoning of past merger waves (e.g. Schwert 2000), recent M&A pattern, however, have taught some distinctive new features that lack coherent theoretic reasoning. First, M&As are no longer geographically restricted where multinationals from industrialized countries predominantly acquire other industrial rivals or takeover targets in less industrialized countries. Rather, the last years have put Western firms under increased threat of being acquired by firms from emerging countries like China, India, Malaysia, among others. In particular, these emerging market firms (EMFs) have accelerated their catch-up process with Western competitors by acquiring firms in foreign markets, like Europe and the US (Barkema and Drogendijk 2007). For instance, *"Chinese firms (...) utilize German acquisitions as gateway to the European market (...). In this respect, M&A has often proven to be a viable market entry option for Chinese companies seeking growth and know-how in Germany"*[1]. Moreover, Luo and Tung (2007) emphasize that, when pursuing international expansion, EMFs frequently engage in series of aggressive acquisitions, typically buying critical assets from mature multinational companies.

[1] Report on Chinese Investors in Germany by PWC.

In addition, the growth strategies performed by EMFs have begun to mimicking what has become a second - and with no doubt more important- recent phenomena in takeover activities of Western multinationals, i.e. the establishment of serial acquisition programs (e.g. Ismail 2008). Some of the most active multiple acquirers like Cisco, GE, Microsoft, among others, are engaged in extensive acquisition programs where each acquired more than 50 companies (see Laamanen and Keil 2008).

A good example is Vodafone's acquisition program in the UK, which gave the company a dominating position in its home market, fundamental for the worldwide expansion (Smit and Moraitis 2015). By now, the literature on serial acquisitions and acquisition programs alike has acknowledged that multiple acquisitions create a strategic momentum due to, e.g., learning, synergies, or risk mitigation, which has motivated an extensive number of empirical research papers in the domain of finance and strategic management (see e.g., Amburgey and Miner 1992, Frick and Torres 2002, Rovit and Lemire 2003, Smit and Moraitis 2015). However, to date less attention has been given to the question why some firms prefer to follow the incremental acquisition steps over single big leaps. Alike, the finance literature dealing with the question whether serial acquisitions create substantial value show also mixed results; for example, while Rovit and Lemire (2003) find evidence that serial acquisitions create value, Fuller et al. (2002) and Billett and Qian (2008) find the opposite.

Apart from specifically analyzing strategic acquisition programs, this paper relates also to a broader theoretical literature on M&A dynamics, where *merger timing* plays an important role. In particular, this stream of real options literature acknowledges the shared real options available to both parties when negotiating the terms of the agreement in such contracting situations. Recent papers have investigated how merger timing and value creation are affected by the way M&A deals are settled, i.e. either friendly or hostile (Lambrecht 2004, Morellec and Zhdanov 2005, Lambrecht and Myers 2007, Thijssen 2008, Lukas and Welling 2012). The findings reveal that in hostile takeovers the bidder can claim a majority stake in the new entity due to its first-mover advantage. However, this is associated with timing inefficiencies, i.e. the hostile takeover occurs inefficiently late when compared with the friendly mergers as being the first-best. So far, however, the literature has predominantly neglected follow-up opportunities M&As generate which are at the essence of serial acquisition programs. There are only two exceptions. Firstly, Alvarez and Stenbacka (2006) look at the possibility of a later sell-off of parts of the new entity to a third party. Secondly, Hackbarth and Morellec (2008) look at subsequent growth options available to the new entity after a merger. Neither of these papers, however, look at compound shared options, i.e. the bargaining about the terms of the first transaction is affected by the bargaining outcome of a subsequent M&A transaction and so on.

Hence, to date some important research questions remain: First, under which circumstances is it optimal to engage in a serial acquisition program rather than follow a big leap? Obviously, a trade-off exists since acquiring more than one firm is costly but this acquisition can enhance subsequent bargaining power in follow-up acquisition. Second, what can we say about the strategy design (hostile/friendly/mix) of an acquisition program and how do uncertainty and synergies affect the optimal strategy design? Again a trade-off emerges since a hostile takeover allows the bidding firm to capture a greater share of the surplus but suffers on the other side from timing inefficiencies, i.e. hostile takeovers are settled inefficiently late. Consequently, discounting can marginalize the greater share of the surplus. Alike, there is no consensus whether an acquisition program accelerates market entry in general as opposed to a single transaction. And finally, under which circumstances do we see negative capital market reactions?

The present paper tries to answer to these questions and sheds light on the trade-offs by considering a new entrant's possibility in designing an optimal serial acquisition program when entering a new market with two incumbents serving as possible targets. We derive analytical closed-form solutions for the optimal contracts offered to both targets and contrast them against the single acquisition possibility. In general, we find that two contract solutions emerge when structuring the serial acquisition process. First, the new entrant might stepwise acquire the two incumbents, i.e. acquire the minor one first followed by a delayed acquisition of the prominent incumbent. In such a case, each contract is designed around the stand-alone value of each entity. Secondly, if the new entrant prefers to simultaneously acquire both incumbents, subsequent deal characteristics associated with the large incumbent affect the optimal contract design offered to the minor incumbent. Moreover, we find that the higher the synergies between the minor incumbent and the buyer the more likely he will choose a hostile takeover followed by a friendly merger strategy (a mixed strategy), while higher synergies between the prominent incumbent and the buyer stimulate a pure hostile M&A strategy, where both acquisitions are unsolicited. Finally, highly uncertain industries will exhibit more pure hostile motivated acquisition programs than industries with less significant uncertainties.

Regarding capital market reactions, the model predicts that higher abnormal returns are only observed in the first acquisition, while subsequent acquisitions do not exhibit any abnormal returns; also predicts that the effects are stronger when the acquisition program is essentially motivated by the synergies with the large incumbent. Additionally, abnormal returns observed in acquisition programs taking place in less volatile industries are higher than in those industries with high volatility.

The paper unfolds as follows. Section 2 presents the derivation of the model for the two alternative strategies, the big leap and small steps, as well as for the different contract designs in the acquisition program. The rules for the best strategy to follow are also presented. Section 3 analyses the optimal strategy choices. Section 4 addresses the capital market reactions and Section 5 presents several testable predictions that arise from the results. Finally, Section 6 concludes.

## 2 The Model

Consider a setting of three firms. One firm, i.e. $E$ is planning to enter a new market that consists of two firms, a large firm $L$ and a minor firm $M$. We will assume that the new entrant's main intention is to acquire the prominent incumbent $L$. To do so, it is faced with two strategies. The first is to make a bid right away to the large firm (the big leap strategy) and the second is to make a bid to the minor firm and, in a subsequent step, offer a bid to the prominent incumbent $L$ (the serial acquisition program).

To implement both generic strategies, the new entrant can choose between a hostile

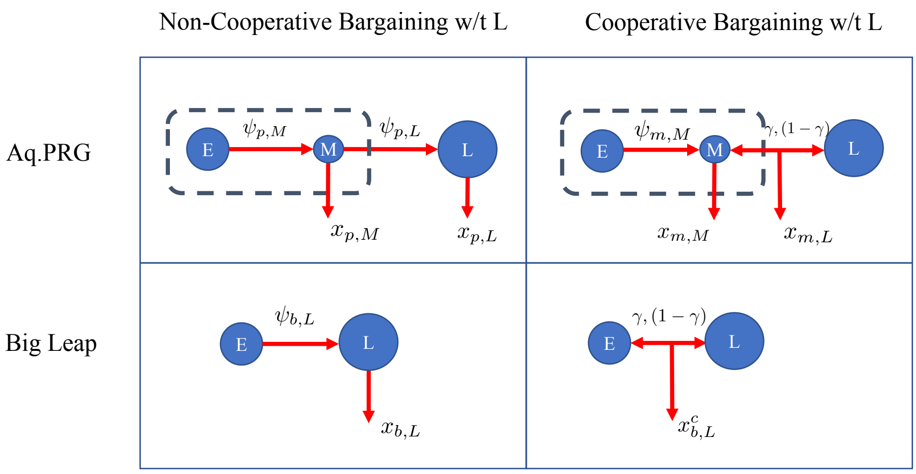



**Figure 1:** $2 \times 2$ matrix characterizing the new entrant's action set

takeover bid and a friendly bid. We will assume that in the case of the serial acquisition program, the new entrant refrains from the possibility of a friendly merger with the minor firm. This assumption needs some further clarification. Obviously, the new entrant could prefer to friendly acquire the minor firm. However, in such a situation he has to reveal information, i.e. that he will subsequently acquire the prominent incumbent. Consequently, he has to share this later surplus with the minor firm which is in general not of interest to the new entrant. Hence, neglecting the possibility of a friendly merger with $M$ leads to a $2 \times 2$ matrix which characterizes the action set of the new incumbent. In particular, the firm can choose between a hostile takeover of the prominent incumbent $L$ and a friendly merger with $L$. Or, it favours the acquisition of $M$ before acquiring $L$. In such a situation, the firm can choose between a hostile takeover of $M$ followed by a friendly merger with $L$ (mixed acquisition program) and a hostile takeover of both $M$ and $L$ (pure hostile takeover program), respectively (see Figure 1).

