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## Cooperating with competitors: Patent pooling and choice of a new standard<sup>☆</sup>

Nancy Gallini

Vancouver School of Economics, 1873 East Mall, Room 997, University of British Columbia, V6T 1Z1, Canada

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## ABSTRACT

I examine the efficiency of patent pooling in a setting that allows for the interplay between the standards process, in which owners of essential intellectual property (IP) develop a new product, and the subsequent pooling decision, in which IP prices are coordinated. If one of the IP owners is also the incumbent of a product that employs the current competing standard – referred to as *overlapping ownership* – then the relationship among the IP owners will be both vertical through their IP, and horizontal through their competing interests in the final products. Consumers are better off when IP owners cooperate, even when these owners are effectively competitors, because of lower prices and greater product variety. Consumers prefer, however, that the agreements not admit firms with overlapping ownership. These results inform antitrust policy on cooperative agreements among competitors.

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## 1. Introduction

Since the mid-19th century, patent pools have been widely used in almost every sector of the economy for the purpose of overcoming blocking patents and facilitating collaboration of essential inputs for a new standard. But they can also be used to extend market power, thereby making them a subject of antitrust scrutiny. In the United States, for example, antitrust oscillated from viewing patent pools as effectively per se legal (in 1902 “the general principle [was] absolute freedom in the use and sale of rights under the patent laws”)<sup>1</sup> to per se illegal (in 1948 a pool of complementary patents was deemed to illegally “fix prices of...commercially successful devices embodying...patents”).<sup>2</sup> More recently, antitrust authorities have adopted a balanced approach,

in recognizing the pro-competitive effects of pools of complementary and, typically standard-essential patents,<sup>3</sup> while remaining cautious of those that admit substitute patents. This has allowed patent pools to re-emerge as a dominant mechanism for sharing intellectual property (IP).<sup>4</sup>

The above approach, inspired by Cournot's (1838) well-known result on the efficiency of price coordination of complements, ignores two striking features of modern collaborations: Prospective members of newly formed pools often are incumbent firms that supply inputs to or produce products that are substitutes for the pool-supported downstream product. The DVD patent pool, for example (see Section 2), comprises patents from technology competitors with a stake in products that compete with the DVD technology. So, even if the IP included in the pool are not in competition with each other, their owners may be, thereby raising potential antitrust concerns. Second, virtually all modern patent pools follow from standard-setting processes;<sup>5</sup> therefore, anticipation of price coordination through pooling can influence the choice of the standard, as well as its prices.

In this article, I examine the efficiency of patent pools between two IP owners in an environment that allows for the interplay between

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E-mail address: [Nancy.Gallini@ubc.ca](mailto:Nancy.Gallini@ubc.ca).<sup>1</sup> *Bement v. National Harrow Co.*, 186 U.S. 70 (1902).<sup>2</sup> *United States v. Line Material*, 333 U.S. 287 (1948).<sup>3</sup> Patents are essential to a standard or product if there are no economic substitutes; that is, anyone implementing the standard would naturally infringe the patents.<sup>4</sup> According to Clarkson (2003), over \$100 billion of sales are generated each year in the United States from products or devices that are based wholly or in part on technologies in patent pools.<sup>5</sup> However, the converse is not true. For example, internet standards, as set by the Internet Engineering Task Force, and world wide web protocols set by the World Wide Web Consortium have not evolved into pools of software or related patents and copyrights. See Baron and Pohlmann (2012) for examples of patent pools that formed around new standards.

the standards process and patent pooling, and for one participant to have a stake in the current competing standard.<sup>6</sup> Under the latter feature – referred to as *overlapping ownership* – an IP owner both supports and competes with a new standard. Therefore, the collaborating IP owners are horizontally related in their involvement in competing downstream products, as well as vertically related by nature of their complementary upstream IP. This hybrid structure gives rise to a tension: Coordination of complements in a pool promotes efficient pricing, but overlapping ownership can soften competition between the pooled and non-pooled competing downstream products. At the standard-setting stage, participants will choose product type (defined by the degree of differentiation from the incumbent standard), taking into account the effect it will have on subsequent pricing – either coordinated or non-cooperative – of the essential IP. In a simple framework, I ask whether the conventional efficiency result on price coordination of complementary IP continues to hold in this environment of endogenous product selection and overlapping ownership.

Two effects of patent pooling under overlapping ownership are identified: the *complements effect* that typically inspires greater price competition in the product market, and the *differentiation effect* that encourages development of a more distant standard. The former relates to the conventional result: if prices of the downstream products are strategic complements then, for a given product type, coordinated pricing of complementary inputs through patent pooling results in lower prices of both competing products than would separate pricing of those inputs. However, the complements effect can render pools unprofitable, in which case socially efficient pools may not form. This is especially true when one party with a stake in the current competing product cannot be adequately compensated for its outside losses, for example, due to technological constraints or antitrust restrictions.

