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THE INDIAN ENERGY DIVIDE: DISSECTING INEQUALITIES IN THE ENERGY TRANSITION TOWARDS LPG

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Key Highlights

- Dissemination of information, particularly to women, on the benefits of using LPG and the government's promotional schemes shall help increase awareness and generate demand.
- Diversification of rural economy with formal employment opportunities in non-agriculture sectors and encouraging entrepreneurship through MSMEs for income security are suggested to ensure sustained LPG usage.
- Decentralised approach that offsets disparities across regions via schemes tailored to local factors are needed to ensure equitable access to LPG.
- Targeted measures that foster inclusive development are required to promote equal access to LPG across social groups and regions.

EXECUTIVE SUMMARY

INTRODUCTION

More than half of the households in India still rely on fuels other than LPG or electricity for their general energy requirements. The dependence on *'unclean'* fuels, such as firewood, crop residue, dung cake, charcoal or kerosene, is the primary reason for indoor air pollution in households which exacts a significant health burden. Women and children, particularly in rural areas where this practice is prevalent, are generally more vulnerable to health disorders arising from poor indoor air quality, sometimes even causing deaths. Clean cooking fuels (such as LPG) and technologies are therefore crucial to improve health and other associated social outcomes. The current pace of transition, however, is too slow to achieve the desired development levels in the near future, which necessitates further research and policy interventions to identify and remove barriers to clean fuel adoption.

The study presents the likelihood of transition to LPG over time, measured using a multidimensional model to assess inequality in energy access on the basis of social, cultural and economic factors, for vulnerable households in nine *'low-income'* states of India. It further provides relative estimates of regional disparities that are observed among the states and between rural and urban areas, for the states under study (in terms of predicted probabilities of LPG adoption). A logit regression analysis of the India Human Development Survey panel 2005 and 2011-12 (IHDS, IHDS-II) is performed to derive the probability estimates.

The key findings from the analysis are: frequent and prolonged exposure to mass media such as newspapers and television increases the probability of transition to LPG; cultural influences, like belonging to a community which usually gifts LPG cooking kits in weddings, encourage the adoption of LPG; households with salary as the primary source of income or with formally employed members/entrepreneurs have

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significantly higher chances of switching to LPG, compared to agricultural households. As regards to the inter-state analysis, households in Assam and Rajasthan are most likely to adopt LPG, while those in Jharkhand and Odisha are the least. Lastly, the differential effect of urbanisation on the probability of switching to LPG in rural households can be reduced by improving economic status, generating formal employment, and improving women's awareness through mass media exposure.

DATA & ECONOMETRIC MODEL

The IHDS panel 2005 and 2011-12, comprising survey data of 11,437 *'vulnerable'* households from nine low-income states of India, viz. Rajasthan, Uttar Pradesh, Bihar, Assam, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh and West Bengal, is used for the analysis. Vulnerable households are classified as those which did not have access to LPG in 2005. The variables included in the regression analysis to capture household-level characteristics are: economic status, highest level of education attained, social group (caste, religion), region (state, rural/urban), primary occupation and income source, exposure to mass media and other culture-specific factors (e.g. gifting LPG cooking kits).

The explanatory variables are regressed using the logit modelling technique to measure their marginal effect on a household's likelihood of transition to LPG over time. The dependent variable in the regression equation is binary in nature. It takes the value '1' in case a household has access to LPG in 2011-12, or '0' otherwise (only the households without access to LPG in 2005 are analysed). The logit coefficients are used in the estimation of post-regression average marginal effects and predicted probabilities.

