THE LIGHT AT THE END OF THE TUNNEL- THE IMPACT OF POLICY ON THE GLOBAL DIFFUSION OF COMPACT FLUORESCENT LAMPS

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Overview

Improving the efficiency of lighting systems is critical in lowering greenhouse gas emissions. Artificial light production accounts for 8.9% of total global energy consumption, and represents approximately 8% of the world CO2 emissions. It is then clear that new and energy-efficient lighting technologies have a role to play, not just in reducing household electricity consumption, but also in contributing to household cost savings. Fluorescent lamps (FL) are capable of significantly lowering electricity consumption. A compact fluorescent lamp (CFL), for instance, consumes 4-5 times less energy, to provide the same level of light as a standard incandescent bulb. Moreover, while the upfront cost of a CFL is more than that of an incandescent lamp, they clearly outperform incandescent bulbs in terms of life-cycle cost savings. However, despite its numerous benefits, the FL has not been widely adopted by household consumers. Barriers to the adoption of these bulbs include high initial cost, compatibility and quality issues that have generated distrust amongst consumers, and incomplete information about the lighting market, along with difficulties in changing consumer preferences. This has led governments and electric utilities to implement several policies to expedite the adoption of these “clean” bulbs, including banning the sale or imports of incandescent bulbs, awareness campaigns to educate consumers, and fiscal incentives such as subsidies on FL, free distribution, etc.

The goal of this paper is to contribute to the literature on clean technology diffusion, by evaluating the extent of effectiveness of different policy options in explaining the adoption of fluorescent lamps in a sample of middle and low-income countries, many of which are not producers. Are fiscal incentives such as subsidies on FL, regulatory policies (such as minimum energy performance standards (MEPS) or banning the use of incandescent lamps) and informational policies such as labeling schemes important determinants of clean technology diffusion? Moreover, trade policy is also considered as a factor to explain technology adoption. Given that China is the largest producer of FL in the world, it is safe to assume that for most countries, the main route to acquire these bulbs is by importing them from China (or the other large producers such as Germany, the Netherlands, Poland, etc.). Although many developing countries have become producers to meet growing domestic demand, the share of bulbs imported far outweighs the share produced domestically. Lastly, effectiveness of the government in policy implementation (particularly with regards to policies such as regulations, and information provision) may also play a role in explaining the adoption of FL.

Methods

The paper builds a theoretical model that evaluates the effectiveness of these policy instruments, and uses panel-data regressions to study their effectiveness in explaining the diffusion of CFL from 1993 to 2013 in 73 countries. The study is devoted to low and middle income countries that are not major manufacturers. The geographic scope of this study includes several sub-Saharan, Latin American, Middle-eastern South Asian, South-east Asian and Central-Asian nations. China is not included in the study, because FL imports are not a relevant measure of technology adoption for the largest producer for these bulbs. This is the first study of its kind on clean light bulbs, both in terms of geographic scope, and the breadth of policies that are considered in explaining diffusion of these bulbs. Several studies exist that evaluate the adoption of FL in individual countries, and estimate it as a national-level consumer demand function, evaluating the role of only a handful of policies. For instance, Mills and Schleich (2008) use household survey data from Germany to study the policies influencing the adoption of CFL, with particular focus on socio-demographic factors. Mills and Schleich (2013) extend the study to evaluate the impact of the EU ban on incandescent bulbs on the adoption of CFL in Germany. Kumar, Jain and Bansal

(2003) explain awareness about CFL using socio-demographic factors, from a household-level survey conducted in India. Alcott and Taubinsky (2013) have looked at the role of imperfect information in explaining the preferred adoption of incandescent bulbs in comparison to CFL, using two randomized control trials in the US that explain to consumers the energy costs of different light bulbs. The main contribution of this paper is to evaluate the role of three sets of factors (domestic policies, trade policy and governance) in explaining clean technology adoption. The topic of this paper is highly relevant to the literature on diffusion of affordable green technologies to developing countries. For a developing country looking to switch to cleaner forms of energy, this is of particular importance. The plethora of policy options considered in the study makes it relevant to many different types of countries. Several factors that may be relevant to the diffusion of different types of technology are studied, such as fiscal incentives, information labels and awareness campaigns, trade policy, government effectiveness, etc.

Results

The results of the study are that the FL-centric policies are important in explaining greater diffusion of these lamps into the low and middle income countries, given that most of them would like to imitate the developed countries in terms of adopting clean technology, but do not manufacture these bulbs. However, it is possible that there policies need to be introduced in certain sequence to be effective. Informational policies and price subsidies are very effective in encouraging CFL adoption, and should be prioritized over policies such as adoption of MEPS, which are may be effective in the long-run. Instruments of trade policy such as trade agreements and tariffs are also expected to affect the diffusion of FL. A role for the effectiveness of the government in implementing policies also arises: it is likely that more “effective” governments, in terms of their ability to implement policies in a timely and efficient manner,and thus build credibility have a higher share of CFL adoption. However, these results need to be confirmed by carrying out further robustness checks.

Conclusions

This paper evaluates the role of different policies in explaining greater adoption of a clean lighting technology, and finds that domestic policies imposed by governments are critical in encouraging adoption, especially if consumers are unfamiliar with the new technology, or there are significant financial hurdles to its adoption. There are several avenues for further research that emerge from this study. Firstly, given that the developed countries have already begun switching to even “cleaner” types of light bulbs such as LED, it will be important to understand whether the same factors may be of any significance in explaining the adoption of these bulbs, which are more expensive than FL. It may also be fruitful to extend the study to other clean technologies. Secondly, it may be interesting to study whether there is a learning process within countries belonging to a certain region, such as the Latin American and Caribbean countries for instance, responding to Cuba’s (pioneering) initiative to replace incandescent bulbs in households with FL. Lastly, it may also be worthwhile to understand the role of other factors such as differences in human capital across regions that may, for instance, be critical in explaining diffusion of more complex technologies.

References

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