# Household Responses to Food Subsidies: Evidence from India

Tara Kaul
International Initiative for Impact Evaluation (3ie)

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# Motivation

- Food subsidies are one of the most critical forms of assistance to the poor
  - Implemented via food stamps, in kind transfers, subsidized quotas or price subsidies
  - Previous literature: impact on nutrition generally small, even zero or negative
- Indian Public Distribution System
  - Nation-wide, used by $\approx$ 45% of the population
  - Poor households receive a monthly quota of cereals (rice/wheat) at discounted prices set by the government
  - Supplementary program $\implies$ infra-marginal households $\implies$ works through income effect
  - On average: cereals contribute 73% of total caloric intake

# Research Questions

- What is the impact of food subsidies on
  - cereal consumption?
  - caloric intake?
  - calories from different food groups?
- How does the marginal effect of the food subsidy compare with the expenditure elasticity of calories?
- Implementation issues:
  - What is the possible loss in caloric intake due to corruption in different states?

# Research Strategy

- Use previously unexploited sources of variation in the value of the subsidy:
  1. State specific program rules

     - Across state variation: states set quotas independently

     - Within state variation: states may or may not index quota to family size
  2. Differences in local (district) market and PDS prices

     - Within state variation, across time: PDS price set for the year, not linked to market prices $\implies$ discount varies by local conditions

# Preview of Results

- Impact on nutrition
  - Positive and significant ↑ in cereals and calories, $\epsilon^{sub}_{kcal} = 0.144$
    - in contrast to earlier studies that find 0 or negative effects
  - Positive and significant ↑ in calories from all food groups
- Effect is smaller than expenditure elasticity, $\epsilon^{exp}_{kcal} = 0.4$
  - presence of transaction costs, corruption
- Impact on calories almost 50% lower in states considered (Khera 2011) most corrupt