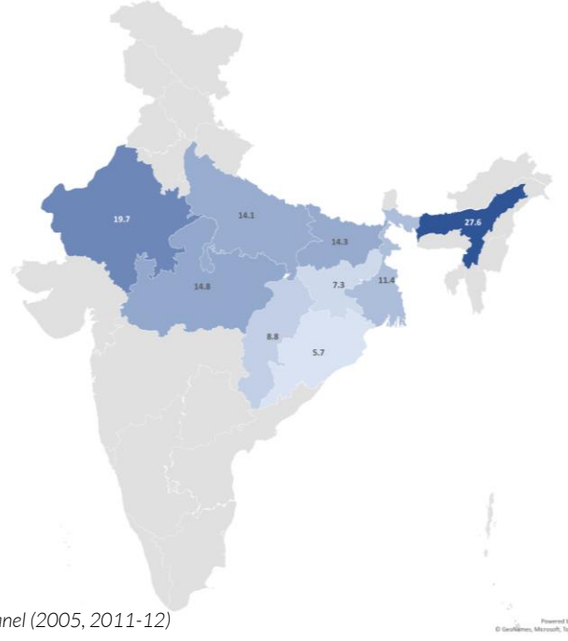
In the first of 5 specifications, all explanatory variables are incorporated into the regression to calculate their relative marginal effects. The model also returns the state-specific predicted probabilities of transitioning towards LPG. In specifications 2 through 5, the regional term (rural/urban) is interacted with four different socioeconomic factors viz. education, economic status, formal employment opportunities and media exposure, respectively, to analyse the differential effect of urbanisation on a household's likelihood of transition.

RESULTS

General analysis:

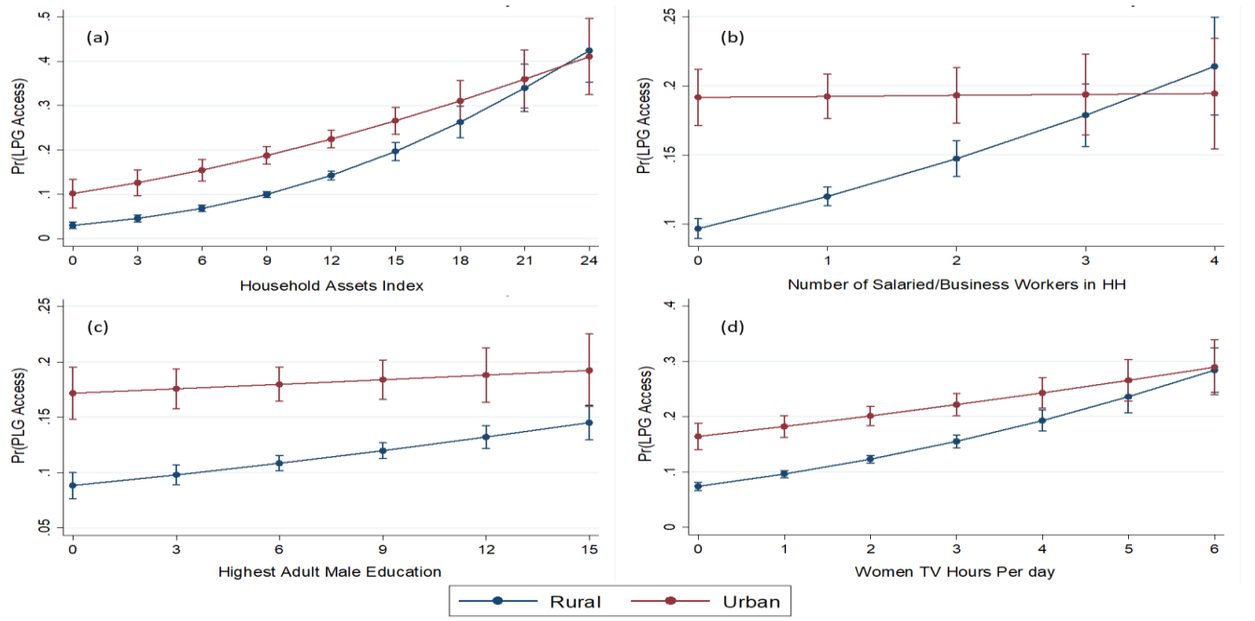
- the number of households using the fuel exclusively increased only by a margin
- the probability of transition for urban households is higher than the rural ones
- richer households are more likely to switch to LPG than their poorer counterparts
- education has a positive and significant effect on the likelihood of shifting to LPG
- mass media exposure (through television, newspapers, etc) positively affects the probability of a household adopting LPG
- households belonging to communities which usually give LPG cylinders and cookstoves as wedding presents, would also prefer using one for themselves, than otherwise
- SC/ST households have significantly less chance of transition to LPG as compared to upper-caste Hindu households

Chart 1: State-wise predicted probabilities (%) of LPG adoption in India



Source: Authors' calculations, based on IHDS Panel (2005, 2011-12)

Chart 2: Predicted probabilities of LPG adoption by rural and urban households



Source: Authors' calculations, based on IHDS Panel (2005, 2011-12)

- Households dependent on casual labour, agriculture and allied activities for their livelihood have less probability of transitioning towards LPG, as compared to salaried households and those with entrepreneurs/members running a business.

