Takeover deterrents and cross partial ownership: The case of golden shares

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Abstract

We analyse takeovers in an industry with bilateral capital-linked firms in Cross Partial Ownership (CPO). Before merger, CPO reduces the profitability of involved firms, confirming the "outsider effect". However, the impact of CPO upon merger profitability is two-sided in a Cournot setting. CPO, by co-integrating profits, increase output collusion leading to anti-competitive effects with facilitated mergers in most cases. Nonetheless, a protective threshold exists for which CPO arrangements can reduce the incentives for hostile takeovers. This has potentially significant regulatory implications. An illustrative example showcases the potential relevance of CPO as a defence against hostile takeovers across different industries.

Keywords: Takeovers; Partial Ownership; Mergers; Market Power

JEL Classification: G34 L22 L41

1. Introduction

The analysis of takeovers incentives is generally associated with the "outsider effect" of mergers (Salant et al, 1993). In a Cournot-organized industry, the benefits of staying outside of a merger outweigh the gains of triggering a

takeover. Others have confirmed this effect by deriving negative incentives to merge (Inderst and Wey, 2004; Willig, 1991). In the UK, this effect has been empirically demonstrated by measuring the financial performance of firms following acquisitions (Dickerson et al., 1997). Partial ownership itself shows anti-competitive effects similar to those of mergers such as output reduction, profit increase and welfare losses (Reitman, 1994; Reynolds and Snapp, 1986). Yet, the "outsider effect" promoted by Salant et al. (1983) has not been confirmed in a Cournot oligopoly with CPO. When associated with partial ownership mergers and takeovers mostly rely on toeholds in the literature (see e.g. Betton et al., 2009; Choi, 1991). In this case, initial equity participation facilitates a complete acquisition because it raises the cost of being outbid by a competitor (Bulow et al., 1999). The strategy of acquiring a toehold raises antitrust issues, as it is detrimental for consumers. However, it is not accounted for by regulation agencies (Jovanovic and Wey, 2014). Jovanovic and Wey (2014) study the impact of an acquisition (with synergies) on the consumer surplus when preceded by an initial ownership and show a post-merger improvement. Our article completes this literature by presenting a model where the target of a takeover can be a firm engaged in a cross partial ownership with another firm, different from the acquirer. Our results (with no synergies involved) demonstrate a disincentivising effect of CPO as a takeover deterrent leading to a more competitive industry than in a traditional Cournot oligopoly.

CPO arrangements are common between horizontally competing firms on both side of the Atlantic. Examples include Multi System Operators (MSOs) in the US such as Tele-Communications Inc. (TCI), Turner Broadcasting Systems (TBS) and Time-Warner (see Table 1). In Europe, examples include BNP Paribas with UAP (AXA) in France and the multiple interlocks between Dresdner Bank, Allianz and Munich Re in Germany (see Table 2). More recently, in December 2017, Spotify and Tencent Music announced plans for a suggested 10% participation in each other. This alliance could be seen both as a way to raise Spotify's market value, ahead of an anticipated Initial Public Offering in 2018, and as a way of protecting against hostile takeovers.

[Insert Table 1 near here]

[Insert Table 2 near here]

In a homogeneous Cournot industry, we are able to determine the profitability of a takeover as a function of the endogenous parameters (CPO and the number of firms). We explore the implications of CPO for takeover profitability. We introduce the concept of partial ownership as a defence against hostile takeover by allowing two cases (see Definition 2, in Section 3) with two different takeover targets. Exploring asymmetric CPOs allows us to obtain competitive results on takeover incentives that are markedly different to the traditional model of mergers within a Cournot oligopoly (Tirole, 1988). Prior to the merger, we confirm the "outsider effect" of CPO. Then, we show that CPO increases the incentives for takeovers in most cases making them profitable for insiders because of increased collusion of CPO. This result complements the findings of Charlety et al. (2009) in the context of Cournot models with endogenous acquisition of capital. However, in the protected case, CPO arrangements can be constructed to reduce the incentives to raid the protected firm. Firstly, we demonstrate that a protection in asymmetric CPO reduces the incentives to merge relative to a benchmark industry without CPO. Secondly, we obtain the minimum value of CPO for which a merger on a protected firm is not profitable though this depends upon the value of the other CPO. These results highlight a unique competitive effect of CPO by making the target less desirable by reducing the overall profitability of the merger. This protective CPO threshold can be defined in terms of the number of firms in the industry (an endogenous parameter of the model) and represents an important finding in this study. This result allows us to confirm that practical takeover deterrent policies with CPO (noyaux-durs, Deutschland AG) are valid. CPO may thus have regulatory implications for competition policy as they improve social welfare. In addition, governments willing to protect strategic sectors from hostile takeovers could use a defence in participations. Indeed, the use of CPO as a defence against hostile takeovers has been implemented both in Europe (the different types of "golden shares") and in the US (see e.g. Goldstein, 1996; Lantenois, 2011; Yergin and Stanislaw, 1998).

