How Consumer Price Subsidies Affect Nutrition

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Research Issues

- Do food price subsidies improve nutrition?
- Does nutrition improve with income?

Significance

- Undernourishment is a huge issue

  780 million chronically undernourished people; 181 million children under age 5 stunted; 101 million underweight (FAO, IFAD and WFP, 2014)
- MDG and SDG
- Food price subsidies have political and public support
- Developing countries spend big on food price subsidies

  China, India, Egypt

Policy Relevance - India

- High prevalence of child undernourishment
- Is economic growth inclusive?
- National Food Security Act to provide highly subsidized food to 75% of rural households and 50% of urban households

Food Price Subsidies and Nutrition

- If staple food is subsidized
  - pure income effect on households
  - Increase in income equal to amount of the subsidy that can be used to buy:
  - higher quantities of subsidized food item
  - higher quantities of non-subsidized costlier sources of nutrition
  - non-food items

  - Unclear if price subsidy would improve nutrition

Food Price Subsidies and Nutrition

- If non-staple food is subsidized
  - Lowers the relative price of non-staple food
  - Increase consumption of non-staple food
  - Reduce consumption of staple food

  - Unclear whether price subsidy will increase or reduce nutritional intake

Research Objective

- Study the effect of the Targeted Public Distribution System (TPDS), India's food price subsidy program, on per capita energy, protein, and fat intake.
- Specifically, effect of an exogenous increase in food price subsidy to poor families resulting from the introduction in 1997 and expansion in 2002 of TPDS.

Research Objective

- Subsidized food – wheat and rice
- Coarse grains – Jowar, Bajara, Maize, Ragi – not subsidized, yet cheaper sources of calories
- Subsidy on wheat and rice may induce the poor families to substitute subsidized food for coarse grains
- Is that the case?

Research Background

- Mixed evidence on effect of food price subsidy on nutrition
  - Kochar (2005)
  - Jenson and Miller (2011)

Targeted Public Distribution System

- Jointly operated by the federal and state
- Subsidized food grains via ~477,000 fair price shops
- In 1997, government replaced the PDS, a universal program, with the Targeted PDS.
- Implementation of TPDS could not begin till 2000.
- Monthly allocation of 10 kg per household, at half the market price, raised to 20 kg in April 2000 and to 35 kg in April 2002.
- Three types of cards issued: AAY, BPL, APL cards.

Targeted Public Distribution System

- State variation in efficacy of TPDS implementation (Khera, 2011)

- We focus on 6 states where the PDS has been functioning well or has 'revived' since TPDS implementation:

  Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Maharashtra, Uttaranchal, and Chattisgarh.

Data

- NSS: 1993-1994, 1999-2000, 2004-2005

- NSS:1999-2000 and 2004-2005 conducted ~2 years before and 2 years after expansion of the TPDS.
- 1993-1994 NSS added to control for the long term trends in nutrition
  - Steady decline in calorie intake in India across income groups (Deaton and Drèze, 2009).
- All analysis is restricted to rural areas.

Data

- Stratify districts based on average household wheat and rice consumption in the pre-TPDS period:

High-wheat/rice consuming districts (35+kg/month)

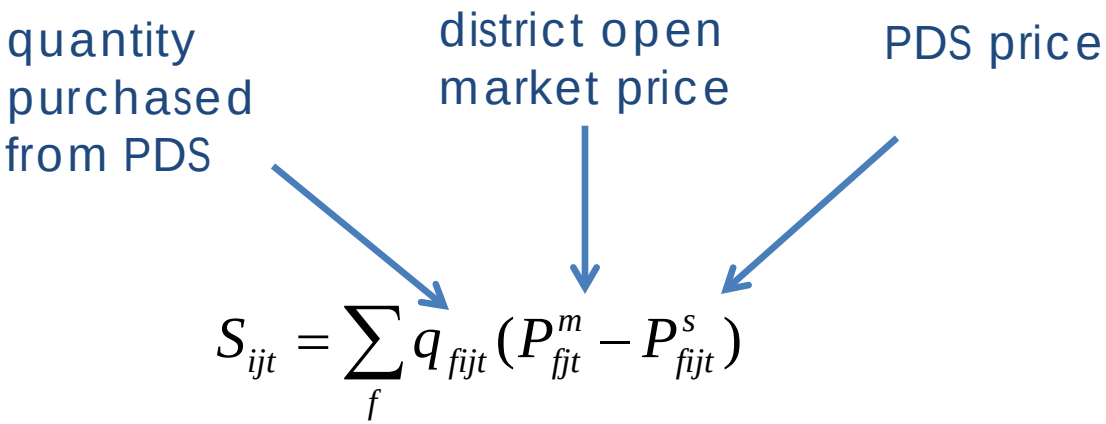
- Income effect of TPDS
- Estimate the effect of subsidy amount (increase in income)

