

‘AVAILABILITY’ AND/OR ‘AFFORDABILITY’: ADDRESSING STATE LEVEL HOUSEHOLD ENERGY SECURITY IN INDIA

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Overview

Energy security is one of the primary economic, political as well as development agenda for all the countries. While the issue is mostly discussed in terms of availability, accessibility, affordability, acceptability and applicability (of energy technology)(Cherp and Jewell, 2014, Yao and Chang, 2014), the implications vary significantly with the change in the country and the stakeholders. While geopolitics is one of the major discourses within which energy availability and affordability are discussed from the macro-perspective of a country, microeconomic studies become equally relevant to understand the same from the perspective of the dwellers in the country. In fact, given the seventh Sustainable Development Goal of access to ‘affordable and clean energy’ (UNDP, 2015), it is important to understand energy security from a micro perspective for developing countries like India with 1.3 billion people and counting faces with the daunting task of providing access to energy in the most basic form (fuels required for cooking and lighting) to its people. India still houses around 65% of households using firewood and chips as primary source of energy for cooking, while 100% household electrification still remains unachieved. Different schemes have been launched from time to time to increase the penetration of LPG (like Rajiv Gandhi Gramin LPG Vitrak 2009, Pradhan Mantri Ujjwala Yojana 2016) as a cleaner cooking fuel as compared to kerosene and fuel-wood and electricity as primary source of lighting (Deen Dyal Upadhyaya Gram Jyoti Yojana (DDUGJY), Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA)). While policies towards LPG penetration emphasized on increase in the supply density and subsidy; policies towards electricity emphasized on greater connectivity and providing initial infrastructure at a lower cost. So basically these policies are aiming at increasing ‘availability’ and ‘affordability’ of LPG and electricity. Against this backdrop, this paper focuses to understand the role of ‘availability’ and ‘affordability’ in determining the use of these two fuels in various states in India. The question that the paper addresses is what leads to increased use of electricity as lighting fuel and LPG as cooking fuel in India? Whether it’s the greater availability manifested in increased supply conditions or affordability, manifested in enhanced demand conditions?

Methods

A state level analysis has been carried out to address the research question stated above. The study makes use of micro-panel data models to understand the supply (related to accessibility) and demand (related to affordability) side determinants for LPG connectivity and electricity use in twenty nine states in India. The period of study includes 2004-05, 2009-10 and 2011-12. Based on the results of Hausman Test, Random Effect models are estimated as

$$Y_{it} = X'_{it}\beta + Z'_{it}\gamma + D'_{it}\varphi + u_{it} + \varepsilon_{it}, \text{ where } u_{it} \sim iid(0, \sigma_u^2) \text{ and } \varepsilon_{it} \sim iid(0, \sigma_\varepsilon^2).$$

u and ε are assumed to be mutually independent over time and across states.

Y_{it} , the dependent variable is the proportion of households that use electricity for lighting/LPG for cooking in state i at time period t . X_{it} represents the set of demand enhancing explanatory variables (such as income, fuel price/subsidy, literacy rate, percentage of urban population) and Z_{it} represents the set of supply enhancing explanatory variables (such as road network, density of LPG distributors, rate of electrification etc.) A set of dummy variables are also included to capture the time-invariant properties such as rural/urban, regional location of the state and their interactions with the supply and demand enhancing variables. Altogether four GLS models for electricity and four for LPG are estimated using STATA 14. Diagnostic tests are performed.

The main sources of data are National Sample Survey on Energy Sources of Indian Households for Cooking and Lighting, 61st Round 2004-05, 64th Round 2009-10 and 68th Round 2011-12, Government of India; Annual Report (2013-14) On Working of State Power Utilities and Electricity Departments (Power and Energy Division), Planning Commission, Government of India; Directorate of Economics and Statistics (Central Statistical Organization) and Census of India 2001 and 2011.

Results

- ✓ The state model for LPG use suggests that increase in LPG use is more of a demand driven phenomenon than supply driven. The states with higher LPG subsidy and higher per capita net domestic product have greater proportion of households using LPG as cooking fuel.
- ✓ Since in India, women are primarily involved in cooking activities, female literacy rate was included as an explanatory variable to understand whether empowerment as a demand generating factor increases the use of LPG as cooking fuel or not. This is found to be significantly positive.
- ✓ Increased supply through higher distributor density is not found to be significantly affecting the uptake of LPG. However, higher road density leads to greater use of LPG.
- ✓ Models for electricity suggest that neither the price of electricity nor the per capita net domestic product is playing a significant role in determining the use of electricity as the primary energy for lighting in Indian states.
- ✓ It's the rate of electrification i.e. providing distribution infrastructure that plays a crucial role to determine the proportion of such households in a state.
- ✓ Use of LPG and electricity both are significantly lower in rural areas.

Conclusions

The study shows that demand enhancing variables such as price/subsidy and income, along with variables such as female literacy and road density play important roles in determination of the proportion of households using LPG as a cooking fuel in Indian states. The scenario is just the reverse in case of use of electricity as a primary source of lighting fuel. This implies mere availability of LPG will not ensure that the households will use LPG as a cooking fuel; rather it has to be affordable. For electricity, on the other hand, availability leads to greater use of electricity for lighting. The behavior can be explained by the inherent difference in the characteristic of these two fuels as a commodity. Purchase of LPG requires a high initial fixed cost each time a cylinder is purchased before the actual use/consumption takes place whereas use of electricity inflicts no such initial cost before the consumption takes place and the consumer can choose the level of consumption in an incremental fashion depending on their budget. Thus if the dual objective of penetration of LPG and electricity is to be fulfilled it requires attention to 'availability' more in case of electricity and 'affordability' in case of LPG.

References

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