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REAL MARKET CONCENTRATION THROUGH PARTIAL ACQUISITIONS

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ABSTRACT :

We study horizontal partial acquisitions in an oligopolistic industry in the absence of synergies. Contrary to existing results, we find that a dominant shareholder may choose to acquire shares in a competitor although the aggregate profit of the group of firms under his control, and even the greater group of firms in which he has a stake, is reduced. This is due to a *"favorite"* effect: after the acquisition, the dominant shareholder will favor the firm in which he eventually holds the relatively higher share to the detriment of shareholders of the other firms. For this reason, a block of shares can be bought at a discount when the value of the firm of the initiator decreases post acquisition. Moreover, we show that the existence of initial silent toeholds in rivals enhances the incentive for a dominant shareholder to buy shares in other firms in the industry, whereas controlling ones may discourage them.

Key-Words :

- Horizontal partial acquisitions
- Real market concentration
- Dominant shareholder
- Minority shareholders
- Silent interests

RESUME :

Nous étudions les stratégies de prises de participation dans une industrie oligopolistique en l'absence de synergies. Contrairement aux résultats existants, nous trouvons qu'un actionnaire dominant peut acquérir des actions dans une entreprise concurrente alors même que le profit joint du groupe d'entreprises qu'il contrôle, et même du groupe élargi d'entreprises dans lesquelles il a une part, diminue. Ce résultat s'explique par un effet «favori» : après l'acquisition, l'actionnaire dominant favorisera l'entreprise dans laquelle il détient la part relativement la plus élevée au détriment des actionnaires des autres entreprises. Pour cette raison, il est même possible qu'un bloc de titres soit acheté avec une prime négative dans le cas où la valeur de l'entreprise-acquéreuse diminue à la suite de l'acquisition. De plus, nous montrons que la propriété initiale d'intérêts silencieux rend plus profitables et encourages ainsi les prises de participation ultérieures dans l'industrie, alors que des intérêts contrôlants peuvent être de nature à les décourager.

Mots-clés :

- Prises de participation horizontales
- Concentration industrielle
- Actionnaire dominant
- Actionnaires minoritaires
- Intérêts silencieux

JEL classification : D23, D43, G32, G34.

Real Market Concentration Through Partial Acquisitions[*]

Patricia Charléty[†], Marie-Cécile Fagart[‡] and Saïd Souam[§]

May 7, 2004

Abstract

We study horizontal partial acquisitions in an oligopolistic industry in the absence of synergies. Contrary to existing results, we find that a dominant shareholder may choose to acquire shares in a competitor although the aggregate profit of the group of firms under his control, and even the greater group of firms in which he has a stake, is reduced. This is due to a *"favorite"* effect: after the acquisition, the dominant shareholder will favor the firm in which he eventually holds the relatively higher share to the detriment of shareholders of the other firms. For this reason, a block of shares can be bought at a discount when the value of the firm of the initiator decreases post acquisition. Moreover, we show that the existence of initial silent toeholds in rivals enhances the incentive for a dominant shareholder to buy shares in other firms in the industry, whereas controlling ones may discourage them.

Keywords: horizontal partial acquisitions, real market concentration, dominant shareholder, minority shareholders, silent interests.

JEL classification: D23, D43, G32, G34.

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1 Introduction

Evidence suggests that in many continental european countries shareholding power is highly concentrated in the hand of large shareholders (Becht and Röell, 1999). Even in the United States, the presence of a large voting block is not uncommon in listed companies (Becht and Mayer, 2002). When the remaining equity is in the hand of small shareholders, their passivity coupled with the voting rules (quorum) in the annual meetings enable the dominant shareholder to control strategic decisions such as the level of production, investments and acquisitions without a strict majority (50%) of equity or voting rights. Even when they do not control firms, the presence of blockholders may still have an impact on their policy and profits. Although partial acquisitions are common in corporate life, they received relatively little attention from economists. In particular, several questions remain largely unanswered: do they have causes and consequences similar to mergers and acquisitions of entire companies? How is the toehold in the target determined? What is their impact on the individual and the overall profit of the firms involved in the transaction, and their competitors? How is each category of shareholders' wealth affected? How do existing toeholds affect the future acquisition policy? In this article, we address these questions in the particular case of block trades between large shareholders of firms from the same industry.

Traditionally, the economic literature concentrates on the consequences of restructurings for the industry (the firms concerned, their competitors and consumers). In the case of horizontal acquisitions, the classical question since Williamson (1968) of the trade-off between the synergy gains and the possible consumers' welfare loss due to higher prices emerges. Horizontal mergers that claim to achieve economies of scale may actually intend to increase market power. However, Salant, Switzer and Reynolds (1983) (hereafter SSR) show that whereas mergers without economies of scale do result in an increase in prices and profits of the overall oligopolistic industry, they are not profitable for the merged entity. This surprising result stems from the reaction of the rivals which, in a model *à la Cournot*, increase their production to profit from the higher prices subsequent to the restriction of the quantity offered by the merged entity. Eventually, the restructuring is not profitable for the merging firms which therefore have no incentive to initiate the transaction *ex ante.* Reitman (1994) has extended this result to partial ownership arrangements: if the industry's overall profit increases following a partial acquisition, the beneficiaries are the rival companies which benefit

from a positive externality (increase in prices) whereas the firms involved in the transaction lose, which removes any incentive. Similarly, Farrell and Shapiro (1990) show that a marginal increase in an initial toehold is profitable only when a cost reduction compensates the negative effect of a less aggressive behavior of the companies involved (production restriction) and may be socially desirable in that case.

The finance literature is on the other hand concerned with the financial conditions of mergers and acquisitions, in particular the split of the takeover gain between shareholders of companies involved in the restructuring. Parallel to the surprising result of SSR, Grossman and Hart (1980, 1981) showed in pioneer articles that tender offers that increase shareholders's wealth may actually not occur in equilibrium because of the "free-rider problem": expecting an increase in the value of their shares post acquisition, small stockholders do not sell and therefore no offer can succeed. The positive role of large shareholders in this context has been emphasized since the seminal paper of Shleifer and Vishny (1986). However the presence of large shareholders, may also create problems, as they may pursue "private interests" at the expense of minority shareholders (what Johnson, La Porta, Lopez-de Silanes and Shleifer (2000) have called "tunnelling", this term describing "the transfer of resources out of a company to its controlling shareholder"). Thus, the conflict between large controlling and weak small shareholders has recently been recognized as probably as important as the traditional agency problem between managers and shareholders.

This article establishes a bridge between these two literatures. We study horizontal partial acquisitions in an oligopolistic industry producing a homogeneous good in the absence of synergies. For the reasons put forward by SSR and Reitman (1994), we find that the overall profit of the companies involved and the consumers' surplus decrease following the transaction. However, unlike these authors, we show the existence of equilibria with effective acquisition of shares. This partial share acquisition may be controlling or silent. This result comes from the fact that the strategic decision to acquire equity in a rival is made by the dominant shareholder of the bidding firm. Maximizing his own wealth, this shareholder may engage in privately profitable transactions at the expense of minority shareholders of his firm in the case where his toehold is relatively small, or to the detriment of minority shareholders of the target if the reverse is true, or even to the detriment of both when he already has large silent stakes outside the two firms. The ownership structure of the bidder and the

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target turns out to be a key variable: the higher the toehold of the dominant shareholder in the company he initially controls, the better the protection of minority shareholders of this firm. We also find that a shareholder with initial silent toeholds in rivals has more incentive to further make partial acquisitions. This comes from the larger value of these outside interests following the price increase in the whole industry as competition lessens. On the other hand, the impact of initial controlling toeholds is ambiguous. Accounting for the effects in the industry is essential for a good understanding of the acquisition process and the consequences for shareholders' wealth. Integrating productive and financial decisions reintroduces an incentive for horizontal equity acquisitions, and initial toeholds in rivals enhance this incentive.

The model is presented in section 2. In section 3, we study the equilibrium in the good market for given toeholds. In section 4, we solve the acquisition game under two different bidding possibilities, analyze the conditions (quantities and price) of the transactions and their wealth consequences for shareholders.