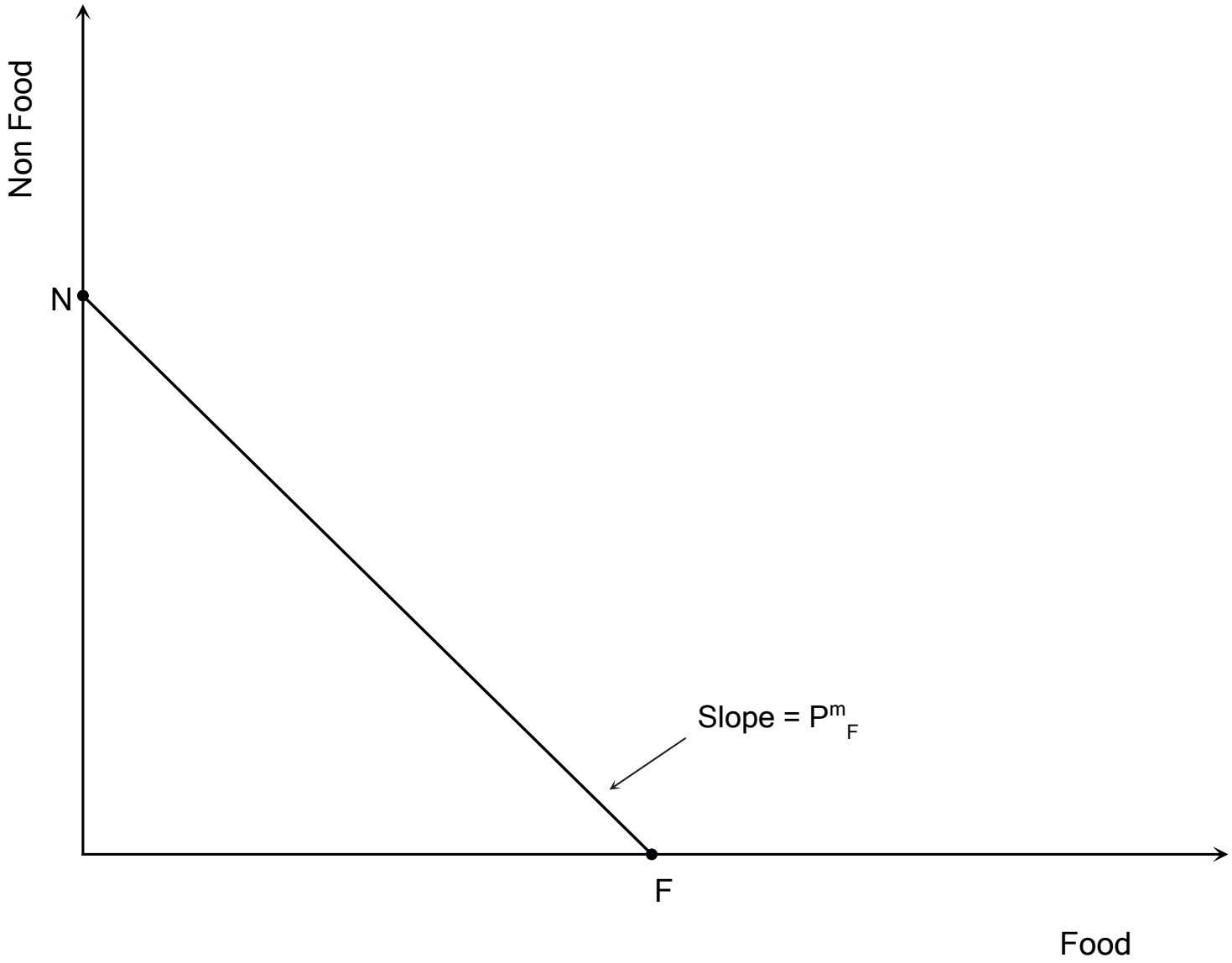
# Public Distribution System in India

- One of the government's most significant anti-poverty programs: Food subsidy $\approx$ 1% of GDP
- Central government procures food grains at the minimum support price set for the year
- Works alongside free market to distribute rice, wheat, sugar and kerosene at subsidized prices through 489,000 Fair Price Shops
- Post 1997: PDS became Targeted
  - Below the poverty line (BPL) households get fixed amount of food grains per month at 50% of the cost to the government
  - Targeted 65.2 million families by 2000
- Jointly run by the central and state governments
- Uniform subsidized price is maintained across districts within a state, rather than uniform subsidy value

# Functioning and Reform

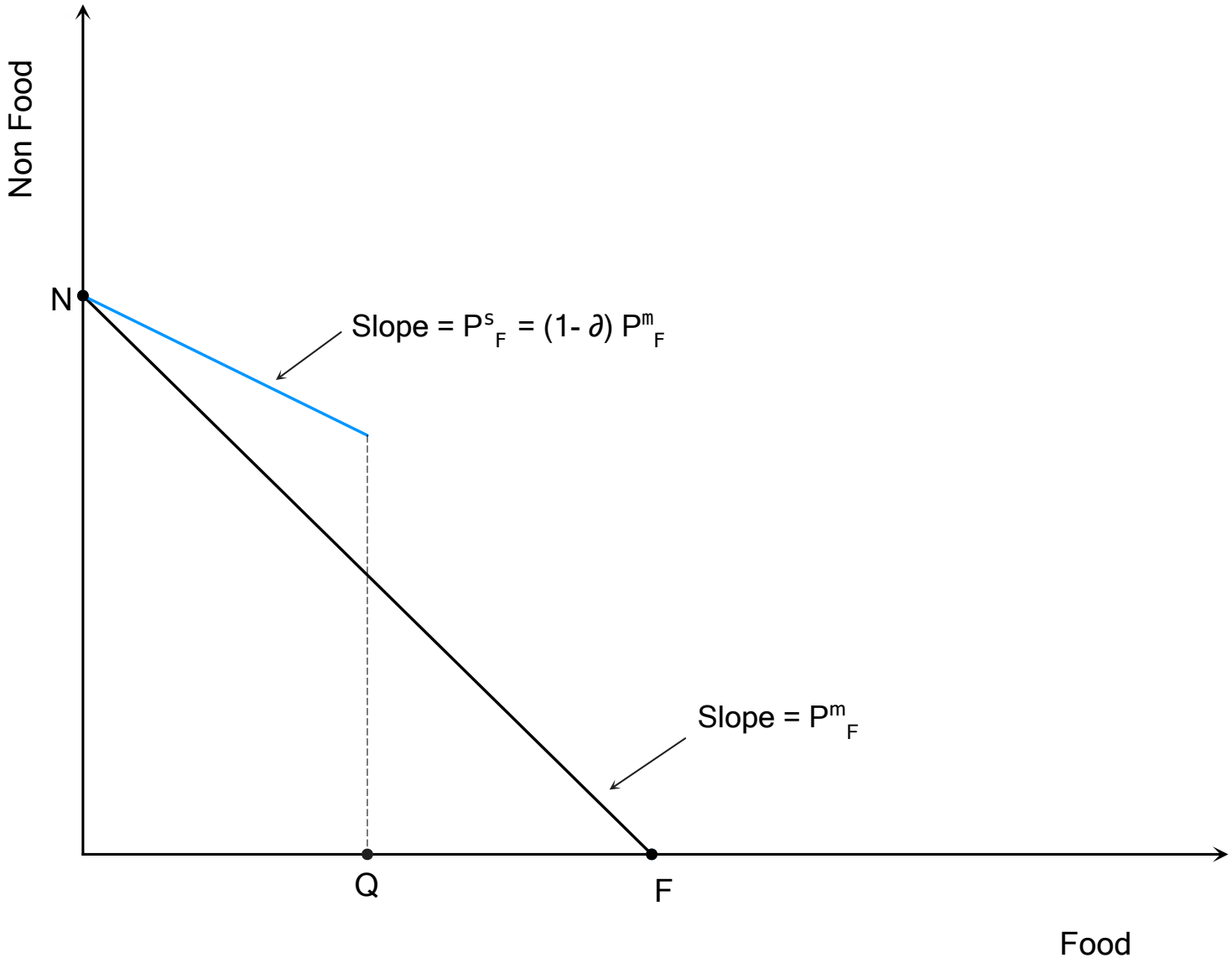
- Criticized for diversion/leakages and inefficiency: Government spends Rs 3.65 to transfer Re 1 to the poor
- Primary means of diversion: illegal sale in open market at some stage of the distribution chain
- Khera (2011) finds regional differences in corruption, 44% grains diverted on average in 2007-08

