# Competitiveness-shifting effects and the prisoner's dilemma in international R&D subsidy wars

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### ARTICLE INFO

### ABSTRACT

We analyze the incentives to subsidize R&D when there is an R&D leader and an R&D follower. Without government intervention, the R&D leader always achieves higher cost competitiveness than the R&D follower. In the presence of R&D subsidies, the country that hosts the R&D follower offers higher R&D subsidies than the country that hosts the R&D leader. As a result, competitiveness-shifting effects arise, since due to the R&D subsidy the R&D follower achieves higher cost competitiveness than the R&D leader. Consequently, the country that hosts the R&D follower does not face a prisoner's dilemma in international subsidy wars, since even when the foreign country retaliates, it is always better off when it intervenes.

## 1. Introduction

According to Brander and Spencer (1985), the literature on the strategic trade policy has two main predictions. First, an export subsidy can promote profit-shifting effects from foreign firms to domestic ones, i.e. an export subsidy increases domestic firms' profits (and domestic welfare) at the expense of foreign firms' profits (and foreign welfare). Second, when a foreign country retaliates to a domestic export subsidy, both countries would be better off by cooperating not to intervene, i.e. there is a policy prisoner's dilemma in international subsidy wars.

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The standard set-up of the strategic trade literature considers a duopolist industry (one domestic and one foreign) with exogenous costs of production and no first-mover advantages. In this paper, we analyze an alternative set-up. First, like in Leahy and Neary (1997), we consider endogenous costs of production where firms invest in cost-reducing R&D that reduces marginal costs but increases fixed costs. Second, similar to Garcia Pires (2009) the foreign firm has a first-mover advantage in R&D. Given that the focus of this paper is on R&D, as in Haaland and Kind (2008), we analyze R&D subsidies instead of export subsidies. However, contrary to what is standard in the strategic trade literature, we do not confine governments to intervention: governments can choose whether to support (or not support) the local firm.[1]

We show that, without government intervention, the R&D leader (the foreign firm) endogenously achieves higher cost competitiveness than the R&D follower (the home firm). However, an R&D subsidy by the home government to the home firm causes competitiveness-shifting effects. In other words, with the R&D subsidy the R&D follower attains higher cost competitiveness than the R&D leader.

In addition, the home country does not face a prisoners' dilemma when there is retaliation by the foreign government. This means that the home country is better off when it gives an R&D subsidy to the home firm than when it abstains from doing so, even if the foreign country also awards an R&D subsidy to the foreign firm. In other words, governments that host R&D followers have no incentives to cooperate with governments that host R&D leaders to not subsidize R&D.

The main message of our paper is then that R&D subsidies differ from export subsidies. This is so because R&D subsidies can trigger competitiveness-shifting effects, while export subsidies are limited to profit-shifting effects. As a result, contrary to the case of export subsidies, it is always optimal for catch-up countries to offer R&D subsidies.

In our view, these results can help to explain the Airbus and Boeing case. Some argue that without the subsidies given by the European Union (EU), Airbus would very easily have been beaten by Boeing and would never have become a serious competitor, as it is today (see Klepper, 1990; Neven and Seabright, 1995; Irwin and Pavcnik, 2004). The first part of the argument can be included in the strategic trade literature's rationale via the profit-shifting effects. However, the second part of the argument cannot easily be reconciled in the strategic trade literature given that, as mentioned above, this theory does not encompass competitiveness-shifting effects.

Furthermore, from the strategic trade literature we would expect that as soon as the US government started to retaliate and subsidize Boeing, Airbus's advantage would vanish, and both countries would be worse off, i.e. a policy prisoner's dilemma. In this case, both the US and the EU would have incentives to cooperate to not subsidize Airbus and Boeing. As we know, however this did not happen. In fact, the US and the EU, instead of agreeing to not subsidize the respective local firms, entered into a long dispute at the WTO (World Trade Organization) to try to justify the subsidies given to Airbus and Boeing.

Our model says that if Boeing had a first-mover advantage on R&D, then the EU had incentives to subsidize Airbus and did not face a prisoner's dilemma by entering into a subsidy war with the US. Only by subsidizing Airbus could the EU guarantee that Airbus would be able to successfully enter the very competitive civil aircraft market and that Airbus would catch up with the R&D leader Boeing.[2]

The rest of the paper is organized as follows. In the next section, we present our modeling framework. In Section 3, we calculate the production equilibrium. In Section 4, we derive the R&D subsidy equilibrium. In Section 5, we analyze the competitiveness-shifting effects of R&D subsidies. In Section 6, we look at the existence of a policy prisoner's dilemma in international R&D subsidy wars. We conclude discussing our main results.

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[1] Cooper and Riezman (1989) endogenize the government decision on alternative policy instruments (quantity controls *versus* export subsidies). Hwang and Schulman (1993) also allow governments to decide not to intervene.

[2] The TRON program in Japan, which had as its objective to develop a viable competitor to Intel and Microsoft, also used the first-mover advantages of Intel and Microsoft as an argument for the support of a local champion. However, the TRON project was not successful. This was in part because the market for software and processors is different from the market for civil aircraft, and in part, because the US managed to convince Japan to restrict the extent of the TRON project, see Takahashi and Namiki (2003).