2   The model

We consider an oligopolistic market with n firms producing a homogeneous good. The demand is $P(X) = 1 - X$ where X represents the total quantity produced in the industry and P the corresponding price. Each company $i = 1, ..., n$ produces X_i and $X = \sum_{j=1}^{n} X_j$. The marginal cost is supposed to be constant and is normalized to zero for all firms. Under these assumptions, profits are $\Pi_i = P(X)X_i$ for all i.

Total equity capital is normalized to 1 for all firms. Each company is controlled by a dominant shareholder. The dominant shareholder chooses the production of the firm(s) he controls (possibly with less than 50% of the shares) and maximizes his own wealth. Initially, the dominant shareholder of any company i holds no equity in other companies $j \neq i$ in this market, except for A, the dominant shareholder of firm 1, who already owns stakes α_j in firms $j > 2$ in addition to his controlling share $\alpha_1 \in]0, 1]$ in firm 1. These toeholds α_j held in competitors may be controlling or non controlling ("silent"). In the case of a controlling share α_k, A initially chooses the production level X_k of firm k controlled in addition to X_1. Controlling shareholders compete à la Cournot.

We look at the case where shareholder A (and only him by assumption) may buy, directly

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or indirectly, all or part of the block of shares β_2 ($\beta_2 \in]0,1]$) initially held by B, the dominant shareholder of firm 2. The remaining equity of 2 is supposed to be widely held. In the case of an indirect acquisition, firm 1 rather than A buys the shares, still under A's initiative. After this acquisition, he may therefore control company B if he (or firm 1) becomes the largest shareholder. In this case, he decides also on the production level X_2. If after the acquisition of stock by A (or firm 1), B remains the largest shareholder in firm 2, B keeps controlling X_2. Let $\alpha_2 \in]0,1]$ be the share of equity acquired in firm 2 by A directly or indirectly from B; in the case of an indirect acquisition, $\widehat{\alpha}_2 \in]0,1]$ represents the amount acquired by firm 1; $\alpha_2 p$ (resp. $\widehat{\alpha}_2 p$) is the total amount paid for the transaction by A (resp. by firm 1). After the acquisition, the wealth of shareholder A is therefore $\alpha_1 \Pi_1 + \alpha_2 (\Pi_2 - p) + \sum_{j>2} \alpha_j \Pi_j$.[1] The wealth of B becomes $(\beta_2 - \alpha_2)\Pi_2 + \alpha_2 p$ after a direct acquisition, or $(\beta_2 - \widehat{\alpha}_2)\Pi_2 + \widehat{\alpha}_2 p$ after an indirect one. The other shareholders' wealth solely depends on the profits of their company. The objective of shareholders is to maximize the value of their financial wealth.[2]

The timing of the global game is therefore the following: A (or firm 1) acquires equity in 2 in the first stage of the game, determining α_2 and p; in the second stage, dominant shareholders choose simultaneously the production level of the firm(s) they control given α_2. Next section examines the Nash equilibrium of this production game. The first stage of the game, the acquisition of equity by A in firm 2, is presented in section 4 where we analyze the existence of bidding Nash equilibria.

3   The equilibrium in the real sector

In this section, we analyze the equilibrium in the real sector after the bidding game has taken place. In the case of a successful acquisition, A has acquired (directly or indirectly) a toehold α_2 in firm 2 (in addition to the shares α_j he already owns in firms $j > 2$) that may or may not give him the control of this firm. At this stage the amount $\alpha_2 p$ paid by A to shareholder B is a sunk cost and therefore does not influence the production decisions of any firm. The toeholds α_2 and α_j affect the production decisions of A in two ways. When setting

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[1] In the case of an indirect acquisition, A's final wealth is: $\alpha_1[\Pi_1 + \widehat{\alpha}_2(\Pi_2 - p)] + \sum_{j>2} \alpha_j \Pi_j = \alpha_1 \Pi_1 + \alpha_2(\Pi_2 - p) + \sum_{j>2} \alpha_j \Pi_j$ where share α_2 of A in 2 is $\alpha_1 \widehat{\alpha}_2$.

[2] This important hypothesis differs from most existing economic literature where managers maximize profits in the interest of shareholders in general and do not consider the dominant shareholder's interest.

the output of the firm(s) he controls (at least firm 1), A takes into account the direct effect of the output level of the controlled firm(s) on its (their) own profits, but also the indirect effect on the profits of the companies in which he holds an interest, silent or controlling. Let $\mathcal{C}$ represent the set of firms (the "core" group) controlled by A, and $\mathcal{G}$ the set of firms in which A holds a stake, controlling or not (the "greater" group). The number of firms in which A has a silent stake is denoted n_s and n_c is the number of firms controlled by A (i.e. the cardinal of $\mathcal{C}$).

Thus we have a *Cournot* game with $(n - n_c)$ dominant shareholders choosing the output of the firm they control in order to maximize its profits, and A choosing the production of the n_c firms controlled in order to maximize his wealth $\sum_{i=1}^{n} \alpha_i \Pi_i$.

Obviously, the quantities produced in equilibrium depend on n_c. It turns out that they also depend on the ratio of the sum of the silent interests held by A in his rivals denoted α_s to his highest controlling stake denoted α_c. Let ρ represent this ratio:[3]

$$\rho = \frac{\alpha_s}{\alpha_c} \text{ with } \alpha_s = \sum_{i \notin \mathcal{C}} \alpha_i \text{ and } \alpha_c = Max\{\alpha_i, i \in \mathcal{C}\}.$$

The following proposition gives the quantities and the profits of the firms in equilibrium.

Proposition 1 *Equilibrium quantities and profits are given by the following equations (1)-(4). Among the n_c firms controlled by A, only the firm with the highest weight may have positive production and profits ($X_i^* = \Pi_i^* = 0$ for $i \in \mathcal{C}$ and $\alpha_i < \alpha_c$).*

$$X_j^*(\alpha_1, \alpha_2, ..., \alpha_n) = \frac{1}{n - n_c + 1 + \max(1 - \rho, 0)} \quad \text{for } j \notin \mathcal{C} \tag{1}$$

$$\sum_{i \in \mathcal{C}} X_i^*(\alpha_1, \alpha_2, ..., \alpha_n) = \frac{\max(1 - \rho, 0)}{n - n_c + 1 + \max(1 - \rho, 0)} \tag{2}$$

$$\Pi_j^*(\alpha_1, \alpha_2, ..., \alpha_n) = \frac{1}{[n - n_c + 1 + \max(1 - \rho, 0)]^2} \quad \text{for } j \notin \mathcal{C} \tag{3}$$

$$\sum_{i \in \mathcal{C}} \Pi_i^*(\alpha_1, \alpha_2, ..., \alpha_n) = \frac{\max(1 - \rho, 0)}{[n - n_c + 1 + \max(1 - \rho, 0)]^2}. \tag{4}$$

All the proofs are given in the appendix.

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[3]For instance, when A holds shares in only three firms, say 1, 2 and 3, and A controls firm 1 only, $\mathcal{C} = \{1\}$, $\alpha_s = \alpha_2 + \alpha_3$, $\alpha_c = \alpha_1$ and $\rho = \dfrac{\alpha_2 + \alpha_3}{\alpha_1}$; when A controls two firms, say 1 and 2, $\mathcal{C} = \{1, 2\}$, $\alpha_s = \alpha_3$, $\alpha_c = Max(\alpha_1, \alpha_2)$ and $\rho = \dfrac{\alpha_3}{Max(\alpha_1, \alpha_2)}$; when A controls all three firms, $\mathcal{C} = \{1, 2, 3\}$, $\alpha_s = 0$ and $\rho = 0$.

3.1 The different effects at play

Proposition 1 reflects the restructuring that A operates within the group $\mathcal{C}$ of the n_c firms he controls given the reaction of his rivals, including the firms in which he has silent interests (belonging to $\mathcal{G}$ but not in $\mathcal{C}$), in equilibrium. Different mechanisms or "effects" are actually at play.

The *"favorite"* effect

Proposition 1 implies $X_i^* = \Pi_i^* = 0$ for $i \in \mathcal{C}$ and $\alpha_i < \alpha_c$. This means that among the n_c firms controlled by A, only the firm which has the highest weight (α_c) in his portfolio (say firm 1) *possibly* remains active. A chooses to stop the production of all other controlled companies. In other words, A favors the controlled firm in which he has the highest stake. This *"favorite"* effect obviously harms shareholders of the other controlled firms. Controlling acquisitions are in this model formally equivalent to a complete merger of the n_c firms into *at most* one company. Indeed, only in the case where the highest controlling stake (say α_1) is greater than the sum of A's silent interests α_s does firm 1 remains active.

