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## Strategic outsourcing with technology transfer under price competition

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### ABSTRACT

Consider a framework where two firms produce differentiated goods and compete in prices, and one of them possesses input production technology, superior to that of an existing independent input supplier. We show that the superior technology owning firm can sell its patent to and outsource inputs from the input supplier. This happens if the degree of product differentiation is small or the technological gap between the two input producing firms is small. While the outsourcing firm gains, both consumers' welfare and social welfare go down. Interestingly, sometimes the rival firm's profit increases. These results have implications for competition policy.

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### 1. Introduction

Outsourcing is a widespread phenomenon in modern business. Almost all firms and business houses are involved in outsourcing activities. In the last two decades the outsourcing activities are growing over 30% per annum. Nokia, for example, depends on more than 300 domestic subcontractors and similar number of foreign subcontractors. In computer industry Sun purchases about 75% of components from other companies. The aircraft giant Boeing outsources products of over 34,000 components from different manufacturers for its production of 747 passenger aircraft. The 1998 Annual Report of WTO estimate shows that only 37% of the production value of a representative American car is generated domestically in the USA. A little search in the internet will reveal many more such information. Recently, R&D outsourcing is also growing fast.<sup>1</sup>

In the literature outsourcing refers to contracting by a firm with another firm or organization regarding performing of some business function (viz., input production) which is ultimately purchased back as a service. So outsourcing decision is the outcome of the choice problem between in-house production of inputs within the vertical structure of the firm and buying inputs from outside decentralized market sources. The traditional literature mostly focuses on cost consideration; accordingly, if a firm can

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<sup>1</sup> See Beladi et al. (2012), for instance.

buy an input from outside at a price lower than its in-house cost of production, it is reasonable that the firm will go for outsourcing of production of such an input.<sup>2</sup> It is in this context that we raise the question as to whether outsourcing of a crucial input can occur even when the in-house production cost is lower.

Motivation behind the question is the following. In an imperfectly competitive market structure how a firm will organize its production and whether it will buy some crucial inputs from outside instead of producing in-house are the outcomes of the subtle and complex decisions involving significant strategic considerations. Here 'cost' is not the only consideration. It is not then surprising that a firm might outsource a key input from an outside supplier even though the input can be produced cheaply in-house. In this paper we focus on such a scenario of outsourcing. There are in fact evidences to show that a firm outsources crucial inputs even when its in-house production is less expensive. For example, the aircraft giant Boeing had entered into a series of outsourcing agreements with three Japanese firms (Mitsubishi Heavy Industries, Kawasaki Heavy Industries Ltd., and Fuji Heavy Industries) regarding supply of some goods related to aircraft production, including R&D, during 2000s when these firms showed interest in entering the market for commercial aircrafts. It was observed that costs in Japan were no less; hence Boeing's outsourcing decision cannot be justified based on cost-saving. Outsourcing contracts between Boeing and Lockheed is another example.<sup>3</sup>

We analyze the problem of outsourcing vs. in-house production in a setting where two firms produce differentiated products and compete in prices in a Bertrand fashion, but only one of them (say, firm 1) has the relevant input production technology to produce a crucial input. There is a third firm (call firm 0) which cannot compete in the final goods market but possesses an input producing technology. Hence both firm 0 and firm 1 can compete in the input market for selling the input to firm 2, the other product market competitor. Assume that firm 1 possesses a superior input production technology compared to that of firm 0, but both firm 1 and firm 2 have symmetric final goods producing technology. In this setting we analyze the decision of firm 1 between outsourcing the input from the independent input supplier and producing it in-house. Since firm 1 has a lower cost of in-house input production, in the absence of any strategic consideration firm 1 would never like to outsource the input production. But since firm 1 possesses the superior technology, it has the option to sell out its patent of the superior technology to the independent input producer. The sale of patent entails that once the patent is sold, firm 1 foregoes rights to produce inputs for itself, and the independent input producer emerges as a monopolist in the input market.<sup>4</sup> Thus firm 1 can induce the input supplier to charge a monopoly price for inputs to all product market competitors. Firm 1 can overcompensate the loss of profits due to the higher input price by means of charging a fee for the transferred patent of the input production technology. The higher input price also relaxes product market competition. We show that such strategic outsourcing of input production is profitable to the outsourcing firm if either the degree of product differentiation is small or the technological gap between two firms producing inputs is not large. On the other hand, in-house production is optimal if the degree of product substitution is small but the technological asymmetry is sufficiently large.<sup>5</sup>

