1   Introduction

This paper presents a strategic model of related-product conglomeration that takes place through mergers and acquisitions (M&As) to exploit technology synergies and reduce variable costs in the presence of competitive pressures. Synergies arising from intra-group transfers of technology provide a reason for conglomeration because, ceteris paribus, they afford merging firms a production cost advantage over independent firms that do not benefit from group-level economies. The synergy-strategic approach is complementary to the theories of M&As that portray takeovers as a market mechanism of check and control over managers acting under imperfect information and agency costs.[1]

The type of firm integration considered here is neither horizontal nor vertical but rather related-firm or "congeneric" integration (Brigham, Kahl, Rentz and Gapenski [1994], p. 839), and should be distinguished from conglomeration between unrelated firms or due to diversification (Montgomery [1994]). In this paper, integrating firms are connected through technology synergies even though they belong to different industries (or are part of the same general industry but have different product lines). Consider the merger of a pharmaceutical producing anti-ulcer drugs with another developing anti-cancerous drugs. These companies generate synergies but have no overlap between their product lines (i.e., there is no horizontal integration) and there is no client-supplier relationship (i.e., there is no vertical integration). Another example of congeneric integration is provided by Japanese conglomerates such as Sharp, which invest in core technologies that can be applied to many products (Collis and Noda [1993]).

We consider a model of two duopoly industries or related products. The possible equilibrium conglomeration structures are (1) two independent firms in each market, (2) one conglomerate and two independent firms, one in each market, and (3) two conglomerates. Antitrust considerations preclude monopolies. With strong enough synergies, simultaneous M&As create two conglomerates. If two firms merge, incentives are created for other firms to follow suit. The reason is that other firms' competitive position will be eroded if they do not also conglomerate to benefit from intra-group technol-

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[1]See Grossman and Hart [1980], Jensen and Ruback [1983], Jensen [1986], and Shleifer and Vishny [1986].

ogy transfers.

Ceteris paribus, the synergy effect of firm integration is value-increasing. This effect is consistent with the evidence on profitable takeovers, showing that both target and acquiring firms can benefit from M&As.[2] However, strategic group interaction encourages technological competition that can lower firms' profits by increasing research costs and inducing a large enough price reduction. This can generate an equilibrium synergy trap in which some or all merging firms have lower profits than in the status quo in which all firms are independent (but higher payoffs than if competing as an independent firm against a conglomerate).

The strategic interaction effect works to undermine two intuitive ideas about firm integration. First, the results provide a counterexample to the notion that conglomeration realized to exploit positive synergies (such as those arising from economies of scope) will result in gains for the merging firms. The synergy trap generated by the model helps to explain empirical evidence showing that takeover activity often involves destruction of firm value.[3]

Second, the paper provides an example in which conglomeration occurs as an equilibrium response to competitive pressures, even if there are diseconomies of scope. Various authors and business managers (Sirower [1997], Geneen with Bowers [1997]) stress that M&As can end up increasing overall costs. In our model, variable cost reductions motivated by competitive pressures are costly themselves and can end up increasing total costs.

Sections 2-4 model technology synergies, and solve the research-output and the firm integration games. Section 5 endogenizes the structure of conglomeration and examines synergy traps, and Section 6 offers conclusions.

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[2]See Franks, Harris and Titman [1991], Dodd and Ruback [1977], Bradley [1980], Bradley, Desai and Kim [1988], Healy, Palepu and Ruback [1992], Morck, Shleifer and Vishny [1990], and Matsusaka [1993].

[3]See Jensen and Ruback [1983], Ravenscraft and Scherer [1987], Agrawal, Jafee and Mandelker [1992], and Sirower [1997].

2 Congeneric Integration Game and Technology Synergies

The three-stage congeneric integration game is summarized in Figure 1. Firm behavior is modeled as a sequential move game and equilibrium is computed using backward induction. We only consider agents playing pure strategies.

At a pre-stage ($t = 0$) all firms operate as independent duopoly firms. Firm integration synergies are not exploited and there are no technology transfers. One could think of the pre-stage as a situation in which the formation of conglomerates is prevented by anti-trust policies, the impact of regulation, or factors that might suddenly change such as weak synergies and high technology adaptation costs. Stage 1 concerns the conglomeration decision (M&A decision). It is assumed that surpluses are equally-shared among merging firms.

