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A Study on Patent Citation Network: The Case of Photovoltaic

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Abstract

Research background: Most of the literature uses patent citation to explore patent value, firm value, innovation performance, or the strategic behavior of firms (Jaffe et al. 2002; Marco, 2007); as well as to explain knowledge transfer and knowledge spillovers (Stolpe, 2002; Chen et al. 2016). However, innovation depends on the accumulation of the overall technology, and innovation growth with a good technical system. Change one of the individual technical field will affect the entire technical system (Fontana, Nuvolari, and Verspagen, 2009).

Purpose of the article: Begin with the first patent of photovoltaic ever granted by the US Patent and Trademark Office (USPTO) on January 13, 1976, this paper investigates the determinants of patent citation network.

Methodology/methods: The five network centrality proposed by Freeman (1979) is used to weigh the importance of patent in the citation network. We then calculate the five network centrality for each patent, and adopt Tobit model for empirical analysis. Data: The data set used in this study consists of the 4288 patents of photovoltaic granted by the US Patent and Trademark Office (USPTO) from 1976/01/13 to 2014/03/11.

Findings: There are five interesting findings. First, the most important determinant is the time lag between granted year and first cited year. If a patent that is immediately cited by other patents, it will have more direct and indirect forward citations. And the citation lag can also affect the position of a patent in the citation network. Second, if assignee keeps paying the renewal fee, it will raise the frequency of direct and indirect forward citations especially when it is due to the last term. Third, the use of non-patent knowledge positively affects direct and indirect backward citations. Fourth, the number of claims has a positive effect toward direct forward citations. However, the degree of influence decreases as the number of claims increases. Fifth, the broader the scope a patent has, the higher the frequency of backward citations and forward citations it can receive. But the degree of influence toward indirect forward citation decreases as the scope increases.