The *"Hara Kiri"* effect

When the highest controlling stake α_c (say α_1) is lower than the sum of the silent interests in competitors α_s, i.e. $\rho \geq 1$, A also shuts down the corresponding controlled firm (say 1) in order to concentrate the production and profit where his stake is the highest: all the controlled production units are closed. This *"Hara Kiri"* effect benefits shareholders of all rivals to the detriment of those of all controlled companies, in particular firm 1.

In this case, partial acquisitions are formally equivalent to a complete merger of $n_c + 1$ production units, and the level of the profits of the $(n - n_c)$ firms which remain active is equivalent to the profits of the merged entity in SSR's model.[4]

The *"silent"* effect

Conversely, when his highest controlling toehold in a firm (say α_1) is greater than the total of silent stakes in rivals α_s (i.e. $\rho < 1$), A would like to concentrate the production in the controlled firm and shut down the firms in which he has a silent stake but, being a

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[4]This extreme result is due to the linearity of the model; similar but less radical effects would be obtained in other frameworks. With quadratic costs, production restructuring would still imply reallocations of production between firms, but far less cases of shutting down a production unit.

minority shareholder, does not have the power to do so. On the contrary, A internalizes the negative consequences of the production of the active controlled company on the value of his silent interests, and therefore *restricts* its output to limit the negative externalities on the value of his outside interests (*"silent"* effect).

Rivals (including competitors in which A has a stake) react to this restriction of the controlled firm (say 1) output by increasing their production to take advantage of the price increase. The higher the value of ρ, the higher the restriction of 1's output, the stronger its competitors' reaction and the higher their profits.

This discussion sheds some light on the crucial role played by ρ (the ratio of the *global silent* interests held by A in his rivals to his *highest controlling* stake) in equilibrium. Actually, keeping the production of non controlled firms constant (out of equilibrium), toeholds always make shareholder A (i.e. the group $\mathcal{C}$ of firms under his control) less "aggressive": he restricts the global production of the controlled group $\mathcal{C}$ to increase its profit. For given production levels of non controlled firms, the global profit of group $\mathcal{C}$ would increase. But as mentioned above, controlling shareholders of rivals outside of $\mathcal{C}$ do not remain passive and react to the restriction of the output by $\mathcal{C}$ and the higher resulting price. This is the strategic effect underlined by Fudenberg and Tirole (1984). We are in their classical case of strategic substitutes. In the Cournot model, when a firm is less aggressive, other firms respond by more aggressiveness.

Figures[56] 1 (resp. 2) illustrate the aggregate best-response curve of firms in group $\mathcal{C}$ (resp. in the "greater" group $\mathcal{G}$), and the aggregate best response curve of their competitors. The Cournot equilibrium lies at the intersection of the best-response curves. In either case, when ρ increases, the best-response curve of the group ($\mathcal{C}$ or $\mathcal{G}$) moves to the left (from the Cournot best response curve for $\rho = 0$ at one extreme to that of the merged entity of the SSR model

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[5]Figure 1 is built as follows. Suppose the production of group $\mathcal{C}$, X is given. The best response of a firm i verifies $X_i = 1 - X - \sum_{j \notin \mathcal{C}} X_j$. For given X, one can calculate the game equilibrium among the other firms, i.e. the response of all the other firms to the choice of X by shareholder A. This response is given by: $Y = \sum_{j \notin \mathcal{C}} X_j = \dfrac{n - n_c}{n - n_c + 1}(1 - X)$. The best response of group $\mathcal{C}$ controlled by A is then: $2X = Max(0, 1 - \dfrac{n - n_c + \rho}{n - n_c}Y)$.

[6]Using the same method, we can determine the response of the firms outside the enlarged group, Y to a quantity $X^{\mathcal{G}}$. We have $Y = \dfrac{n - n_c - n_s}{n - n_c - n_s + 1}\left(1 - X^{\mathcal{G}}\right)$ and $X^{\mathcal{G}} = Max\{\dfrac{(2 - \mu)n_s + 1 - [(2 - \mu)n_s + \mu]Y}{(2 - \mu)n_s + 2}; \dfrac{n_s(1 - Y)}{n_s + 1}\}$ where $\mu = \dfrac{n - n_c + \rho}{n - n_c}$.

when $\rho > 1$ at the other extreme). Thus both groups $\mathcal{C}$ and $\mathcal{G}$ become less aggressive as ρ increases.

Insert Figure 1 and Figure 2.

3.2 Welfare effects of partial acquisitions

Starting from an initial situation characterized by α_s, α_c and n_c, we now examine the consequences of an increase in one of A's stakes (say α_2 in firm 2) on the equilibrium profits of the whole industry (and welfare), of the "greater" group $\mathcal{G}$ of firms in which A has a positive stake, and of group $\mathcal{C}$ of firms controlled by A.

Are partial acquisitions anticompetitive?

From Proposition 1, it is clear[7] that an increase in a controlling share (say α_2) does not change the equilibrium as long as it remains below the highest controlling share ($\alpha_2 \leq \alpha_c$), and simply results in a continuous decrease in ρ when it becomes the highest controlling share. Thus, any partial acquisition that increases a toehold in an already controlled company benefits (or at least does not harm) consumers: the larger the controlling shareholder, the higher the welfare; this is due to a reverse *"silent"* effect: his controlling stake becoming relatively higher than his outside interests, A becomes more aggressive since the negative impact on silent stakes counts less relatively.

On the contrary, as a silent share (say α_2) goes up while remaining silent, ρ increases continuously. Therefore any silent partial acquisition is harmful for consumers: as seen before, a higher silent stake (say α_2) encourages the acquirer (say shareholder A) to restrict the production in the companies he controls to protect the value of his higher outside interests (the *"silent"* effect).

Finally, the overall effect of a partial acquisition which turns a silent toehold into a controlling stake is *a priori* ambiguous. Indeed, as α_2 keeps increasing, it eventually reaches the control threshold $\dfrac{\beta_2}{2}$; at this level, ρ drops from $\dfrac{\alpha_s + \dfrac{\beta_2}{2}}{\alpha_c}$ to $\dfrac{\alpha_s}{Max(\alpha_c, \dfrac{\beta_2}{2})}$ and the number of controlled firms goes up from n_c to $n_c + 1$. The simultaneous decrease in ρ and increase

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[7]The quantity produced by the entire industry (X^{ind}), and therefore welfare, is a decreasing function of n_c and ρ. In our Cournot model with a constant unit cost, a restriction of the total supply results in an increase in the profit of the whole industry and a decrease in total welfare.

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in the number of firms under A's control affect total production (and welfare) in opposite directions. However, calculation shows that it actually drops. Acquiring control of a new company leads A to shut an additional firm; this direct effect outweighs the simultaneous indirect effect (higher production of the active controlled firm following the decrease in outside interests). Overall, increasing the number of firms under the control of A is always anticompetitive. Moreover, although production (and welfare) increase as the share in the newly controlled company gets larger, it never reaches the level prevailing before the acquisition of control: the highest possible silent stake in firm 2 (close to $\frac{\beta_2}{2}$) is always less harmful than the highest controlling share ($\alpha_2 = 1$).

Figure 3 illustrates how industry output (or welfare) varies with the toehold α_2 held by A in firm 2, keeping other stakes constant.

Insert Figure 3.

Who gains, who loses?

Obviously, silent partial acquisitions always benefit non controlled companies whereas group $\mathcal{C}$ loses (as well as the greater group $\mathcal{G}$ if the number n_s of companies in which A has a silent interest is small enough). The reverse is true for operations which increase already controlling shares. As a consequence, partial acquisitions which do not change n_c however lead to a production restructuring and a reallocation of production and profits within the greater group.

Controlling acquisitions also clearly benefit companies that remain out of the control of A. The production and profit of the group of $(n_c + 1)$ firms under A's control is however always lower than the sum of the output of the n_c firms initially controlled by A and the output of the newly controlled firm before the acquisition (the price increase is outweighed by the quantity decrease). Therefore, the profits of the group of firms involved in partial acquisitions generally decrease.