Stages 2 and 3 entail a Nash-Cournot game determining the levels of research spending and output. We examine a strategic research-output framework in the spirit of the duopoly partial equilibrium models of research spillovers developed by D'Aspremont and Jacquemin [1988] and Steurs [1995]. In our model, there are no spillovers but rather cross-product synergistic effects requiring technology adaptation costs and fixed conglomeration costs. Cross-product synergies can only be captured by integration to form a multiproduct firm.

Consider a duopoly partial equilibrium model of two related products. Initially, two firms, labelled "1" and "2," compete in one market, and two firms labelled "1*" and "2*" compete in the other. Demand functions are of the form: $P = D^{-1}(Q) = a\text{-}bQ$ and $P^* = D^{-1}(Q^*) = a\text{-}bQ^*$, where $a, b > 0$, P and P^* denote prices, $Q = q_1 + q_2$ and $Q^* = q_1^* + q_2^*$.

The post-merger operating profit functions of cross-product groups formed by firms 1 and 1*, and firms 2 and 2*, are given by adding up the demand and operating cost functions C in both product lines:

$$\Pi_1^C (\cdot) = (a - bQ) q_1 + (a - bQ^*) q_1^* - C_1 (\cdot) - C_1^* (\cdot)$$

$$\Pi_2^C (\cdot) = (a - bQ) q_2 + (a - bQ^*) q_2^* - C_2 (\cdot) - C_2^* (\cdot). \tag{1}$$

Intra-group synergies represent the key interaction between a group's members. Figure 2 depicts the synergy profile in the three possible cases.

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Figure 2a illustrates a setting with independent firms that do not benefit from synergies. Figure 2b depicts the synergy network that arises when there are two conglomerates. Each group-member has access to a portion β of the technology developed by the member producing another product. Figure 2c presents intra-group transfers of technology when a single group competes with independent firms.

Linear versions of conglomerates' operating cost functions are given by:

$$C_1\left(\cdot\right) + C_1^*\left(\cdot\right) = \left(A - x_1 - \beta x_1^*\right) q_1 + \left[\gamma\left(x_1\right)^2 + c x_1 x_1^*\right] \tag{2}$$
$$+ \left(A - x_1^* - \beta x_1\right) q_1^* + \left[\gamma\left(x_1^*\right)^2 + c x_1^* x_1\right], x_1, x_1^* \geq 0,$$

$$C_2\left(\cdot\right) + C_2^*\left(\cdot\right) = \left(A - x_2 - \beta x_2^*\right) q_2 + \left[\gamma\left(x_2\right)^2 + c x_2 x_2^*\right] \tag{3}$$
$$+ \left(A - x_2^* - \beta x_2\right) q_2^* + \left[\gamma\left(x_2^*\right)^2 + c x_2 x_2^*\right], x_2, x_2^* \geq 0,$$

where costs are positive for positive quantities of final output but zero otherwise. The synergy coefficient $\beta \in [0,1]$ represents cost-reducing intra-group transfers of technology, A and γ are variable cost and own-research cost parameters, and $c \in [0,1]$ represents technology adaptation and implementation costs.

2.1 Benefits and Costs

The variable cost reduction achieved by research can be decomposed into a direct and an indirect effect. The first one refers to the direct cost reduction effect of firms' own research investment, x, and the second one to the cost-reduction gain βx due to the R&D activities of the other group's member. The indirect effect reflects transfers of technology among the firms that form the conglomerate, and is the feature that justifies a takeover or merger motivated by the search for variable cost-reduction. Expressions $(x_1 + \beta x_1^*)$ and $(x_1^* + \beta x_1)$ in (2) represent the sum of the unit cost reduction achieved by own and intra-group research efforts for firms 1 and 1* of group 1 (the same applies for group 2).

R&D synergies between firms belonging to the same combination imply that the group obtains production cost-reduction benefits. However, synergies are not cost-free. In order to benefit from the technology developed

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within the group, member firms must afford some adaptation costs (represented by c). The terms $[\gamma (x_1)^2 + cx_1 x_1^*]$ and $[\gamma (x_1^*)^2 + cx_1 x_1^*]$, denote group 1 firms' own research costs plus the costs associated with the use of technology created by the other conglomerate member. In addition, there are conglomeration fixed costs $C^{M\&A}$.

