



Price competition, technology licensing and strategic trade policy[☆]



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ABSTRACT

We consider strategic trade policy when two firms from two different countries that start out with different production costs compete in prices in a third country, and technology transfer between the two firms is possible through technology licensing. We find that optimal policy when technology licensing is possible can be very different from optimal policy in the standard strategic trade policy set-up where the possibility of technology licensing is ignored. For example, we find that in a differentiated duopoly with price competition, optimal policy can be an export subsidy and not an export tax. Also, unlike results regarding strategic trade policy with asymmetric costs, optimal policy for a government when technology licensing is possible is neither necessarily (a) higher in absolute value, the more cost-competitive its domestic firm, nor (b) monotonically related to the extent of cost-competitiveness of its domestic firm. Furthermore, we find cases in which welfare is lower when technology licensing is possible than in circumstances where technology licensing is not allowed.

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1. Introduction

Technology licensing between firms has increasingly become common across the globe (Anand and Khanna, 2000; Caves et al., 1983; Contractor, 1981; Degnan, 1998; Lightman, 1970; Macho-Stadler et al., 1996; Nadiri, 1993; Rostoker, 1983; Vishwasrao, 2007; Wilson, 1977). This increase in licensing has occurred, in part, as a result of improvements in contracting institutions. Examples of such technology licensing include agreements between firms from different countries. For example, Belderbos (1998) provides extensive data on licensing activity between Dutch and Japanese firms during 1981–1986, while Vishwasrao (2007) notes activity between Indian and foreign firms between 1989 and 1993. More recent examples of such deals between specific firms include those between Nokia and Samsung, Apple and HTC, and Philips and Shanghai Dangoo Electronics Company. According to the Bureau of Economic Analysis, US companies received a total of \$32.8 billion from foreign enterprises in royalties and fees in 1996, and made total payments of \$7.85 billion in the same period. The corresponding figures in 2009 were more than two-and-a-half times those of 1996, and stood at \$89.79 billion and \$25.2 billion respectively.

More specifically, there have been numerous instances where firms that are product market rivals, and from different countries, have

engaged in technology licensing followed by product market competition. In such cases, the licensee and licensor firms are typically from developing and developed countries respectively. The licensee in such cases often has to focus on exports due to factors in its own domestic market, such as small market size and low demand, especially for technologically advanced products (Inoue et al., 1993; Mathews and Cho, 2007). This, along with (i) weak penetration by the licensee into the licensor's domestic market without technology licensing, and (ii) marketing restrictions in the licensing agreement regarding the licensor's domestic market, has often led to export competition between the licensor and the licensee in primarily third-country markets once technology licensing is in place. At the same time, the national governments of these firms have often pursued export promotion measures. This has occurred in several industries including, for example, semiconductor and electronics industries. Such export promotion measures have formed an important component of the industrial policy pursued by national governments (Hobday, 1995; Inoue et al., 1993; Mathews and Cho, 2007). Moreover, there is empirical evidence that confirms the importance of such export promotion measures (Desai and Hines, 2008).

Given the observations above, it would be natural to ask what the implications of technology licensing or collaboration between firms of different countries might be for government trade policies. The answer to this question is likely to be sensitive to the form of product market competition. There has been some work on trade policies and technology licensing in the context of Cournot–Nash competition (Ghosh and Saha, 2008; Kabiraj and Marjit, 1993, 2003; Mukherjee, 2002; Mukherjee and Pennings, 2006), but none, as far as we know, in the context of price competition. In this paper, we incorporate trade policy and

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the possibility of technology licensing in an international, differentiated duopoly model of price competition, and study the implications for strategic trade policy in such a scenario.^{1,2}

We consider the case where there are two firms from two different countries producing differentiated products. The two firms start out with different per-unit costs of production; however, transfer of production technology between the two firms is possible. We assume that only the government of the firm that starts off with the lower per-unit cost of production engages in unilateral policy-making.³ We use a three-stage model. First, the government of the firm that starts out with the lower per-unit cost of production decides upon the subsidy or tax rate that it will offer to its domestic firm. Second, given this subsidy or tax rate, the two firms decide whether or not to engage in technology licensing. Third, following the licensing decision, production takes place and the two firms compete in prices in a third-country market.

We find that optimal policy with price competition when technology licensing is possible can vary significantly from optimal policy in the standard strategic trade policy set-up where the possibility of technology licensing is ignored. Optimal policy for a government under a standard price competition set-up that ignores the possibility of technology licensing typically (a) is an export tax (Eaton and Grossman, 1986), (b) involves the choice of a higher subsidy or a higher tax (depending on whether optimal policy is an export subsidy or an export tax) for a more cost-competitive domestic firm (Neary, 1994), and (c) is monotonically related to the extent of cost-competitiveness of its domestic firm. We find that each of these three features need not be true for optimal policy in our framework. Further, we also find that welfare can be lower in our framework compared to the circumstances in which technology licensing is not allowed by the government. Recall that in our framework only one government engages in policy-making. Thus, unlike welfare immiserization arising from non-cooperative subsidization by competing governments, immiserization in our framework can occur solely because of the possibility of technology licensing.

This paper contributes to the existing literature in two different ways.

