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The organizational advantage in early inventing and patenting: Empirical evidence from interference proceedings



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ABSTRACT

Recent research suggests that individual inventors produce less valuable inventions than those operating within organizational boundaries. The current study demonstrates that organizations invent and file for patents earlier than individuals. Analyses of priority contests between competing agents reveal that public and private corporations invent faster than individual inventors, whereas public and private corporations, universities, and research institutes patent their inventions earlier than do individuals. We examine the outcomes of patent interference proceedings involving about 650 U.S. patents and patent applications occurring between 2005 and 2013. We theorize that individual inventors lack resources as well as functional and integrative capabilities needed to invent and patent as quickly as organizations. The paper offers policy-making insights and contributes quantitative-based grounds for further research into more efficient and effective intellectual property regimes.

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1. Introduction

Thomas Edison, Steve Jobs, and other mythologized ‘garage inventors’ feed the ‘romantic’ view of the lone inventor as a heroic genius (Dolfsma and Seo, 2013). The U.S. constitution states, ‘The Congress shall have power (...) to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries’ (section 8.8). Implicit in this text is an assumption that discoveries and inventions are made by individuals, and thus the U.S. patent system instituted a first-to-invent regime designed to reward only the first (and presumably true) inventor of a given technology (Franzoni and Scellato, 2010). The U.S. patent system never recognized independent reinvention as a defense against accusations of patent infringement, unless the invention could be shown to have occurred earlier than the one granted a patent (Lemley, 2007; Vermont, 2006). In 2013, a historic implementation of changes to U.S. patent law embodied in the ‘2011

America Invents Act’ shifted the patent system from a first-to-invent to a first-to-file regime. This move put the U.S. in line with the rest of the world, which was already using first-to-file systems. Global standardization of intellectual property regimes is expected to facilitate trade by removing any special advantages or disadvantages that non-conforming countries might have had (Matal, 2011, 2012; Trilling, 2012).

Despite the benefits, first-to-file systems have their critics, including the U.S. Professional Inventors Alliance, which points out that first-to-file regimes generally favor corporations over individual inventors. Their concerns are supported by evidence generated by legal scholars such as Abrams and Wagner (2013) who find that after Canada switched to a first-to-file system, there was a significant drop in patents granted to individual inventors. They conclude, ‘the March 2013 implementation of a first-to-file rule in the United States is likely to result in a reduced share of patents granted to individual inventors’ (p. 517). More generally though, as invention has become increasingly industrialized, individual inventors have been marginalized, dropping from being granted 86% of U.S. patents in 1910 to just 15% in 1998 (Dahlin, 2004; Rosenberg, 1994).

Adopting a legal change that potentially puts individual inventors at a disadvantage is controversial because the act was designed to regulate the actions of patent trolls, a group that does not overlap perfectly with the category of individual inventors (Lemley, 2012). Little is known about how reforms might affect individual inventors (Macdonald,

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1986), partly because little knowledge exists about the inventing and patenting behaviors of individual inventors in the first place. An argument can be made that those individual inventors who become technology entrepreneurs are important engines of economic growth that should not be ignored (Acs and Sanders, 2008; Autio and Acs, 2010; Pathak et al., 2013; Veer and Jell, 2012). Deeper insights about how the patent system benefits or constrains individual inventors could provide guidelines for policy-making aimed at improving conditions for potential technology entrepreneurs and fostering innovation-based economic development.

Although prior research is a bit scattered and contradictory, a recent study suggests that individual inventors make less valuable inventions and are less likely to make radical innovations than corporations (Singh and Fleming, 2010). Already, these results may put individual inventors on the defensive because they suggest that individual inventors deserve less (or at least no more) assistance from publicly-funded subsidy sources such as tax incentives, grants, and cheap loans (Holbrook et al., 2000). The controversy is heightened because patent market failures are more problematic for individual inventors who receive only a pittance of total royalties—the vast majority go to large companies (Hagi and Yoffie, 2013; Hagi et al., 2011), and increasingly to non-practicing entities (i.e., patent trolls) (Fischer and Henkel, 2012; Lemley, 2012; Pohlmann and Opitz, 2013).

Using a unique dataset of U.S. patent interference cases, we corroborate that (1) private and public corporations have temporal advantages over individual inventors in terms of invention speed (i.e., they invent earlier), and (2) that all types of organizations (private and public companies, research institutes, universities, and governments) have an advantage over individual inventors in terms of their patent filing speed (i.e., they file patents earlier).