For the sake of simplicity, we will assume that each firm is endowed with a capital stock $K_j$ with $j \in \{E, L, M\}$ and subject to an industry wide shock modeled by means of a geometric Brownian motion, i.e.:

$$dx(t) = \alpha x(t)dt + \sigma x(t)dW \tag{1}$$

where $\alpha \in \mathbb{R}$ denotes the instantaneous drift, $\sigma \in \mathbb{R}$ denotes the instantaneous variance and $dW$ denotes the standard Wiener increment. We will assume that

$$V_j(t) = K_j x(t), \qquad j \in \{E, L, M\} \tag{2}$$

were $V_j(t)$ approximates the firms' individual stand-alone values. In the following, we will take a closer look at the new entrants individual strategies.

For modeling purposes a pair $\{i, j\}$, appearing in subscript, defines the M&A program, where $i \in \{b, m, p\}$ indicates the strategy ($b$ for the big-leap, $m$ for the mixed strategy−consisting in a hostile takeover and subsequently a friendly merger, and $p$ for the pure hostile strategy−consisting in hostile takeovers of both firms); and $j$, as before, identifies the firm.

## 2.1 Big Leap: Acquisition of the Large Firm

In order to model the acquisition process, we will rely on a non-cooperative bargaining solution, i.e. the new entrant offers the large incumbent a premium $\psi_{b,L} > 0$ while the large firms times the acquisition, following Lukas and Welling (2012). Let $\omega_{EL} > 1$ denote the synergies on the large firm's value, $\epsilon_{EL} T_{EL}$ and $(1 - \epsilon_{EL}) T_{EL}$ denote the transaction costs assigned to each party where $\epsilon_{EL} \in (0, 1)$ indicates the fraction of the transaction costs ($T_{EL}$) assigned to $E$.

Consequently, the large firm receives a premium $\psi_{b,L} K_L x(t)$ in exchange for its asset worth $K_L x(t)$ and has to bear transaction cost of size $(1 - \epsilon_{EL}) T_{EL}$. Following standard real option reasoning, for any given premium level, $\psi_{b,L}$, $L$'s timing decision to sell the company solves the following optimization problem:

$$\begin{aligned} f(x) &= \max_{\tau} \left[ \mathbf{E} \left[ \left( (\psi_{b,L} - 1) K_L x(t) - (1 - \epsilon_{EL}) T_{EL} \right) e^{-r\tau} \right] \right], \qquad (3) \\ &= \max_{x^*_{b,L}(\psi_{b,L})} \left[ \left( (\psi_{b,L} - 1) K_L x^*_{b,L}(\psi_{b,L}) - (1 - \epsilon_{EL}) T_{EL} \right) \left( \frac{x(t)}{x^*_{b,L}(\psi_{b,L})} \right)^{\beta_1} \right] \qquad (4) \end{aligned}$$

where $\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left(-\frac{1}{2} + \frac{\alpha}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}}$ is the positive root of the standard fundamental quadratic equation (see Dixit and Pindyck 1994). On the other side, the new entrant anticipates the reaction function of the target and grants an optimal premium such that it maximizes her objective function, i.e.:

$$\max_{\psi_{b,L}} \left[ \left( \left( \omega_{EL} \left( K_E + K_L \right) - K_E - \psi_{b,L} K_L \right) x^*_{b,L}(\psi_{b,L}) - \epsilon_{EL} T_{EL} \right) \left( \frac{x(t)}{x^*_{b,L}(\psi_{b,L})} \right)^{\beta_1} \right] \tag{5}$$

Solving both objective functions recursively leads to the following result:

**Proposition 1.** *The acquisition of the large firm takes place, if the large firm receives an optimal premium $\psi^*_{b,L}$ and waits until $x(t)$ hits the optimal trigger value $x(t) = x^*_{b,L}$ where $\psi^*_{b,L}$ and $x^*_{b,L}$ are given by:*

$$\psi^*_{b,L} = 1 + \frac{(\beta_1 - 1)(1 - \epsilon_{EL})}{(\beta_1 - \epsilon_{EL})} \frac{(\omega_{EL} - 1)(K_E + K_L)}{K_L} \tag{6}$$

$$x^*_{b,L} \equiv x^*_{b,L}(\psi^*_{b,L}) = \frac{\beta_1}{(\beta_1 - 1)^2} \frac{(\beta_1 - \epsilon_{EL}) T_{EL}}{(\omega_{EL} - 1)(K_E + K_L)} \tag{7}$$

*Proof.* See Appendix. □

A higher uncertainty (higher $\sigma$ and $\beta_1$) induces the bidder to offer a lower premium and to wait for a higher level of the state variable $x$. If the merger produces more synergies, it will occur sooner with a higher premium (Corollary 1).

**Corollary 1.** *The sensitivities of the optimal solution are as follows:* $\frac{\partial \psi^*_{b,L}}{\partial \sigma} < 0$, $\frac{\partial x^*_{b,L}}{\partial \sigma} > 0$, $\frac{\partial \psi^*_{b,L}}{\partial \omega_{EL}} > 0$, $\frac{\partial x^*_{b,L}}{\partial \omega_{EL}} < 0$.

## 2.2 Small Steps: Sequential Acquisition

### 2.2.1 Acquisition of the Minor Firm

Let us assume now that firm $E$ can alternatively start the acquisition program by making an offer to the minor firm $M$ (with the ultimate goal of acquiring $L$). In particular, the new entrant offers the minor incumbent a premium $\psi_{i,M} > 0$ while the later firm times the acquisition. In the generic premium $\psi_{i,M}$, the first subscript $i \in \{m, p\}$ represent the acquisition strategy followed by $E$. Either the acquisition program follows a mixed strategy ($i = m$), where the acquisition of $M$ is hostile (non-cooperative) but a friendly (cooperative) merger with $L$ occurs, or it follows a pure hostile strategy ($i = p$), where both acquisitions are non-cooperative.

Let $\omega_{EM}$ denote the resulting synergies, $\epsilon_{EM}T_{EM}$ and $(1-\epsilon_{EM})T_{EM}$ denote the transaction costs assigned to each party where $\epsilon_{EM} \in (0, 1)$ indicates the fraction of the transaction costs ($T_{EM}$) assigned to $E$. Hence for any given premium level $\psi_{i,M}$ $M$'s timing decision to sell the company solves the following optimization problem which is analogous to the one of the large firm alluded to earlier:

$$\begin{aligned} g(x) &= \max_{\tau} \left[ \mathbf{E}\left[ \left( (\psi_{i,M} - 1) K_M x(t) - (1 - \epsilon_{EM}) T_{EM} \right) e^{-r\tau} \right] \right], & (8) \\ &= \max_{x^*_{i,M}(\psi_{i,M})} \left[ \left( (\psi_{i,M} - 1) K_M x^*_{i,M} - (1 - \epsilon_{EM}) T_{EM} \right) \left( \frac{x(t)}{x^*_{i,M}(\psi_{i,M})} \right)^{\beta_1} \right] & (9) \end{aligned}$$

where $\beta_1$ comes as before.

Again, firm $E$ anticipates the reaction function of the minor firm and grants an optimal premium such that it maximizes her objective function. However, since the new entrant's true intention is to buy the large firm a subsequent option emerges, i.e. to buy the large firm after acquiring the minor firm. Hence, firm $E$'s objective function becomes:

$$\max_{\psi_{i,M}} \left[ \left( \left( \omega_{EM} \left( K_E + K_M \right) - K_E - \psi_{i,M} K_M \right) x^*_{i,M}(\psi_{i,M}) + F_i(.) - \epsilon_{EM} T_{EM} \right) \left( \frac{x(t)}{x^*_{i,M}(\psi_{i,M})} \right)^{\beta_1} \right] \tag{10}$$

where $F_i(.)$ with $i \in \{m, p\}$ denotes the option to buy the large firm after successful acquisition of the minor firm. Obviously, a solution to the decision problem is only obtainable once a flexibility value can be assigned to the subsequent option to merge with the large firm.

At this point also two alternative strategies need to be considered: either the acquisition of the large firm is a cooperative game (i.e., the firm opts for a friendly merger), or, on contrary, is a non-cooperative game (where the firm places an hostile takeover). There are arguments that may justify each strategy. On the one hand, the entrant prefers to gain a fast entry into the new market. Obviously, negotiating the takeover non-cooperatively would lead to timing inefficiencies and unnecessarily delays the acquisition of $L$. On the other hand, the hostile takeover strategy allows the new entrant $E$ to capture a greater fraction of the generated surplus since it will hold the greater bargaining power due to the first-mover advantage.