The layout of this article is as follows. Section 2 reviews the literature on partial ownership. Section 3 outlines the model used. Section 4 highlights the key analytical results obtained. Section 5 discusses an illustrative example, which

allows comparison of the theoretical protective threshold to real-world CPO arrangements. The results of our model can hence be shown to have empirical relevance for real-world CPO arrangements. Section 6 concludes and discusses the opportunities for further work. A mathematical appendix is included at the end of this article.

2. Literature Review

2.1. Partial ownership

Partial Ownership (PO) consists in a firm acquiring a fraction of equity capital of a rival at the horizontal level or of a supplier/manufacturer in a vertical relationship. The capital in participations does not generally give the majority of voting rights and in this case is a non-controlling operation or silent participation (Bresnahan and Salop, 1986; Reitman, 1994). Thresholds or ceilings in participations exist (usually at the 5%, 10%, 20% and 30% levels) and listed companies have to notify regulatory agencies when they cross these levels. The importance of partial ownership is threefold. Firstly, the impact of partial ownership on competition is much studied and is very important for antitrust regulation agencies. As for mergers (see e.g. Compte et al., 2002; Jullien and Rey, 2007) the collusive aspect of partial ownership causes a trade-off between firms' efficiency (profits) and reduced consumer surplus. Secondly, as for mergers more generally, the study of incentives to engage in PO is also important. Similarly, we anticipate an "outsider effect" (Salant et al., 1983) when partial ownerships do not involve any synergies. Thirdly, the link between participations and technological investment is also significant (see e.g Barcena-Ruiz and Olaizola, 2007; Minetti et al., 2015).

The impact of PO on competition and market structure is substantial. Reynolds and Snapp (1986) show that PO reduces output and increases prices in a Cournot model with barriers to entry. Even when the amount of PO is small, this result has anticompetitive effects similar to those of mergers (O'Brien and Salop, 2000). Gilo et al. (2006) consider the case of cross participations in a dynamic Bertrand model and conclude that tacit collusion can be sustained in the long run. In the case of vertically-related industries, Jullien and Rey (2007) study

the impact of the resale price maintenance contract on collusion. Vertical contract models are empirically tested by Bonnet and Dubois (2010). The issue of reinforced market power also applies after the privatization of historically public companies and the subsequent liberalization of the market (see e.g. Amundsen and Bergman, 2002; Lee and Hwang, 2003). In an application to the US and Japanese automobile industries Alley (1997) derives empirical results confirming the collusive effects of PO. In contrast, Malueg (1992) finds that in a dynamic Cournot framework repeated interactions between competitors can produce less collusion. Further, other authors study competitive aspects of participations either in a vertical supplier-dealer relationship or in a mixed framework (see e.g. Greenlee and Raskovich, 2006; Serbera, 2010). Our article extends the study of the competitive role of PO by introducing asymmetric CPOs and leads to modified results depending on whether or not CPOs are used to prevent further concentration (takeovers).

2.2. Mergers and partial ownership

Allied to the above the explicit comparison of partial ownership and mergers is also of interest. The literature on toehold acquisitions is significant. Acquiring participations prior to a merger can be effective as it raises the cost of rival bids (see e.g. Bulow et al., 1999; Choi, 1991). However, Betton et al. (2009) explain the recent decline in the number of toehold arrangements by the need to acquire a sufficient amount of shares for the deal to be completed. Similarly, Jovanovic and Wey (2014) find that the acquisition of equity participations into the capital of a firm facilitates a later takeover – ultimately reinforcing market power. In the US railroad industry Reiffen (1998) empirically tests the validity of a foreclosure strategy using partial ownerships. Results are that, contrary to mergers, vertical PO align both firms' interests and do not lead to a potentially anti-competitive foreclosure. Fatica (2010) studies the effects of POs prior to foreign direct investments. It is shown that toeholds can facilitate full acquisition over a greenfield investment though the result depends on the value of investment costs. Foros et al. (2011) investigate the effect of controlling participations on the pay-tv industry in Scandinavia and find that the anti-competitive effects are potentially greater than for full mergers.

