Did the US shale gas boom crowd out clean energy innovation?

Isabel Bodas-Freitas, Grenoble School of Management
David Grover[†], Grenoble School of Management and University College London
Kaboo Leung, London School of Economics and Political Science

This paper will be presented in English

1. Overview: presentation of topic with background and significance

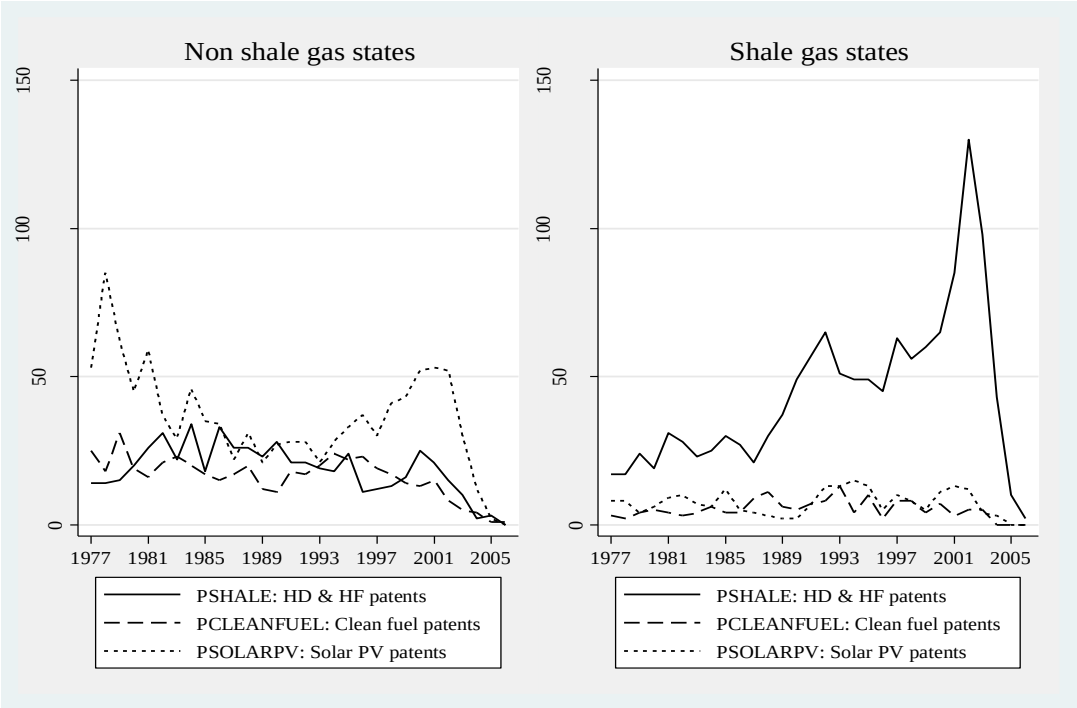
This paper examines how the developmental pathways of peer technologies occupying a similar market space may interact with one another in rivalrous ways, particularly when the technologies have a high degree of relatedness. Interaction in technologies' developmental pathways is important because energy innovation policy frequently favors one technology over another with little appreciation of whether support may stunt related (or unrelated) technologies' development. The empirical context for this research is a handful of emerging technologies in the US energy industry, where one of the most significant innovation events in the last 50 years has been the boom in innovation in shale gas extraction technologies. US patent data for 51 states over 30 years is used to test the relationship between shale gas innovation activity and clean energy innovation activity, comparatively in states that did and did not experience the shale gas extraction boom. The expectation is that shale gas patenting crowded out clean energy patenting in shale states but not in non-shale states. The findings show a positive unconditional relationship between shale gas patenting and clean energy patenting, inconsistent with a crowding out effect. When this relationship is conditioned on the states where the shale gas boom occurred, the relationship is strongly weakened, consistent with the idea that shale gas patenting pulled innovation resources away from clean energy patenting. Further tests investigate whether the supposed crowding out relationship is more pronounced when the clean energy technology in question is more closely related to shale gas technology. Suggestive but not strong evidence is found to support this idea.

2. Methodology

The research regresses patent counts for clean energy technologies on patent counts for shale gas extraction technologies, using an econometric model for count data. The relationship is then conditioned on whether US states were geologically endowed with shale gas resources, a measure of how strongly the state experienced the shale gas extraction boom. The second expectation that greater crowding out occurred between related technologies is tested with a modified dependent variable (non-hydrocarbon liquid and gaseous fuel technologies) that is take to be more similar to shale gas extraction technologies than technologies for producing clean electricity. The dataset is a balanced panel of 51 US states over the period 1977-2006. All patent data for shale gas and clean energy technology variables was extracted from the NBER-USPTO patent citation data files on the basis of US patent classification. Further data on natural gas price and mining GDP are matched in on the basis of state and year.

3. Expected results and key findings

The figure below plots shale gas and clean energy patenting levels for all non shale gas states and all shale gas states, respectively. Shale gas patenting levels began to increase in shale gas states well before the shale gas extraction boom began in earnest in the early 2000s. Also observable is a substantially higher level of clean fuel and solar PV patenting in non-shale gas states, at all time periods, relative to shale gas states.



Early econometric results treating the data as a pooled cross section and not as a panel indicate a positive unconditional relationship between shale gas patenting and clean energy patenting, contrary to the crowding out expectation. However when the relationship is conditioned on the status of being a shale gas state, the relationship is strongly weakened. This is not interpretable as evidence of crowding out per se. It is interpreted as evidence that the shale gas boom weakened what would otherwise have been a positive relationship between shale gas patenting and all clean energy patenting.

4. Conclusions, lessons and implications

Early results support the idea that technologies' development pathways influence one another in ways that can amount of crowding out of innovation activity in one technology by innovation activity in another. This suggests that when policymakers cannot adhere to technology neutrality in setting innovation policy, they should at least consider potential unintended consequences of policies that favour individual technologies.