In addition to institutional constraints affecting the decision to pool, the product type selected at the standard-setting stage will determine the profitability of patent pooling. If costs of developing a differentiated product are low, then the IP owners will select a weak substitute to the current standard. This choice of product type (differentiation effect) softens price competition that arises from pooling (complements effect), thereby increasing the profitability of price coordination. However, if development costs of differentiation are high, then IP owners will choose a closer substitute to the current standard but then moderate competition by pricing their inputs noncooperatively. That is, when IP owners can combine product and price coordination (through standard-setting and pooling agreements), they may soften competition by either choosing to pool a relatively differentiated substitute or commit to separate pricing of a similar substitute. In fact, if the costs of differentiating are so high that only a very close substitute would be developed, then the incumbent may foreclose new product entry by refusing to license its essential IP. Depending on the costs of new product development, pooling may not always be chosen, but the firms are no worse off having the option.

The impact on consumer welfare, in general, depends on consumers' tradeoff between product variety and price competition. For the case of quadratic preferences, for example, consumers are better off when pooling is an option. Pooling has the effect of redirecting product choice toward greater differentiation from the current standard while facilitating efficient price coordination of complementary IP. These findings have implications for antitrust policy; in particular, a more permissive policy on patent pooling to encourage efficient cooperation that otherwise would not take place can be socially beneficial.

Although pooling generates positive social benefits (through its effect on prices and product choice) given a member owns a competing product, the converse is not true: Consumers are worse off under

overlapping ownership relative to independent ownership, given pooling is chosen. That is, while consumers prefer pooling under overlapping ownership, they would be better off if pool members were divested of their assets in competing products or, less dramatically, were prevented from integrating further. Of course, this especially will be true if the pool extends beyond the essential complementary IP to facilitate price coordination among substitute downstream products.

Section 2 reviews the related literature and offers examples of IP sharing agreements with overlapping ownership. In Section 3, a simple product-pooling-pricing framework is presented. Three organizational decisions are outlined: First the standard-setting process for developing a new product; second the decision to combine the patentees' complementary inputs through a patent pool; and third the pricing game in which the new standard competes with the current product. In Section 4, the benchmark case of an independent incumbent (no overlap) is explored. Section 5 derives the equilibrium under overlapping ownership for the standard-setting, pooling and pricing decisions. The results are then used to inform antitrust policy. Section 6 concludes with a discussion of the testable predictions and normative implications for IP and antitrust policy.

## 2. Related literature and policy relevance

### 2.1. Related literature

The analysis in this paper builds upon the economics literature in two ways. First, it analyzes the industrial structure of overlapping ownership in the context of IP cooperative agreements. Second, it extends the IP literature in interacting the standard-setting decision on product choice with the pooling decision on price coordination to analyze the efficiency of patent pooling.

Regarding the first extension, Fig. 1 gives a sense of how overlapping ownership is distinct from other industrial organizations examined in the literature such as vertical integration. In both panels, an incumbent has exclusive rights to a standard-essential patent bundle  $X_0$  for  $Z_0$ , which it produces as a monopolist or sells to perfectly competitive  $Z_0$  producers; whereas Firms 1 and 2 own respective patent bundles  $X_{11}$  and  $X_{12}$ , required for production of the competing downstream product  $Z_1$ . The right oval, encompassing  $X_{11}$  and  $X_{12}$  in both panels, reflect that the IP owners' standard-essential patents are coordinated within a patent pool. Solid lines indicate production relationships along the respective vertical chains, and the dotted ovals in both panels indicate integration within a firm. So, in panel (a), the incumbent is independent from the IP owners of  $Z_1$  and Firm 1 is shown to be vertically integrated along the vertical chain of production from its input  $X_{11}$  to downstream product  $Z_1$ . In panel (b), Firm 1 is shown to be horizontally integrated across two bundles of essential IP,  $X_0$  and  $X_{11}$ , which compete with each other indirectly through their respective downstream products requiring them. Note that the set of IP owned/coordinated by the two competing parties – the incumbent and the patent pool – overlaps.<sup>7, 8</sup> That is, under vertical integration, the IP owner produces the downstream product  $Z_1$  that requires her IP; under overlapping ownership, she effectively competes with it.

These differences imply distinct effects on prices, pooling incentives and the standard-setting process. In Kim (2004) and Lerner and Tirole (2004) two inefficiencies are identified in the absence of pooling: the complements problem (Cournot (1838), Shapiro (2001)) and raising rivals' costs to non-members selling differentiated versions of the

<sup>7</sup> Fig. 1 suggests that overlapping ownership also can be described as *diagonal* integration from Firm 1's control of the downstream product  $Z_0$  to its upstream input bundle  $X_{11}$ , required by the competing product  $Z_1$ .

<sup>8</sup> Firm 1 can be reinterpreted as selling its input bundle  $X_{11}$  to Firm 2, which it then combines with its IP to produce  $Z_1$  in competition with Firm 1's  $Z_0$ , thereby highlighting the horizontal nature of the firms' relationship in Fig. 1(b).

<sup>6</sup> In this paper, a standard is defined by a bundle of inputs that gives rise to a particular product; therefore "standard" and "product" are used interchangeably.

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