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Delegation and Firms' Ability to Collude: A Comment*

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Abstract

Lambertini and Trombetta (2002) extend Vickers' (1985) Cournot model of strategic delegation to an infinitely repeated setting and conclude that delegation does not affect cartel stability if managers collude. This result rests on the assumption that managers are rational, but owners are not. This note shows that if owners behave fully rational, then delegation improves cartel stability if managers collude.

Keywords: delegation, cartel stability

JEL codes: D43, L13, L21

1 Introduction

In a contribution to the *Journal of Economic Behavior and Organization*, Lambertini and Trombetta (2002) (hereafter: LT) investigate cartel stability in an infinitely repeated version of Vickers' (1985) strategic delegation Cournot model. When managers are rewarded with a linear combination of firm profit and output, Vickers (1985) shows that firm owners have an incentive to delegate control to managers so as to commit to producing a larger output than the standard Cournot output without delegation. In equilibrium, both owners delegate and are worse off compared to the situation in which none of them would have delegated. Extending Vickers (1985) to an infinitely repeated setting, LT argue that the option to delegate does not affect cartel stability if managers collude.

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In this note, however, I show that cartel stability is in fact increased by delegating control to managers. This result diverges from that of LT due to different assumptions on the rationality of owners. While LT's context is one of full rational behavior, LT implicitly assume owners to be naive in the sense that they set the *same* managerial incentives independent on whether or not the managers will collude. However, rational owners can improve cartel stability by setting *different* incentives in both situations. This note thus shows that LT's conclusion that cartel stability is not affected by delegation only holds for the case of naive owners, and is not robust when allowing for rational owners.

2 The model: collusion between managers

Consider LT's model in which only managers can collude – see LT's Section 3. Two firms $i = 1, 2$ produce at unit cost $c < A$ and compete in quantities on a market with inverse demand $p = A - \sum_{i=1}^{2} x_i$, where x_i is firm i's quantity. The profit-maximising owner of each firm i decides whether to delegate control to a manager who maximises $M_i = \pi_i + \theta_i x_i$, which can be rewritten as

$$M_i = (A - x_i - x_j - c + \theta_i)\, x_i, \tag{1}$$

from which we see that delegation effectively mimics a downward shift θ_i in unit cost c.

In each period $t \in \{1, ..., \infty\}$, the owners delegate control to their managers by independently, but optimally, setting incentives for sales θ_i, after which managers interact on the market. Owners and managers maximise their discounted stream of profits with discount factor $\delta \in [0, 1]$ and $\alpha \in [0, 1]$, respectively. By LT's Assumption 2, managers will not collude if $\theta_1 \neq \theta_2$.

Define labels $\{N, C, D\}$ as static Nash behavior, collusive behavior and defection, respectively. Symmetric equilibria are considered. Collusion is stable if and only if

$$\alpha \geq \alpha^* = \frac{M_i^D - M_i^C}{M_i^D - M_i^N}. \tag{2}$$

In the benchmark Cournot model with integrated firms, relevant profits and cartel stability are, respectively,

$$\pi_i^N = \frac{(A-c)^2}{9}, \;\; \pi_i^C = \frac{(A-c)^2}{8}, \;\; \pi_i^D = \frac{9\,(A-c)^2}{64}, \;\; \sigma \geq \sigma^* = \frac{\pi_i^D - \pi_i^C}{\pi_i^D - \pi_i^N} = \frac{9}{17}. \tag{3}$$

3 Delegation with naive owners

LT's Appendix B solves for managerial payoffs as a function of incentives,

$$M_i^N = \frac{\left(A - c + \theta^N\right)^2}{9}, \qquad M_i^C = \frac{\left(A - c + \theta^C\right)^2}{8}, \qquad M_i^D = \frac{9\left(A - c + \theta^C\right)^2}{64}, \tag{4}$$

where incentives in the punishment regime are set equal to incentives in the collusive regime, i.e. $\theta^N = \theta^C = \theta$. Owners are thereby implicitly assumed to be irrational: when setting incentives they do not rationally anticipate the regime-specific behavior of managers.