# Conceptual Framework




Example

# Conceptual Framework




Example

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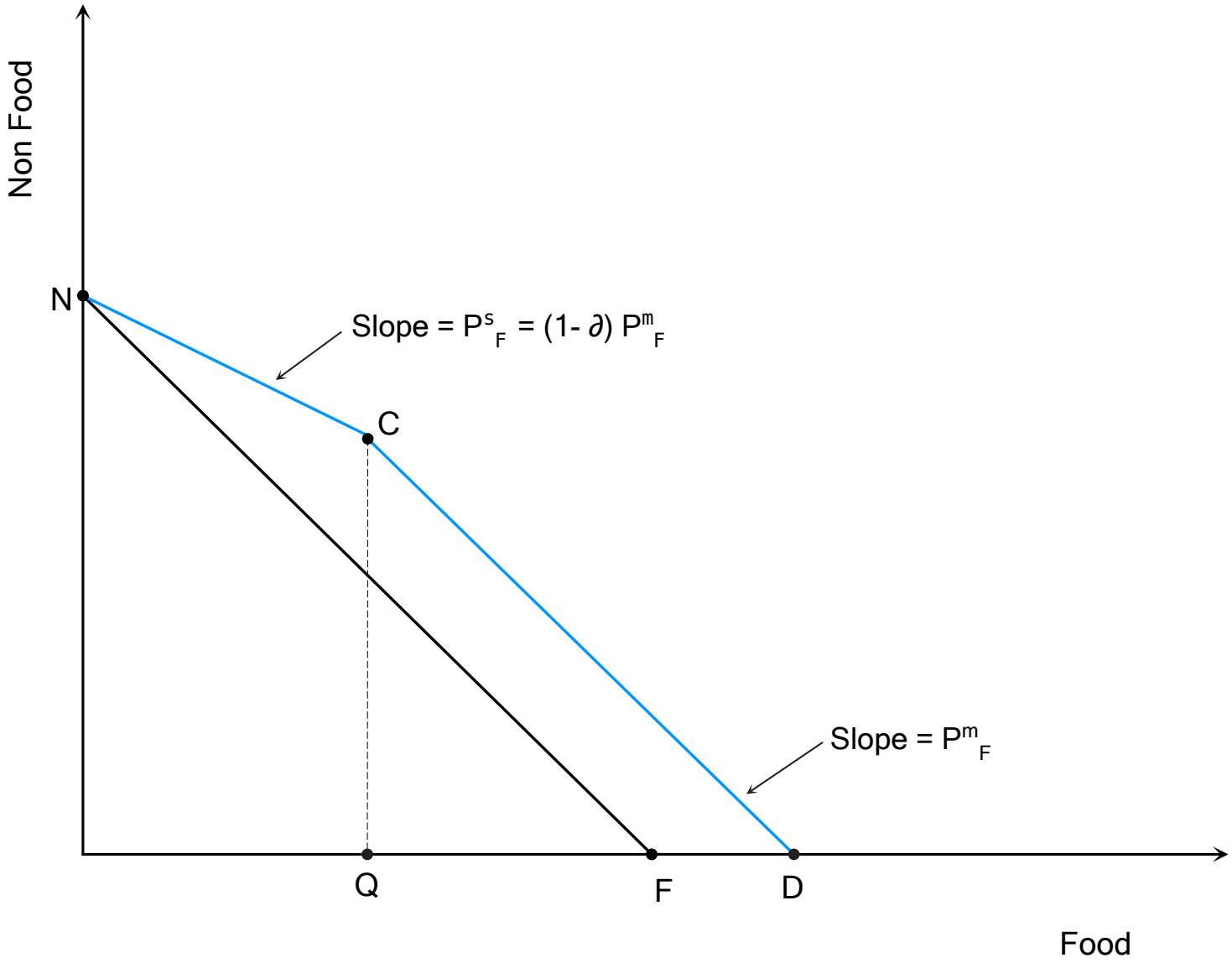