Complex arrangements in cross participations are a practical reality and exist in various different forms worldwide. They have been much studied in the literature. Cases include horizontal and vertical PO in the Cable TV industry in the US (Besen et al., 1999), "Keiretsu" in Japan (Brown and Fung, 2009), "Deutschland AG" in Germany (Lantenois, 2011), "noyaux-durs" in France (Goldstein, 1996), and "golden shares" in the United Kingdom (Yergin and Stanislaw, 1998). The study of these reciprocal participations can be compared with the effect of toeholds on takeovers (see e.g. Charlety et al., 2009). However, in this paper, the focus is on external takeovers incentives from outside companies. This article considers CPO as "golden shares" used as protection to guard against foreign hostile takeovers. See Sections 3-4.

Defensive strategies against hostile buyouts are of great importance. Numerous defensive strategies (also known as shark repellents such as "Pac-Man", "Nancy Reagan", "greenmail", or "white knight") against hostile buyouts have been devised and implemented (see e.g. Barry and Hatfield, 2012). Most of these takeover defences do not directly modify the capital structure of the target. However, in the context of buy-outs, the question of capital appears to be crucial. This motivates our study of the use of CPO to deter hostile takeovers (see e.g. Serbera, 2017). We highlight the defensive role of cross participations against hostile takeovers useful to protect national interest in strategic sectors. In addition, we demonstrate that bilateral partial ownerships have a competitive impact as they may limit further market concentration. This important innovation brings our model closer into line with financial reality and may also have significant regulatory implications. Serbera (2017) discusses three decisions of the European Court of Justice (ECJ) related to the use CPO by governments to block foreign investment in strategic sectors. The ruling of the ECJ against these protective polices based on free market "laissez-faire" arguments is thus criticized because CPOs may prove socially more beneficial than traditional competition frameworks.

3. Takeovers in a Cournot oligopoly with cross partial ownership

Our analysis uses the traditional model of a Cournot oligopoly with homogenous goods that has $n \geq 1$ firms $f_1, f_2, . , f_n \in F$, $n \in \mathrm{N}$ (Tirole, 1988). Assuming a quadratic utility function for the consumption q_i of firm f_i with associated price p_i the homogeneous substitutability condition gives $p_i(q) = a - \sum_k q_k$. Whilst an obvious simplification the homogeneous substitutability condition seems to have empirical relevance to applications spanning the oil, automobile and finance industries. See Section 5. Set up in this way this model arises as an important special case of the classical model in Farrell and Shapiro (1990). Finally, firms' marginal costs satisfy $c_i = c$.

Definition 1 *A cross partial ownership is a mutual agreement in which two firms acquire cross equity participations in each other's capital structure.*

(i) Cross partial ownership are silent participations (Bresnahan and Salop, 1986; Reitman, 1994), giving the acquirer no right in the other firm management decisions.

(ii) The cost of acquisition is a transfer price $t_{i,j}$ with $f_i, f_j \in F$ is normalised to zero[1].

Let $\beta_{i,j} \in [0, 0.5)$ denote the capital of firm f_j held by firm f_i. Two firms f_1 and f_2 say are in a cross partial ownership agreement if $\beta_{1,2} > 0$ and $\beta_{2,1} > 0$. We write $f_1, f_2 \in CPO$. The special case $\beta_{i,j} = \beta_{j,i} = 0$ represents a benchmark case and reduces to the traditional model of a Cournot oligopoly without CPO (Tirole, 1988).

Profits for the two protected firms $f_1, f_2 \in CPO$ are given by $\Pi_i = (1 - \beta_{j,i})\pi_i + \beta_{i,j}\pi_j$, where $\pi_i = [p_i(q) - c]q_i$, $i,j \in \{1,2\}$. The operating profit of an unprotected firm without equity participations and representative of the majority of the industry is denoted by $\pi_r = [p_r(q) - c]q_r$, $r \geq 3$. The merger profit of a non-protected firm is given by $\Pi_M = 2\pi_r$. The takeover profits on a protected firm are given by $\Pi'_M = \pi_r + \Pi_i$.

Definition 2 *The type of ownership depends on if:*

(i) The target is a firm with no CPO arrangement in which case it is an unprotected takeover.

[1] The transfer price is thus independent of produced quantities and offset with each other when CPO are equal as in the "golden shares" framework.

(ii) The target is a firm with a CPO arrangement in which case it is a protected takeover.

We have two cases: pre-takeover and post-takeover. In the pre-takeover case there are n firms and equilibrium values are denoted ^{n}. In the post-takeover case there are $n-1$ firms and we observe two possibilities: a takeover of an unprotected firm (denoted $^{n-1}$) and a takeover of a protected firm (denoted $^{n-1,p}$). Benchmark values are denoted ^{b}. An illustration of the organisation of the industry is shown in Figure 1.