Substituting (4) in (2), LT then state in their equation (7) that collusion is stable if and only if $\alpha \geq \alpha^* = \sigma^* = \frac{9}{17}$ as the term $(A - c + \theta)^2$ cancels out when determining the critical discount factor. They thus consequently conclude in their Proposition 1 that delegation does not affect cartel stability if manager collude.

4 Delegation with rational owners

The result derived by LT does not constitute an equilibrium when owners are rationally forward-looking, because such owners would optimally anticipate the impact of incentives on managerial behavior. Since information is complete and all actions (or: market outcomes) are observable, rational owners set *different* incentives in the collusive regime than in the punishment regime, thereby changing the analysis as well as the conclusion. This section subsequently determines these incentives in the punishment regime and in the collusive regime, thereby deriving the collusive equilibria when owners are rational.

Incentives in the punishment regime. After a managerial defection, managers revert to Nash competition and independently maximise (1), yielding $x_i = \frac{A-c+2\theta_i-\theta_j}{3}$, where j is i's rival. Owners substitute these quantities into their profit functions and independently maximise $\pi_i = \left(A - \frac{A-c+2\theta_i-\theta_j}{3} - \frac{A-c+2\theta_j-\theta_i}{3} - c\right)\frac{A-c+2\theta_i-\theta_j}{3}$, resulting in the equilibrium

$$\theta_i = \theta^N = \frac{A-c}{5}, \qquad \pi_i^N = \frac{2\,(A-c)^2}{25}, \qquad M_i^N = \frac{4\,(A-c)^2}{25}. \tag{5}$$

Incentives in the collusive regime. When managers collude on the market, they jointly maximise $M_1 + M_2$ by solving $\frac{\partial(M_1+M_2)}{\partial x_i} = A - c - 2x_i - 2x_i + \theta_i = 0$ for $i = 1, 2$, resulting in $x_1 + x_2 = \frac{A-c+\theta_1}{2} = \frac{A-c+\theta_2}{2}$. Following LT's symmetry assumptions, we have $x_1 = x_2 =$

$\frac{A-c+\theta^C}{4}$, which gives profits and managerial payoff as a function of incentives

$$\theta_i = \theta^C, \qquad \pi_i^C = \frac{(A-c)^2 - \left(\theta^C\right)^2}{8}, \qquad M_i^C = \frac{\left(A-c+\theta^C\right)^2}{8}, \tag{6}$$

while a deviant manager maximises $M_i = \left(A - x_i - \frac{A-c+\theta^C}{4} - c + \theta^C\right) x_i$, yielding

$$M_i^D = \frac{9\left(A-c+\theta^C\right)^2}{64}. \tag{7}$$

To determine the equilibrium value of θ^C, some necessary conditions need to be satisfied.

First, since owners do *not* collude in setting incentives, θ^C must be a static Nash equilibrium from the owners' perspective. The Appendix shows this is the case if and only if $\theta^C \geq 0$.

Second, managerial payoff when managers collude must be higher than when they compete, because otherwise managers would defect for all discount factors. Provided that $\theta^C \geq 0$, by (5c) and (6c), we have

$$M_i^C > M_i^N \quad \Leftrightarrow \quad \theta^C \geq \underline{\theta} = \frac{4\sqrt{2}-5}{5}(A-c).$$

Third, profit associated with "managerial collusion and incentives θ^C" must be at least as large as profit associated with "managerial competition and incentives θ^N", because otherwise owners would prefer the fully competitive equilibrium.[1] Provided that $\theta^C \geq 0$, by (5b) and (6b), we have

$$\pi_i^C \geq \pi_i^N \quad \Leftrightarrow \quad \theta^C \leq \overline{\theta} = \frac{3}{5}(A-c).$$

Collusive equilibria. Collecting all necessary conditions on equilibrium incentives derived above, shows that there exist multiple collusive equilibria with incentives

$$\theta^C \in \left[\frac{4\sqrt{2}-5}{5}(A-c), \frac{3}{5}(A-c)\right],$$

where in every collusive equilibrium profit (6b) is lower than the full monopoly profit associated with the benchmark case of integrated firms (3b), because $\theta^C \neq 0$.