### 2.2.2 Cooperative Acquisition of the Large Firm

Let us start by considering a friendly merger between the new entity $EM$ and the large firm $L$. In particular, let us assume that after the merger, each firm holds an equity stake $\gamma$ in the new firm. The large firm will give up his stand-alone value $V_L = K_L x(t)$ and receives upon paying the transaction cost $(1-\epsilon_{ML})T_{ML}$ a stake in the new venture thereby profiting from the synergies $\omega_{ML}$ that arise out of the merger. Hence, firm $L$'s net gain becomes:

$$(1-\gamma)(\omega_{ML}(K_L + \omega_{EM}(K_M + K_E)) - K_L)x(t) - (1-\epsilon_{ML})T_{ML} \tag{11}$$

where $\omega_{EM}(K_M + K_E)$ denotes the size of the new entity $EM$ formed ealier. On the contrary, firm $EM$'s net gain amounts to:

$$\gamma(\omega_{ML}(K_L + \omega_{EM}(K_M + K_E)) - \omega_{EM}(K_M + K_E))x(t) - \epsilon_{ML}T_{ML} \tag{12}$$

Assuming that both firms possess a certain amount of bargaining power, $\eta$ for firm $EM$ and $1-\eta$ for firm $L$, then the optimal share each firm has in the new venture solves the following optimization problem:

$$\begin{aligned} &\max_{\gamma} \Big[((1-\gamma)(\omega_{ML}(K_L + \omega_{EM}(K_M + K_E)) - K_L)x(t) - (1-\epsilon_{ML})T_{ML})^{1-\eta} \\ &(\gamma(\omega_{ML}(K_L + \omega_{EM}(K_M + K_E)) - \omega_{EM}(K_M + K_E))x(t) - \epsilon_{ML}T_{ML})^{\eta}] \end{aligned} \tag{13}$$

where the bargaining power is assumed to correspond to the relative value of each entity.

Accordingly:

$$\eta = \frac{\omega_{EM}(K_M + K_E)}{\omega_{EM}(K_M + K_E) + K_L} \tag{14}$$

Since we are focusing on a cooperative game the optimal investment trigger equals the central planner's optimal investment threshold. Hence, the central planner's objective function equals:

$$\begin{aligned} G(x) &= \max_{\tau} \left[\mathbf{E}\left[\left((\omega_{ML}(K_L + \omega_{EM}(K_M + K_E) - K_L) - K_L)x(t) - T_{ML}\right) e^{-r\tau}\right]\right] \\ &= \max_{x^*_{m,L}} \left[\left((\omega_{ML}(K_L + \omega_{EM}(K_M + K_E) - K_L) - K_L)x^*_{m,L} - T_{ML}\right) \left(\frac{x(t)}{x^*_{m,L}}\right)^{\beta_1}\right] \end{aligned} \tag{15}$$

Regarding the derivation of the optimal decision of the overall sequential M&A entry sequence, we have to solve the presented objective functions recursively. In particular, we first solve firm $EM$'s and firm $L$'s cooperative bargaining setting as stated by Equation (13) and (15), i.e. $\gamma^*$ and $x^*_{m,L}$ and then subsequently solve for the optimal premium and acquisition threshold of the non-cooperative game between $E$ and $M$.

Consequently, solving the cooperative bargaining game by means of the Nash-Bargaining solution leads to the following proposition:

**Proposition 2.** *Both firms will agree to merge, if $x(t)$ hits the optimal timing threshold $x^*_{m,L}$ from below:*

$$x^*_{m,L} = \frac{\beta_1}{\beta_1 - 1} \frac{T_{ML}}{(\omega_{ML} - 1)\theta_{ML}} \tag{16}$$

*Firm EM's optimal stake $\gamma^*(x^*_{m,L})$ in the merger amounts to:*

$$\gamma^*(x^*_{m,L}) = \frac{(\beta_1 - 1)}{\beta_1} \frac{(\omega_{ML} - 1)\epsilon_{ML}}{\omega_{ML}} + \frac{(\beta_1 - 1 + \omega_{ML})}{\beta_1 \omega_{ML}} \frac{\omega_{EM}\theta_{EM}}{\theta_{ML}} \tag{17}$$

*with $\theta_{EM} = K_E + K_M$ and $\theta_{ML} = \omega_{EM}\theta_{EM} + K_L$.*

*Proof.* See Appendix. □

Now that we have derived the optimal policy for the two firms to merge, we can deduce firm $E$'s ex-ante option value for this strategy, i.e.:

$$F_m(x) = \begin{cases} \left((\gamma^* \omega_{ML}\theta_{ML} - \theta_{ML})x^*_{m,L} - \epsilon_{ML}T_{ML}\right)\left(\dfrac{x(t)}{x^*_{m,L}}\right)^{\beta_1} & x(t) < x^*_{m,L} \\ (\gamma^* \omega_{ML}\theta_{ML} - \theta_{ML})x(t) - \epsilon_{ML}T_{ML} & x(t) \geqslant x^*_{m,L} \end{cases} \tag{18}$$

where $\gamma^* \equiv \gamma^*(x^*_{m,L})$.

By inserting Equation (18) into Equation (10) we can now solve for the optimal premium $\psi^*_{m,M}$ and acquisition threshold $x^*_{m,M}$ marking the first phase of the sequential acquisition program.

A closer look, however, reveals that two cases are possible. First, the entry by $E$ follows a real sequence, i.e. after buying the minor firm it will later on buy the large incumbent. In such a case the ordering of the M&A threshold follows $x^*_{m,M} < x^*_{m,L}$. On the other hand, the entry might be characterized by a big-bang solution where the firm will buy both firms simultaneously at the investment trigger which implies that $x^*_{m,M} \geqslant x^*_{m,L}$. In the following we will present the solutions for both cases.

**Case 1: Sequential Entry ($x^*_{m,M} < x^*_{m,L}$)**

In such a case, firm $EM$ can capture the full value of the option to merge subsequently with the large incumbent $F_m(.)$ when offering the bid to $M$. The following proposition summarize the optimal contract.

**Proposition 3.** *The acquisition of the minor firm takes place, if the minor firm receives an optimal premium $\psi^*_{m,M}$ and waits until $x(t)$ hits the optimal trigger value $x(t) = x^*_{m,M}$ from below where $\psi^*_{m,M}$ and $x^*_{m,M}$ are given by:*

$$\psi^*_{m,M} = 1 + \frac{(\beta_1 - 1)(1 - \epsilon_{EM})}{(\beta_1 - \epsilon_{EM})}\frac{(\omega_{EM} - 1)\theta_{EM}}{K_M} \tag{19}$$

$$x^*_{m,M} \equiv x^*_{m,M}(\psi^*_{m,M}) = \frac{\beta_1}{(\beta_1 - 1)^2}\frac{(\beta_1 - \epsilon_{EM})T_{EM}}{(\omega_{EM} - 1)\theta_{EM}} \tag{20}$$

*Proof.* See Appendix. □

From the optimal results it becomes apparent that the merger between $M$ and $L$

is irrelevant for both, the firm $E$'s optimal offered premium as well as for the minor incumbent's timing decision. Neither $\psi^*_{m,M}$ nor $x^*_{m,M}$ depend on the characteristics of the subsequent merger with $L$, e.g. its synergies, transaction costs or equity shares.

The following corollary summarizes the different sensitivities of the optimal solution. The effects are the same as for the big leap strategy: a higher uncertainty and lower synergies induce smaller premiums and merger deterrence.

**Corollary 2.** $\frac{\partial \psi^*_{m,M}}{\partial \sigma} < 0$, $\frac{\partial x^*_{m,M}}{\partial \sigma} > 0$, $\frac{\partial \psi^*_{m,M}}{\partial \omega_{EM}} > 0$, $\frac{\partial x^*_{m,M}}{\partial \omega_{EM}} < 0$.

**Case 2: Simultaneous Entry ($x^*_{m,M} \geqslant x^*_{m,L}$)**

In the second case, however, firm $E$ assigns no additional flexibility value to merge subsequently with the large incumbent $F_m(.)$. Rather, it is already very profitable to merge with the large incumbent. Consequently, there is no added value due to further postponement and $F_m(.)$ just reflects the intrinsic value assigned to the immediate merger with $L$. Consequently, as soon as $E$ finds it optimal to give up the option to wait with acquiring the minor firm it will exercise the option to merge with the large firm, too. Hence, the following proposition summarizes the optimal contract for such a big-bang entry.

**Proposition 4.** *The acquisition of the minor firm takes place, if the minor firm receives an optimal premium $\psi^*_{m,M}$ and waits until $x(t)$ hits the optimal trigger value $x(t) = x^*_{m,M}$ from below where $\psi^*_{m,M}$ and $x^*_{m,M}$ are given by:*

$$\psi^*_{m,M} = 1 + \frac{(\beta_1 - 1)(1 - \epsilon_{EM})T_{EM}}{(\beta_1 - \epsilon_{EM})T_{EM} + \eta(\beta_1 - 1)T_{ML}} \frac{z_m}{K_M} \tag{21}$$

$$x^*_{m,M} \equiv x^*_{m,M}(\psi^*_{m,M}) = \frac{\beta_1}{(\beta_1 - 1)^2} \frac{(\beta_1 - \epsilon_{EM})T_{EM} + \eta(\beta_1 - 1)T_{ML}}{z_m} \tag{22}$$

*with*

$$z_m = (\omega_{EM} - 1)\theta_{EM} + \eta(\omega_{ML} - 1)\theta_{ML} \tag{23}$$

*Proof.* See Appendix. □

By comparing both optimal solutions it becomes apparent that the characteristics of the subsequent merger are relevant when offering a premium to the minor incumbent and thus impact his timing decision.