Example

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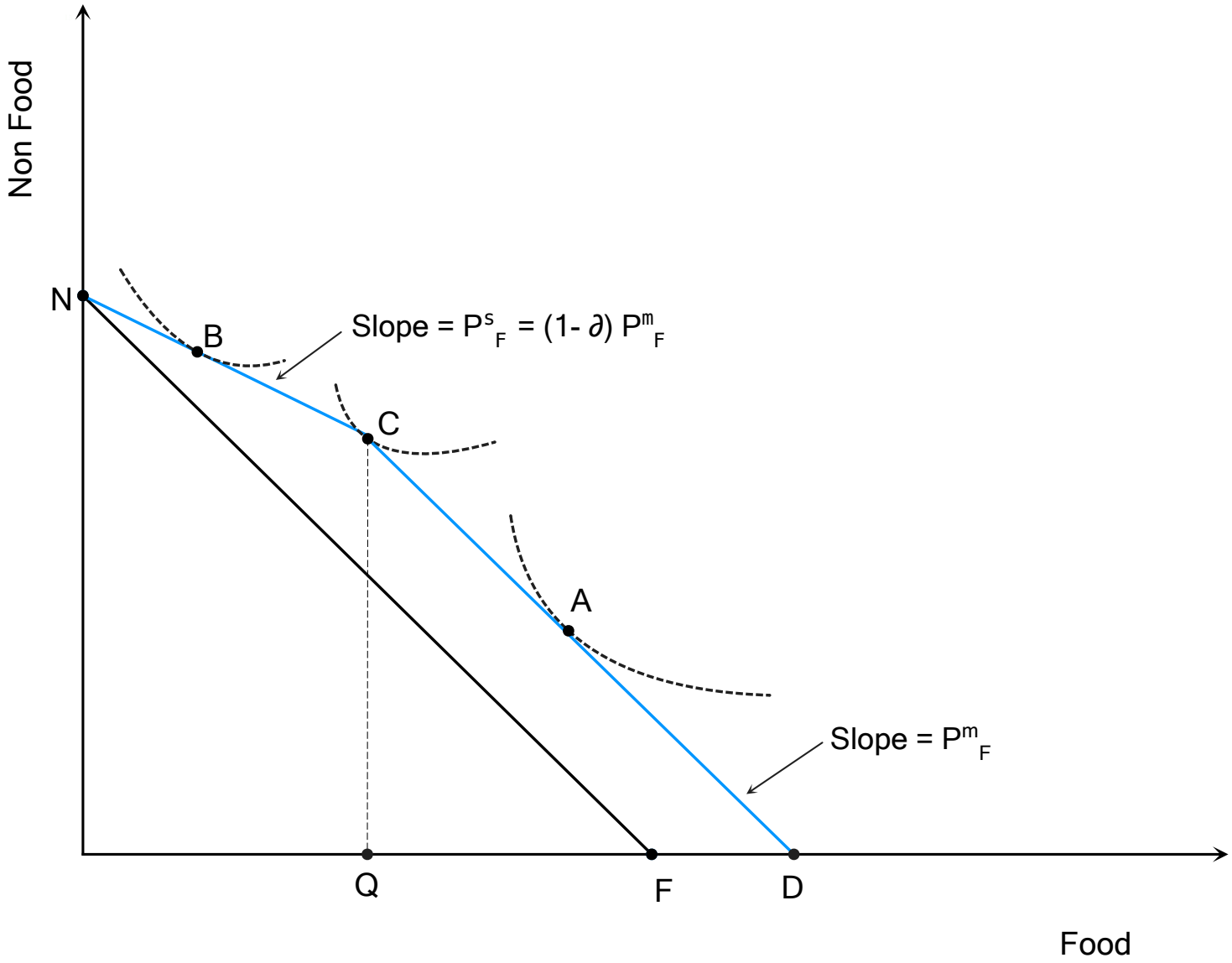