[Insert Figure 1 near here]

Pre-takeover. The $n-2$ firms with no CPO arrangements choose to maximise their individual profit over q_r:

$$\pi_r = \max_{q_r}\{(a-\textstyle\sum_k q_k - c)q_r\}\ ;\ q_r = \frac{a-c-\sum_{k\neq r} q_k}{2} \qquad (1)$$

For the two protected firms f_1, $f_2 \in CPO$ with $i, j \in \{1, 2\}$ we have that

$$\pi_i = \max_{q_i}\left\{(1-\beta_{j,i})[a-\sum_k q_k - c]q_i + \beta_{i,j}[a-\sum_k q_k - c]q_j\right\}.$$

This can be solved to give the first-order conditions

$$\frac{\partial \Pi_1}{\partial q_1} = -2q_1(1-\beta_{2,1}) + (1-\beta_{2,1})(a-\sum_{k\neq 1} q_k - c) - \beta_{1,2}q_2 = 0$$

$$q_1(2-2\beta_{2,1}) + q_2(1+\beta_{1,2}-\beta_{2,1}) = (1-\beta_{2,1})(a-\textstyle\sum_{k\notin\{1,2\}} q_k - c), \qquad (2)$$

$$\frac{\partial \Pi_2}{\partial q_2} = -2q_2(1-\beta_{1,2}) + (1-\beta_{1,2})(a-\sum_{k\neq 2} q_k - c) - \beta_{2,1}q_1 = 0$$

$$q_2(2-2\beta_{1,2}) + q_1(1+\beta_{2,1}-\beta_{1,2}) = (1-\beta_{1,2})(a-\textstyle\sum_{k\notin\{1,2\}} q_k - c), \qquad (3)$$

because $\sum_{k\neq 1} q_k = \sum_{k\notin\{1,2\}} q_k + q_2$ and $\sum_{k\neq 2} q_k = \sum_{k\notin\{1,2\}} q_k + q_1$.

Takeover of an unprotected firm. The $n-4$ firms with no CPO arrangement and outside of the merger choose to maximise π_r as per equation (1). The two protected firms f_1, $f_2 \in CPO$ maximise the partially joint profits Π_i, $i = 1, 2$ given in (2-3). The two merged firms, f_3 and f_4 say, maximise their consolidated joint profit:

$$\Pi_M = \max_{q_3,q_4}\left\{(a-\sum_k q_k - c)q_3 + (a-\sum_k q_k - c)q_4\right\}$$

This gives

$$\frac{\partial \Pi_M}{\partial q_3} = (a-\sum_{k\neq 3} q_k - c) - 2q_3 - q_4 = 0; 2q_3 = a - \sum_{k\notin\{3,4\}} q_k - c - 2q_4.$$

Takeover of a protected firm. The $n-3$ firms with no CPO arrangement and out of the merger choose to maximise π_r as per equation (1). The protected firm f_1 is the target of a takeover by a firm f_3, say. The protected firm outside of the merger, f_2 say, maximises the joint profit shown in equation (3). Here, it is convenient to re-write this equation as

$$q_2(2-2\beta_{1,2}) + q_1(1+\beta_{2,1}-\beta_{1,2}) + q_3(1-\beta_{1,2}) = (1-\beta_{1,2})(a-\textstyle\sum_{k>3} q_k - c). \quad (4)$$

The merged firm solves

$$\max_{q_1,q_3} \Pi'_M = (1-\beta_{2,1})[a-\sum_k q_k - c]q_1 + \beta_{1,2}[a-\sum_k q_k - c]q_2 + [a-\sum_k q_k - c]q_3,$$

leading to the first-order conditions

$$\frac{\partial \Pi'_M}{\partial q_1} = -2(1-\beta_{2,1})q_1 + (1-\beta_{2,1})(a-\sum_{k\neq 1} q_k - c) - \beta_{1,2}q_2 - q_3 = 0$$

$$q_1(2-2\beta_{2,1}) + q_2(1+\beta_{1,2}-\beta_{2,1}) + q_3(2-\beta_{2,1}) = (1-2\beta_{2,1})(a-\textstyle\sum_{k>3} q_k - c). \quad (5)$$

$$\frac{\partial \Pi'_M}{\partial q_3} = -q_1(1-\beta_{2,1}) - \beta_{1,2}q_2 - 2q_3 + (a-\sum_{k\neq 3} q_k - c) = 0$$

$$q_1(2-\beta_{2,1}) + q_2(1+\beta_{1,2}) + 2q_3 = a - \textstyle\sum_{k>3} q_k - c \quad (6)$$

because $\sum_{k\neq 1} q_k = \sum_{k>3} q_k + q_2 + q_3$ and $\sum_{k\neq 3} q_k = \sum_{k>3} q_k + q_1 + q_2$.