Like previously, the following corollary summarizes the different sensitivities of the optimal solution, showing that the same effects hold, enhanced by the synergies of the subsequent merger.

**Corollary 3.** $\frac{\partial \psi^*_{m,M}}{\partial \sigma} < 0$, $\frac{\partial x^*_{m,M}}{\partial \sigma} > 0$, $\frac{\partial \psi^*_{m,M}}{\partial \omega_{ML}} > 0$, $\frac{\partial x^*_{m,M}}{\partial \omega_{ML}} < 0$, $\frac{\partial \psi^*_{m,M}}{\partial \omega_{EM}} > 0$, $\frac{\partial x^*_{m,M}}{\partial \omega_{EM}} < 0$.

Finally, we can provide an answer to the question what are the key determinants when choosing between the sequential entry and the big-bang solution, i.e. buying both firms simultaneously. A closer look reveals that the ordering of the investment thresholds depends on the level of achievable synergies, the transaction costs and the sizes of the capital stock. An analytical solution can be provided that marks the choice between simultaneous and sequential acquisition which is summarized by the following proposition.

**Proposition 5.** *The new entrant will switch from sequentially acquiring the incumbent firms $M$ and $L$ to a simultaneous acquisition of $M$ and $L$ should the substantially achievable synergies $\omega_{ML}$ due to acquiring the large firm are higher than:*

$$\omega_{ML} > 1 + \Omega_m \tag{24}$$

*with*

$$\Omega_m = \frac{\beta_1 - 1}{\beta_1 - \epsilon_{EM}} \frac{(\omega_{EM} - 1)\theta_{EM}}{\theta_{ML}} \frac{T_{ML}}{T_{EM}} \tag{25}$$

*Proof.* See Appendix. □

### 2.2.3 Non-Cooperative Acquisition of the Large Firm

Let us now move to the second possible strategy, where $EM$ opts to acquire $L$ under an hostile takeover. The dynamics of this game have already been presented and consist in $EM$ offering a given share of the synergies to $L$, while $L$ times the merger. Following the same procedures as before we state that,

**Proposition 6.** *For the non-cooperative takeover, the large firm receives an optimal premium $\psi^*_{p,L}$ and waits optimally until $x(t)$ hits the trigger value $x^*_{p,L}$, given by:*

$$\psi^*_{p,L} = 1 + \frac{(\beta_1 - 1)(1 - \epsilon_{ML})}{(\beta_1 - \epsilon_{ML})} \frac{(\omega_{ML} - 1)\theta_{ML}}{K_L} \tag{26}$$

*and,*

$$x^*_{p,L} \equiv x^*_{p,L}(\psi^*_{p,L}) = \frac{\beta_1}{(\beta_1 - 1)^2} \frac{(\beta_1 - \epsilon_{ML})T_{ML}}{(\omega_{ML} - 1)\theta_{ML}} = \frac{\beta_1 - \epsilon_{ML}}{\beta_1 - 1} x^*_{m,L} \tag{27}$$

*Proof.* See Appendix. □

The non-cooperative takeover occurs later than the cooperative merger ($x^*_{p,L} > x^*_{m,L}$). Moving now backwards to the first acquisition (hostile takeover of $E$ over $M$), we analyze this deterrence effect on the timing and premium offered. As before, two possible cases need again to be considered. In the first case, $E$ acquires $M$ and waits before moving towards $L$, as the trigger to acquire the latter has not yet been achieved ($x^*_{p,M} < x^*_{p,L}$), while in the second, that occurs when $x_{p,M} \geqslant x^*_{p,L}$, firm $E$ takes $M$ and after which immediately acquires $L$ (the big-bang solution).

**Case 1: Sequential Entry ($x^*_{p,M} < x^*_{p,L}$)**

In this case the acquisitions happen sequentially and the following propositions summarize the findings regarding an optimal contract design.

**Proposition 7.** *For the first takeover, the firm $E$ offers the premium $\psi^*_{p,L}$ and waits optimally until $x(t)$ hits the trigger value $x^*_{p,M}$, given by:*

$$\psi^*_{p,M} = 1 + \frac{(\beta_1 - 1)(1 - \epsilon_{EM})}{(\beta_1 - \epsilon_{EM})} \frac{(\omega_{EM} - 1)\theta_{EM}}{K_M} = \psi^*_{m,M} \tag{28}$$

*and,*

$$x^*_{p,M} \equiv x^*_{p,M}(\psi^*_{p,M}) = \frac{\beta_1}{(\beta_1 - 1)^2} \frac{(\beta_1 - \epsilon_{EM})T_{EM}}{(\omega_{EM} - 1)\theta_{EM}} = x^*_{m,M} \tag{29}$$

*Proof.* See Appendix. □

Again, the findings reveal that in the case of sequential entry by means of acquisitions the optimal contract offers to $M$ is not affected by the subsequent merger with $L$. Therefore, when the sequential merger is optimal, both the mixed and pure strategies occur at the same timing and with the same premiums ($x^*_{p,M} = x^*_{m,M}$ and $\psi^*_{p,M} = \psi^*_{m,M}$).

**Case 2: Simultaneous takeover ($x^*_{p,M} \geqslant x^*_{p,L}$)**

In this case the two acquisitions happen simultaneously. Obviously, as in the case for the mixed acquisition program, we would expect that in such a setting the contract design with $M$ is affected by the characteristics of the subsequent takeover with $L$ which is supported by the results.

**Proposition 8.** *For the first takeover, the firm $E$ offers the premium $\psi^*_{p,M}$ and waits optimally until $x(t)$ hits the trigger value $x^*_{p,M}$, given by:*

$$\psi^*_{p,M} = 1 + \frac{(\beta_1 - 1)(1 - \epsilon_{EM})T_{EM}}{(\beta_1 - \epsilon_{EM})T_{EM} + (\beta_1 - \epsilon_{ML})T_{ML}} \frac{z_p}{K_M} \tag{30}$$

$$x^*_{p,M} \equiv x^*_{p,M}(\psi^*_{p,M}) = \frac{\beta_1}{(\beta_1 - 1)^2} \frac{(\beta_1 - \epsilon_{EM})T_{EM} + (\beta_1 - \epsilon_{ML})T_{ML}}{z_p} \tag{31}$$

*with*

$$\begin{aligned} z_p &= (\omega_{EM} - 1)\theta_{EM} + (\omega_{ML} - 1)\theta_{ML} \\ &= z_m + (1 - \eta)(\omega_{ML} - 1)\theta_{ML} \geqslant z_m \end{aligned} \tag{32}$$

*Proof.* See Appendix. □

As the following proposition (9), however, indicates there is a major difference to the mixed acquisition program. In particular, since $E$ possess in both takeovers a first-mover advantage it will anticipate that it can do better if it transfers part of consequences the negotiation with $M$ might bring with it to $L$. To see this consider the previous mixed acquisition program case where $x^*_{m,M} > x^*_{m,L}$ has indicated that the friendly merger with $L$ is that profitable that immediately after acquiring $M$ the option to acquire $L$ will be exercise. While $E$ had the bargaining power to stimulate $M$ to sell its assets earlier in order to accelerate the asset transfer with $L$, however, it had no whatsoever power to further improve its situation, e.g. by paying less to acquire $L$. It is precisely this advantage that materializes in the pure hostile takeover program. In particular, $E$ will recognize that the situation $x^*_{p,M} > x^*_{p,L}$ indicates that it has paid too much for $L$. Hence, by paying less to $L$ the entrant can further enhance its position, thereby inducing the prominent incumbent to postpone its assets sale. Obviously, the resulting gain can be used to motivation $M$ to sell its assets even sooner. Consequently, the possibility to stimulate early acquisition of $M$ at the cost of delaying the takeover of $L$ leads to the following result:

**Proposition 9.** *Given that acquiring the minor incumbent $M$ immediately opens up the possibility to acquire a highly profitable prominent incumbent $L$, then the new entrant's pure hostile takeover program will be simultaneously consummated as soon as $x(t)$ hits a unique trigger $x^*_{p,M} \equiv x^*_{p,L}$.*

*Proof.* See Appendix. □

Finally, the choice between simultaneous takeover and sequential acquisition is summarized by the following proposition.

**Proposition 10.** *The new entrant will switch from sequentially acquiring the incumbent firms $M$ and $L$ to a simultaneous takeover of $M$ and $L$ should the substantially achievable synergies $\omega_{ML}$ due to acquiring the large firm are higher than:*

$$\omega_{ML} > 1 + \Omega_p \tag{33}$$

*with*

$$\Omega_p = \frac{\beta_1 - \epsilon_{ML}}{\beta_1 - \epsilon_{EM}} \frac{(\omega_{EM} - 1)\theta_{EM}}{\theta_{ML}} \frac{T_{ML}}{T_{EM}} = \frac{\beta_1 - \epsilon_{ML}}{\beta_1 - 1} \Omega_m > \Omega_m \tag{34}$$

*Proof.* See Appendix. □

A simultaneous takeover requires higher synergies for the pure strategy than for the mixed strategy ($\Omega_p > \Omega_m$), as the subsequent merger becomes optimal later for the pure hostile strategy.

