

Fueling the Engines of Liberation with Cleaner Cooking Fuel

Tushar Bharati¹, Yiwei Qian², Jeonghwan Yun²

¹University of Western Australia, ²University of Southern California

Objectives

We examine the causal impact of the "Conversion to Liquefied Petroleum Gas (LPG) program", an LPG subsidy program in Indonesia, on the:

- household's adoption LPG as the primary cooking fuel;
- labor force participation of women;
- other outcomes, like health conditions, general well-being, household expenditure and intra-household decision-making power of women.

Introduction

- Women held back from participating in productive market activities is human capital wasted.
- **Engines of liberation** (Greenwood et al. 2005): Adoption of cheap, time-saving technology increased female labor force participation in developed countries.
- The channel has not received enough attention in the context of developing countries.
- We study the "Conversion to LPG program" in Indonesia to examine the potential role of a household cooking technology in determining female labor force participation in developing countries.

Conversion to LPG program

- Before the "Conversion to LPG Program" was introduced, 48 out of 52 million Indonesian households depended on kerosene, which was highly subsidized at the time.
- In 2007, to reduce the subsidy burden, the Indonesian government launched the "Conversion to LPG Program" to promote the use of LPG in Indonesian households.
- Depending on the readiness of the LPG procurement, storage, and distributional infrastructure in the region, the program was rolled out at different times in different regions (Budya and Arofat, 2011).

Data

- 1 The program roll-out information at province level;
- 2 Census data;
 - Indonesian censuses (2000, 2010) and Intercensus Population Surveys (1995, 2005);
 - Repeated cross section balanced at the district level.
- 3 Detailed representative panel household survey;
 - The Indonesian Family Life Survey (IFLS) waves 3-5 (2000, 2007, 2014).

Empirical Strategy

The identification relies on two sources of variations:

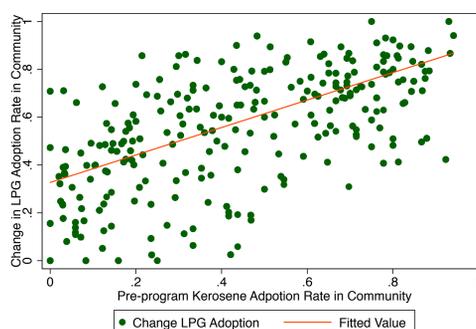
- 1 **The staggered program roll-out** at the province level over time
 - Difference-in-Difference strategy using census data

Figure 1: Staggered roll-out of the LPG subsidy program across provinces



- 2 **Variation in pre-program kerosene usage rates** across communities/sub-districts
 - The distribution of LPG depended on the existing kerosene distribution infrastructure.
 - Kerosene subsidy was removed when the LPG program was introduced.
 - Difference-in-Difference strategy using in census and IFLS data

Figure 2: LPG adoption correlates with pre-program Kerosene distribution infrastructure



Specification

$$Y_{icpt} = \alpha + \beta_1 Post_t \times H_{c,2000}^{Pre} + \tau_t \times H_{c,2000}^{Pre} + \gamma_{pt} + \delta_c + \epsilon_{icpt}$$

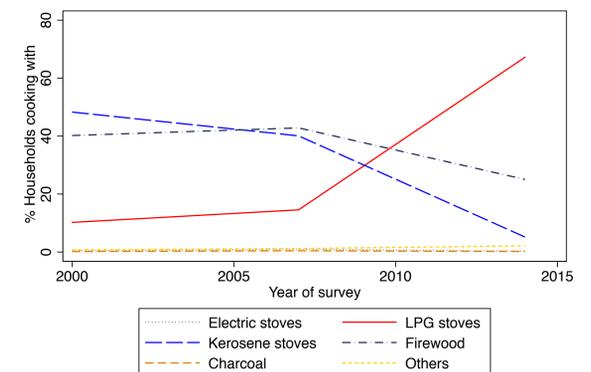
- where Y_{icpt} is the outcome interest of individual/household i in the community c in the province p at year t ; $H_{c,2000}^{Pre}$ is the pre-program kerosene adoption level at 2000; $Post_t$ takes value '1' for years after year; $\tau_t \times H_{c,2000}^{Pre}$ controls for possible differences in trends across community that are spuriously correlated with the community treatment effect; γ_{pt} controls for province-specific trend; δ_c controls for time-invariant differences across communities;
- We add $Treat_p$ to the interaction terms in the specification for the census data;

Results

The program led to

- **Increased use of LPG as the primary fuel.**

Figure 3: Primary cooking method over time (source: IFLS)



- **Increase in the female labor force participation.**

Table 1: The Impact on employment status (source: IFLS)

| | Primary activity | | Ever worked the past year |
|--------------------------------------|-------------------|-------------------|---------------------------|
| | work for pay | housekeeping | |
| Post × pre-program kerosene | 0.03 (0.03) | 0.03* (0.01) | 0.04* (0.02) |
| Post × pre-program kerosene × female | 0.07* (0.04) | -0.07** (0.03) | 0.05* (0.03) |
| Estimated effect for females | 0.09*** (0.04) | -0.04* (0.03) | 0.09*** (0.03) |
| Mean of DV | 0.59 | 0.24 | 0.72 |
| Pre-program kerosene usage rate | 0.53 | 0.53 | 0.53 |
| Observations | 63633 | 63633 | 63633 |

- No significant health improvements.
- Increased in household expenditure on food and education.
- **Improved decision-making power of women.**

Table 2: The Impact on decision-making power (source: IFLS)

| | Complete say in | |
|--------------------------------------|---------------------------------|--------------------------------------|
| | all decisions (score out of 18) | financial decisions (score out of 8) |
| Post × pre-program kerosene | 0.25 (0.23) | 0.05 (0.12) |
| Post × pre-program kerosene × female | 0.39 (0.28) | 0.35** (0.15) |
| Estimated effect for females | 0.64** (0.29) | 0.40*** (0.15) |
| Mean of DV | 3.52 | 1.3 |
| Pre-program kerosene usage rate | 0.53 | 0.53 |
| Observations | 44456 | 44456 |

Conclusion

- The program introduced a significant increase in LPG adoption and female labor force participation probably through the time-saving nature of the cooking technology.
- The program improved the decision-making power of women within households that could promote sustained use of LPG even after the subsidy is withdrawn.
- In this way, the program served as an engine of liberation for women in Indonesia.

Contact Information

- Email: yiweiqia@usc.edu