Local demand-pull policy and the locus of innovation: Evidence from solar PV in China

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Overview

Market demand has been emphasized as an important driver that can induce innovation (Hicks 1932, Griliches 1957, Schmookler 1962, Utterback 1974). Many empirical studies also support the demand-induced innovation hypothesis (Lin 1990, Lanjouw & Mody 1996, Jaffe & Trajtenberg 2002, Nemet 2009). However, key questions regarding the ability of firms to identify demand and respond to it quickly and on the nature (incremental vs. non-incremental) of innovations engendered by demand linger (Nemet 2009). Furthermore, there is mixed evidence in the literature about whether the locus (local vs. non-local) of demand-pull policy matters (Lanjouw and Mody 1996, Popp 2006, Popp et al. 2011, Dechezleprêtre 2013, Peters et al. 2012). In order to fill these gaps, in this paper we use empirical evidence from the distributed solar photovoltaic (PV) market in China to address the following questions: (1) Is there evidence of demand-induced innovation? (2) Does the effect of local demand-pull policy differ from the effect of nonlocal demand-pull policy on demand-induced innovation?

In this paper we build a new database of PV BOS patents in distributed PV from State Intellectual Property Office of The People's Republic of China (SIPO) website between 2005 and 2014. Specifically, we classify PV BOS into four categories—inverter, monitoring, mounting and site assessment—and use keywords-based Boolean search for each category to search the patent text in SIPO website. By reviewing the claims of every patent, we identify the patents that are relevant to PV BOS. Our patent data of PV BOS in China reveals the trend of PV BOS patenting behaviours in China from 2005 to 2014.

Methods

We use negative binominal regression modeling to test for evidence of demand-induced innovation as well as impact of local vs. non-local demand on PV BOS innovation, controlling for other variables. As the variation of local demand within a province over time only accounts for 9% of total variation of local demand, we use and compare the regression results of year-province fixed effect model, time trend-province fixed effect model, random effect model and year-group effect model.

Results

We find that growth in PV BOS patents and local demand are highly correlated. The geographic distribution of PV BOS patents are also highly correlated with the geographic distribution of local demand. Our regression results support the demand-induced innovation hypothesis and indicate that only local demand (for distributed PV) significantly induces PV BOS innovations. The different effects of local demand and non-local demand suggests that: (1) local demand is important for inducing innovation; (2) local context, such as local knowledge and local experience, is a key element in the learning and innovation process for PV BOS.

Conclusions

Previous studies provide mixed evidence about whether the locus (local vs. non-local) of demand-pull policy matters. Our study shows that only local demand-pull policy could significantly promote local PV BOS innovation. It emphasizes that, depending on the nature of technology, local demand plays an important role in shaping local innovation advantage, potentially leading to local competitiveness advantage. One implication of our findings is that when user-producer interaction and local context are important in innovation process – as they are in the case of PV BOS – the effect of local demand-pull policy on innovative capability is difficult to diffuse to other jurisdictions. This suggests that the local "innovation boost" driven by local demand-pull policies could form the platform that could potentially drive local competiveness advantage.

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