Example

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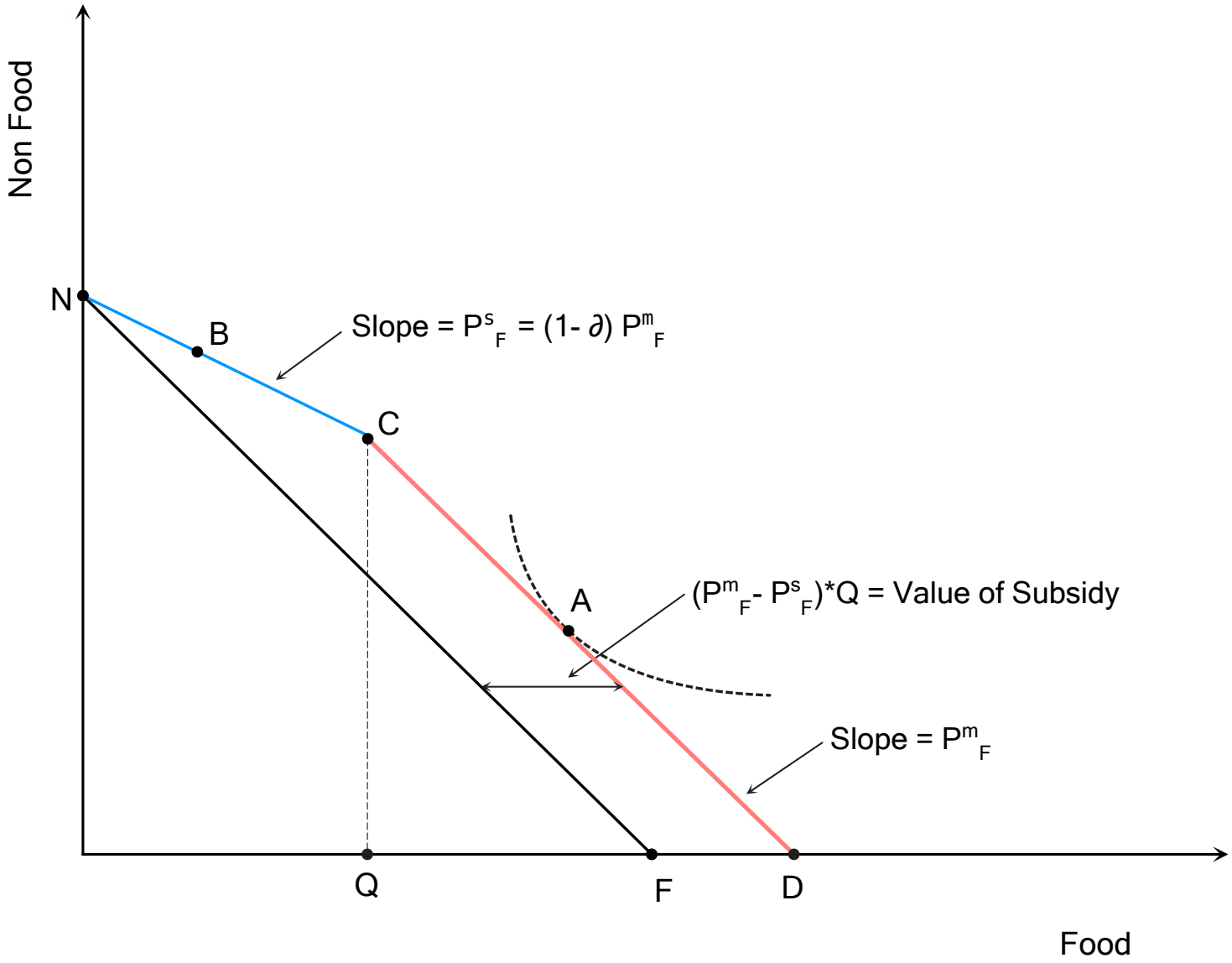



Example

# NSSO Socio-Economic Surveys

- Nationally representative, repeated cross sections (2002-2008)
  - Household expenditures (Value and Quantity)

    - Monthly : Over 150 food items, beverages etc Example

    - Yearly : Durable goods, medical expenditure, education expenditure, conveyance, rent etc
  - Household characteristics: age, education level, location, religion etc
  - Does not collect information on BPL status (exception: 2004-05 round)
- Sample for analysis
  - 8 rice consuming states (151 districts)
  - PDS users: Households that report purchase of rice from the PDS
  - Local prices calculated using quantity and value reported by PDS users in a district-season-year cell
  - Food purchases converted into calorie availability

IHDS data

# Identification Strategy

- Variation in the per capita value of the subsidy
  - State quotas
  - District-season-year price differences
  - Household size
- Value of the subsidy calculated as

$$PerCapValSub_{ijswt} = (P^{mkt}_{jwt} - P^{sub}_{jwt}) * PerCapQuota_{is}$$

Where:
$i = household$, $j =$ $district$, $s = state$, $w = season$, $t = year$

# Variation in State Quotas

| State | Rice (kg) | Wheat (kg) |
|---|---|---|
| Andhra Pradesh | 4 per person (20 kg max/hh) | 5 (at unsubsidized price) |
| Assam | 20 | 0 |
| Bihar | 15 | 15 |
| Chattisgarh | 25 | 0 |
| Gujarat | 1 per person (3.5 kg max/hh) | 1.5 per person (9 kg max/hh) |
| Haryana | 10 | 25 |
| Jharkhand | 35 | 0 |
| Karnataka | 16 | 4 |
| Kerela | 8 per adult 4 per child (20 kg max/hh) | 5 (at unsubsidized price) |
| Madhya Pradesh | 6 | 17 |
| Maharashtra | 5 | 15 |
| Meghalaya | 2 per person | 0 |
| Orissa | 16 | 0 |
| Rajasthan | 5 | 25 |
| Uttar Pradesh | 20 | 15 |
| West Bengal | 2 per person | 2 per person |

Sources: Planning Commission (2005), Khera (2011) &
"Simplifying the food security bill" at $http://bit.ly/PM_NFSB$