However, A may gain from these operations for two reasons. First, the profitability of the acquisition depends on the price paid for the toehold. Second, A's wealth ($\sum_i \alpha_i \Pi_i$) is not proportional to the profit of the group ($\sum_i \Pi_i$). When the toeholds are asymmetric, shareholder A may well become wealthier whereas the total profit of the firms in which he has a stake decreases. For example, if group $\mathcal{C}$ loses while rivals (including firms in which A

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has a silent interest) gain, the loss incurred by A in $\mathcal{C}$ may be more than compensated by the increase in the value of his silent stakes (for $\alpha_c < \alpha_s$). The next section examines these questions.

4   The acquisition game

In this section, we study the first stage of the global game in which shareholder A may acquire a share of the equity of firm 2. We showed in the previous section that the strategic choices of output in the second stage depend on the level of the toehold acquired and its nature, controlling or not.

In practice, there exist multiple ways to acquire a share or the entire equity of a firm: private negotiation, snapping up shares on the stock market, block trades, tender offers, etc...

We explore two hypotheses. In the first sub-section, shareholder A makes a "take it or leave it" block offer to B. In this case, A acquires a stake in 2 directly. Since he controls firm 1's productive and financial decisions, its M&A policy in particular, A may have firm 1 acquire a share of equity in firm 2. This case of an indirect acquisition is studied in the second sub-section in which firm 1 (rather than shareholder A) makes a "take it or leave it" block offer to B. At this stage of the analysis, there is no reason why these two modes of acquisition should be equivalent. *A priori* neither dominates from A's point of view.

4.1   Shareholder A makes a direct block offer to B

Let us suppose that shareholder A makes a block offer (quantity, price) to the dominant shareholder of 2, namely B, who accepts or rejects it.[8] Proposition 2 describes the equilibrium.

Proposition 2 *The optimal share α_2^* maximizes the joint wealth of A and B. Depending on the value of β_2, acquisitions are hostile, friendly or do not occur. In:*

- *zone I ($\beta_2 \leq \beta_I$): A acquires a controlling share in firm 2 with any $\alpha_2^* \in]\dfrac{\beta_2}{2}, \beta_2]$ (hostile acquisitions);*

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[8]The results obtained under this hypothesis can be generalized to the case where shareholders A and B negotiate at the first stage a block sale. See Charléty, Fagart and Souam (2003).

- *zone II ($\beta_I < \beta_2 \le \beta_{II}$): A acquires no share in firm 2 ($\alpha_2^* = 0$) when his silent interest α_s is small, and is indifferent between any share $[0, \frac{\beta_2}{2}]$ when it is high (no acquisition or friendly acquisitions);*

- *zone III ($\beta_{II} < \beta_2 \le \beta_{III}$): A acquires a silent interest in firm 2, $\alpha_2^* = 2\beta_2 + \alpha_s - \alpha_c(n - n_c)$ (friendly acquisitions);*

- *zone IV ($\beta_{III} < \beta_2$): any silent interest $\alpha_2^* \in [\alpha_c - \alpha_s, \frac{\beta_2}{2}]$ in firm 2 is an equilibrium when $\alpha_s > 0$. A is indifferent between acquiring a controlling or a silent interest in firm 2 when $\alpha_s = 0$ and $\alpha_2^* \in [\alpha_c, \beta_2]$ (friendly acquisitions).*

The values taken by the three thresholds β_I, β_{II} and β_{III} are given by the following equations:

$$\beta_I = Max(\alpha_c, \alpha_s) \frac{2(n - n_c + 1 - \frac{\alpha_s}{Max(\alpha_c, \alpha_s)}) + 1}{[n - n_c + 1 - \frac{\alpha_s}{Max(\alpha_c, \alpha_s)}]^2} \tag{5}$$

$$\beta_{II} = \alpha_c \frac{[n - n_c - \frac{\alpha_s}{\alpha_c}]}{2} \quad \text{when } \alpha_s \le \alpha_c \text{ and } \beta_{II} = 1 \text{ otherwise.} \tag{6}$$

$$\beta_{III} = \alpha_c \frac{[n - n_c + 1 - \frac{2\alpha_s}{\alpha_c}]}{2} \quad \text{when } \alpha_s \le \alpha_c \text{ and } \beta_{III} = 1 \text{ otherwise.} \tag{7}$$

Figure 4 presents the different zones as a function of β_2 and α_s for a given value of α_c.

Insert Figure 4.

As already suggested at the end of the third section, the decision criterion for an acquisition is not the sum of the profits of firms 1 and 2 involved in the operation, but the joint profit of shareholders A and B. Thus, even though the joint profit of 1 and 2 combined always decreases, A and B joint wealth may increase when their respective controlling shares are "not too close". Only when α_c (= α_1 by assumption) and β_2 are equal and $\alpha_s = 0$ is the joint shareholders's wealth proportional to the joint firms' profit, in which case we go back to SSR's results. As long as the joint wealth of A and B increases following the acquisition (possibly at the expense of other shareholders), A and B are able to share this gain in this game where other shareholders play no role.

Remembering that among the firms in which A holds a controlling stake, only the firm in which A has the highest interest may remain active in equilibrium (due to the *"favorite"* and

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the *"Hara Kiri"* effects), we look more closely at the equilibrium depending on the relative size of α_s.

Small silent interest $(\alpha_c \geq \alpha_s \geq 0)$

Let us begin with the case where A has a small initial silent interest in firms outside of 1 and 2.

- In zone I, as β_2 is small relatively to α_c, in order to maximize the joint wealth of A and B, firm 2 should be closed, the increase in the value of the stake in 1 far outweighing the decrease in the value of the stake in 2. Therefore, A buys enough equity in 2 to get its control[9] and favors firm 1 afterwards. This also benefits his silent stakes. The acquisition can be considered as hostile, the *"favorite"* effect always playing in favor of the previously controlled firm with the highest interest (firm 1).

- In zone II, no acquisition takes place: the weights of A and B in their original firms are too close, and α_s too small, to make any acquisition profitable. Indeed, the joint wealth of A and B is closely related to the sum of the profits of firms 1 and 2, which would decrease following the acquisition. This generalizes SSR's results.

- Zones III and IV correspond to friendly acquisitions, in the sense that firm 2's profit increases at the expense of the minority shareholders of the firms initially controlled by A.

In zone III, A acquires a silent interest in firm 2, β_2 is greater than α_c, but not enough to make it profitable for A to close firm 1 (both firms keep a distinct control and positive productions, the *"silent"* effect is at play).

In zone IV where β_2 is high enough, maximizing A and B joint wealth implies closing firm 1. Thus A acquires a sufficiently high interest in firm 2 and stops production in all the previously controlled firms; the *"Hara Kiri"* effect is at play. When $\alpha_s = 0$, he is actually indifferent between controlling firm 2 or not. In fact, when A controls firm 2, he maximizes its value exactly as B would if he remained the controlling shareholder. Their interests are completely aligned. When $\alpha_s > 0$, A is no longer indifferent between acquiring a controlling or a silent stake in firm 2. Indeed, when A controls firm 2, he takes into account the negative impact of firm 2's output on the value of his silent interests, and therefore chooses a level of production for firm 2 that is lower than what would prevail under B's control. As a consequence, when β_2 is high, the overall wealth of A and B would actually be smaller under

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[9]In the production game, the number of firms controlled by A increases by one (n_c is replaced by $(n_c + 1)$).

A's control rather than B's. Acquiring a silent share is a commitment not to decrease 2's value afterwards, which explains the rather counter-intuitive result that silent acquisitions dominate.

High silent interest $(\alpha_s > \alpha_c)$

In this case, since A's silent interest is high compared with his highest initial controlling share $(\alpha_1 = \alpha_c)$, the output of 1 is initially null in order to favor competitors in which he has a high stake. A silent acquisition in firm 2 would of course not affect this equilibrium in the real sector $(\alpha_s$ would become even higher). Therefore, no silent partial acquisition possibly increases the joint wealth of A and B. Since A acquires shares at a price which reflects the initial value of firm 2 in our take-it or leave-it game, and nothing really changes after a silent acquisition, A is obviously indifferent between acquiring a silent interest or nothing.