2.2 Economies and Diseconomies of Scope

Consider two symmetric merging firms ($x_1 = x_1^* = x$ and $q_1 = q_1^* = q$) that require a fixed cost of conglomeration $C^{M\&A}$. Compare the conglomerate costs function with the sum of the costs of producing separately (without synergies and attached adaptation and conglomeration costs). It is more costly to produce the same level of output and research in the same firm than in separate firms if

$$
\begin{aligned}
&(A - x_1 - \beta x_1^*)\, q_1 + \gamma (x_1)^2 + cx_1 x_1^* \\
&+ (A - x_1^* - \beta x_1)\, q_1^* + \gamma (x_1^*)^2 + cx_1^* x_1 + C^{M\&A} \\
={}& 2\,(A - (1 + \beta)\, x)\, q + 2\,(\gamma + c)\, x^2 + C^{M\&A}
\end{aligned}
$$

$$
>\;\; (A - x_1) q_1 + (A - x_1^*) q_1^* + \gamma (x_1)^2 + \gamma (x_1^*)^2 = 2(A - x)q + 2\gamma (x)^2 ,
$$

which implies the condition

$$
C^{M\&A} + 2cx^2 > 2\beta xq. \tag{4}
$$

The multiproduct cost function exhibits diseconomies of scope (as defined by Baumol, Panzar and Willig [1988]) when the fixed conglomeration cost plus total synergy costs exceed total synergy benefits.

It would seem that conglomerates would hinge on the presence of economies of scope in the relevant range. We will show, however, that firms' strategic interaction sustain multiproduct firms with cost functions that exhibit diseconomies of scope in equilibrium. In this case, conglomeration is not based on economies of scope, but rather on the strategic drive for variable cost reduction to maintain market share in the face of competitive pressures.

3 Research-Output Choices under Congeneric Integration

We proceed to solve the research-production problem and determine the profit functions under the three possible conglomeration structures: two conglomerates, one conglomerate coexisting with independent firms, and four independent firms.

3.1 Conglomerates' Research-Output Decisions and Synergies

Firms have incentives to spend in process innovation that translates into net advantages against their product market competitors. The Nash-Cournot equilibrium for conglomerate research spending $(x = x_1 = x_2 = x_1^* = x_2^* = x^*)$ yields:

$$x = x^* = \frac{2\left(a - A\right)\left(1 + \beta\right)}{\left[9b\left(c + \gamma\right) - 2\left(1 + \beta\right)^2\right]}. \tag{5}$$

If $\beta \in [0, 1]$, $c \in [0, 1]$ and $a > A$, groups will engage in research when $9b\left(c + \gamma\right) - 2\left(1 + \beta\right)^2 > 0$. The greater the difference $a - A$ between market size and operating cost parameters, and the larger the intra-group transfer of technology parameter $\beta \in [0, 1]$, the greater the equilibrium research investment. On the other hand, higher adaptation costs c lead to lower technology expenditures.

Substituting for x and x^* into the solution for output as a function of research, $q_i\left(x, x^*\right)$ and $q_i^*\left(x^*, x\right)$, $i \in \{1, 2\}$ yields the unique firms' equilibrium outputs:

$$q = q^* = \frac{3\left(a - A\right)\left(\gamma + c\right)}{\left[9b\left(c + \gamma\right) - 2\left(1 + \beta\right)^2\right]}. \tag{6}$$

Stronger intra-group synergies stimulate research spending, reduce marginal costs and lead to expanded final output production. Higher costs c of adapting intra-group research discourage research and induce firms to produce less output.

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Output prices are obtained by substituting output quantities into the inverse demand functions:

$$P = P^* = \frac{a\left[3b\left(c+\gamma\right) - 2\left(1+\beta\right)^2\right] + 6bA\left(\gamma+c\right)}{\left[9b\left(c+\gamma\right) - 2\left(1+\beta\right)^2\right]}. \tag{7}$$

Prices decline with the strength β of synergistic effects, but increase with the magnitude of adaptation costs c and the operating cost parameter A. Larger synergistic gains reduce operating costs both directly and through increased research, leading to higher output and lower prices. On the other hand, higher cost parameters lead to higher prices. A greater demand size parameter a implies higher (lower) prices if the demand slope b and cost parameters c and γ are large (low) enough in relation with β.