Map

# Variation in Rice Discount

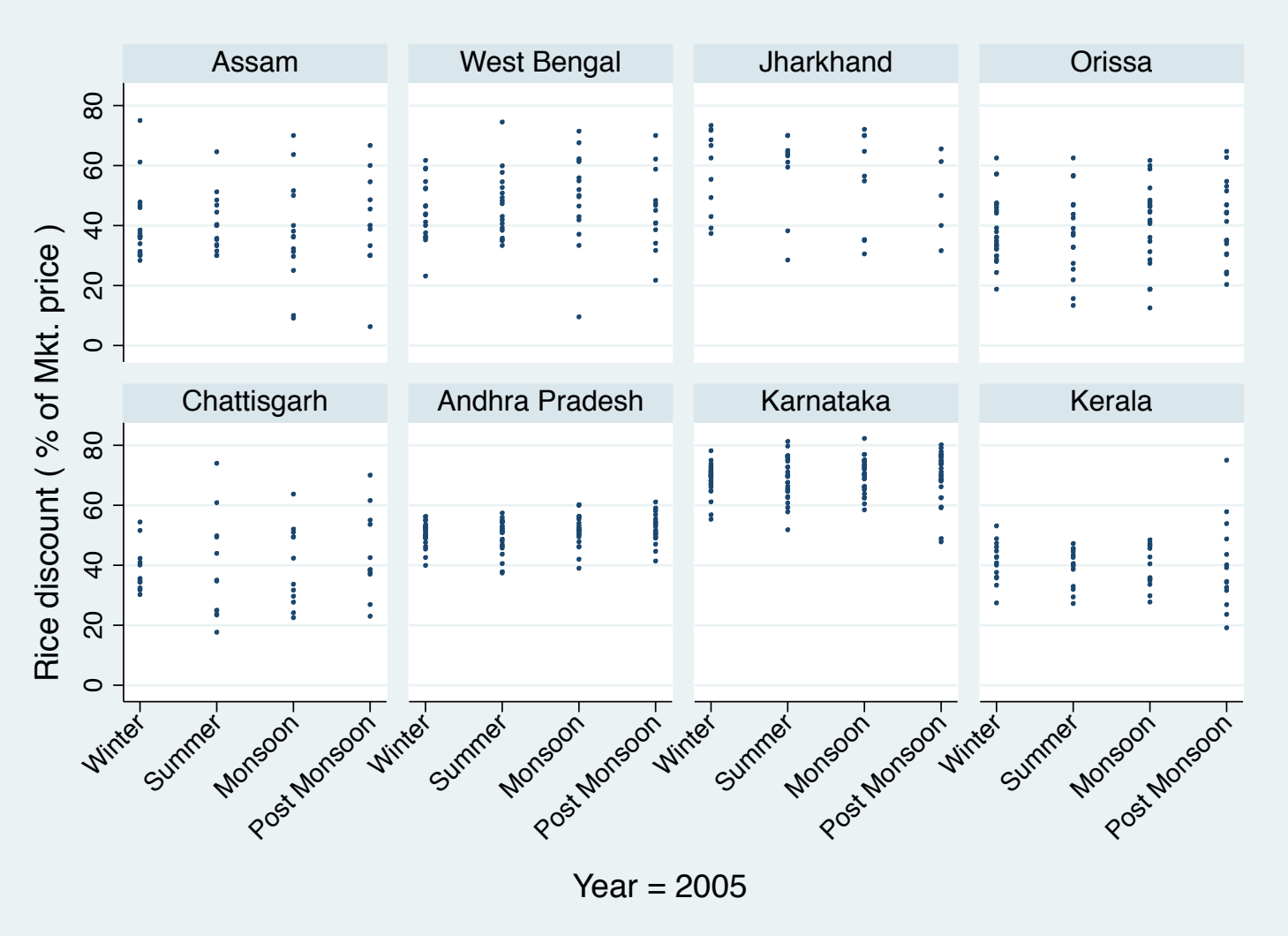
| State | Mean (%) | Std. Dev | p10 | p90 | N |
|---|---|---|---|---|---|
| *Winter (January-March)* | | | | | |
| Karnataka | 66.92 | 11.6 | 23.39 | 77.32 | 1239 |
| Assam | 41.46 | 10.59 | 20 | 56.45 | 233 |
| *Summer (April-May)* | | | | | |
| Karnataka | 66.86 | 11.63 | 35.56 | 78.18 | 791 |
| Assam | 41.78 | 11.11 | 6.17 | 54.17 | 163 |
| *Monsoon (June-September)* | | | | | |
| Karnataka | 58.22 | 15.45 | 24.38 | 75.07 | 1697 |
| Assam | 38.1 | 13.92 | 4.55 | 60 | 283 |
| *Post Monsoon (October-December)* | | | | | |
| Karnataka | 60.2 | 15.04 | 14.67 | 75 | 1335 |
| Assam | 39.44 | 13.41 | 17.65 | 59.13 | 230 |

Source: Calculations using 2002-2008 NSSO Socio-Economic Surveys.

Notes: 1. Discount calculated as (Market price - PDS price)/Market price*100.