Inter-state analysis

Households in Assam, followed by Rajasthan are most likely to adopt LPG among the sample of states, while those in Chhattisgarh, Jharkhand and Odisha are least likely (see Chart 1). The disparity among the states in LPG access is a result of multiple factors, such as (i) climatic conditions: the arid or semi-arid climate in Rajasthan is unsuited to cattle rearing and therefore the availability of cow-dung cake is limited, whereas the prolonged wet season in Assam prohibits firewood usage; (ii) natural resources: the presence of oil/gas reserves in Assam and Rajasthan implies lower selling price of LPG in the states, which acts as a promoter; whereas the availability of alternatives like coal in Jharkhand implies easy access to coal which deters LPG adoption; (iii) LPG distribution network; and (iv) heterogenous prices and incomes.

Regional (rural-urban) analysis

As per the Census 2011, little over a tenth of households in rural India use LPG for cooking, compared to nearly two-thirds in urban regions. The region-specific interaction term (rural/urban) in the econometric model assesses how the probability gap between rural and urban households narrows with increments in their economic status, education levels, formal employment and mass media exposure. The post-estimation predicted probabilities of the interaction terms are illustrated in Chart 2.

Chart 2a shows that at income levels (measured using household assets) corresponding to upper middle-income households, the likelihood of transition to LPG is equal for both rural and urban households. In Chart 2b, the predicted probabilities of LPG adoption as a function of the number of household members involved in formal employment or business activities/ entrepreneurship are plotted for both regions. The chart depicts that for rural households with more than 3 members employed with regular salaries or engaged in business, the likelihood is equal (or even higher) to those in urban regions. Charts 2c and 2d show the variation in probabilities with respect to men's education levels and women's exposure to mass media, respectively, for both the regions. While the effect of men's education (measured as the highest level of education attained by the adult male in a household) is limited and insufficient, that of women's access to information (measured here as hours/day spent watching television) is greater and sufficient for parity between rural and urban households' probability of transition to LPG.

POLICY IMPLICATIONS

Based on the analysis, the following policy areas which require interventions to reduce inequality and accelerate the pace of transition towards clean fuels/LPG are identified:

1. Inclusiveness: multi-dimensional inequality in energy access persists across social groups and regions in India. Rural population in general (because of infrastructure deficit, lower incomes, etc.), and marginalised sections of the society, like the SC and ST population, in particular

(due to societal discrimination) have significantly less chances of shifting to LPG than compared to urban and upper-caste groups, respectively. Targeted measures that foster inclusive development are needed to promote equal access to energy across groups and regions.

2. Decentralisation: owing to several factors, considerable heterogeneities exist across states and rural-urban regions; in order to ensure equitable energy access, subsidy schemes must be adapted to incorporate regional disparities, such as price and income differences, so that the cost to households is uniform across states. A decentralised approach suited to specific regions/states would result in better outcomes.
3. Income security and sustained use: LPG entails an inflexible and recurring cost that is higher than that of the alternatives, and therefore requires a consistent source of income; diversification of the rural economy with formal/organised employment opportunities in non-agriculture sectors. Encouraging entrepreneurship through micro, small and medium enterprises (MSMEs) at the village level will augment household income, thus not only ascertaining access to LPG, but also its exclusive and sustained usage. Avenues to integrate rural livelihoods and employment guarantee programmes with LPG promotion schemes should be explored for the purpose.
4. Information and awareness: mass media exposure positively affects the status and decision-making authority of women within households in India. Extensive dissemination of information through *infomercials* on television and advertisements in newspapers about the benefits of using LPG, and on the government's promotional schemes will be very helpful in increasing awareness and generating demand from women. Mass media interventions focussing on women's skill development shall further strengthen their authority by generating employment opportunities and accelerate the transition to LPG.

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