4. Analytical results

In this section, we establish the results of cross partial ownership both before and after the takeover. Table 3 summarises how the equilibrium profits depend upon the type of ownership.

[Insert Table 3 near here]

As a corollary to the equilibrium values shown in Table 3, we obtain the following propositions. Proposition 1 confirms the "outsider effect" as the firms inside the CPO arrangement are worse off than the firms outside (Salant et al., 1983). As with full mergers CPO reinforces the concentration in the industry leading to an increase of market power and a strategic output's reduction in the oligopoly. Proposition 2 brings novelty to the analysis of mergers by offering conditions for a merger to be profitable for the insiders.

Proposition 1 (The outsider effect.) *The impact of CPO upon profit margins is as follows:*

(i) The CPO increases the profits of the wider industry outside the CPO.

(ii) The CPO reduces the combined profits of the firms inside the CPO.

Proof

(i) From Table 3 π_r^n is an increasing function of $\beta_{1,2}$ and $\beta_{2,1}$.

(ii) The combined profit of Firms 1-2 is $\frac{2-\beta_{1,2}-\beta_{2,1}}{(n+1-\beta_{1,2}-\beta_{2,1})^2}$ which is a decreasing function of $\beta_{1,2}$ and $\beta_{2,1}$, because it is assumed we have $n \geq 3$ firms.

■

In the following proposition, we obtain the results for profitability of mergers within the setting of CPO. This result adds to the debate on the outsider effect of mergers (see e.g. Charlety and Souam, 2002) by allowing profitable mergers for insiders in the case of symmetric costs in Cournot models. In our set-up, the presence of CPO increases tacit collusion of firms. In the event of a merger, CPO helps by reducing the strategic reaction of rival firms to increase output, following the increase in price, thus making a merger profitable for insiders.

Proposition 2 (Profitability of mergers)

Mergers are profitable under the following conditions

(i) Unprotected takeover

$$\beta_{1,2} + \beta_{2,1} > \frac{n(\sqrt{2}-1)-1}{\sqrt{2}}. \qquad (7)$$

(ii) Protected takeover

$$\sqrt{1-\beta_{2,1}}+\frac{\sqrt{2}(\beta_{1,2}+\beta_{2,1})}{n+1}>\sqrt{2}\frac{n}{n+1}. \tag{8}$$

Proof.

We need to show that the profit for the merged firm is greater than the two firms in isolation, i.e. $\Pi_M^{n-1}>2\pi_r^{n,b}$. From equation (7) it follows that $n-\beta_{1,2}-\beta_{2,1}<\frac{n+1}{\sqrt{2}}$, $\sqrt{2}(n-\beta_{1,2}-\beta_{2,1})<n+1$, $2(n-\beta_{1,2}-\beta_{2,1})^2<(n+1)^2$ and the result follows. In the protected case, multiplying (8) by n+1 gives $\sqrt{1-\beta_{2,1}}(n+1)+\sqrt{2}(\beta_{1,2}+\beta_{2,1})>\sqrt{2}n$, $(n+1)\sqrt{1-\beta_{2,1}}>\sqrt{2}(n-\beta_{1,2}-\beta_{2,1})$, $(n+1)^2(1-\beta_{2,1})>2(n-\beta_{1,2}-\beta_{2,1})^2$.

■

In the sequel, we address the issue of hostile takeovers. The excess profit from a hostile takeover is given by

$$\frac{\Pi_M^{n-1}}{\pi_r^n}. \tag{9}$$

Under a benchmark industry equation (9) gives

$$\frac{(a-c)^2}{n^2}\times\frac{(n+1)^2}{(a-c)^2}=\frac{(n+1)^2}{n^2}. \tag{10}$$

From equation (9) the return from a hostile takeover of a protected target is given by

$$\frac{(1-\beta_{2,1})^2(a-c)^2}{(n-\beta_{1,2}-\beta_{2,1})^2}\times\frac{(n+1-\beta_{1,2}-\beta_{2,1})^2}{(a-c)^2}=\frac{(1-\beta_{2,1})(n+1-\beta_{1,2}-\beta_{2,1})^2}{(n-\beta_{1,2}-\beta_{2,1})^2}. \tag{11}$$

It is easy to show that the return shown in equation (11) is decreasing in $\beta_{2,1}$ but increasing in $\beta_{1,2}$. In principle high values of $\beta_{1,2}$ may mean that the return in equation (11) may exceed the benchmark return shown in equation (10). However, Proposition 3 lays out conditions under which the CPO adds protection irrespective of the fraction $\beta_{1,2}$ of the company owned by a second party. Proposition 3 shows that in an industry with CPO the incentives for a hostile takeover are reduced relative to a benchmark industry.