Substituting the solution for production, research, and prices into the conglomerate operating profits $\Pi_1^C = P(q_1+q_1^*)$-$C_1(\cdot)$-$C_1^*(\cdot)$ and $\Pi_2^C = P(q_2+q_2^*)$-$C_2(\cdot)$-$C_2^*(\cdot)$, yields:

$$\Pi_1^C\left(a,A,\beta,c,\gamma,b\right) = \Pi_2^C\left(a,A,\beta,c,\gamma,b\right) \tag{8}$$

$$= \frac{2\left(a-A\right)^2\left[\gamma+c\right]\left[9b\left(c+\gamma\right) - 4\left(1+\beta\right)^2\right]}{\left[9b\left(c+\gamma\right) - 2\left(1+\beta\right)^2\right]^2}$$

Operating profits are strictly positive for $b > \frac{4(1+\beta)^2}{9(c+\gamma)}$, augment with market size a, and decline with the variable cost parameter A.

The presence of a mimicking symmetric rival causes duopoly conglomerate profits to decline with greater synergies' strength. The reason is that excessive technology creation entails high research costs and leads to disadvantageously low prices. Also, higher technology adaptation costs c act as a barrier to excessive technology creation, lowering research costs, increasing prices, and raising profits. Notice that these synergy and cost effects are due to the joint effect of both firms' actions. Ceteris paribus, stronger synergies (a higher β) do add up to the profits contributed by a given firm research facilities, and a higher cost of technology adaptation parameter c reduces firm profits.

The point that technology competition entailing high group research costs can be detrimental to participants, applies to other settings such as the for-

mation of competing research teams. In particular, research-based industries such as computers, telecommunications, and biotech are vulnerable to these effects.

3.2 Independent Firms

Independent firms constitute the status quo. The solution for independent firms can be obtained by making synergies β and adaptation costs c equal to zero in the two-conglomerate case. There exists a unique symmetric solution for research spending, final output, and output prices:

$$x = x^* = \frac{2\left(a - A\right)}{\left(9\gamma b - 2\right)}, q = q^* = \frac{3\gamma\left(a - A\right)}{\left(9\gamma b - 2\right)}, P = P^* = \frac{a\left(3b\gamma - 2\right) + 6b\gamma A}{\left(9\gamma b - 2\right)}.$$
(9)

Whether or not R&D spending is larger under conglomeration than under independent firms (compare equations (5) and (9)), depends on a condition relating technology adaptation costs c and synergies β. There is a threshold cost-benefit relation that equalizes conglomerate and independent firms research:

$$c = \frac{\beta\left(9b\gamma + 2\left(1 + \beta\right)\right)}{9b}.$$
(10)

If costs are low enough in relation to the synergy coefficient, $c < \frac{\beta(9b\gamma+2(1+\beta))}{9b}$, a firm forming part of a conglomerate would invest more in R&D than an independent firm; if costs are large enough in relation to synergies, $c > \frac{\beta(9b\gamma+2(1+\beta))}{9b}$, the conglomerate member firm would spend less than an independent firm.

How do conglomerate and independent firms contrast as regards prices and output? A conglomerate might but does not necessarily produce less output and set higher prices than independent firms (compare expressions (9) and (6) for output, and (9) and (7) for prices). Output levels and prices remain unaffected when the cost-benefit relation is:

$$c = \gamma\beta\left(2 + \beta\right).$$
(11)

If costs are small in relation to the synergy coefficient, $c < \gamma\beta\left(2 + \beta\right)$, a conglomerate member firm produces more output and sets lower prices than an

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independent firm. These are the conditions that can lead to a synergy trap. If costs are large relative to benefits, $c > \gamma \beta \left(2 + \beta \right)$, a conglomerate member produces less final output and sets a higher price than an independent firm.

