Public Distribution System vs. Market: Analysis of Staple Food Consumption in India Using QUAIDS with Rationing

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GEWISOLA 2015

Poster anlässlich der 55. Jahrestagung der
Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e.V.
„Perspektiven für die Agrar- und Ernährungswirtschaft nach der Liberalisierung“

Gießen, 23.-25. September 2015

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Summary

The current study explains the impact of the Targeted Public Distribution System (TPDS) in India on total staple food consumption. First, we show that under-purchase from TPDS is due to the supply constraints. Next, we estimate a three-stage demand system for staple foods. In the third stage, we estimate a Quadratic Almost Ideal Demand System with Rationing, where the TPDS grains are treated as strictly rationed goods and the rest of the consumption goods in the system are the market consumed staples.

Keywords

QUAIDS with rationing, Targeted Public Distribution System, India, food subsidy

Introduction

If the Targeted Public Distribution System (TPDS) and market grains are perfect substitutes, the subsidy should work as an income transfer to households that receive PDS grains and as a result, slightly increase the total demand. However, literature suggests that they are imperfect substitutes (Khera, 2011a; Kozicka et al., 2015; Ramaswami & Balakrishnan, 2002), for example due to the poor quality of the TPDS grains (Khera, 2011b). This means that greater TPDS off-takes might lead to a significantly higher demand (higher purchases for TPDS plus higher market consumer demand) and as a result, increase in market price. In the light of high targeting errors and taking into account that even the TPDS recipients need to purchase part of the grains from the market (Saini & Kozicka, 2014), the market price of wheat and rice plays an important role in food security of the poor in India. Consequently, determining the impact of the TPDS deliveries on total wheat, rice and other staple demand can provide policy makers with vital information.

Analytical Framework and Methods

The current study, apart from better explaining the impact of the TPDS on total staple food consumption, contributes to a growing discussion on implementing cash transfers instead of food subsidies. Our research questions are as follows:

- What is the impact of TPDS wheat and rice consumption on total wheat and rice consumption?
- How does a higher subsidy affect consumption?
    - What are the reasons for TPDS under-purchase?
    - Would cash transfer be a more cost-effective way to increase cereals/staples consumption?

Our analysis is based on the 68th round of the Indian National Sample Survey (NSS) of Household Consumer Expenditure, carried out by India's National Sample Survey Office of the Ministry of Statistics and Programme Implementation. The survey is cross-sectional and representative at the national level. It covers 101,651 households. Data was collected between July 2011 and June 2012 and it covers demographic data and household characteristics, as well as consumption quantity and value, total consumption expenditure, and TPDS consumption quantity and expenditure (NSSO, 2013).

We consider a consumer, who has a ration card, so consumes wheat and/or rice from two sources - PDS and the market. Amount consumed from the PDS, q_s, is constrained with the

(state-specific) PDS entitlement, q_s^*. However, what is usually observed, $q_s < q_s^*$. The under-purchase can have two types of reasons – demand (voluntary under-purchase) or supply specific (due to supply constraints).

1 $$\boldsymbol{q_s = \alpha_0 + \alpha_1 p_{diff} + \alpha_2 p_{diff}^2 + \alpha_3 MPCE + \alpha_4 S + \alpha_5 \mathbb{H},}$$

where q_s is a quantity of wheat/rice consumed from the TPDS, p_{diff} is a price difference between the market price of wheat/rice and its TPDS price, MPCE is a monthly per capita expenditure, S is a state dummy, and $\mathbb{H}$ vector of household characteristics (ration card type, household type, social group, land possessed, years of education of the household head).

In the equation 1, we found a significant negative impact of the variable p_{diff}on the q_s for rice and no effect for wheat. This suggests that under-purchase is due to the supply constraints and as a result consumption from TPDS is exogenous to market consumption (TPDS cardholders purchase maximum available TPDS volume).

Based on this first result we proceed with estimating a three-stage demand system for staple foods. It is assumed that a consumer allocates their budget in three stages – first they decide between two commodity groups – food and non-food items. Second, they allocate their budget (conditional on the first stage decision) between broad food groups – staple foods, milk and milk products, other animal products, fruit and vegetables, and eventually other foods. In the last, third, stage the staple food groups are considered. These are rice (TPDS and market), wheat (TPDS and market), other cereals and cereal substitutes, pulses. It is assumed that food groups are weakly separable from the non-food products, as well as the staple food groups are weekly separable from all the other food goods consumed.

In the first stage, we estimate budget allocation to food using linear Engel curve approach. In the second stage, we estimate a Quadratic Almost Ideal Demand System (QAIDS), developed by Banks, Blundell and Lewbel (1997). Eventaully, in the third stage, we estimate a Quadratic Almost Ideal Demand System with Rationing (QAIDSR), which is an extension to Deaton (1981) with the quadratic Engle curve.

The third stage QAIDSR model can be represented as follows:

2 $$\boldsymbol{w_i = \Phi(\mathbb{H}'_i \hat{\theta}_\iota)\left\{\alpha_i + \sum_{k\in S}\rho_{ik} q_k + \sum_{j\in M}\gamma_{ij} \ln p_j + \beta_i \ln \frac{I_s^d}{a(P)} + \frac{\lambda_i}{b(P)} \ln^2 \frac{I_s^d}{a(P)} + \tau_i \hat{e}\right\} + \phi(\mathbb{H}'_i \hat{\theta}_\iota)}$$

where $i, j \in M = \{$ market rice, market wheat, other cereals, cereal substitutes, pulses$\}$ and $k \in S = \{$ TPDS rice, TPDS wheat$\}$. $w_i = \frac{q_i p_i}{I_s^d}$, where q_i is a quantity consumed solely from market with price p_i and $I_s^d = MPCE_s - \sum_{k\in S} p_k q_k$, , so $w_i$is a share of expenditures on market-consumed staple in the total expenditures in the market staples. p_k and $q_k$are the price and the quantity actually of consumed TPDS grains. $\mathbb{H}_i$ is a vector of household characteristics. $\Phi(.)$ and $\phi(.)$ are the cumulative distribution function and probability density function estimated with a probit model to correct for the zero consumption observations (based on Shonkwiler and Yen (1999) work). $\hat{e}$ is estimated in a previous stage, to treat the endogeneity of total expenditure problem (based on Blundell and Robin (1999) approach). $a(P)$ is a price index, $b(P)$ is a Cobb Douglas price aggregator. Through the intercept equation, we allow for the demographic effects. Standard restrictions of adding up, homogeneity and symmetry conditions are imposed.

As an output, we will present results of the simulations of higher subsidy, higher ration and higher income (cash transfer) on wheat, rice and other staple food consumption.

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