On the other hand, when A takes the control of firm 2, he considers the impact of 2's production level on competitors in which he holds silent interests and reduces the production of 2. A controlling acquisition in firm 2 thus reduces the value of firm 2 and increases the value of competitors. This dilution of 2 is profitable, from the point of view of A and B together, only when β_2 is low enough (zone I). This explains why we only have two zones depending on the value of β_2 as illustrated by Figure 4.[10]

Prices, block premia and minority shareholders' wealth

In this take-it or leave-it framework, the level of the offer (when it exists) made by A is such that it leaves B's wealth unchanged.[11] Therefore, when the acquisition is hostile (leading to a decrease in 2's profits), the price paid for each share acquired by A must include a premium compared with the initial price in order to compensate B for the lower value of his remaining holdings post acquisition. On the other hand, when the acquisition is friendly (leading to an increase in 2's value), the price actually displays a discount compared with the previously prevailing price, since B benefits from the increased value of his remaining holdings post acquisition. Of course, in the case where A acquires the entire block β_2, there

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[10]The fact that firm 1 which initially produces nothing is active on the market for corporate control may seem strange; however the extreme result concerning the output is once again due to the linearity of the model; another interpretation is that firm 1 is as an "empty shell" serving shareholder A's interests.

[11]In equilibrium, $\alpha_2^* p(\alpha_2^*) + (1 - \alpha_2^*)\Pi_2^{*post\ acquisition} = \beta_2 \Pi_2^{*before\ acquisition}$. In a negotiation game, the same acquisitions would occur but the increase in A and B joint wealth would be shared.

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is no premium or discount.[12]

Whereas partial acquisitions always benefit A and B, they always harm minority share-holders of either firm 1 (friendly acquisitions) or firm 2 (hostile acquisitions). As already noticed, they benefit shareholders from other companies. The asymmetry of the weights of A and B in their original firms is crucial for partial acquisitions to be (privately) profitable.

The incentive to acquire partial interests and the role of initial toeholds

The incentive to acquire a toehold obviously depend of the total number of firms in the industry: the fiercer is competition in this model *à la Cournot*, the less frequent are acquisitions (the size of zone II increases with the number of firms in the industry). As increasing the number n_c of firms controlled by A (leaving α_c unchanged) is equivalent to closing one firm, more control in this sense not only reduces competition and welfare, but also enhances the incentives to make further acquisitions.

More control can as well be interpreted as an increase in the controlling toehold. For small values of α_c ($\alpha_c < \alpha_s$, which corresponds to a high silent interest), no firm belonging to group $\mathcal{C}$ produces in equilibrium. Thus a small increase in α_c, as long as the silent interest remains high, plays no role in either the production or the acquisition policy (β_I is independent of α_c and there are only two zones). For higher values of α_c ($\alpha_c \geq \alpha_s$, which corresponds to a small silent interest), β_I, β_{II} and β_{III} increase with α_c. As the controlling interest gets larger, zone I (hostile acquisitions) increases and zones III and IV (friendly acquisitions) shrink. In zone I, shareholder A acquires the control of firm 2 and favors firm 1 afterwards. Therefore, the larger shareholder A, the more profitable the acquisition for him, and the higher the incentive to acquire. On the other hand, in zones III and IV where α_c is relatively small w.r.t β_2, the acquisition favors firm 2 at the expense of 1. Thus, friendly acquisitions are less profitable for A and occur less frequently when α_c increases.

Whereas controlling toeholds have an ambiguous effect on the incentive to make additional partial acquisitions, silent toeholds always encourage them. It can easily be shown that zone I and zones III and IV together (where shareholder A acquires shares in firm 2) are larger when α_s increases. Acquisitions are more frequent for firms which already hold silent interests in rivals; this is obviously due to the fact that being anti-competitive, they

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[12]Premia would of course be more frequent in a negotiation game and would in particular be present when the whole block β_2 is acquired.

always benefit firms outside of these operations. Thus, the higher A's silent interest in rivals, the higher the incentive to acquire new toeholds.[13]

4.2 Shareholder A makes an indirect block offer to B

In this sub-section, we study the case of an indirect acquisition[14] in which firm 1 (rather than shareholder A) makes, under the control of A, a "take it or leave it" block offer to B. In this framework, $\widehat{\alpha}_2$ represents the toehold acquired by firm 1, and α_2 the share acquired by shareholder A indirectly through his holdings in 1. Proposition 3 states that only zone I (hostile acquisitions) and zone II (no partial acquisition) remain in this context.

Proposition 3 *In the indirect acquisition game of shares from the dominant shareholder of firm 2 by firm 1 controlled by A :*

- *if $\beta_2 \leq \beta_I^{ind}$ (zone I), any $\widehat{\alpha}_2^* \in]\dfrac{\beta_2}{2}, \beta_2]$ is an equilibrium, firm 1 acquires the control of firm 2;*

- *if $\beta_2 > \beta_I^{ind}$ (zone II), $\widehat{\alpha}_2^* = 0$ (firm 1 acquires no share in firm 2). The threshold β_I^{ind} is given by:*

$$\beta_I^{ind} = Max(1, \frac{\alpha_s}{\alpha_c}) \frac{2(n - n_c + 1 - \dfrac{\alpha_s}{Max(\alpha_c, \alpha_s)}) + 1}{[n - n_c + 1 - \dfrac{\alpha_s}{Max(\alpha_c, \alpha_s)}]^2}. \tag{8}$$

Let as before $\alpha_c = \alpha_1$. A's final wealth after an indirect acquisition is: $\alpha_1[\Pi_1 + \widehat{\alpha}_2(\Pi_2 - p)] + \sum_{j>2} \alpha_j \Pi_j = \alpha_1 \Pi_1 + \alpha_2(\Pi_2 - p) + \sum_{j>2} \alpha_j \Pi_j$ where share α_2 of A in 2 is $\alpha_1 \widehat{\alpha}_2$. Therefore, in the production game (p is a sunk cost), if A controls 2 indirectly, he always shuts it down since his stake in 2 is by construction lower than his holding in 1 ($\alpha_2 = \alpha_1 \widehat{\alpha}_2 \leq \alpha_1 \beta_2 < \alpha_1$). The *"favorite"* effect is at play. On the other hand, if A holds (indirectly) α_2 silent, although $\alpha_1 > \alpha_2$, A restricts the output of firm 1 due to the *"silent"* effect.[15]

For these reasons, *ex ante*, it is never profitable for A to acquire a silent interest in 2 indirectly: the loss incurred on his stake in 1 being by construction relatively large compared

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[13] It can also be shown that the size of the toehold acquired in 2 is non-decreasing in α_s in the sense that when α_s increases, there always exist a higher new equilibrium α_2^*.

[14] By assumption, the initial toeholds of A in other firms are owned directly.

[15] This comes directly from Proposition 1.

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to the gain made on his indirect share in 2. Only controlling indirect acquisitions which increase firm 1's operating profits possibly occur.[16]

Whereas such indirect partial acquisitions always harm minority shareholders of 2 (shareholder B being indifferent in this take-it-or-leave game), they do not necessarily benefit minority shareholders of firm 1. First, although it is true that firm 1's equilibrium operating profits Π_1^* always increase, firm 1's equilibrium value $\Pi_1^* - p\widehat{\alpha}_2^*$ may decrease after the acquisition: firm 1 pays the pre-acquisition value of B's stake which is worth nothing afterwards. If A has no silent interest, A's final wealth is proportional to firm 1's value; acquisitions that benefit A also create value for minority shareholders of firm 1. But when A has silent stakes in rivals, the increase in their value may compensate a loss in the value of A's interest in 1. This is likely to be true when α_s is high and $\alpha_c = \alpha_1$ low. The profitability threshold[17] $\widehat{\beta}_I^{ind}$ for the minority shareholders of firm 1 is lower than shareholder A's threshold β_I^{ind}. Therefore, for $\beta_2 \in [\widehat{\beta}_I^{ind}, \beta_I^{ind}]$, A initiates controlling partial acquisitions that also expropriate the minority shareholders of firm 1.