Substituting the solution for research spending, output and prices into the profit functions $\pi^I = Pq\text{-}(A - x)q\text{-}\gamma x^2$ and $\pi^{I*} = P^*q^*\text{-}(A - x^*)q^*\text{-}\gamma \left(x^* \right)^2$, yields:

$$\pi^I = \pi^{I*} = \frac{\left(9\gamma b - 4 \right) \gamma \left(a - A \right)^2}{\left(9\gamma b - 2 \right)^2}. \tag{12}$$

3.3 Partial Conglomeration

Partial conglomeration entails one group spread across two industries or products, competing with an independent firm in each market. The conglomerate operating profits Π^P are (the P superscript represents a single-conglomerate structure):

$$\Pi^P \left(a, A, \beta, c, \gamma, b \right) = \frac{2 \left(a - A \right)^2 \left[c + \gamma \right] \left(3b\gamma - 2 \right)^2 \left[9b \left(c + \gamma \right) - 4 \left(1 + \beta \right)^2 \right]}{\left[27b^2 \gamma \left(c + \gamma \right) - 12b \left(c + \gamma \left(\beta^2 + 2\beta + 2 \right) \right) + 4 \left(1 + \beta \right)^2 \right]^2}. \tag{13}$$

Operating profits π^P of independent firms competing with a conglomerate are:

$$\pi^P \left(a, A, \beta, c, \gamma, b \right) = \frac{\left(a - A \right)^2 \gamma \left(9b\gamma - 4 \right) \left[3b \left(c + \gamma \right) - 2 \left(1 + \beta \right)^2 \right]^2}{\left[27b^2 \gamma \left(c + \gamma \right) - 12b \left(c + \gamma \left(\beta^2 + 2\beta + 2 \right) \right) + 4 \left(1 + \beta \right)^2 \right]^2}. \tag{14}$$

The single-conglomerate and independent firms profits increase with market size a, and decline with variable cost A. The conglomerate's profits increase with stronger synergies (a higher β), and decline with the technology adaptation cost parameter c. The profits of independent firms competing with a conglomerate decline with greater synergies and with lower costs of technology adaptation. We show next that, when these profit-lowering effects are large enough, independent firms will have an incentive to conglomerate and partial conglomeration will not be sustained in equilibrium.

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4   Congeneric Integration Equilibrium

In this section we examine the firm integration game and related equilibrium conditions.

4.1   Integration Game and Equilibrium Conditions

Figure 3 illustrates the duopoly congeneric integration decision. The conglomeration (M&As) game involves four players. The duopoly structure means that there are at most two potential conglomerates each formed by two players. The conglomeration decision is taken on the basis of a given conjecture about the result of the other simultaneous conglomeration decision. Equilibrium requires all agents' conjectures to be sustained.

4.2   Conglomeration Equilibrium Conditions

Full Conglomeration (or simultaneous M&As) arise in equilibrium if merging firms' net profits, Π^C - $C^{M\&A}$, are no less than their joint profits as independent firms $2\pi^P$, given the conjecture that there is a rival conglomerate:

$$\Pi^C\left(a, A, \beta, c, \gamma, b\right) - C^{M\&A} \geq 2\pi^P\left(a, A, \beta, c, \gamma, b\right). \tag{15}$$

In a *Partial Conglomeration* equilibrium (a single conglomerate and two independent firms), the following conditions should be satisfied:

(i) one conglomerate will be profitable, given the conjecture of no other conglomerate:

$$\Pi^P\left(a, A, \beta, c, \gamma, b\right) - C^{M\&A} \geq 2\pi^I\left(a, A, \gamma, b\right), \tag{16}$$

(ii) a second conglomerate would be unprofitable in relation to remaining independent:

$$2\pi^P\left(a, A, \beta, c, \gamma, b\right) \geq \Pi^C\left(a, A, \beta, c, \gamma, b\right) - C^{M\&A}. \tag{17}$$

Independent Firms arise in equilibrium if, when conjecturing that there is no other conglomerate, firms prefer not to conglomerate. The profits firms could obtain from merging, conjecturing that there is no rival conglomerate, are less than the combined payoffs they could obtain in case of disagreement:

$$2\pi^I\left(a, A, \gamma, b\right) \geq \Pi^P\left(a, A, \beta, c, \gamma, b\right) - C^{M\&A}. \tag{18}$$

The single-conglomerate inequality condition (17) is the reverse of the full conglomeration equilibrium inequality condition (15), except at the boundary. This means that full conglomeration and partial conglomeration structures are both equilibria only when the inequalities above hold as equalities; otherwise they are mutually exclusive in equilibrium. The same type of incompatibility arises between partial conglomeration and independent firms equilibria, because expression (16) is the reverse of condition (18), except at the boundary.