## 2.3 Big Leap: Friendly Merger with the large Firm

Obviously, the new entrant could also acquire $L$ by means of a friendly merger which marks the fourth strategy indicated in Figure 1. Hence, both will jointly negotiate the terms of the contract. Since we have already dealt with a similar situation analytically (see 2.2.2) we will refrain from a thorough derivation. In particular, when marginalizing $M$'s and the corresponding hostile takeover's attributes, respectivly the entity's $EM$ features become $E$ features. Coonsequently, both parties $E$ and $L$ will agree to the conditions of the following contract:

**Proposition 11.** *Both firms will agree to merge, if $x(t)$ hits the optimal timing threshold $x^*_{f,L}$ from below:*

$$x^*_{f,L} = \frac{\beta_1}{\beta_1 - 1} \frac{T_{EL}}{(\omega_{EL} - 1)(K_E + K_L)} = \frac{\beta_1 - 1}{\beta_1 - \epsilon_{EL}} x^*_{b,L} < x^*_{b,L} \tag{35}$$

*Firm $E$'s optimal stake $\gamma^*(x^*_{b,L})$ in the merger amounts to:*

$$\gamma^*(x^*_{f,L}) = \frac{(\beta_1 - 1)}{\beta_1} \frac{(\omega_{EL} - 1)\epsilon_{EL}}{\omega_{EL}} + \frac{\beta_1 - 1 + \omega_{EL}}{\beta_1 \omega_{EL}} \frac{K_E}{K_E + K_L}. \tag{36}$$

## 2.4 Choosing the best strategy

Equations (10) and (5) mark all possible acquisitions' option values. Taking the derived optimal contract solutions into account and assuming that the initial value of $x(t)$ at $t_0$ is very small compared to each strategy's optimal exercise threshold then the optimal real option values can be expressed as follows:

$$F_b = A_b \; x^{\beta_1} \tag{37}$$

$$F_f = A_f \; x^{\beta_1} \tag{38}$$

$$F_m = A_m \; x^{\beta_1} \tag{39}$$

$$F_p = A_p \; x^{\beta_1} \tag{40}$$

where

$$A_b = \frac{\beta_1 - \epsilon_{EL}}{(\beta_1 - 1)^2} T_{EL} \left( \frac{1}{x^*_{b,L}} \right)^{\beta_1} \tag{41}$$

$$A_f = \frac{1}{\beta_1 - 1} \frac{K_E}{K_E + K_L} T_{EL} \left( \frac{1}{x^*_{f,L}} \right)^{\beta_1} \tag{42}$$

$$A_m = \left( \frac{\beta_1 - \epsilon_{EM}}{(\beta_1 - 1)^2} T_{EM} + \frac{\eta}{\beta_1 - 1} T_{ML} \times \begin{cases} \left( \frac{\omega_{ML} - 1}{\Omega_m} \right)^{\beta_1} & \omega_{ML} < 1 + \Omega_m \\ 1 & \omega_{ML} \geqslant 1 + \Omega_m \end{cases} \right) \left( \frac{1}{x^*_{m,M}} \right)^{\beta_1} \tag{43}$$

$$A_p = \left( \frac{\beta_1 - \epsilon_{EM}}{(\beta_1 - 1)^2} T_{EM} + \frac{\beta_1 - \epsilon_{ML}}{(\beta_1 - 1)^2} T_{ML} \times \begin{cases} \left( \frac{\omega_{ML} - 1}{\Omega_p} \right)^{\beta_1} & \omega_{ML} < 1 + \Omega_p \\ 1 & \omega_{ML} \geqslant 1 + \Omega_p \end{cases} \right) \left( \frac{1}{x^*_{p,M}} \right)^{\beta_1} \tag{44}$$

Regarding the two possible strategies for the big leap (friendly or hostile), it is important to define the conditions under which one strategy is preferable over the other. At the first trigger, $x^*_{f,L}$ (notice that $x^*_{f,L} < x^*_{b,L}$), the firm compares the payoff of the immediate friendly merger with $L$:

$$F_f(x^*_{f,L}) = \frac{1}{\beta_1 - 1} \frac{K_E}{K_E + K_L} T_{EL}, \tag{45}$$

with the continuation value of the hostile acquisition, $F_b(x^*_{f,L})$, choosing the one with the highest value. The firm will go for the hostile takeover of $L$ if:

$$\frac{K_L}{K_E} > \left( \frac{\beta_1 - \epsilon_{EL}}{\beta_1 - 1} \right)^{\beta_1 - 1} - 1 \tag{46}$$

which reveals to be true for reasonable values of $\epsilon_{EL}$.[2] In fact, for reasonable values such as $\epsilon_{EL} \in [0.5, 1)$[3], the hostile strategy always dominates the friendly merger, as

[2]Taking the limits of the right-hand side of equation (46), we see that it tends to 0 as $\beta_1 \to 1$, and goes to $e^{1-\epsilon_{EL}} - 1$ as $\beta_1 \to \infty$. Assuming $L$ larger than $E$ we have $K_L/K_E > 1$. Accordingly, the condition that excludes the friendly merger is simply $\epsilon_{EL} > 1 - \log(2) \approx 0.307$, for the most restrictive case. For any $\beta_1 < \infty$ the condition becomes even less constrained.

[3]It is also possible to show that, even for $L$ smaller than $E$, the condition (46) could remain. In fact, considering the reasonable low limit $\epsilon_{EL} = 0.5$, the condition applies for every $K_L/K_E > 0.649$ for the most restrictive case ($\beta_1 \to \infty$).

$F_b(x^*_{f,L}) > F_f(x^*_{f,L})$. Accordingly, in our analysis, we ignore the friendly big leap as a valid alternative.

For defining the strategy to follow over the remaining alternatives, $E$ should compare the value of $A_b$, $A_m$, and $A_p$ choosing the alternative with the highest value, i.e. $\max_{A_i}\{A_b, A_m, A_p\}$. If $A_b$ is the most valuable, $E$ chooses the big leap strategy and places an hostile bid for $L$, if not, the firm should follow the small steps strategy. Here, $E$ will follow a mixed acquisition program or a pure hostile takeover program depending on the relative values of $A_m$, and $A_p$.

## 3 Optimal strategy choices

In the following, we will analyze the analytical results by means of a comparative-static analysis which of the generic entry strategies, i.e. single takeover of $L$ or sequential M&A program is more valuable to $E$. If not noted otherwise, we will assume that the transaction costs that arise are split evenly between the parties, i.e. $\epsilon_{EL} = \epsilon_{EM} = \epsilon_{ML} = 0.5$ and that the absolute transaction costs are $T_{EL} = 0.15$, $T_{EM} = 0.1$, $T_{ML} = 0.1$. Here, we acknowledge the fact that it is more expensive to acquire the larger incumbent than the smaller firm when entering the market for the first time.

Against the background of the M&A literature we first want to discuss the impact of synergies and how they impact the optimal entry strategy. In particular, each generic entry strategy is associated with specific synergies, i.e. $\omega_{EL}$, $\omega_{EM}$, $\omega_{ML}$. For the sake of simplicity, we will assume that the synergies generated when acquiring the prominent incumbent by means of a big leap equate the synergies of the follow-up acquisition, i.e when the new entity that result out of the acquisition of $M$ by $E$ acquires $L$. Hence $\omega_{ML} = \omega_{EL}$. Consequently, it is only $M$'s size that improves $E$'s situation in the follow-up acquisition and no additional direct synergy effect due to e.g. $\omega_{ML} \neq \omega_{EL}$ matters. Figure (2(a)) depicts how the level of synergies affects the choice between big leap and acquisition program. In particular, for synergies $\omega_{EM} < 1$, i.e. when acquiring the minor firm would destroy value, a serial acquisition program is not optimal at all and the big leap strategy's option value exceeds the alternatives' option values (Region b). For $\omega_{EM} > 1$

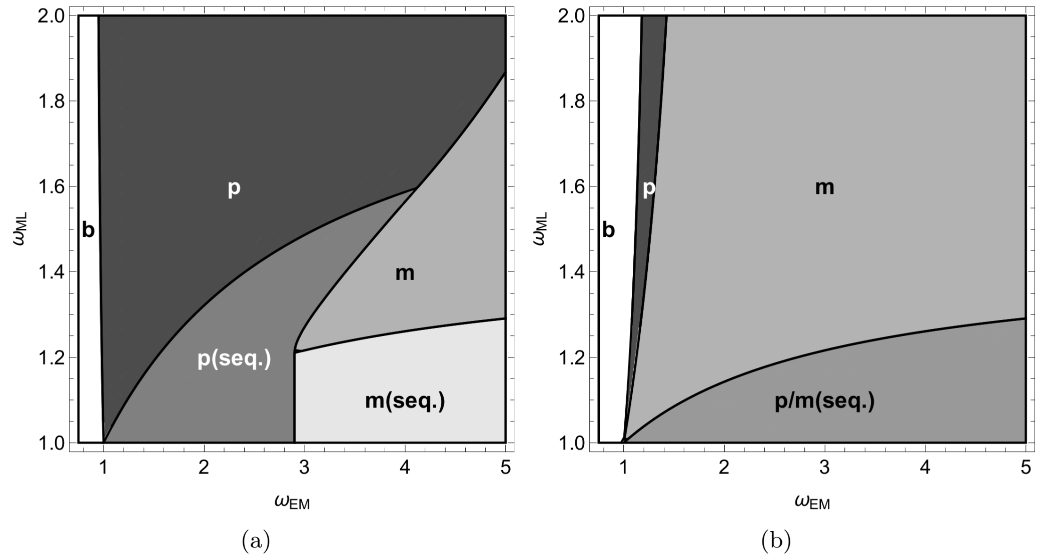



**Figure 2:** Optimal M&A strategy choice depending on synergy levels $\omega_{ML}, \omega_{EM}$. Here, Region $b$ marks the big leap strategy (hostile takeover of $L$), Region $p$ characterizes an optimal pure hostile acquisition program where $E$ prefers to acquire $M$ and $L$ by means of a hostile takeover, and Region $m$ characterizes an optimal mixed acquisition program where $E$ prefers to acquire $M$ by means of a hostile takeover and to subsequently merge with $L$. While $p$ and $m$ indicate that the acquisition progam is implemented simultaneorusly by acquiring $M$ and $L$ at the same time, (*seq.*)indicates that the acquisition program is implemented sequentially.