In the present paper we thoroughly examine the implications of the possibility of outsourcing. We find that strategic outsourcing always reduces consumers' welfare as well as overall welfare. However, under outsourcing equilibrium the overall industry profit will be higher when the goods are relatively close substitutes but lower when the goods are highly differentiated. Our model is closely related to the idea of raising rivals' costs as illustrated in Salop & Scheffman (1983, 1987). However, in the standard literature on raising rival's cost the rival is adversely affected. On the contrary, surprisingly in our model we show that the rival's profit may be higher even though firm 1's outsourcing strategy raises input costs for firm 2. This brings into focus that both firms might like the outsourcing arrangement although the society as a whole will be worse off.

There are some interesting works which focus on strategic outsourcing.<sup>6</sup> Among those, one paper which is very closely related to ours is by Arya, Mittendorf, & Sappington (2008a). They have constructed a three-firm model with one wholesale input supplier and two product market competitors, of which one firm, say firm 1 has the capability to produce inputs in-house but the other firm has only output production technology. The paper shows that even though firm 1 can produce inputs at a cost less than the input price charged by the whole sale input supplier, firm 1 will outsource to gain strategic advantage. The wholesaler decides the prices to be charged to firm 1 and firm 2 sequentially. Then firm 1 by its strategic outsourcing decision can induce a higher input price for its product market rival, and in the extreme case this might deter entry of the rival. Our paper is different

<sup>2</sup> The literature on the theory of firm defines the boundaries and limitations of vertical and horizontal extensions of a firm. This leads to the choice of production organization based on cost consideration. The problem is explained in terms of transaction costs, specificity of factors, incomplete contracting and property rights. One may look at the works of Coase (1937), Grossman & Hart (1986), Grossman & Helpman (1999, 2002), Hart & Moore (1990), Holmstrom & Roberts (1998) and Williamson (1985). Gibbons (2005) provides a nice survey on the theory of firm.

<sup>3</sup> See in Chen (2011) for further details.

<sup>4</sup> There are cases of competing firms in many industries outsourcing to a common supplier. For example, in the United States more than 60% of auto parts suppliers make parts for big three car manufacturers (namely, GM, Chrysler and Ford) (see Alexandrov, 2010).

<sup>5</sup> Our present structure follows from the consideration of the following three sets of observations. First, in the emerging countries like India business process outsourcing (BPO) is common. Here a foreign company sets up business processing units outside the parent country, transfers its technological knowhow, but recruits personnel mostly from the local country. These units are involved in collecting and processing data and other information from different parts of the globe and on behalf of the company provide informational and other services to the customers. Second, there are evidences to show that firms have outsourced some crucial inputs even when their in-house input costs are not larger. We have already mentioned the case of the aircraft giant Boeing which had entered a series of outsourcing agreements with the Japanese firms when costs in Japan were not less. Finally, the papers like Arya et al. (2008a) have shown the case when a firm outsources a crucial input at a higher price than its in-house production cost. However, in Arya et al. (2008a) outsourced firm's cost of production is low compared to the cost of the outsourcing firm. So it is also a theoretical interest to examine whether outsourcing can occur even when the input production cost is lower.

<sup>6</sup> See, for instance, Shy and Stenbacka (2003), Buchler & Haucap (2006), Arya, Mittendorf, & Sappington (2008a, 2008b), Chen, Dubey, & Sen (2011), Chen (2011), and Mukherjee & Tsai (2010, 2013). A brief outline of these works can be found in Kabiraj (2013).

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