5 Equilibrium Conglomeration and Synergy Traps

This section endogenizes the industrial conglomeration structure. Even if the duopoly structure is maintained, competition between conglomerates can displace all independent firms, and there is the possibility that equilibrium entails competition between a conglomerate and independent firms. The gains and losses deriving from M&As depend on the industrial conglomeration structure generated. Simultaneous M&As can generate a synergy trap, but a single conglomerate always gains while independent firms competing against a conglomerate always lose.

5.1 Equilibrium Conglomeration Structure

The equilibrium results are summarized in Figure 4 (constructed for a=10, A=7, b=γ = 2, and $C^{M\&A} = 0.1$; the appendix contains the equations for each boundary). Independent firms constitute the unique equilibrium structure in the area above the curve II. In this area, intra-firm synergy gains are "too low" relative to technology adaptation costs and do not justify total conglomeration costs.

Partial conglomeration arises in equilibrium when the intra-firm synergy parameter is in the range between curves labelled by II and CC. Adaptation costs are "too large" to permit two firms to merge, but not for two firm to conglomerate while the other firms remain independent. The duopoly structure is maintained, but industrial concentration increase because the conglomerate's market share in each market exceeds the independent firm's

market share. Independent firms competing with a conglomerate always lose in comparison with the status quo (compare equations (12) and (14)).

Two-conglomerate duopoly equilibria arise when the gains obtained from implementing group R&D, are large relative to the technology costs associated with implementing the synergies (the area below curve CC). In this area, the profits π^P of an independent firm competing with a conglomerate are lower than the net profits obtained under conglomeration. Therefore, simultaneous M&As take place in both markets, generating a bandwagon effect that resembles M&As waves. Notice that conglomerates can occur even if there are diseconomies of scope. For instance, recalling condition (4), we can verify that when $\beta = 0.7$ and $c = 1$, then $C^{M\&A}$ - $2cx^2$ - $2\beta xq = 0.1 + 0.089 - 0.166 = 0.023 > 0$.

5.2   Equilibrium Synergy Traps

By equilibrium synergy trap we mean that there are economies of scope but conglomeration results in lower profits than what firms could obtain in their status-quo as independent firms. Because status quo profits do not depend on synergies or adaptation costs, comparisons between pre- and post-conglomerate gains do not depend on the initial point on the (β, c) plane. The analysis of gains is equally valid when conglomeration results from deregulation (with no change in β or c) or from a large enough increase of β, or an appropriate reduction of c.

In general, a synergy trap can allude to losses by the raider (raider's synergy trap), the target (target's synergy trap), both firms (joint synergy trap), as well as to losses for the conglomerate as a whole (that is the group loses, although not necessarily all member firms). Because we assume that merging firms equally divide the surpluses from conglomeration, we will focus on the case of group synergy traps:

$$\Pi^C\left(a, A, \beta, c, \gamma, b\right) - C^{M\&A} < 2\pi^I\left(a, A, \gamma, b\right).$$

In the single-conglomerate case, a group always obtains greater payoffs than the sum of the profits obtainable by its members under a regime of independent firms. In the whole area below curve CC, however, simultaneous conglomerates entail excessive technology rivalry leading to aggregate losses (Π^C-$C^{M\&A} < 2\pi^I$).

5.3 Discussion

In this model, integration losses (called the synergy paradox) result from the simultaneity of the conglomeration process (i.e., M&As waves in a dynamic setting). The synergy trap phenomenon is not due to entrepreneurs' mistakes or myopic behavior, or the result of managers acting under imperfect information, as frequently stressed (see Sirower [1997]). Even though there are synergy traps, firms merge in equilibrium because, if they do not integrate with another firm they would be even worse off.