Proposition 3 (CPO protection relative to a benchmark industry)

If

$$\beta_{2,1}>\frac{2}{n^2}-\frac{1}{n^4}, \tag{12}$$

then the return on a hostile takeover on a protected target is lower than in a benchmark industry.

Proof

If equation (12) holds then

$$\beta_{2,1} - 1 > \frac{2n^2 - 1 - n^4}{n^4}; 1 - \beta_{2,1} < \frac{n^4 - 2n^2 + 1}{n^4}$$

The return shown in equation (11) is then bounded above by

$$\frac{(n^4 - 2n^2 + 1)}{n^4} \frac{n^2}{(n-1)^2} = \frac{(n+1)^2}{n^2},$$

i.e. the benchmark return shown in equation (10).

■

Definition 3 *An asymmetric CPO* $\beta_{1,2}$ *and* $\beta_{2,1}$ *is said to be completely effective against hostile takeovers iff the return given in equation (8) is less than or equal to one.*

Definition 3 thus enables us to pinpoint precisely when a CPO can protect against hostile takeovers be reducing the profit levels that can be achieved by the raiding firm. These conditions are laid out in Proposition 4:

Proposition 4 (Protective CPO threshold)

If an asymmetric CPO $\beta_{1,2}$ *and* $\beta_{2,1}$ *is completely effective against hostile takeovers then*

$$\beta_{1,2} < n + 1 - \beta_{2,1} - \frac{\left(1 + \sqrt{1 - \beta_{2,1}}\right)}{\beta_{2,1}},$$

subject to the constraint

$$0 \leq n + 1 - \beta_{2,1} - \frac{\left(1 + \sqrt{1 - \beta_{2,1}}\right)}{\beta_{2,1}} \leq \frac{1}{2}.$$

Proof

Suppose that the return in equation (11) is equal to one. In this case, it follows that

$$\left(1 - \beta_{2,1}\right)(n + 1 - z)^2 = (n - z)^2,$$

where $z = \beta_{1,2} + \beta_{2,1}$. This leads to the following quadratic in $n - z$:

$$\beta_{2,1}(n-z)^2 - 2(1-\beta_{2,1})(n-z) - (1-\beta_{2,1}) = 0,$$

with solution

$$n - z = \frac{1-\beta_{2,1} + \sqrt{1-\beta_{2,1}}}{\beta_{2,1}}; \beta_{1,2} = n + 1 - \beta_{2,1} - \frac{(1+\sqrt{1-\beta_{2,1}})}{\beta_{2,1}}.$$

■

5. Illustrative example

In this section, we compare the prediction given in Proposition 3 by (12) with empirical data on the "Deutschland AG" and "noyaux-durs" policies much discussed in the academic literature (Goldstein, 1996; Franks and Mayer, 1998; Lantenois, 2011; Yergin and Stanislaw, 1998). See Table 4.

[Insert Table 4 near here]

Based on available data from the Bloomberg database results constructed in Table 4 correspond to taking *n* = 6 large financial companies in Germany and *n* = 10 large French conglomerates across the oil, automobile and finance industries. Results shown in Table 4 demonstrate that the threshold given in equation (12) offers a very reasonable prediction of real-world CPO arrangements given different industry sizes and the simplicity of the model. However, there is some suggestion of varying levels of protection for firms in either industry. For example, Munich Re and BNP do not meet the minimal requirement for a CPO to be effective in deterring hostile takeover. However, our illustrative example allows theoretical validation of the takeover deterrents in CPO implemented by European firms during the golden share era.

6. Conclusions and discussion

This article explores the theoretical study of the impact of CPO in the context of mergers. A mixture of theoretical work (see e.g. Malueg, 1992; O'Brien and Salop, 2000) and

applied work (see e.g. Perotti, 1992; Reiffen, 1998) investigate participations but does not explicitly link them with takeover incentives. Our contribution is also timely and relevant. Numerous articles highlight the role and functioning of different forms of "golden shares" across several countries. Examples include O'Brien and Salop (2000) in the US, Brown and Fung (2009) on Keiretsu, Lantenois (2011) on "Deutschland AG", Yergin and Stanislaw (1998) on UK "golden shares", and Goldstein (1996) for French "noyaux-durs". In addition, Jovanovic and Wey (2014) study the role of CPO when takeovers offer synergies.

