

# Research joint ventures and optimal R&D policy with asymmetric information

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## Abstract

When to allow Research Joint Ventures (RJVs) or not is an important instrument in the development of an optimal R&D policy. The regulator, however, is unlikely to know all the relevant information to regulate R&D optimally. The extent to which there exist appropriability problems between the firms is one such variable that is private information to the firms in the industry. In a duopoly setting we analyze the characteristics of a second-best R&D policy where the government can either allow RJVs or not and give lump-sum subsidies to the parties involved. The second-best R&D policy without subsidies will either block some welfare improving RJVs or allow some welfare reducing ones. With lump-sum subsidies, the second-best policy trades off the expected subsidy cost with allowing welfare decreasing RJVs or blocking welfare increasing ones. © 2000 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

Two features distinguish R&D from ordinary capital investments. First, R&D is a public good (Arrow, 1962; Grossman and Shapiro, 1986). The use by one firm of

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the information produced by its R&D investments does not diminish the amount of information available to other firms. The optimal economy-wide allocation would therefore involve the free distribution of this information. Second, R&D investment is plagued by an externality problem. Firms investing in R&D typically cannot fully appropriate the results from their own R&D investments. This tends to reduce the incentive to invest in R&D when firms act non-cooperatively (Spence, 1984; d'Aspremont and Jacquemin, 1988; De Bondt and Veugelers, 1991; Kamien et al., 1992).<sup>1</sup> In this paper we concentrate on two policy options that have been proposed to reduce these market failures: internalization of the externality and subsidies (Katz and Ordover, 1990). One way to avoid the appropriability problem is to internalize the spillovers by forming Research Joint Ventures (RJV). In an RJV the firms internalize the positive effect these spillovers have on the R&D and profits of their partners by deciding jointly on their R&D investments, taking their spillovers into account. Subsidies provide an additional R&D policy instrument to improve the allocation of resources to R&D investments (Jacquemin, 1988; Brodley, 1990). Subsidies can be lump-sum transfers which implement the R&D policy or per unit R&D subsidies which change the marginal incentive to invest in R&D. In this paper we only consider lump-sum subsidies that implement the R&D policy. A subsidy per unit of R&D creates additional incentive problems in reporting the true level of R&D investments and would complicate the analysis considerably.<sup>2</sup>

When firms are allowed to form RJVs, R&D investments increase with the level of spillovers, exceeding the non-cooperative investment level when the spillovers are substantial (d'Aspremont and Jacquemin, 1988; De Bondt and Veugelers, 1991). Firms that cooperate in R&D might thus not only increase profits but also welfare when the spillovers are substantial. Policywise, a case can then be made for allowing RJVs to form when there are high spillovers in R&D. However, when there are low or no spillovers, firms acting non-cooperatively with respect to R&D bring about higher welfare than when allowed to form an RJV. The only effect of an RJV in this case is to reduce R&D competition, which in turn decreases welfare (Katz, 1986).<sup>3</sup> This theoretical finding has fueled the debate on the issue of

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<sup>1</sup> However, see Levin and Reiss (1988), Cohen and Levinthal (1989) and Papaconstantinou (1990) for a different result.

<sup>2</sup> Brown (1984) noted a significant increase in R&D expenditures reported on tax forms in response to the tax credit for increases in R&D spending of the 1981 Economic Recovery Act. The increase greatly exceeded the growth in spending reported in Business Week's survey of R&D expenditures. This divergence between growth rates is consistent with the existence of an informational problem in reporting the true level of R&D expenditures.

<sup>3</sup> It has often been suggested that RJVs might also facilitate collusion in the output market. We do not exclude the possibility that firms in an RJV behave more cooperatively in the output market. A necessary condition for an RJV to be welfare improving in this case is that total R&D investments increase. See Yi (1995) for an analysis of the welfare effects of product market collusion by an industry-wide RJV. We abstract from any dynamic considerations in this paper. See Martin (1993) for an analysis of the increased potential for tacit collusion in RJVs. For an analysis of the effects of collusion in the output market on RJV formation, see Greenlee and Cassiman (1996).

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