At an empirical level, increased synergies due to technological change, and the reduction of costs of absorbing and applying technology, can help to explain takeover waves. In fact, M&As frequently marry related firms and are often motivated by long-term factors such as operating cost-reductions and the exploitation of cross-industry or related-product synergies. The model also suggests that simultaneous takeovers relate to losses that would be not realized if industrial concentration would substantially increase.

The analysis helps to understand why industrial countries' takeover phenomenon is not extensive in developing countries characterized by firms that do not engage in research, do not produce large synergies, and face high cost of adapting technologies. Also, at first sight, one could think that M&As entail a reduction of competition, but this is not necessarily true in this model. When there are two conglomerates concentration does not change in each market. However, in the single-conglomerate region there is an increase in market concentration because the conglomerate's market share exceeds the independent firms share. Finally, if outside opportunities available are profitable enough, independent firms could be indirectly forced to exit. In that case, conglomeration serves as an indirect strategy to displace independent firms and establish a monopoly.

6 Conclusions

We have presented a model of M&As leading to the formation of multiproduct firms motivated by related-product technology synergies. The model helps to rationalize key features regarding the direction of conglomeration, effects on research, gains and losses, and simultaneity in time. First, a great many combinations are largely based on expansion to related products that have

cross-production and research synergies and economies of scope. Kaplan and Weisbach [1992] report that related acquisitions were less likely to be subsequently divested than unrelated acquisitions. Second, Healy, Palepu and Ruback [1992] report that research expenditures are maintained after the M&A, an implication of the strategic research model presented here for strong synergies. Third, framework can generate synergy traps, which is consistent with the mixed evidence concerning both M&As in general, and the comparative gains of related and unrelated M&As (Kaplan and Weisbach [1992]). Fourth, the model generates simultaneous takeovers that exploit synergies or arise as a reaction to rivals' M&As, helping to explain the nineties M&As wave (Markides [1995]), and the late sixties combination mergers and eighties takeover wave (Golbe and White [1988]).

Mergers and acquisitions leading to integration that represent technology enhancing processes can have a significant impact on firms' competitive position and the vitality of industries. In the nineties, the restructuring wave affecting computers, telecommunications, pharmaceuticals and other technology-based industries, has altered market conditions at a global scale. The examination of the microeconomic foundations of such phenomena might provide useful insights about the "real" basis of macroeconomic behavior and financial markets.

7   Appendix

The boundaries of the areas in Figure 4 can be derived as follows. The equilibrium condition that characterizes a duopoly conglomerate structure is given by condition (15). Substituting the firm operating profits defined in expressions (8) and (14) on (15), we obtain that the parameter condition for an equilibrium duopoly conglomerate structure (the area below the curve CC in Figure 4) is:

$$\frac{2\left(a-A\right)^{2}\left[\gamma+c\right]\left[9b\left(c+\gamma\right)-4\left(1+\beta\right)^{2}\right]}{\left[9b\left(c+\gamma\right)-2\left(1+\beta\right)^{2}\right]^{2}}-C^{M\&A} \tag{19}$$

$$> 2\frac{\left(a-A\right)^{2}\gamma\left(9b\gamma-4\right)\left[3b\left(c+\gamma\right)-2\left(1+\beta\right)^{2}\right]^{2}}{\left[27b^{2}\gamma\left(c+\gamma\right)-12b\left(c+\gamma\left(\beta^{2}+2\beta+2\right)\right)+4\left(1+\beta\right)^{2}\right]^{2}}.$$

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Independent firms arise as an equilibrium when two times the profits from remaining an independent firm exceed the profits from conglomeration while coexisting with two independent firms (condition (18)). Substituting the profit equations (13) and (12) on inequality (18), yields the independent firms parameter condition (the area above the curve II in Figure 4)

$$2 \frac{(9\gamma b - 4)\gamma(a - A)^2}{(9\gamma b - 2)^2}$$

$$> \frac{2(a - A)^2[c + \gamma](3b\gamma - 2)^2\left[9b(c + \gamma) - 4(1 + \beta)^2\right]}{\left[27b^2\gamma(c + \gamma) - 12b(c + \gamma(\beta^2 + 2\beta + 2)) + 4(2 + \beta)^2\right]^2} - C^{M\&A}.$$

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