Moderate wheat/rice consuming districts (0-20kg per month)

- Substitution effect of TPDS
- Estimate the effect of the price subsidy (% decrease in price)

Food Price Subsidy Amount

- The food price subsidy amount that household *i* in district *j* receives in year *t*:



Food Subsidy % price discount

- % price discount for each household:

$$\frac{Subsidy\ Amount}{quantity\ of\ wheat\ \&\ rice\ consumed\ X\ market\ price\ of\ wheat\ \&\ rice}$$

Food Price Subsidy

BPL Cards

- The 2004-2005 NSS provides ration card type data
- New ration cards not issued in 1993-94 or1999-2000.
- Use the 2004-2005 data to predict the probability of BPL/AAY card ownership

Effect of TPDS on food subsidy (First stage regression)

- per capita food price subsidy:

$$S_{ijt} = X_{it}\beta + \beta_c(\Pr Card_i * Post_t) + \delta_0 * \Pr Card_i + \delta_1 * D_{jt} + \pi_j + \pi_t + u_{ijt}$$

X_{it}	household characteristics
$\Pr Card_i$	predicted probability that household has BPL/AAY card.
$Post_t$	equal to 1 if observation taken after the TPDS expansion.
D_{jt}	district-level time varying factors: mean district level MPCE, open market price of rice and wheat, and district-specific trends.
π_j, π_t	district and year fixed effects.

IV Model

- per capita nutrition intake of household *i* in district *j* in year *t*:

$$N_{ijt} = X_{it}\phi + \varphi * Subsidy_{ijt} + \varphi_0 \Pr Card_i + \phi_0 * D_{jt} + \eta_j + \eta_t + e_{ijt}$$

X_{idt} household characteristics

$Subsidy_{ijt}$ per capita food grains subsidy

$\Pr Card_i$ predicted probability that household has BPL/AAY card.

D_{jt} district-level time varying factors

η_j, η_t district and year fixed effects.

$Subsidy_{ijt}$ is instrumented with $\Pr Card_i * Post_t$

Table 1. Estimates of the Effect of TPDS on Per Capita Subsidy Amount

	Model 1	Model 2	Model 3
High Rice/Wheat Consumers			
Predicted probability of BPL card ownership*PostTPDS	15.40***	16.12***	18.02***
N	13,056	13,056	13,056
Moderate Rice/Wheat Consumers			
Predicted probability of BPL card ownership*PostTPDS	14.04***	10.90***	11.44***
N	3,744	3,744	3,744
Controls:			
District specific trend	No	Yes	No
District-PostTPDS interactions	No	No	Yes

Table 2. Estimates of the Effect of TPDS on % Price Discount

	Model 1	Model 2	Model 3
High Rice/Wheat Consumers			
Predicted probability of BPL card ownership*PostTPDS	16.41***	17.04***	19.35***
N	13,056	13,056	13,056
Moderate Rice/Wheat Consumers			
Predicted probability of BPL card ownership*PostTPDS	20.50***	17.72***	17.44***
N	3,744	3,744	3,744
Controls:			
District specific trend	No	Yes	No
District-PostTPDS interactions	No	No	Yes

Table 3. Consumption Pattern in High rice/wheat consuming districts

	Cost per 1000 calories		Share of total calories	
	Pre-TPDS Expansion	Post-TPDS Expansion	Pre-TPDS Expansion	Post-TPDS Expansion
Wheat and rice	1.91	2.38	**0.598**	**0.528**
Wheat and rice, PDS	1.42	1.65	**0.050**	**0.147**
Coarse cereals	1.17	1.63	**0.087**	**0.053**
Pulses	4.63	6.46	0.052	0.046
Milk and milk products	8.41	11.78	0.037	0.039
Edible oils	3.82	5.71	0.058	0.069
Sugars	3.03	4.37	0.046	0.048
Egg, fish and meat	32.4	45.76	0.003	0.003
All other foods	11.53	17.76	0.070	0.067

