R&D policies, trade and process innovation [☆]

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Abstract

We set up a simple trade model with two countries hosting one firm each. The firms invest in cost-reducing R&D, and each government may grant R&D subsidies to the domestic firm. We show that it is optimal for a government to provide higher R&D subsidies the lower the level of trade costs, even if the firms are independent monopolies. If firms produce imperfect substitutes, policy competition may become so fierce that only one of the firms survives. International policy harmonization eliminates policy competition and ensures a symmetric outcome. However, it is shown that harmonization is not necessarily welfare maximizing. The optimal coordinated policies may imply an asymmetric outcome with R&D subsidies to only one of the firms.

1. Introduction

This paper has two main purposes. The first is to explore the relationship between trade costs and R&D investments. We show that increased integration (lower trade costs) may increase both private and social incentives to invest in R&D, and may lead firms to sell more both domestically and abroad. The second purpose is to study the effects of policy competition and cooperation in imperfectly competitive international markets, and in particular to show that R&D subsidies may

in fact reduce the number of product varieties in the market. This turns out to be true both if the subsidies are set in a policy game between governments maximizing domestic welfare and if the governments set R&D subsidies cooperatively to maximize aggregate welfare.

These results are developed in a simple two-country model with trade costs, where each country hosts one firm. The firms produce horizontally differentiated goods, and can invest in process-improving R&D to reduce marginal production costs. Freer trade between the countries implies that the size of the market increases, making it profitable to invest more in cost-reducing R&D. Thereby marginal production costs and consumer prices fall. Other things equal, this leads to more export as well as higher sales at home. The latter implies that the social value of any given R&D investment then increases, due to higher domestic consumer surplus. Trade liberalization thus induces the government to increase the subsidy level. It should be noted that the motive for R&D subsidies is not to promote exports *per se*; the size of the export market is important only because it matters for the choice of R&D investments and hence for consumer surplus at home.[1]

In addition to the consumer-surplus motive for subsidizing R&D, there is also a strategic motive for active R&D policies when firms from different countries produce (imperfect) substitutes. This strategic ('business stealing') motive may give rise to policy competition between the countries. Contrary to many previous studies we find that policy competition does not necessarily result in too high subsidies; it may, however, lead to unstable or asymmetric equilibria. The determining factor in our model is the degree of product differentiation. If goods are close substitutes, policy competition may be so fierce that it is impossible for both firms to survive in the market. Depending on the degree of product differentiation in the industry, we may thus have a stable symmetric equilibrium, an unstable symmetric equilibrium, or no symmetric equilibria at all. In the latter two cases there may exist stable asymmetric equilibria where one firm monopolizes the market (and the other firm is inactive), even if the countries and the firms at the outset are completely symmetric.

The outcome of the competitive policy game is suboptimal from a global point of view. Hence, there is a need for R&D policy cooperation that takes into account profit and consumer surplus in both countries, and eliminates policy competition. Coordination of R&D policies may be particularly relevant within closely integrated regions where the use of other policy measures to support domestic industry is already regulated. Based on *e.g.* actual and proposed tax reforms in the EU, a natural approach could be to require that R&D subsidies are harmonized between the countries. If the countries harmonize their R&D subsidies to a common level in our context, the outcome where one firm monopolizes the market is avoided. Somewhat surprisingly, this is not necessarily welfare maximizing. If the two goods are sufficiently close substitutes, it will not be optimal from society's point of view to invest in process innovation in both firms. Hence, the optimal cooperative R&D policy for the two countries could be to subsidize R&D in one of the countries, but not in the other. In fact, it may even be optimal to tax R&D in the other country. The intuition is that the consumers do not gain very much from having access to different varieties if the goods are close substitutes. So to avoid duplication of the investment costs, the first-best cooperative policy could be to stimulate R&D in one firm and reduce the R&D incentives in the other.

Little research has been done on the links between trade liberalization and R&D policies. In particular, we are not aware of any other studies showing how trade liberalization may increase

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[1] The effect is similar to what Krugman (1984) labelled "import protection as export promotion", in that it focuses on the links between the size of the market and the marginal costs of production. However, while Krugman's focus was on how to promote exports, in our case export is a means to ensure lower costs and higher domestic sales.