In this article, we study takeover incentives in a Cournot oligopoly model with two firms linked by cross participations. The use of CPO can increase market concentration by offering incentives for firms to takeover rivals, therefore offsetting the "outsider effect" confirmed in the case of CPOs. However, asymmetric CPO can also serve as an effective defence against hostile takeovers by making the target less attractive. The implications for competition policy are compelling. This competitive aspect is highlighted by a comparison of takeover incentives between two industries – one with CPO and one benchmark industry without such participations. Higher levels of protection may also be possible if the level of CPO is greater than the threshold shown in equation (12). Because the full integration of a rival's profits (buyout) is more harmful in terms of competition than partial ownerships authorizing CPO could thus prove socially beneficial.

This article sheds new light on the analysis of competition and market power. It also raises questions in the case of an "attack" and thus gives ample scope for additional investigations. Results shown in Section 5 also show that our model may have some empirical relevance across a diverse range of industries. Future work will examine the consequences of cross participations on protected firms' incentives to raid competitors. This protection could be used in this case to "attack" competitors. This could prove decisive in the analysis of the influence of CPO on market concentration and on economic welfare. Other types of demand function with non-homogeneous goods could allow for further extensions of the model to other settings e.g. Bertrand competition. A comparative statics analysis will explore the role of other parameters (number of firms, marginal costs) on market power in our model. Further studies of equity strategies, against or in support of a buyout, may have important implications both for policy makers in charge of the current regulatory monitoring process and for continued applied research in the subject.

Mathematical Appendix

Derivation of equilibrium values

(i) Summing (1) over the $n-2$ firms outside the CPO gives

$$2\sum_{k\notin\{1,2\}} q_k = (n-2)(a-c) - (n-3)\sum_{k\notin\{1,2\}} q_k - (n-2)(q_1+q_2). \quad (13)$$

Adding (13) and equations (2-3) gives

$$\sum_k q_k = \frac{(n-\beta_{2,1}-\beta_{1,2})}{n+1-\beta_{2,1}-\beta_{1,2}}(a-c). \quad (14)$$

It follows from equation (14) that

$$q_{r=}\frac{a-c}{2} - \frac{\sum_k q_k}{2} + \frac{q_r}{2}; q_r = \frac{a-c}{n+1-\beta_{2,1}-\beta_{1,2}}, \quad (15)$$

$$\pi_r^n = [a - \sum_k q_k - c]\, q_r = \frac{(a-c)^2}{(n+1-\beta_{2,1}-\beta_{1,2})^2}. \quad (16)$$

It follows from equations (14-15) that

$$q_1 + q_2 + (n-2)q_r = \frac{(n-\beta_{2,1}-\beta_{1,2})(a-c)}{n+1-\beta_{2,1}-\beta_{1,2}};\ q_1+q_2 = \frac{(n-\beta_{2,1}-\beta_{1,2})(a-c)}{n+1-\beta_{2,1}-\beta_{1,2}}. \quad (17)$$

Combining (14) and equations (2-3) it follows that

$$q_i = \frac{(n-\beta_{j,i})(a-c)}{n+1-\beta_{2,1}-\beta_{1,2}}; \Pi_i^n = \frac{(1-\beta_{j,i})(a-c)^2}{(n+1-\beta_{2,1}-\beta_{1,2})^2}.$$

(ii) Because in this case the $n-3$ firms outside of the CPO solve the optimisation problem shown in equation (1) this reduces to Case (i) discussed above with n replaced by $n-1$.

(iii) Summing (1) over the $n-3$ firms outside the CPO and outside of the merger gives

$$(n-3)(q_1+q_2+q_3) = (n-3)(a-c) - (n-2)\sum_{k>3}(q_k). \quad (18)$$

Summing equations (4-6) and (18) gives

$$(n+1-\beta_{2,1}-\beta_{1,2})\sum_k q_k + (1-\beta_{2,1})q_1 + \beta_{1,2}q_2 + q_3 = (n-\beta_{2,1}-\beta_{1,2})(a-c)$$

$$(n+1-\beta_{2,1}-\beta_{1,2})\sum_k q_k + \left(a - \sum_k q_k - c\right) = (n-\beta_{2,1}-\beta_{1,2})(a-c),$$

where the second equality follows from equation (6). This gives

$$\sum_k q_k = \left(\frac{n-1-\beta_{2,1}-\beta_{1,2}}{n-\beta_{2,1}-\beta_{1,2}}\right)(a-c). \quad (19)$$