2. Averages based on PDS and market prices reported by PDS users in the sample.

# Variation in Rice Discount for 2005




Rice Discount

# Variation in Value of the Rice Subsidy

| State | Mean (Rs) | Std. Dev | p10 | p90 | N |
|---|---|---|---|---|---|
| *Winter (January -March)* | | | | | |
| Karnataka | 35.89 | 21.56 | 6.93 | 58.24 | 1239 |
| Assam | 23.52 | 11.11 | 8.64 | 38.67 | 233 |
| *Summer (April-May)* | | | | | |
| Karnataka | 37.93 | 25.26 | 8.32 | 63.76 | 791 |
| Assam | 26.56 | 14.4 | 3.86 | 43.42 | 163 |
| *Monsoon (June-September)* | | | | | |
| Karnataka | 32.62 | 20.37 | 6.63 | 55.37 | 1697 |
| Assam | 24.38 | 13.98 | 2.7 | 41.81 | 283 |
| *Post Monsoon (October-December)* | | | | | |
| Karnataka | 33.71 | 21.71 | 4.79 | 56.25 | 1335 |
| Assam | 26.12 | 18.65 | 7.2 | 41.63 | 230 |

Source: Calculations using 2002-2008 NSSO Socio-Economic Surveys.

Notes: 1. Value of subsidy calculated as Per Capita Quota*(Market price - PDS price).

2. Averages based on PDS and market prices reported by PDS users in the sample.

# Descriptive Statistics

| Sample: | Full Sample | | PDS users | |
|---|---|---|---|---|
| | Mean | (Std. Dev.) | Mean | (Std. Dev.) |
| Monthly expenditure per capita (Rs) | 1011.0 | (1085.3) | 636.8 | (393.4) |
| Daily calories per capita (kcal) | 2334.2 | (1300.9) | 2190.9 | (623.7) |
| Proportion spent on food | 0.547 | (0.142) | 0.577 | (0.116) |
| Size of the household | 4.570 | (2.382) | 4.736 | (1.891) |
| Number of children below 15 | 1.411 | (1.428) | 1.538 | (1.339) |
| Proportion of women | 0.515 | (0.207) | 0.512 | (0.152) |
| Age of household head | 46.58 | (13.61) | 45.38 | (12.17) |
| Urban dummy | 0.363 | (0.481) | 0.219 | (0.414) |
| SC/ST/OBC | 0.592 | (0.491) | 0.765 | (0.424) |
| Observations | 124228 | | 22564 | |

Notes: 1. Rural Poverty line is Rs 497.6, Urban Poverty line is Rs 635.7 (Planning Commission, Government of India). 2. Average daily minimum calorie requirements are 2400 kcal for rural and 2100 kcal for urban areas. 3. All prices in 2005 Rupees (Rs 45.3 = 1 USD in 2005).

# Rice Prices and Quantities

| | Mean | (Std. Dev.) |
|---|---|---|
| PDS rice price (Rs/kg) | 5.271 | (1.855) |
| Mkt rice price (Rs/kg) | 10.80 | (2.193) |
| PDS rice qty (kg) | 18.64 | (9.392) |
| Market rice qty (kg) | 26.11 | (20.24) |
| Food expenditure per capita (Rs) | 400.5 | (168.9) |
| Cereal expenditure per capita (Rs) | 116.0 | (43.85) |
| Rice subsidy per capita (Rs) | 25.71 | (11.90) |
| Rice proportion of food expenditure | 0.260 | (0.130) |
| Proportion of calories from rice | 0.615 | (0.175) |
| Proportion of calories from cereals | 0.727 | (0.0987) |
| Observations | 22564 | |

# Empirical Specification

$$Y_{ijswt} = \alpha + \beta PerCapValSub_{ijswt} + \mathbf{X}_{ijswt}\gamma + \delta_j + \chi_w + \theta_{st} + \varepsilon_{ijswt}$$

Where: $i = household$, $j =$ $district$, $s = state$, $w = season$, $t = year$ & $PerCapValSub_{ijswt} = (P^{mkt}_{jwt} - P^{sub}_{jwt}) * PerCapQuota_{is}$

**Controls**

- Determinants of calories in **X** (Behrman & Deolalikar 1988)
  Education of household head and spouse, proportion of women, urban location, land holdings, age and squared age of household head
- Regional (district) and seasonal effects
- State*year effects
- Standard errors clustered at the district level

Identifying variation

## Assumptions

- Conditional on controls, value of subsidy exogenous to unobservable factors affecting demand
  - perform falsification test on non PDS users ▸ Falsification
- Household size exogenous to state level program rules
  - use national average family size ▸ Size
- Prices unaffected by demand from any one household
  - standard from perfect competition

## Sources of measurement/specification error

- Calculation of local prices using unit values from expenditure survey
  - use median prices instead of average (robust to outliers)
- Independent effect of family size
  - use alternative scale to correct for family size
  - use household level outcomes and explicitly control for size

▸ Other checks

# Impact on Food consumption and Caloric Intake

- $\uparrow$ Rs 10 in subsidy value $\Rightarrow \uparrow$ 20.3 gram/day cereal consumption (60 kcal/day)
- $\uparrow$ Rs 10 in subsidy value $\Rightarrow \uparrow$ 126 kcal/day
- $\epsilon^{sub}_{kcal} = 0.144$
- Positive elasticity for all food groups: supports income effect hypothesis

