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Input complementarity, patent trolls and unproductive entrepreneurship

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ABSTRACT

I introduce and analyze an equilibrium model of discovery, innovation, patenting and infringement. Firms that innovate must adapt complementary inputs, and are ex ante uncertain about whether adaptations will be costly and whether they will infringe other patents. If adaptation requires undiscovered technology, then the firm faces a direct cost but never infringes another firm's patent. If adaptation requires technology previously discovered by another firm, then the firm faces no direct cost but may infringe another firm's patent and pay a licensing royalty. The main analysis considers the desirability and feasibility of having some firms specialize in discovery and patenting—that is, behave as non-practicing entities—while other firms innovate. I find that non-practicing entities increase welfare only if the cost of discovery and patenting is sufficiently low. But if royalties are too high, then too many firms choose to be non-practicing entities instead of innovating, and welfare is higher without them. If litigation is costly, then it may be optimal to deter non-practicing entities by eliminating patents for discoveries.

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1. Introduction

Many products are complex, requiring multiple complementary inputs and creating complicated innovation environments. A firm that innovates may need to adapt complementary technology to profit from its innovation and may be uncertain about which adaptations will ultimately be necessary. As a result, innovation carries uncertain direct adaptation costs and may lead to patent infringement and generate indirect (licensing and/or litigation) costs. Some firms may prefer not to carry innovation all the way through production, and instead seek higher profits as non-practicing entities (NPEs)—specialists in inventive discovery, patenting and "monetization" of patents that other innovators need.

NPEs, often referred to as "trolls," are the source of an active policy debate. By discovering and disclosing technology in patents, NPEs could lower the direct costs that other firms pay in commercializing products. But in pursuing patent infringement litigation, NPEs could also raise the indirect costs firms must pay. In recent decades, the number of patent infringement lawsuits filed by NPEs in the US has surged (Bessen et al., 2015). Most NPE suits assert patents claiming inventions in computer and communications technology (Bessen et al., 2012),[1] and by 2013 NPEs were responsible for over half of all suits (PriceWaterhouseCoopers, 2014).[2]

In this paper, I develop and analyze a monopolistic competition model to study the welfare impact and policy implications of NPEs. The model specifies that a continuum of firms have the same cost of discovery, but are heterogeneous with respect to their costs of innovation. Hence, firms have different relative costs of discovery. The model also specifies that discovery precedes innovation, and treats the decision to innovate as potentially separate from the decision to discover. Hence, some firms may choose to specialize in discovery and patenting, i.e., function as NPEs. To isolate the welfare effects of NPEs, I consider two different patent regimes. Under a lenient regime, a firm must just discover technology to get a patent, so NPEs are permitted. Under a strict regime, a firm must discover and innovate technology to receive a patent, so NPEs are prohibited.

Regardless of the regime, innovating firms must adapt complementary technology to make final products and earn revenue. Firms are ex ante uncertain about whether adaptations will require using previously undiscovered technology (which imposes direct costs) and about whether adaptations will infringe other firms' patents (which imposes indirect costs, through licensing royalties). The risk that innovation leads to infringement

[1] See also Lemley and Shapiro (2007), who highlight how technology overlaps in complex products make resolving disputes particularly costly.

[2] Note that the problem of technology overlaps leading to conflicting property rights is not new. Mossoff (2011) details the "sewing machine wars" of the 1850s, in which Elias Howe, Isaac Singer and others patented complementary components of sewing machines and battled each other in court for years prior to forming a pool in 1856. Hayter (1947) argues that farmers faced a thicket of patents on farm equipment during the 1870s and 1880s. Radio patents in the 1920s also arguably formed a thicket (Sabety, 2005). Heller and Eisenberg (1998) discuss how overlapping property rights may lower innovation through a "tragedy of the anticommons."