This study contributes to the extant literature in two key ways. First, it provides statistical support that organizations have an advantage over individuals both in terms of inventing and patenting. These results are unique and interesting because they contest the notion of the lone inventor as an American icon (Abrams and Wagner, 2013) on new grounds. Second, it offers new objective operationalizations of *invention speed* and *patent filing speed*, which are unique to data covering priority disputes—prior studies have tended to rely on productivity measures such as patents per year (Leone and Reichstein, 2012), and subjective measures, for example, asking managers to rate the speed of their invention activities (Lukas et al., 2002). Together these contributions help to resolve several debates in the literature about the role of individual inventors and the nature of organizational advantages in inventing and patenting, and can inform policies serving to promote innovation.

In the following sections, we begin with a review of the literature on individual inventors and organizational advantages in R&D. Next, we develop two hypotheses regarding the temporal advantages of organizations with respect to inventing and patenting. Then, we present our methods and results. Finally, we discuss our findings and their implications for theory, research, and public policy considerations.

2. Theoretical background

Using a relatively small sample of patents, Dahlin et al. (2004) find that individual inventors were overrepresented both among the more impactful as well as the less impactful patents. They argue that individual inventors are more likely to produce radical innovations because of their outsider status. For instance, they are not constrained by existing standards, product architectures, dominant designs, bureaucracy, backward compatibility demands, and organizational routines, and should therefore be more likely to create variations that are highly distinct and valuable (Henderson and Clark, 1990; Prusa and Schmitz, 1991; von Hippel, 1988).

However, the higher hit rate for radical innovation by individual inventors was recently challenged by Singh and Fleming (2010) who report evidence disconfirming the theory in a very large sample of U.S. patents. Their results indicate that corporations have the upper hand even in radical innovation and have lower failure rates than individual inventors. They attribute this organizational advantage to the collaborative searching and sorting that organizations facilitate (Pandza et al., 2011). By working productively together, more diverse collaborative teams can create, filter, and select more options, leading to better outcomes (Tsai, 2009). Individual inventors, 'especially those without affiliation to organizations, are less likely to achieve breakthroughs and more likely to invent particularly poor outcomes' (Singh and Fleming, 2010). Other scholars also claim that the patents individual inventors file are less important as compared to those filed by organizations (Chartrand, 1999; Narin, 1991).

In sum, there are arguments and evidence both in favor of individuals as well as organizations in inventing and filing for patents. More research is needed to tease this out as we are currently left with a contradictory picture. In an attempt to add another piece to the puzzle, in the next section we consider the potential for organizational advantages in inventing and patenting timeliness.

However, before moving on, it should be clear that the literature suggests two main reasons why early invention is valuable. First, an agent that invents sooner may be quicker to commercialize the invention or license it for gain. Second, if speedier invention leads to earlier patent filing then it can also result in faster disclosure and patent expiry, which can be both considered public goods (Lemley, 2012). If individual inventors are earlier to invent and patent, then their lower average patent innovativeness (Singh and Fleming, 2010) might easily be justified. Studying temporal dimensions of advantage is important given the evidence of speed's advantages in other contexts, such as in strategic decision making (Brown and Eisenhardt, 1995) and in new product development (Cohen et al., 1996). First mover advantages are also well documented and seem robustly connected to market share growth (Kerin et al., 1992; VanderWerf and Mahon, 1997) and the rise of monopolies (Gilbert and Newberry, 1982). These ideas are in line with a patent racing theory proposed as an alternative to the traditional justifications for the patent system. Invention is highly social in nature and multiple independent invention (where more than one individual or team makes the discovery independently from each other) is very common and often occurs nearly simultaneously (Lamb and Easton, 1984; Simonton, 1979, 2010; Voss, 1984). Patent racing theory holds that *intellectual property rights may benefit society particularly through the fostering of a racing culture among inventors and their employers* (Lemley, 2012).

3. Model and hypotheses

3.1. Temporal advantages in inventing

In addition to accessing greater resources, knowledge integration (Subramanian and Soh, 2010) or the recombination of components to produce valuable technologies is a fundamental organizational function that may contribute to the timeliness of inventions. An organization's existing knowledge base impacts its ability to generate new valuable combinations in the form of various innovations (Fleming and Sorenson, 2004; Galunic and Rodan, 1998; Yayavaram and Ahuja, 2008). Organizations can build on their current knowledge by actively drawing upon their existing knowledge clusters or by internalizing new knowledge components and recombining them with its extant knowledge (Katila and Ahuja, 2002). Over time, an organization can gain a better understanding of knowledge components through mechanisms such as codification (Pérez-Luño and Valle-Cabrera, 2011), and expand its combinative capabilities (Katila, 2002; Katila and Ahuja, 2002). Concurrently, integrative capabilities allow firms to absorb new

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