Table 4: Consumption Pattern in Moderate rice/wheat consuming districts

	Cost per 1000 calories		Share of total calories	
	Pre-TPDS Expansion	Post-TPDS Expansion	Pre-TPDS Expansion	Post-TPDS Expansion
Wheat and rice	1.96	2.59	0.142	0.157
Wheat and rice, PDS	1.35	1.55	**0.045**	**0.105**
Coarse cereals	1.13	1.74	**0.494**	**0.410**
Pulses	5.31	7.41	0.057	0.050
Milk and milk products	8.21	12.01	0.034	0.034
Edible oils	3.94	5.55	**0.066**	**0.090**
Sugars	3.17	4.62	0.071	0.068
Egg, fish and meat	37.36	60.28	0.004	0.003
All other foods	11.2	16.74	0.087	0.082

Table 5. Effect of Subsidy Amount on Per Capita Daily Intake (High Rice/Wheat Consuming Districts)

	OLS	IV Linear	IV Log-Linear	IV Log-log
Calories per capita	2.99***	-8.04	-0.004	-0.016
Protein per capita, g	0.09***	-0.32*	-0.005	-0.021
Fat per capita, g	0.01	-0.14	-0.004	-0.02
N	13,055	13,053	13,053	13,055

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Effect of Subsidy Amount on Per Capita Daily Calories Intake from Various Food Groups (High Rice/Wheat Consuming Districts)

	OLS	IV Linear	IV Log-Linear	IV Log-log
Wheat and Rice	4.39***	1.53	0.005	0.021
Coarse cereals	-1.54***	-7.45**	-0.166**	-0.747**
Pulses	0.06	0.47	-0.006	-0.024
Edible oils	0.03	0.09	0.002	0.009
Milk, eggs, fish & meat	0.08	-1.48	-0.032	-0.142
Sugar and sugar Substitutes	0.23***	0.80*	0.047**	0.210**
All other foods	-0.29**	-2.33**	-0.011*	-0.051*
N	14,247	14,247	14,160	14,160

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Effect of % Price Discount on Per Capita Daily Intake (Moderate Rice/Wheat Consuming Districts)

	OLS	IV Linear	IV Log-Linear	IV Log-log
Calories per capita	1.004	2.471	0.005	0.022
Protein per capita, g	0.028	-0.002	0.003	0.018
Fat per capita, g	-0.016	0.214	0.008	0.023
N	3,742	3,742	3,741	3,372

*** p<0.01, ** p<0.05, * p<0.1

Table 8. Effect of % price Discount on Per Capita Daily Calories Intake from Various Food Groups (Moderate Rice/Wheat Consuming Districts)

	OLS	IV Linear	IV Log-Linear	IV Log-log
Wheat and Rice	1.50*	11.40**	0.027**	0.129*
Coarse cereals	-0.65	-12.85**	-0.061**	-0.256**
Pulses	0.06	0.51	0.004	0.014
Edible oils	-0.01	1.81**	0.015***	0.050**
Milk, eggs, fish & meat	0.07	-0.39	-0.003	0.012
Sugar and sugar Substitutes	0.09*	1.73**	0.005	0.063
All other foods	-0.03	0.61	0.006	0.004
N	3,742	3,742	3,736	3,370

*** p<0.01, ** p<0.05, * p<0.1

Conclusion

- TPDS led to a large increase in food price subsidy for households with a BPL card
- Increase in subsidy amount increased calorie intake from wheat, rice and sugar and lowered calorie intake from coarse grains and other foods, leaving the overall calorie intake unchanged
- Decline in the price of wheat and rice, due to subsidy, changed consumption patterns away from coarse grains towards wheat, rice, sugar and edible oil
- Food price subsidy changes consumption patterns that may be an unintended or undesirable effect

Contribution to the Literature

- Larger subsidy (50% of the market price) compared to Jenson and Miller (2011) (8 - 25% of the market price)
- Larger sample to detect small effects
  - (16,000 households compared to 1,293 households in Jenson and Miller (2011)

Contribution to the Literature

- Use states with higher off-take rates compared to Kochar (2005)
- Larger ration quotas and more time for completion of program roll-out compared to Kochar (2005)
- Study the effect of rice and wheat PDS
- Have data on ration cards