Moreover, it can be checked that $\beta_I^{ind} > \beta_I$: controlling indirect partial acquisitions are more likely than controlling direct acquisitions by A. This is of course due to the fact that A pays only a fraction α_1 of the amount offered to B (and also gets α_1 of firm 1's operating profits) in indirect operations but receives the total increase in value of his silent stakes as in direct acquisitions. Therefore, indirect acquisitions may dominate for low values of β_2. On the other hand, for high values of β_2, indirect acquisitions are never profitable for A. Direct acquisitions will be preferred by A in that case.

Finally, the effect of higher controlling initial interests is no more ambiguous, contrary to the case of direct acquisitions: they always discourage further acquisitions. As silent initial toeholds encourage them, they play in opposite directions. This is due to the fact that acquisitions are always hostile.

[16]Proposition 3 derives from Proposition 2 where β_2 is simply replaced by $\alpha_1\beta_2$; it is then clear that zones III and IV can never emerge (zones III and IV correspond to values of $\beta_2 > \alpha_1$, which can never hold when β_2 is replaced by $\alpha_1\beta_2$).

[17]Simple calculus shows that $\widehat{\beta}_I^{ind} = (1 - \frac{\alpha_s}{Max(\alpha_s,\alpha_c)})\frac{2(n-n_c)+3-\frac{2\alpha_s}{Max(\alpha_c,\alpha_s)}}{[n-n_c+1-\frac{\alpha_s}{Max(\alpha_c,\alpha_s)}]^2} = Max[\alpha_c(\alpha_c - \alpha_s);0]\beta_I^{ind}$. This threshold decreases with $\frac{\alpha_s}{\alpha_c}$.

5 Conclusion

In a standard framework *à la Cournot,* we show that partial acquisitions, both controlling and silent, always lead to a decrease in the overall profit of the companies involved in the transaction, an increase in their competitors' profit and have a negative impact on the consumer surplus. In this sense, our results generalize to the case of partial acquisitions the findings of SSR that, in the absence of cost savings, mergers are not profitable operations.

Still, we do obtain equilibria where a large shareholder gains from acquiring a block of shares, silent or controlling, from a shareholder in a rival firm. This result is partly due to the assumption that a blockholder may actually control a firm when the remaining shares are dispersed among atomistic shareholders. In our model, the relative separation of ownership and control gives rise to "favoritism" within the group of firms in which the dominant shareholder has a stake. When choosing the production level of the firms he controls, he "favors" the firm in which he holds the relatively highest share. If, for example, the controlling block in the target is relatively small compared with his initial toeholds in the other companies, he closes the new firm under his control after the acquisition. Such a hostile acquisition implies the payment of a premium to the selling shareholder, and a decrease in the value of the target following the transaction. On the contrary, the acquisition of a relatively high share in a rival will lead the acquiring shareholder to close his own company at the expense of its minority shareholders and to the benefit of the target. For such a friendly operation, the block may be bought at a discount since, if he keeps a stake in the company, the seller will profit from its increase in value. When the acquirer initially holds high silent toeholds in rivals, he may even sacrifice the controlled companies to the benefit of competitors only. Thus the presence of large shareholders generally tends to protect minority shareholders of their company, as already pointed out in other articles.[18] Another interesting result concerns the choice between a direct acquisition of shares and an indirect acquisition through the controlled company (a stock "pyramid", see Faccio and Lang, 2000). In particular, even in the absence of financial constraints, we show that an indirect controlling acquisition may be preferred when the acquirer already owns silent toeholds in rivals and the targeted block is relatively small. On the other hand, relatively large blocks should be acquired directly according to our findings. The initial ownership structure of firms and the

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[18]See for example Shleifer and Vishny (1986).

presence of initial stakes in rivals[19] therefore play important roles in determining the share of the target acquired, the nature of the toehod (controlling or silent), the type of acquisition (direct or indirect) and its feasibility for the dominant shareholder.

An important feature of our model is the linkage between productive and financial decisions. As for Brander and Lewis (1986) in another context (the choice of debt), the functioning of financial markets has an important impact on the economic performance of the real sector.

Another implication of our analysis is that in particular, when the share acquired in the target by the dominant shareholder is higher than his toehold in his original firm, the minority shareholders of the latter are expropriated. In most countries, financial markets regulation aims at protecting the interest of target firms' shareholders and overlooks the interest of bidding firms' shareholders. This finding may explain, at least partly, the well documented poor financial performance of acquiring firms in takeovers.

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6 Appendix

6.1 Proof of proposition 1

We look for the *Cournot-Nash* equilibrium of the production game between firms outside of A's control and group $\mathcal{C}$ of firms under A's control.

(i) Any independent firm $k \notin \mathcal{C}$ simply maximizes its profit given by:

$$(1 - \sum_{i=1}^{n} X_i)X_k. \tag{9}$$

Thus its best response quantity is:

$$X_k = \frac{Max(1 - \sum_{i=1, i \neq k}^{n} X_i, 0)}{2}. \tag{10}$$

Let $X = \sum_{i \in \mathcal{C}} X_i$, represent the total quantity produced by the firms controlled by A and define $\widehat{X} = \sum_{i \notin \mathcal{C}} X_i$ the total quantity produced by the firms outside group $\mathcal{C}$ of firms controlled by A. Equation (10) can be rewritten as follows:

$$2X_k = Max(1 - X - \widehat{X} + X_k, 0), k \notin \mathcal{C}. \tag{11}$$

For X given, since all independent firms respond in the same way, by symmetry we can write:

$$X_k = \frac{\widehat{X}}{n - n_c} = \frac{1 - X}{n + 1 - n_c}. \tag{12}$$

(ii) We now determine the behavior of group $\mathcal{C}$. A's wealth can be written as:

$$(1 - \sum_{i=1}^{n} X_i)(\sum_{j=1}^{n} \alpha_j X_j). \tag{13}$$

For $j \in \mathcal{C}$, A chooses the production X_j of firm j and $X = \sum_{j \in \mathcal{C}} X_j$ in order to maximize his wealth:

$$(1 - X - \widehat{X})(\sum_{j \in \mathcal{C}} \alpha_j X_j + \sum_{i \notin \mathcal{C}} \alpha_i X_i). \tag{14}$$

Given X, A's wealth is maximized for $X_j = 0$ when $\alpha_j < Max(\alpha_i, i \in \mathcal{C}) \equiv \alpha_c$ and $\sum_{j \in \mathcal{C}} X_j = X$. It can then be rewritten as $(1 - X - \widehat{X})(\alpha_c X + \frac{\sum_{i \notin \mathcal{C}} \alpha_i}{n - n_c} \widehat{X}) = \alpha_c (1 - X - \widehat{X})(X + \frac{\rho}{n - n_c} \widehat{X})$ where $\rho = \frac{\sum_{i \notin \mathcal{C}} \alpha_i}{\alpha_c}$.

The best response of shareholder A is thus $2X = Max(1 - \frac{n - n_c + \rho}{n - n_c} \widehat{X}, 0)$.

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(iii) Finally, equilibrium quantities are given by:

$$X = \frac{1 - \rho}{n - n_c + 2 - \rho} \text{ and } \widehat{X} = \frac{n - n_c}{n - n_c + 2 - \rho} \text{ when } \rho \leq 1$$

$$X = 0 \text{ and } \widehat{X} = \frac{n - n_c}{n - n_c + 1} \text{ when } \rho > 1.$$

The equilibrium price is then given by $p^e = \dfrac{1}{n - n_c + 1 + Max(1 - \rho, 0)}$ and A's wealth is $\alpha_c \dfrac{Max(1 - \rho, 0) + \rho}{[n - n_c + 1 + Max(1 - \rho, 0)]^2}$.