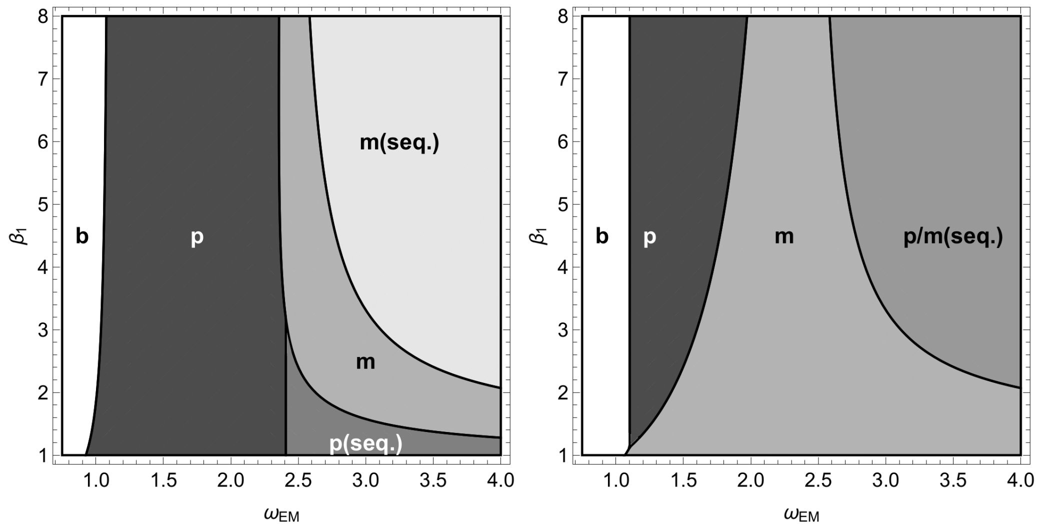
we see that the firm will prefer an acquisition program over the big leap strategy. In particular, the firm will initially prefer to acquire $M$ by means of a hostile takeover and subsequently friendly acquire $L$ (Region $m$). Should, however, the synergies $\omega_{EM}$ further increase then the likelihood increases that $E$ prefers to switch from a friendly merger with $L$ to a hostile takeover of $L$ (Region $p$). In general, we can conclude that *ceteris paribus* as synergies $\omega_{EM}$ further increase an acquisition program consistent of a hostile takeover followed by a friendly merger becomes more and more dominant. Alike, *ceteris paribus* as synergies $\omega_{ML}$ further increase an acquisition program consistent of a hostile takeover followed by a hostile takeover becomes more and more dominant (pure hostile takeover program).

To what extend does uncertainty affect the choice of the acquisition program? To answer this question Figure (3(a)) shows the different strategies' option values as a function of uncertainty (measured by the $\beta_1$ factor with $\partial\beta_1/\partial\sigma < 0$) and the synergies $\omega_{EM}$

between $M$ and $E$. It becomes apparent that in the case of increasing uncertainty the strategy to acquire both incumbents sequentially by means of a pure hostile takeover program cannibalizes both other strategies. In particular, as uncertainty increases we see that the other alternatives' option values, i.e. acquiring the prominent incumbent (big leap) as well as the mixed acquisition program get more and more dominated by the pure hostile takeover acquisition program for a wider range of synergies $\omega_{EM}$.

Consequently, there are two different economic reasons for this. First, consider the case of low synergies, i.e. $\omega_{EM} \simeq 1$ and high uncertainties. At the first glance, it seems unprofitable to acquire $M$ at all, however, the firm favors the acquisition of $M$ over the big leap. The intuition behind this dominance of the acquisition program over the big leap is that uncertainty increases the option value to subsequently acquire the large incumbent which offset the loss due to low synergies when acquiring $M$. Second, for considerable high synergies $\omega_{EM}$ the pure hostile acquisition program will dominate the mixed acquisition program (unfriendly followed by friendly) as uncertainty increases because the subsequent hostile takeover of $L$ adds an additional gain as opposed to the friendly merger and this might offset its earlier timing advantages. In particular, when negotiating the unfriendly takeover the entrant $E$ acts again as a proposer and thus possesses a first-mover advantage. Hence, as opposed to the friendly takeover this advantage allows him to better adapt to changing environment. For example, when uncertainty is high and the synergies between the large incumbent $L$ and the new entity $EM$ are high, $E$ can use his better bargaining power to stimulate an earlier sale of the minor firm $M$ - this will work against the discounting effect - by proposing a lower premium to the prominent incumbent $L$. In contrast, in a friendly merger $E$ cannot act in this manner. Obviously, the higher the uncertainty the more valuable becomes the additional degree of freedom the unfriendly takeover provides and explains why the pure hostile acquisition program will dominate the mixed acquisition program.

Apart from looking whether the big leap or the acquisition program is more valuable, we want to look closer at the contract structure of each of the acquisition programs. As the results in the previous section have indicated, there exists a unique boundary that




(a) (b)

**Figure 3:** Optimal M&A strategy choice depending on synergy levels $\omega_{EM}$ and uncertainty level as measured by $\beta(\sigma)$. Here, Region $b$ marks the big leap strategy (hostile takeover of $L$), Region $p$ characterizes an optimal pure hostile acquisition program where $E$ prefers to acquire $M$ and $L$ by means of a hostile takeover, and Region $m$ characterizes an optimal mixed acquisition program where $E$ prefers to acquire $M$ by means of a hostile takeover and to subsequently merge with $L$. While $p$ and $m$ indicate that the acquisition progam is implemented simultaneorusly by acquiring $M$ and $L$ at the same time, $(seq.)$indicates that the acquisition program is implemented sequentially.

separates the stepwise acquisition of assets from the simultaneous acquisition of assets (see propositions (5) and (10)). Consequently, each of the two regions that mark the possible strategies of an acquisition program can further be divided in stepwise acquisition and simultaneous acquisition, i.e. big bang.

In particular, Figure (2(a))s Region $p$ illustrates that the new entrant will prefer to simultaneously acquire both firms $M$ and $L$ simultaneously while Region $p(seq.)$ indicates that the firm will favor to first acquire $M$ and then wait to acquire $L$ subsequently. Obviously, the same Regions, i.e. $m$ and $m(seq.)$, exist for the other acquisition program. As the analytical results indicate this has consequences for the acquisition thresholds and offered premiums. In particular, the contract stimulating simultaneous acquisition explicitly accounts for the subsequent acquisition possibility expressed by the characteristics of the prominent incumbent $L$, e.g. $K_L, T_{ML}$ etc. (see proposition (4) and (8)). The economic rational for this is that simultaneous acquisition occurs because the subsequent acquisition is much more attractive than the first acquisition, i.e. $x^*_{j,L} \leq x^*_{i,M}$ with $i \in \{m, p\}$ and in order to get access to such synergies $E$ has to induce $M$ to sell its assets sooner. Consequently the new entrant has to pay $M$ a little bit more in order to induce her to sell the asset sooner.