The managers' critical discount factor is determined by substituting (5c), (6c) and (7) in

[1] Owners can induce the fully competitive equilibrium by setting $\theta_i = \theta^N$ and $\theta_j = \theta_i + \epsilon$ with ϵ arbitrarily small, because by assumption managers compete when incentives are asymmetric.

(2), resulting in

$$\alpha^* \left(\theta^C\right) = \frac{25 \left(A - c + \theta^C\right)^2}{\left[15\theta^C + 31 \left(A - c\right)\right] \left[15\theta^C - \left(A - c\right)\right]}.$$

Straightforward algebra shows that $\frac{\partial \alpha^* \left(\theta^C\right)}{\partial \theta^C} < 0$ for all $\theta^C \in \left[\underline{\theta}, \overline{\theta}\right]$ and

$$\alpha^* \left(\overline{\theta}\right) = \frac{1}{5} < \sigma^* = \frac{9}{17} < \alpha^* \left(\underline{\theta}\right) = 1,$$

that is, there exist collusive equilibria entailing a critical discount factor lower than the critical discount factor associated with the integrated firms benchmark.

Only if owners set incentives $\theta^C = \frac{A-c}{5}$, cartel stability is equivalent to that found in LT, i.e. $\alpha^* \left(\frac{A-c}{5}\right) = \sigma^* = \frac{9}{17}$. Summarising all results, the following Proposition rewrites LT's Proposition 1.

Proposition 1 *When owners do not collude in setting incentives and collusion takes place between managers, delegation increases cartel stability, while decreasing cartel profitability.*

5 Concluding remark

The observation of this comment carries over to the case in which managers *as well as* owners have the opportunity to collude on any strategic variable. Therefore, the analysis in LT's Section 5 and 6 is similarly affected by considering rational owners.

References

[1] Lambertini, L. and M. Trombetta (2002). Delegation and Firms' Ability to Collude. *Journal of Economic Behavior & Organization* 47, 359-373.

[2] Vickers, J. (1985). The Strategic Choice of Managerial Incentives. *Economic Journal* 95 (Conference Papers), 138-147.

Appendix

Incentives θ^C constitute a static Nash equilibrium from the owners' perspective if and only if owner i cannot profitably deviate by setting incentives θ' different from θ^C.

If owner i sets $\theta' \neq \theta^C$, then by LT's Assumption 2, managers will *not* collude on the market, but they will compete, because incentives are asymmetric. Nash quantities are then $x_i = \frac{A-c+2\theta'-\theta^C}{3}$, $x_j = \frac{A-c+2\theta^C-\theta'}{3}$, which owner i substitutes in her profit function to get

$$\pi_i^{'}\left(\theta',\theta^C\right) = \left(A - \frac{A-c+2\theta'-\theta^C}{3} - \frac{A-c+2\theta^C-\theta'}{3} - c\right)\frac{A-c+2\theta'-\theta^C}{3},$$

which she maximises at $\theta' = \frac{A-c-\theta^C}{4}$, yielding $\pi_i^{'} = \frac{\left(A-c-\theta^C\right)^2}{8}$.

If both owners stick to incentives θ^C, profit is determined by (6b), that is,

$$\pi_i\left(\theta^C,\theta^C\right) = \frac{(A-c)^2-\left(\theta^C\right)^2}{8},$$

and therefore owner i is not better off setting incentives θ' instead of θ^C if and only if

$$\pi_i^{'}\left(\theta',\theta^C\right) \leq \pi_i\left(\theta^C,\theta^C\right) \quad \Leftrightarrow \quad \theta^C \geq 0.$$