6.2 Proof of proposition 2

Assume that A makes a block offer (p, α_2) to B. If B rejects this offer, his wealth is $\beta_2 \Pi_2^*(\alpha_1, 0, ..., \alpha_n)$. If he accepts, he gets $(\beta_2 - \alpha_2)\Pi_2^*(\alpha_1, \alpha_2, ..., \alpha_n) + \alpha_2 p$. He will therefore accept provided that the proposed price is such that $(\beta_2 - \alpha_2)\Pi_2^*(\alpha_1, \alpha_2, ..., \alpha_n) + \alpha_2 p \geq \beta_2 \Pi_2^*(\alpha_1, 0, ..., \alpha_n)$. Anticipating this behavior, A offers the smallest price compatible with this condition, such that his participation constraint is binding. Shareholder A's wealth is then given by:

$$\sum_{i \neq 2} \alpha_i \Pi_i^*(\alpha_1, \alpha_2, ..., \alpha_n) + \alpha_2 \Pi_2^*(\alpha_1, \alpha_2, ..., \alpha_n) - \alpha_2 p$$

$$= \sum_{i \neq 2} \alpha_i \Pi_i^*(\alpha_1, \alpha_2, ..., \alpha_n) + \beta_2 \Pi_2^*(\alpha_1, \alpha_2, ..., \alpha_n) - \beta_2 \Pi_2^*(\alpha_1, 0, ..., \alpha_n),$$

and he will propose $\alpha_2 \in [0, \beta_2]$ which maximizes the above expression. Define $L(\alpha_2) = \sum_{i \neq 2} \alpha_i \Pi_i^*(\alpha_1, \alpha_2, ..., \alpha_n) + \beta_2 \Pi_2^*(\alpha_1, \alpha_2, ..., \alpha_n)$. In equilibrium the optimal share α_2 maximizes $L(\alpha_2)$ in $[0, \beta_2]$ since $\beta_2 \Pi_2^*(\alpha_1, 0, ..., \alpha_n)$ does not depend on α_2.

The optimum among the controlling interests

Consider the case where A controls firm 2. As n_c denotes the number of firms controlled by A before the partial acquisition in firm 2, the number of controlled firms becomes $n_c + 1$. α_c is the highest initial controlling share ($\alpha_c = Max(\alpha_i, i \in \mathcal{C} - \{2\})$) and α_s the sum of A's silent interests. Thus $\rho = \dfrac{\alpha_s}{Max(\alpha_c, \alpha_2)}$. L can be nicely expressed:

$$L(\alpha_2) = \frac{Max(\alpha_c, \alpha_2, \alpha_s) + (\beta_2 - \alpha_2)\lambda Max(1 - \rho, 0)}{[n - n_c + Max(1 - \rho, 0)]^2}$$

with $\lambda = 1$ if $\alpha_2 > \alpha_c$ and $\lambda = 0$ otherwise.

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We want to show that the optimal value of L is:

$$L_c^* = \frac{Max(\beta_2, \alpha_c, \alpha_s)}{[n - n_c + 1 - \frac{\alpha_s}{Max(\beta_2, \alpha_c, \alpha_s)}]^2}. \tag{15}$$

(15) obviously holds when $Max(\beta_2, \alpha_c, \alpha_s) = \alpha_c$ or $Max(\beta_2, \alpha_c, \alpha_s) = \alpha_s$. Indeed, in these two cases, $L(.)$ does not depend on α_2, either because $\lambda = 0$ or because $\rho > 1$. As a consequence, when $\beta_2 \leq Max(\alpha_c, \alpha_s)$, the optimal solution α_2^* is any share in $]\frac{\beta_2}{2}, \beta_2]$. We thus assume in the following that $\beta_2 > Max(\alpha_c, \alpha_s)$.

When $\alpha_2 \leq Max(\alpha_c, \alpha_s)$, $L(.)$ does not depend on α_2. Conversely, when $\alpha_2 > Max(\alpha_c, \alpha_s)$, we have $\lambda = 1$, and $\rho < 1$ so L can be written $\dfrac{\alpha_s + \beta_2(1 - \frac{\alpha_s}{\alpha_2})}{[n - n_c + 1 - \frac{\alpha_s}{\alpha_2}]^2}$. $L(.)$ does not depend on α_2 when $\alpha_s = 0$. When $\alpha_s > 0$, the derivative of L with respect to α_2 has the sign of:

$$\beta_2[n - n_c + 1 - \frac{\alpha_s}{\alpha_2}] - 2[\alpha_s + \beta_2(1 - \frac{\alpha_s}{\alpha_2})] = \beta_2[n - n_c - 1 + \frac{\alpha_s}{\alpha_2}] - 2\alpha_s$$

$$\geq \beta_2[n - n_c - 1] - \alpha_s \text{ as } \alpha_2 \leq \beta_2.$$

This latter expression is positive since $\beta_2 > \alpha_s$ and $n - n_c \geq 2$. Hence $L(.)$ increases with respect to α_2, and the optimal share, constrained to be higher than $Max(\alpha_c, \alpha_s)$, is β_2. We have to prove now that the optimal share is actually not smaller than $Max(\alpha_c, \alpha_s)$ when feasible (that is when $\frac{\beta_2}{2} < Max(\alpha_c, \alpha_s) < \beta_2$). When $\alpha_s \geq \alpha_c$, $L(.)$ is continuous w.r.t. α_2, so the optimal share is β_2. When conversely $\alpha_c > \alpha_s$, $L(.)$ is discontinuous at $\alpha_2 = \alpha_c$, equates $L(\alpha_c) = \dfrac{\alpha_c}{[n - n_c + 1 - \frac{\alpha_s}{\alpha_c}]^2}$ for any $\alpha_2 \leq \alpha_c$. Moreover $L(\alpha_c^+) < L(\alpha_c^-)$. However, it is easy to show that $L(\alpha_c)$ increases with respect to α_c whenever $n - n_c \geq 2$, so finally $L(\alpha_c) \leq L(\beta_2)$ as $\beta_2 > \alpha_c$.

Comparing controlling and silent acquisitions

Assume now that A does not control firm 2. Define $\alpha_s = \sum_{i \neq 2, i \notin C} \alpha_i$ the sum of the initial silent interests held by shareholder A in other firms. Thus $\rho = \dfrac{\alpha_2 + \alpha_s}{\alpha_c}$ and $\alpha_2 \in [0, \frac{\beta_2}{2}]$ so $L(\alpha_2)$ can be written as:

$$L_s(\alpha_2) = \frac{\alpha_c Max(1 - \frac{\alpha_2 + \alpha_s}{\alpha_c}, 0) + \beta_2 + \alpha_s}{[n - n_c + 1 + Max(1 - \frac{\alpha_2 + \alpha_s}{\alpha_c}, 0)]^2}. \tag{16}$$

• As a first step, note that $L_s(\alpha_2)$ does not depend on α_2 in case of high silent interests that

is when $\alpha_s > \alpha_c$. Comparing $L_s(0)$ and L_c^* in that case gives

$$L_s(0) - L_c^* = \frac{\beta_2 + \alpha_s}{[n - n_c + 1]^2} - \frac{Max(\beta_2, \alpha_s)}{[n - n_c + 1 - \frac{\alpha_s}{Max(\beta_2, \alpha_s)}]^2}. \tag{17}$$

When $\beta_2 \leq \alpha_s$, $L_s(0) - L_c^* > 0$ if and only if $\beta_2 > \beta_I$. When $\beta_2 > \alpha_s$, $L_s(0) - L_c^* > 0$.

So when $\beta_2 > \beta_I$ (i.e. in zone II for high silent interest), A prefers acquiring any silent interest to a controlling one.

- In case of small silent interests (i.e. when $\alpha_c > \alpha_s$), $L_s(.)$ is a continuous function of α_2. Taking the derivative of $L_s(\alpha_2)$ w.r.t. α_2 in $[0, \alpha_c - \alpha_s]$ shows that L_s increases with α_2 if and only if $\alpha_2 \leq \alpha_2^* = 2\beta_2 + \alpha_s - \alpha_c[n - n_c]$. When $\alpha_2^* \leq 0$ ($\beta_2 \leq \beta_{II}$), the optimal silent interest is thus zero (zones I and II). Conversely, when $0 < \alpha_2^* \leq \alpha_c - \alpha_s$ ($\beta_{II} < \beta_2 \leq \beta_{III}$) the optimal silent interest is α_2^* (zone III). Finally, if $\alpha_2^* > \alpha_c - \alpha_s$, ($\beta_2 > \beta_{III}$) $L_s(\alpha_2)$ does not depend on α_2. A is thus indifferent between any silent share higher than $\alpha_c - \alpha_s$ (zone IV).