To what extend does an acquisition program also allow the firm to take advantage of a quicker market entry? In the following, we use the difference between the optimal investment thresholds as a proxy for the propensity to invest earlier. Thus, a particular takeover strategy is assumed to be faster when its corresponding threshold is below that of its alternatives. As Figure (2) reveals, for synergies $\omega_{EM}$ below one, the big leap is the preferred choice as it is more valuable and at the same time a faster way to enter than all other alternatives. Obviously, as the synergies with the large firm, i.e. $\omega_{ML}$, increase, however, the attractiveness of the big leap strategy becomes lower although it represents still the fastest entry. Hence, as the synergies with the minor firm increase, an acquisition program becomes more and more valuable. At the same time it also becomes the fastest way to enter the new market as its investment threshold is always below the big leap's entry threshold (see Figure (2(b)))). While this holds true for all values of

$\omega_{EM} >> 1$ the way the optimal acquisition program is designed will be different. In particular, while for considerable high synergies $\omega_{EM} > 5$ and $\omega_{ML} > 3$, respectively the mixed acquisition program is the fastest and at the same time most valuable entry strategy, the pure hostile acquisition program is the most valuable and fasted entry when $\omega_{EM}$ is modest, i.e. around one. For values in between we see that although the pure hostile takeover is the most valuable entry choice it is not the fastest takeover entry strategy. As Figure (3(b)) indicates, the threshold of the pure hostile takeover acquisition program is lower compared to the entry threshold of the mixed takeover acquisition program. With respect to the impact of uncertainty we find the following. For low synergies between the new entrant an the minor firm, the big leap entry is not always the most valuable but also the fastest way to enter the market. This holds especially true when uncertainty is less pronounced. Should uncertainty and the synergies $\omega_{EM}$ increase, entering by means of an acquisition program become more valuable and at the same time also the fastest way to enter the new market (see Figure (3(b))). When comparing both acquisition program strategies we find that especially when synergies $\omega_{EM}$ are below 1.5 and uncertainty levels are not that high the pure acquisition program is the fastest and most valuable entry strategy while for higher levels of uncertainty it remains the most valuable but not the fastest means. Here, the mixed entry strategy would have allowed the firm to faster enter the new market.

# 4 Capital markets reaction

Obviously, when the acquisition of $M$ is announced the higher premium is unexpected because it justifies by parts also the acquisition of the prominent incumbent. Thus, we will use the spread between the premiums as a proxy for the abnormal returns at acquisition announcement, i.e.:

$$\Delta\psi = \psi^*_{i,M}\mathbf{1}_{x^*_{i,M} \geqslant x^*_{i,L}} - \psi^*_{i,M}\mathbf{1}_{x^*_{i,M} < x^*_{i,L}} \text{ with } i \in \{p, m\} \tag{47}$$

where $\mathbf{1}_{x^*_{i,M} \geqslant x^*_{i,L}}$ indicates the indicator function which become one once $x^*_{i,M} \geq x^*_{i,L}$ is fulfilled.

Figure (4) shows the results of the spread $\Delta\psi$ as a function of the synergy levels $\omega_{EM}$ and $\omega_{ML}$ while Figure (5) indicates how uncertainty and the synergy between the entrant and the minor incumbent affect the abnormal returns.[4]

The findings reveal that *ceteris paribus* the spread between the payed premium to the minor incumbent and expected stand-alone premium increases as the synergies between $EM$ and $L$, i.e. $\omega_{ML}$ increases while the abnormal returns decrease as $\omega_{EM}$ increase. The first result follows directly from the incentive effect of the premium offered to $M$, i.e. should the acquisition of the prominent incumbent promise a great amount of synergies then $E$ is willing to pay a larger premium to $M$ in order to stimulated earlier asset sale such that he can sooner acquire the prominent incumbent. Obviously, the more profitable the deal with $M$ as reflected by higher synergies $\omega_{EM}$ the more expensive the takeover becomes and thus the weaker the propensity to take over $M$ sooner.

From the standard results of the non-cooperative bargaining it follows that as uncertainty increases the target is willing to further postpone the decision to sell its assets. As a reaction, the bidding firm has to pay a higher premium in order to motivate the target to sell its assets. As Figure (5) reveals, higher uncertainty is associated with lower abnormal returns. Obviously, as high uncertainties already imply higher premiums, the stand-alone contracted premium and the premium offered due to incentivize the target do not differ much.

# 5 Testable predictions

Our results generate several new predictions which might motivate empirical research. In particular we find:

1. If synergies in an acquisition program are dominantly driven by the minor firm's capabilities, i.e. $1 < \omega_{ML} << \omega_{EL}$ the new entrant will prefer mixed acquisition

[4] For the sake of convenience, we have just illustrated the effects for the pure hostile takeover acquisition program. Please note that similar results hold for the mixed acquisition program.

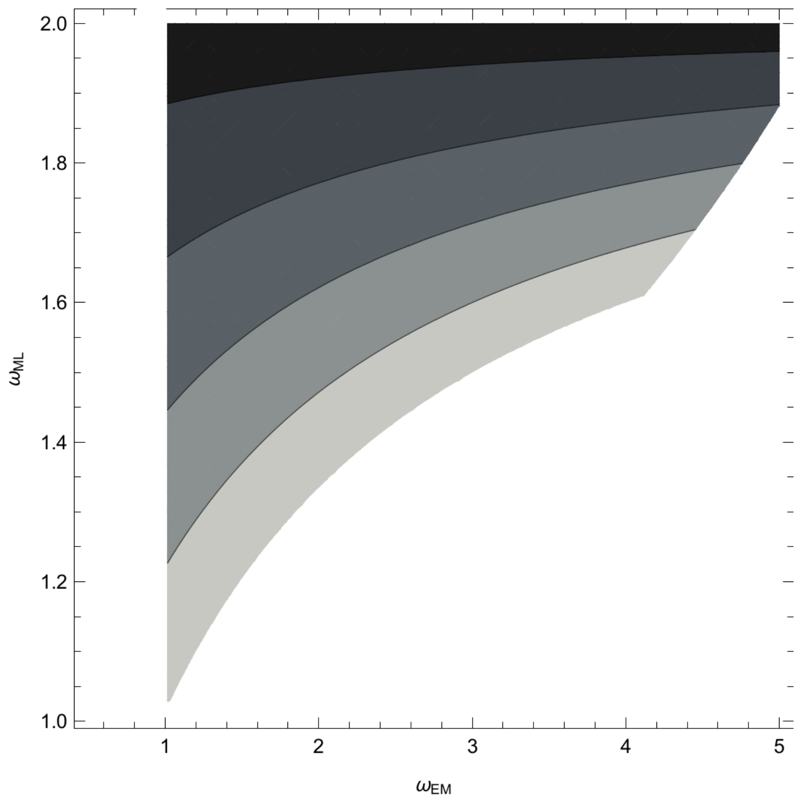



**Figure 4:** $\Delta\psi$ depending on the synergy levels $\omega_{EM}$ and $\omega_{ML}$. Here, the white region characterizes the sequential case of the pure hostile acquisition program while the grey colors indicate the simultaneous case. Darker grey levels correspond with higher abnormal returns.

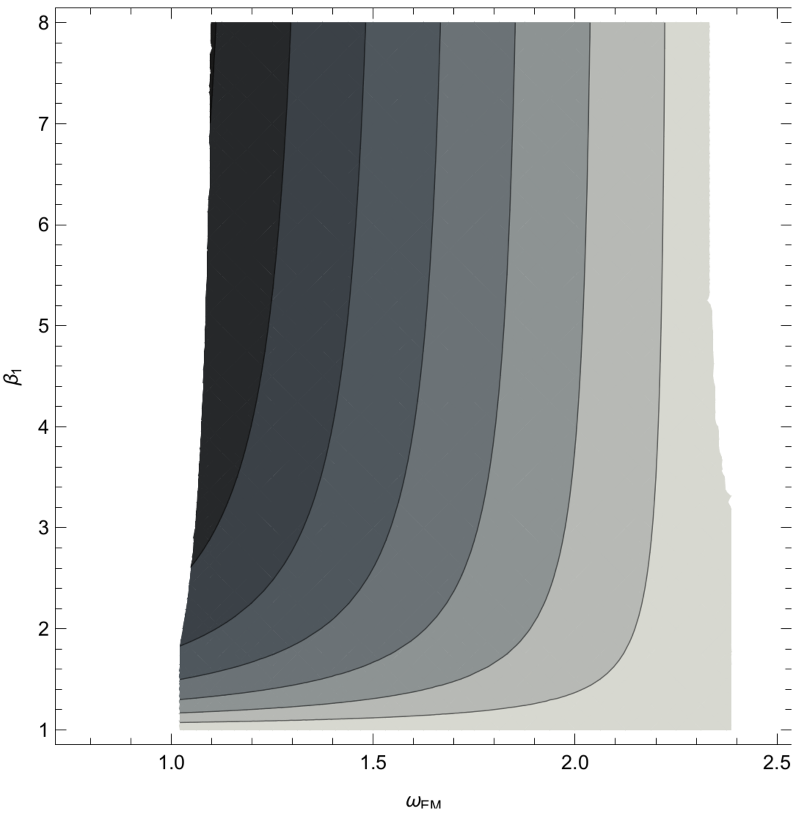



**Figure 5:** Abnormal returns depending on synergy level $\omega_{EM}$ and uncertainty $\sigma$ as measured by $\beta_1(\sigma)$. Here, the white region characterizes the sequential case of the pure hostile acquisition program while the grey colors indicate the simultaneous case. Darker grey levels correspond with higher abnormal returns.

programs.

2. If synergies in an acquisition program are dominantly driven by the large firm's capabilities, i.e. $1 < \omega_{EL} << \omega_{ML}$ the new entrant will prefer pure hostile acquisition programs.

3. The new entrant will favor pure hostile acquisition programs over mixed acquisition programs when entering highly volatile industries

4. The first acquisition in an acquisition program exhibits higher abnormal returns while subsequent acquisitions exhibit not abnormal returns. The announcement effects are stronger when the acquisition program is mainly driven by synergies that can be achieved with the prominent incumbent, i.e. $\omega_{EL} << \omega_{ML}$

5. Abnormal returns observed in acquisition programs that take place in less volatile industries are higher than for acquisition programs in highly volatile industries.