Combining equations (1) and (19) gives

$$q_r = \left(a - \sum_k q_k - c\right) = \frac{a-c}{n-\beta_{2,1}-\beta_{1,2}};\ \pi_r^{n-1} = \frac{(a-c)^2}{(n-\beta_{2,1}-\beta_{1,2})^2}$$

From equations (4) and (5) it follows that

$$\Pi_2^{n-1,p} = \frac{(1-\beta_{1,2})(a-c)^2}{(n-\beta_{2,1}-\beta_{1,2})^2};\ \Pi_M^{n-1,p} = \frac{(1-\beta_{2,1})(a-c)^2}{(n-\beta_{2,1}-\beta_{1,2})^2}.$$

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Table Legends

Table 1. Partial Ownerships in major communication networks in 1996 before and after the merger of Time Warner and Turner. Source www.lesechos.fr

Table 2. Example Cross Partial Ownerships in Germany and France. Source www.lesechos.fr

Table 3. Equilibrium profits under different scenarios

Table 4. Model predictions compared to actual CPO values for Deutschland AG and noyaux-durs arrangements.

Figure Legend

Figure 1: Schematic model of hostile takeovers within an industry with cross partial ownership.

Table 1. Partial Ownerships in major communication networks in 1996 before and after the merger of Time Warner and Turner. www.lesechos.fr

Multi System Operators	Time Warner-TBS	TCI-TBS (before merger)	TCI-Time Warner(after merger)	Seagram-Time Warner (before) after merger
Partial Ownerships	18%	22%	9%	(15%) 10%

Table 2. Example Cross Partial Ownerships in Germany and France. Source www.lesechos.fr

Germany (2000)	Munich Re-Allianz 20%-20%	Deutsche Bank-Allianz 7%-5%	Munich Re-Dresdner Bank 2.3%-8.3%
France (1994)	UAP-BNP 10%-10%	ELF-Renault 4%-1.5%	ELF-BNP 2%-1%

Table 3. Equilibrium profits under different scenarios

Situation	Equilibrium Profits	Benchmark

Pre-takeover	$\Pi_i^n = \frac{(a-c)^2(1-\beta_{j,i})}{(n+1-\beta_{j,i}-\beta_{i,j})^2}$ $\pi_r^n = \frac{(a-c)^2}{(n+1-\beta_{j,i}-\beta_{i,j})^2}$	$\pi_r^{n,b} = \frac{(a-c)^2}{(n+1)^2}$
Post-takeover unprotected	$\Pi_i^{n-1} = \frac{(a-c)^2(1-\beta_{j,i})}{(n-\beta_{j,i}-\beta_{i,j})^2}$ $\Pi_M^{n-1} = \pi_r^{n-1} = \frac{(a-c)^2}{(n-\beta_{j,i}-\beta_{i,j})^2}$	$\pi_r^{n-1,b} = \frac{(a-c)^2}{n^2}$
Post-takeover protected	$\Pi_M^{n-1,p} = \frac{(a-c)^2(1-\beta_{2,1})}{(n-\beta_{1,2}-\beta_{2,1})^2}$ $\Pi_2^{n-1,p} = \frac{(a-c)^2(1-\beta_{1,2})}{(n-\beta_{1,2}-\beta_{2,1})^2}$ $\pi_r^{n-1,p} = \frac{(a-c)^2}{(n-\beta_{1,2}-\beta_{2,1})^2}$	$\pi_r^{n-1,b} = \frac{(a-c)^2}{n^2}$

Table 4. Model predictions compared to actual CPO values for Deutschland AG and noyaux-durs arrangements.

Observed $\beta_{1,2}$	No. of major firms	Observed $\beta_{2,1}$	$\frac{2}{n^2} - \frac{1}{n^4}$
Munich Re 0.2	6	Allianz 0.2	0.055
Allianz 0.2	6	Munich Re 0.2	0.055
Deutsche Bank 0.07	6	Allianz 0.05	0.055
Allianz 0.05	6	Deutsche Bank 0.07	0.055
Munich Re 0.023	6	Dresden Bank 0.083	0.055
Dresden Bank 0.083	6	Munich Re 0.023	0.055
UAP 0.1	10	BNP 0.1	0.019
BNP 0.1	10	UAP 0.1	0.019
ELF 0.04	10	Renault 0.015	0.019
Renault 0.015	10	ELF 0.04	0.019
ELF 0.02	10	BNP 0.01	0.019
BNP 0.01	10	ELF 0.02	0.019