International R&D Tournaments and Industrial Policy

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Abstract

This paper provides a unified approach to study the influence of uncertainty and spillovers on the direction of R&D policy when firms engage in international R&D competition. When the reward to the winner is exogenously given, it is shown that whether a government will tax or subsidize its firm is sensitive to the type of uncertainty that characterizes the R&D process. When the reward to the winner is endogenously determined by R&D spending, the direction of optimal policy is not only sensitive to the type of uncertainty, but also sensitive to the degree of spillovers.

- JEL classification: F12, F13
- Keywords: International R&D tournaments, Industrial policy, Uncertainty, Spillovers

I. Introduction

Two key features of R&D are uncertainty and spillovers. Uncertainty in R&D has been well recognized in the literature. Examples include Bagwell and Staiger (1992, 1994). In their empirical study, Coe and Helpman (1995), Keller (2004), and Park (2004) found that international R&D spillovers were significant. In this paper, a unified approach is provided to study the influence of uncertainty and spillovers on R&D policy when firms engage in international R&D competition. We show that both uncertainty and spillovers are important in affecting the
direction of optimal policy. In this paper, domestic firms compete with foreign firms in product innovation. Governments make policy announcements before firms choose their R&D spending. A firm’s R&D output is affected by uncertainty and the spillovers from its rivals. When the reward to the winner of the R&D competition is exogenously given, optimal policy is sensitive to the type of uncertainty that characterizes the R&D process. Depending on the type of uncertainty, the optimal policy can be subsidizing its firm, laissez-faire, or taxing its firm. The reason behind the above result is that different types of uncertainties lead to different types of reaction functions. Depending on the form of uncertainty, the foreign firm’s R&D spending may decrease, remain the same, or increase with an increase in the domestic firm’s R&D spending. As a result, the optimal policy depends on the form of uncertainty.

When the reward to the winner of R&D competition is endogenously determined by R&D spending, the direction of optimal policy is shown to be sensitive to the degree of spillovers. The intuition is the following. Optimal policy depends on whether an increase in the foreign firm’s R&D spending decreases or increases the domestic firm’s expected profit. An increase in the foreign firm’s R&D spending has two effects on the domestic firm’s expected profit. First, it decreases the domestic firm’s probability of winning. This effect decreases the domestic firm’s expected profit. Second, the total amount of spillovers to the domestic firm increases and the domestic firm’s R&D output increases. Since the reward to the winner is its R&D output, an increase in the foreign firm’s R&D spending increases the domestic firm’s reward if the domestic firm wins. The latter effect increases the domestic firm’s expected profit. When the degree of spillovers is small, the first effect dominates and an increase in the foreign firm’s R&D spending decreases the domestic firm’s expected profit. When the degree of spillovers is large, the second effect dominates and an increase in the foreign firm’s R&D increases the domestic firm’s expected profit. Thus, optimal policy when the degree of spillovers is small may be opposite to the optimal policy when the degree of spillovers is large.

In a seminal paper, Spencer and Brander (1983) studied the situation that a domestic firm engaged in Cournot competition with a foreign firm. They showed that the domestic government could increase national welfare by announcing a subsidy plan for the domestic firm before firms chose their R&D spending. While

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1See Brander (1995) for a survey of the literature on strategic trade theory.