BIOMASS ENERGY USE, PRICE CHANGES AND IMPERFECT LABOR MARKET IN RURAL CHINA: AN AGRICULTURAL HOUSEHOLD MODEL-BASED ANALYSIS

Qiu Chen, Center for Development Research (ZEF), University of Bonn, Phone: +49 0172590772, E-mail: chen.qiusau@gmail.com

Overview

To date in China, due to the limited access to advanced energy technologies and modern energy services, a considerable share of the rural population still depends heavily on direct combustion of traditional solid biomass (i.e. crop residues and firewood) for cooking and space heating. The potential influence of a price change on traditional biomass energy use is complex, since household's consumption, production and labor market decisions are interlinked and markets are missing or imperfect. Thus, based on estimation of an agricultural household model with survey data from 36 villages in Sichuan Province of China, our results support the conventional wisdom that, holding other variables constant, higher market prices directly lead to more biomass energy consumption. Nevertheless, under the imperfect labor market, the total behavioral effect of the price change consists of a direct effect (i.e. the consumption of biomass energy and the labor demand for biomass collection responds to an exogenous shock) and an indirect effect (i.e. the consumption of biomass energy and the labor demand for biomass collection adjustments to the endogenous variations in the shadow wage induced by this exogenous shock). Neglecting the indirect effect can bias the final effect on household behaviors.

The structure of this paper is organized as follows: After the introduction section, section two establishes the theoretical framework based on an agricultural household model (AHM). The empirical specification and estimation strategy of the AHM are described in Section three. Section four presents the data used in analysis and reports the estimation results of the AHM, and section five summarizes the main findings of this study and gives policy implications.

Methods

Based on an agricultural household model, this research extends the existing literature by proposing a comprehensive analytic framework that simultaneously takes into account the direct impact on the supply and demand reactions due to the price change and the indirect impact on the supply and demand adjustments to the endogenous variations in the shadow wage generated by the price change. The developed household model is estimated by adopting a two-stage estimation strategy: the shadow wage of household labor and the shadow price of biomass energy are firstly estimated using a Cobb-Douglas multi-output production function system and then included in a linear approximation of the Almost Ideal Demand System (LA/AIDS) and a system of translog profit function with labor cost share equations to estimate consumption and labor demand systems.

Results

According to the results of model estimations, a 1% increase in the price of self-consumed agricultural products is associated with a 0.104% increase in the the demand for biomass energy. A 1% increase in the price of commercial energy or of other purchased goods increases leads to a (-0.157% or-0.528%) decrease in biomass energy consumption, while a 1% increase in the market wage rate raises demand for biomass energy by 0.709%. It can be also found that if the price of self-consumed agricultural products increases, the indirect effect via the internal labor price increase reinforces the direct positive effect, meaning that households consume more biomass energy in response to a price increase of self-consumed agricultural products. This also implies that agricultural production and biomass collection are competitive, as the consumption of these two categories of goods derives from their own production. At the same time, with positive cross-price elasticities of biomass energy consumption with respect to the market price of commercial energy and other purchased goods, the internal labor price decrease offsets the increase in biomass energy use that occurred in response to the exogenous price increase and causes further decline in biomass energy consumption. As for a change in the market wage rate, the positive indirect effect via the shadow wage rate increase reinforces the direct positive effect.

Conclusions

The study shows that neglecting the indirect effect can bias the final effect on household biomass using behaviours, implying that labor market failures reduce the flexibility in houshold's behaviours. The findings of this paper also provide important policy implications for future biomass energy development in rural China: the

market prices should be adjusted to control the demand for biomass energy, and the measures aiming at eliminating the market failures should be attached importance at the same time.

References

Chen, Q., Yang, H.R., Liu, T.B., and Zhang, L., (2016). Household biomass energy choice and its policy implications on improving rural livelihoods in Sichuan, China. Energy Policy 93, 291-302.

Henning, C. H.C.A., and Henningsen, A., (2007). Modeling farm households' price responses in the presence of transaction costs and heterogeneity in labor market. American Journal of Agricultural Economics 89(3), 665-681.

De Janvry, A., Fafchamps, M., and Sadoulet, E., (1991). Peasant Household Behavior with Missing Markets: Some Paradoxes Explained. Then Economic Journal 101(409), 1400-1417.