

# Cooperative and Noncooperative R & D in Duopoly with Spillovers: Erratum\*

Claude d'Aspremont and Alexis Jacquemin<sup>†</sup>

In our article published in this *Review* (volume 78, no. 5, December 1988, pp. 1133–37), we have shown that in the presence of sufficient spillovers of the R&D benefits, duopolists, cooperating in R&D but not in the output, spend more on R&D than noncooperating firms at both stages, and also produce more output, closest to the socially optimal level. A second symmetric result is that for small spillovers, duopolists cooperating neither in R&D nor in output spend more on R&D and produce more output than cooperative firms. However, this result has been obscured by an obvious inequality inversion and other typos implying a modification in the conclusions. Indeed in fn. 13 on p. 1135 one should have that  $\tilde{x} > x^*$  iff

$$\frac{(1 + \beta)}{4b\gamma - (1 + \beta)^2} > \frac{(2 - \beta)}{4.5b\gamma - (2 - \beta)(1 + \beta)} \text{ or } \beta > 0.41.$$

This implies that the classification in fn. 16 on p. 1137 should be changed to

$$x^{**} > x^* \geq \tilde{x} > \hat{x}; \quad Q^{**} > Q^* > \hat{Q} > \tilde{Q}.$$

Therefore, “for some spillovers, such that  $\beta \leq 0.4$ , the classifications are different *and* the ‘second-best’ for R&D is obtained by a *noncooperative* behavior in both stages” (p. 1137, lines 5–8).

These results have now been generalized to a wide class of oligopoly models (K. Suzumura, 1989); the stability conditions of the solutions have been established (I. Henriques, this issue); and the effects of various rates of research spillovers have been explored (N. Vonortas, 1989). All

---

\*Reprinted from *The American Economic Review*, 80, 641–642, 1990.

<sup>†</sup>Université catholique de Louvain, 1348 Louvain-la-Neuve, Belgium

these papers emphasize the crucial role played by the spillover parameter  $\beta$  and, implicitly or explicitly, suggest the usefulness of endogenizing it. Three main types of factors corresponding to the three dimensions of the relevant game can influence the value of  $\beta$ .

First, there is the nature of the research: a priori, results of precompetitive, generic research are less easily appropriable and therefore lead to more spillovers than those of specific, applied development activities.

Second, the nature of the product is important with the usual distinction between homogeneous and differentiated goods that could lead to different solution concepts such as Cournot and Bertrand: a priori, spillovers are superior in the former case, given that the more standardized is a product, the easier it is to embody in it the results of R&D.

Third, the nature of the contract and the degree of perfection in information also affect the rate of spillovers. On one side, these spillovers are higher for members of the cooperative agreement than for noncooperative firms. On the other side, within the cooperative group itself,  $\beta$  can vary according to the organizational arrangement,  $\beta = 1$  corresponding to perfect communication and utilization of the resulting information, for example, through integrated laboratories.

In terms of empirical verification and public-policy decisions, it is therefore crucial to extend the analysis of the welfare effects of cooperative R&D by taking into account the main determinants that can modify, at one moment of time and over time, the level of the corresponding externalities.

## References

Henriques, I. Cooperative and noncooperative R&D in duopoly with spillovers: Comment. *American Economic Review*, June 1990, 80, 638–640.

Suzumura, K. Cooperative and noncooperative R&D with spillovers in oligopoly. Working Paper, The Institute of Economic Research, Hitotsubashi University, Naka 2-1, Kunitachi, Tokyo, Japan, 1989.

Vonortas, N. Inter-firm cooperation in imperfectly appropriable research: industry performance and welfare implications. Working Paper, Department of Economics, New York University, 1989.