- Let us now show that A always prefers controlling in zone I under small silent interests. As a technical point, it is easy to state that the function $f(x) = \frac{x}{[n - n_c + 1 - \frac{\alpha_s}{x}]^2}$ increases with respect to $x \geqslant \alpha_s$ whenever $n - n_c \geq 2$. Thus the difference $L_s(0) - L_c^*$ is such that:

$$L_s(0) - L_c^* \leq \frac{\alpha_c + \beta_2}{[n - n_c + 2 - \frac{\alpha_s}{\alpha_c}]^2} - \frac{\alpha_c}{[n - n_c + 1 - \frac{\alpha_s}{\alpha_c}]^2}. \tag{18}$$

This last expression is negative if $\beta_2 \leq \beta_I$, that is in zone I.

- Finally we have to show that within the zones II, III and IV, A prefers acquiring silent shares rather than controlling ones if $\alpha_s > 0$.

In zone IV, $\beta_2 > \beta_{III} > \alpha_c$, a straightforward calculus shows that $L_s^* - L_c^*$ increases with α_s and equates 0 for $\alpha_s = 0$ (in this case, A is indifferent between controlling firm 2 and acquiring a silent interest in it).

Note that whenever $n - n_c \geq 3$, $L_s(0) - L_c^*$ is strictly positive at $\beta_2 = \alpha_c$. Moreover, $L_s(0) - L_c^*$ increases with respect to α_c when $\alpha_c \leq \beta_2 < \beta_{III}$ so is strictly positive in zones II and III. As a consequence, whenever $\beta_2 \geq \alpha_c$, $L_s(\alpha_2^*) \geq L_s(0) > L_c^*$ and the optimal silent interest dominates the optimal controlling one.

Lastly, in zone II when $\beta_2 < \alpha_c$, we have $L_s(0) - L_c^* > 0$. Indeed, it is easy to see that $L_s(0) - L_c^*$ increases w.r.t. β_2 and equals zero when $\beta_2 = \beta_I$. So in this case, acquiring a silent interest is better than controlling firm 2.

6.3 Proof of proposition 3

Assume now that shareholder A buys shares through firm 1 in which he has the highest controlling interest. When firm 1 buys $\widehat{\alpha}_2 \in [0, \beta_2]$ shares from shareholder B, control is obtained when $\widehat{\alpha}_2 > \dfrac{\beta_2}{2}$. Moreover, for given quantities $X_1, X_2, ..., X_n$, the wealths of shareholders A and B are given by:

$$W_A = \sum_{i \neq 2} \alpha_i \Pi_i(X_1, X_2, ..., X_n) + \alpha_c \widehat{\alpha}_2 \{\Pi_2(X_1, X_2, ..., X_n) - p\}$$

$$W_B = (\beta_2 - \widehat{\alpha}_2)\Pi_2(X_1, X_2, ..., X_n) + \widehat{\alpha}_2 p.$$

Recall that A owns α_i shares of firm i, with $\alpha_2 = \alpha_c \widehat{\alpha}_2$ shares of firm 2. Taking into account the equilibrium in the real sector, we obtain:

$$W_A = \sum_i \alpha_i \Pi_i^*(\alpha_1, \alpha_2, \alpha_3, ..., \alpha_n) - \alpha_2 p \text{ with } \alpha_2 \leq \alpha_c \beta_2$$

$$\text{and } W_B = (\beta_2 - \frac{\alpha_2}{\alpha_c})\Pi_2^*(\alpha_1, \alpha_2, \alpha_3, ..., \alpha_n) + \frac{\alpha_2}{\alpha_c} p.$$

As in the preceding proof, assume that firm 1 offers to buy $\widehat{\alpha}_2 = \dfrac{\alpha_2}{\alpha_c}$ shares at a price p. If B rejects the offer, he gets $\beta_2 \Pi_2(\alpha_1, 0, \alpha_3, ..., \alpha_n)$. If he accepts it, his wealth becomes W_B. He therefore accepts the offer if:

$$(\beta_2 - \frac{\alpha_2}{\alpha_c})\Pi_2^*(\alpha_1, \alpha_2, \alpha_3, ..., \alpha_n) + \frac{\alpha_2}{\alpha_c} p \geq \beta_2 \Pi_2^*(\alpha_1, 0, \alpha_3, ..., \alpha_n).$$

Anticipating this behavior, A offers B a pair quantity-price such that his participation constraint is binding, involving a wealth:

$$
\begin{aligned}
W_A = \ & \sum_{i \neq 2} \alpha_i \Pi_i^*(\alpha_1, \alpha_2, \alpha_3, ..., \alpha_n) + \beta_2 \alpha_c \Pi_2^*(\alpha_1, \alpha_2, \alpha_3, ..., \alpha_n) \\
& - \beta_2 \alpha_c \Pi_2^*(\alpha_1, 0, \alpha_3, ..., \alpha_n)\}.
\end{aligned}
$$

The optimal share $\alpha_2 \in [0, \alpha_c \beta_2]$ maximizes the above expression. Finally, we obtain the same problem as in proposition 2, where β_2 is replaced by $\beta_2 \alpha_c$.
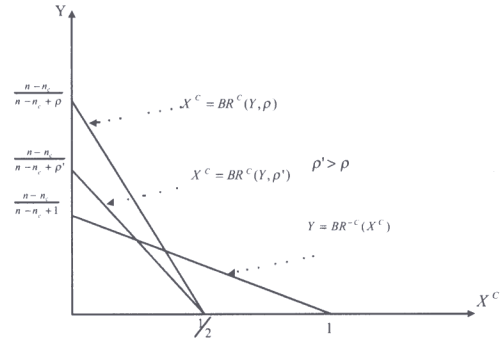
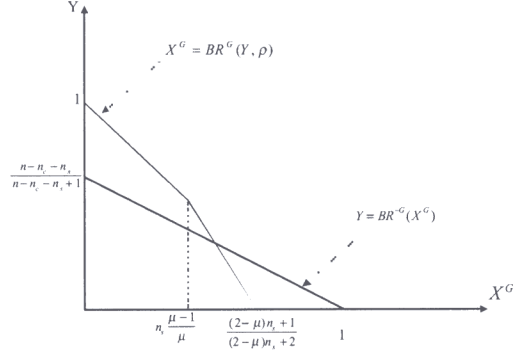Figure 1: Aggregate best-response curve of group $\mathcal{C}$.

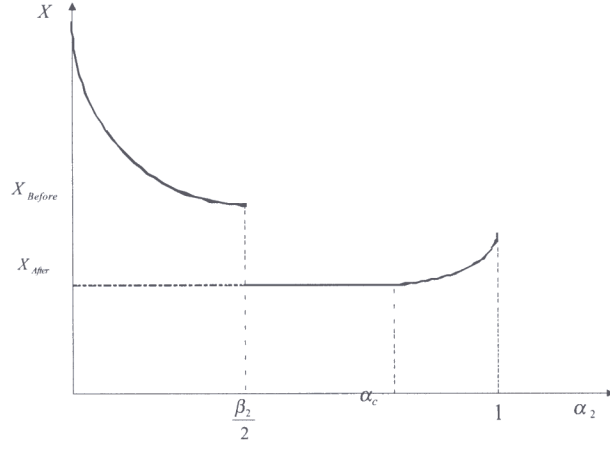Figure 2: Aggregate best-response curve of group $\mathcal{G}$.

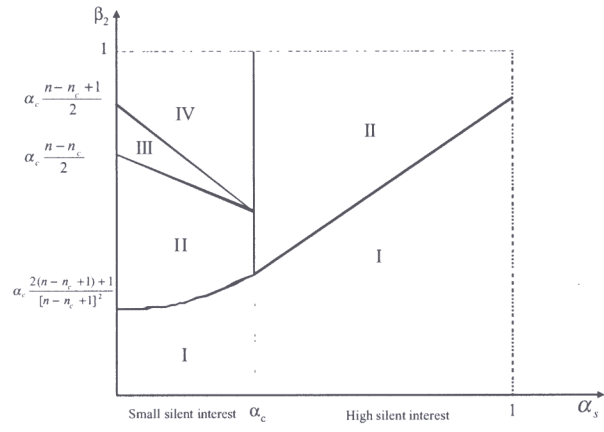Figure 3: Variation of the total output with the toehold α_2.

Figure 4: Zones with or without acquisitions.

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