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The role of inter-sectoral knowledge spillovers for technological innovations

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Abstract

The role of inter-sectoral knowledge spillovers for technological innovations Name: Annegret Stephan
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Expected final date: Autumn 2016 Email: astephan@ethz.ch State-of-the-art The creation of new knowledge is

a prerequisite for technological change. Especially knowledge that is transferred from other domains (Mowery & Rosenberg 1998) plays an important role for innovations and a technology's trajectory (Dosi 1982). These knowledge spillovers (Jaffe 1986; Trajtenberg et al. 1997) and – more specifically – the role of knowledge diversity across different domains have been widely investigated. While literature provides no uniform understanding of knowledge diversity, analyses typically take (and measure) a technology perspective (Fleming 2001; Lettl et al. 2009; Battke et al. 2015) while simultaneously referring to sectoral spillovers (Schoenmakers & Duysters 2010; Nemet & Johnson 2012; Nemet 2012; Verspagen 1997). Research gap As existing knowledge spillover analyses do not distinguish between technological fields and sectors they (implicitly) assume that sectors produce what they invent/know and vice versa. The sectoral diversity of knowledge spillovers is therefore yet underexplored in literature. In this paper, we address this gap by investigating the role of knowledge diversity across sectors for a technology's knowledge development. More specifically, we investigate whether the role of knowledge diversity and distance across sectors increases the importance of an invention (Hypotheses 1a/b). We furthermore take the direction of subsequent knowledge flows into account (where does the knowledge flow to) by investigating whether the role of knowledge diversity and distance across sectors increases future cross-sectoral applicability (Hypotheses 2a/b) and its usefulness for distant sectors (Hypotheses 3a/b). Theoretical arguments While there might be an overlap, literature has shown that technological fields and sectors generally differ. Sectors know more than they produce and their knowledge may serve as input for various technologies (Bergeron et al. 1998; Stephan et al. 2015; Jaffe 1986; Scherer 1982). Furthermore, modern technologies typically consist of various components and subsystems (Tushman & Rosenkopf 1992) originating from different sectors and thereby increasingly requiring sectoral interaction (Mowery & Rosenberg 1998). This might strongly be affected by the sectors' differences in innovation behaviour (Pavitt 1984; Malerba 2002; Malerba 2004). Method We employ negative binomial and fractional logit regressions to investigate our research question. We analyse patent data of two technologies, lithium-ion batteries and thin-film photovoltaics. Both technologies cut across different sectors and exhibit substantial technological progress within the last 30 years – providing the basis for knowledge (and patent) development. We classify each patent's assignee into its sector in terms of production. Our final database comprises 39,603 battery patents and 9,160 thin film patents. Results & Discussion We obtain inconsistent results for H1a/b regarding the different technologies. While H1a/b is supported for lithium-ion batteries, we do not find evidence for thin-film photovoltaics. This confirms previous analyses' findings regarding a technological knowledge diversity. We discuss differences in technology characteristics, e.g., complexity, as possible explanatory factors. H2a/b and H3a/b are supported for both technologies. This confirms that extending the question of the importance of knowledge diversity towards the direction of subsequent knowledge flows (where does the knowledge flow to) leads to interesting results and furthermore yields in implications for policy makers.

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