6. Industries where the incumbents hold promise for considerable high synergies are characterized by a higher frequency of acquisition programs than single acquisitions of the industry's prominent incumbent as they allow the new entrants to speed up entry.

7. Highly volatile industries are characterized by a higher frequency of acquisition programs than single acqusitions of the industry's prominent incumbent as they allow the new entrants to speed up entry.

While the literature has not yet been tested predictions (1)-(3) and (6)-(7) we find some empirical support for predictions (4)-(5). Recent empirical literature has indicated that cumulative abnormal returns decline from deal to deal in a serial acquisition (Fuller et al. 2002, Ismail 2008, Ahern 2008) While these articles mainly argue that this is a result of growing hubris across the deal sequence we show that this might also arise for a different reason, i.e. faster seizing of subsequent contingent growth opportunities. Our results are supported by e.g. Klasa and Stegemoller (2007) who found evidence that serial acquisition programs are a result of a time-varying change in a buyer's growth opportunity set. In particular, Klasa and Stegemoller (2007) show that serial acquisitions are mainly triggered by subsequent growth opportunities and terminate once those subsequent opportunities vanished. Related to our work, we see that acquiring the minor incumbent is partly due to better exploiting subsequent growth options which motivates the deal sequence.

## 6 Conclusions

This paper studies the entrance in a market by means of M&A considering two alternative strategies available to the acquirer. One is the big leap, consisting in the acquisition of the large incumbent; the other strategy is to set an acquisition program moving in small steps, first acquiring a minor firm with the option to acquire the larger player later on. The paper also considers alternative contract designs for the acquisition program, such as hostile, friendly or mix. We derive the analytical closed-form solutions for the optimal offers to both targets in the case of the acquisition program and contrast them against the single acquisition possibility.

When structuring the serial acquisition program, two contract solution has been considered. First, the new entrant might stepwise the acquisition of the two incumbents, i.e. first acquire the minor firm and then waiting for the acquisition of the large incumbent at the optimal timing. In such a case, each contract is designed around the stand-alone value of each entity. Secondly, the new entrant may prefer to simultaneously acquire both incumbents. In such a case, the subsequent deal characteristics associated with the large incumbent affect the optimal contract design offered to the minor incumbent.

The impact of synergies on the optimal entry strategy has been studied. We find that the higher the synergies between the buyer and the minor incumbent more likely he chooses a hostile takeover followed by a friendly merger strategy (a mixed strategy), while higher synergies between the buyer and the large incumbent stimulate a pure hostile M&A strategy, where both acquisitions are non-cooperative. Additionally, analyzing the effect of uncertainty on the acquisition strategy, we show that highly uncertain industries will exhibit more pure hostile motivated acquisition programs than industries with less significant uncertainties.

The reaction of capital markets to the acquisition program has also been considered. The model predicts that higher abnormal returns are only observed in the first acquisition, and that the effects are stronger when the acquisition program is essentially driven by the synergies with the large firm. Additionally, abnormal returns observed in acquisition programs taking place in less volatile industries are higher than for those acquisition in highly volatile industries.

Finally, from the model several new testable implications have been presented which might motivate empirical research.

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## Appendix

*Proof of Proposition 1.* Solving the maximization problem in Equation (4), the $L$'s trigger for any given $\psi_{b,L}$ is obtained:

$$x^*_{b,L}(\psi_{b,L}) = \frac{\beta_1}{\beta_1 - 1} \frac{(1-\epsilon_{EL})T_{EL}}{(\psi_{b,L}-1)K_L} \tag{48}$$

This optimal trigger is anticipated by $E$. Incorporating (48) into Equation (5) and maximizing for $\psi_{b,L}$, the solution presented in Equation (6) stands. Finally, the trigger that incorporates the optimal premium is $x^*_{b,L} \equiv x^*_{b,L}(\psi^*_{b,L})$ for which simply incorporate the solution for $\psi^*_{b,L}$ into (48) and obtain (7). □

*Proof of Proposition 2.* The cooperative trigger is obtained by solving the maximization problem (15), for which Equation (16) is the solution. The solution for the optimization problem (13), for any $x(t)$ is:

$$\gamma^*(x(t)) = \frac{1+\eta(\omega_{ML}-1)}{\omega_{ML}} - \frac{K_L x(t) - T_{ML}(\epsilon_{ML}-\eta)}{x(t)\omega_{ML}(\omega_{EM}(K_E+K_M)+K_L)} \tag{49}$$

Computing the optimal stake at the optimal trigger, i.e., setting $x(t) = x^*_{m,L}$, substituting $\eta$ according (14), and rearranging we get (17). □

*Proof of Proposition 3.* To obtain the solutions simply follow the procedure presented earlier, for proving Proposition 1. Notice, however, that the objective function (10) includes the value of the subsequent acquisition $F(.)$. Under a sequential entry, the value of this function is obtained from the first branch of (18). Accordingly, at $x^*_{m,M}(< x^*_{m,L})$, the value function to be incorporated in Equation (10) is:

$$((\gamma^*\omega_{ML}\theta_{ML} - \theta_{ML})x^*_{m,L} - \epsilon_{ML}T_{ML})\left(\frac{x^*_{m,M}}{x^*_{m,L}}\right)^{\beta_1} \tag{50}$$

□

*Proof of Proposition 4.* Follow the same procedure as for Proposition 3. The relevant value function to incorporate in Equation (10) is is now the one represented in the second branch of (18), as $x^*_{m,M} \geqslant x^*_{m,L}$. Notice that the optimal $\gamma$ needs to be computed at $x(t) = x^*_{m,M}$, and not at $x(t) = x^*_{m,L}$, as in Equation (17). Use Equation (49) for this purpose. □

*Proof of Proposition 5.* Considering Equations (16) and (20), set $x^*_{m,L} = x^*_{m,M}$ and solve for $\omega_{ML}$. □

*Proof of Proposition 6.* Similarly to the Proof of Proposition 1, firm $L$ times the merger conditional on the $\psi_{p,L}$ offered by $EM$:

$$\max_{x^*_{p,L}(\psi_{p,L})}\left[((\psi_{p,L} - 1)K_L x^*(\psi_{b,L}) - (1 - \epsilon_{EL})T_{EL})\left(\frac{x(t)}{x^*_{p,L}(\psi_{p,L})}\right)^{\beta_1}\right] \tag{51}$$

obtaining the trigger:

$$x^*_{p,L}(\psi_{p,L}) = \frac{\beta_1}{\beta_1 - 1}\frac{(1 - \epsilon_{ML})T_{ML}}{(\psi_{p,L} - 1)K_L} \tag{52}$$

which is anticipated by $EM$ who optimally finds the premium:

$$\max_{\psi_{p,L}}\left[((\omega_{ML}\theta_{ML} - \omega_{EM}\theta_{EM} - \psi_{p,L}K_L)\,x^*_{p,L}(\psi_{p,L}) - \epsilon_{ML}T_{ML})\left(\frac{x(t)}{x^*_{p,L}(\psi_{p,L})}\right)^{\beta_1}\right] \tag{53}$$

By solving (53), we obtain $\psi^*_{p,L}$ as presented in (26). Incorporating $\psi^*_{p,L}$ into (52) and rearranging we get (27). □

*Proof of Proposition 7.* Proceed as for Proposition 3. The continuation value to be incorporated as $F(.)$ into Equation (10) to maximize for $\psi_{p,M}$ is:

$$\left(\left(\omega_{ML}\theta_{ML} - \omega_{EM}\theta_{EM} - \psi^*_{p,L}K_L\right) x^*_{p,L}(\psi^*_{p,L}) - \epsilon_{ML}T_{ML}\right)\left(\frac{x^*_{p,M}(\psi_{p,M})}{x^*_{p,L}(\psi^*_{p,L})}\right)^{\beta_1} \tag{54}$$

□

*Proof of Proposition 8.* The relevant value function to be incorporated as $F(.)$ into (10) is now:

$$\left(\omega_{ML}\theta_{ML} - \omega_{EM}\theta_{EM} - \psi_{p,L}K_L\right) x^*_{p,M}(\psi^*_{p,M}) - \epsilon_{ML}T_{ML} \tag{55}$$

At $x^*_{p,M}$ the premium $\psi_{p,L}$ to be offered to $L$ is the one that solves $x^*_{p,L}(\psi_{p,L}) = x^*_{p,M}(\psi_{p,M})$, which leads to:

$$\psi_{p,L} = 1 + \frac{(\psi_{p,M} - 1)(1 - \epsilon_{ML})T_{ML}K_M}{(1 - \epsilon_{EM})T_{EM}K_L} \tag{56}$$

Incorporate (56) into (55). All the remaining maximizing procedures for finding $\psi^*_{p,M}$ and $x^*_{p,M}(\psi^*_{p,M})$ are as before and lead to the solutions presented in (30) and (31). □

*Proof of Proposition 10.* Considering Equations (27) and (29), set $x^*_{p,L} = x^*_{p,M}$ and solve for $\omega_{ML}$. □