First, following Eaton and Grossman (1986), quite a significant amount of work has been conducted about possible effects of a variety of real world features on strategic trade policy when firms compete in prices. Some of the features whose effects have been examined so far include the sequence of firm and government actions (Carmichael, 1987; Gruenspecht, 1988; Neary and Leahy, 2000), cost asymmetry (Clarke and Collie, 2006, 2008; Neary, 1994), private information (Qiu, 1994), process R&D (Bagwell and Staiger, 1994), unionization (Bandyopadhyay et al., 2000), product R&D (Jinji, 2003; Liang and Mai, 2010; Park, 2001; Zhou et al., 2002),⁴ intermediate goods (Chang and Sugeta, 2004; Kawabata, 2010), delegation (Miller and Pazgal, 2005), cooperative R&D (Carlson, 2008), and competition policy (De Stefano and Rysman, 2010). This paper explores the possible effects of technology licensing on strategic trade policy when firms compete in prices, and thus adds to this body of work. Ghosh and Saha (2008) examine licensing and strategic trade policy in a Cournot duopoly set-up. Their findings are similar in spirit to ours, as they also show that the presence of licensing can reverse the sign of optimal policy, and reduce welfare. However, as is well known from the literature on strategic trade policy, there are typically important differences in optimal policies under Cournot and Bertrand competition. For example, we show in this paper that with Bertrand competition, the

sign of the optimal policy can be reversed, but that reversal is from an export tax to an export subsidy, whereas in the case of Cournot, as discussed in Ghosh and Saha (2008), the reversal of optimal policy refers to a switch from an export subsidy to an export tax.

Second, there is a small, recent literature that has considered welfare implications of technology licensing, and in particular the possibility of welfare-reducing licensing when firms compete in prices (Erkal, 2005; Fauli-Oller and Sandonis, 2002). One of the issues that we consider in our framework is whether welfare can be lower when technology licensing is possible compared to when technology licensing is not allowed. Thus, this paper also adds to our knowledge regarding the welfare implications of technology licensing, and the possibility of welfare-reducing licensing with Bertrand product market competition. More generally, several papers have shown the possibility of welfare-reducing licensing in a variety of contexts (Chang et al., 2013; Mukherjee, 2005; Mukherjee and Mukherjee, 2008; Sinha, 2010). A common theme of these papers is that licensing may lower consumer surplus which in turn leads to lower welfare. We focus on welfare reduction in exporting countries that do not have any domestic consumers for their product.

The rest of the paper is organized as follows. Section 2 lays down the basic framework. Section 3 presents basic results about the occurrence of technology licensing in our framework. Section 4 contains our findings regarding optimal policy with price competition when technology licensing is possible. Section 5 concludes. All proofs are in Appendix A.

2. The model

There are two firms from two different countries that produce two differentiated products and compete in prices in a third country. As in standard third-country trade models, each firm sells in this market only. Also, these are the only firms in this market.

On the production side, we assume that the two firms have production functions with constant marginal cost, and zero fixed cost. The firms start off with different production technologies, i.e. different marginal costs. The initial marginal cost is c_l or c_h , with $0 \leq c_l < c_h$.

Hereafter, we call the firm starting with c_l the low-cost firm and denote it as firm l , while the firm starting with c_h will be called the high-cost firm and denoted as firm h . We call the country that firm l belongs to and its government the low-cost country and low-cost government, and denote them as country l and government l respectively. The high-cost country and high-cost government have a similar connotation and are denoted as country h and government h respectively. We attach the respective subscripts l and h to all variables related to the relevant firm, country, or government.

In our framework, production technology is transferable through technology licensing.⁵ We assume that technology licensing, if it occurs, takes place through the payment of only a fixed fee by firm h to firm l , and entails no retooling or training costs. Further details of the licensing mechanism are described later.

On the demand side, we assume a demand structure as in Dixit (1979) and Singh and Vives (1984) for the products of the two firms in the third country market. We use P_l and P_h to denote the price chosen by firm l and firm h respectively in the third country market, and denote the corresponding outputs by x_l and x_h respectively. Then,

$$x_i = \frac{(1-\theta) - P_i + \theta P_j}{(1-\theta^2)}; \quad i, j \in \{l, h\}, i \neq j, \text{ where } \theta \in (0, 1). \quad (1)$$

¹ In standard homogenous product models with price competition and absent commitment, there will be Bertrand competition ex-post leading to zero profits for both the licensor and the licensee, and thus licensing will not occur. Hence, we use a differentiated duopoly set-up with price competition for our analysis.

² Several papers have considered technology licensing under price competition for differentiated products in a closed economy set-up (Erkal, 2005; Fauli-Oller and Sandonis, 2002; Muto, 1993; Wang and Yang, 1999).

³ We do this to highlight the possible effects of licensing alone on optimal policy, which is consistent with our aim in this paper.

⁴ Miyagiwa and Ohno (1997) conduct an analysis that can be applied to either process or product R&D.

⁵ While licensing between direct product market rivals means lower product market profits for the licensor, revenues from licensing may make it worthwhile, which is the reason for licensing in our framework (Arora et al., 2001; Gallini and Winter, 1985; Kabiraj and Marjit, 1992; Katz and Shapiro, 1985).

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