# Impact on Cereal Consumption

| Dependent variable: | Cereal consumption (1) | Log cereal consumption (2) | Cereal consumption (3) |
|---|---|---|---|
| Rice subsidy per capita | 2.030*** | | |
| | (0.158) | | |
| Log rice subsidy per capita | | 0.123*** | |
| | | (0.00963) | |
| Rice quota per capita | | | -1.968 |
| | | | (4.442) |
| Market price* quota per capita | | | 1.697*** |
| | | | (0.436) |
| PDS price* quota per capita | | | 0.157 |
| | | | (0.463) |
| PDS price | | | -1.607 |
| | | | (2.849) |
| Market price | | | -6.131** |
| | | | (2.395) |
| Observations | 22564 | 22564 | 22564 |
| Adjusted $R^2$ | 0.250 | 0.270 | 0.258 |

Standard errors in parentheses. * $p < 0.10$,** $p < 0.05$, *** $p < 0.01$

# Impact on Caloric Intake

| Dependent variable: | Caloric intake | Log caloric intake | Log caloric intake from food group | | | |
|---|---|---|---|---|---|---|
| | | | Cereals | Lentils | Fruits & Veg | Meat |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rice subsidy per capita | 12.58*** | | | | | |
| | (1.116) | | | | | |
| Log rice subsidy per capita | | 0.144*** | 0.123*** | 0.154*** | 0.234*** | 0.170*** |
| | | (0.0103) | (0.00963) | (0.0177) | (0.0160) | (0.0187) |
| Observations | 22564 | 22564 | 22564 | 22118 | 22562 | 19833 |
| Adjusted $R^2$ | 0.124 | 0.166 | 0.270 | 0.215 | 0.441 | 0.426 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# Comparison with Expenditure Elasticity

| Dependent variable: | Log caloric intake | | Log food expenditure | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log monthly expenditure per capita | 0.406*** | | 0.751*** | |
| | (0.0103) | | (0.00883) | |
| Log rice subsidy per capita | | 0.140*** | | 0.146*** |
| | | (0.0135) | | (0.0153) |
| Observations | 13333 | 13333 | 13333 | 13333 |
| Adjusted $R^2$ | 0.437 | 0.157 | 0.820 | 0.404 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Sample comprises rural households, to facilitate comparison with estimates in Subramanian and Deaton (1996).

Full Sample

# Supplementary data: IHDS 2005

- India Human Development Survey
- 41,554 households: 1,503 villages, 971 urban neighborhoods
- More detailed household information than NSSO ▸ NSSO

  In addition to consumption, collects information on income, debt, savings, insurance
- Food module similar to NSSO, less detailed

# Income Elasticity

**Panel A: IHDS data**

| Dependent variable: | Log cereal consumption | | Log food expenditure | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log monthly income per capita | 0.0462*** | 0.0304*** | 0.0966*** | 0.0827*** |
| | (0.00972) | (0.00959) | (0.0108) | (0.0105) |
| Log rice subsidy per capita | | 0.295*** | | 0.259*** |
| | | (0.0323) | | (0.0323) |
| Observations | 3962 | 3962 | 3962 | 3962 |
| Adjusted $R^2$ | 0.306 | 0.354 | 0.402 | 0.429 |

**Panel B: IHDS and NSSO data**

| Dependent variable: | Log cereal consumption | | | |
|---|---|---|---|---|
| Data: | IHDS | NSSO | IHDS | NSSO |
| Log monthly expenditure per capita | 0.247*** | 0.269*** | | |
| | (0.0178) | (0.0264) | | |
| Log rice subsidy per capita | | | 0.320*** | 0.179*** |
| | | | (0.0314) | (0.0390) |
| Observations | 3962 | 4255 | 3962 | 4255 |
| Adjusted $R^2$ | 0.388 | 0.357 | 0.358 | 0.286 |

Standard errors in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Sample Statistics

# Corruption

| Dependent variable: | Cereal consumption per capita (1) | Caloric intake per capita (2) |
|---|---|---|
| Rice subsidy per capita | 2.359*** | 12.04*** |
| | (0.180) | (1.148) |
| Corrupt*Rice subsidy | -1.207*** | -7.060*** |
| | (0.304) | (1.480) |
| Observations | 22564 | 22564 |
| Adjusted $R^2$ | 0.251 | 0.117 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# Conclusion

- Subsidy has a positive and significant impact on calories, positive elasticity for all food groups: contrast to results for price subsidies
  - Support for hypothesis that subsidy generates income effects
  - Elasticity smaller than expenditure elasticity of calories: transaction costs & corruption
  - Smaller impact in corrupt states
- Future work
  - District level outcomes by PDS performance and other government programs

# Bonus Slides

# Adding controls

| Dep. variable: | Cereal consumption per capita | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Rice subsidy | -0.231 | -0.000971 | -0.00491 | 1.831*** | 2.030*** | 1.450*** | 1.985*** |
| | (0.253) | (0.228) | (0.229) | (0.179) | (0.158) | (0.134) | (0.158) |
| **Controls** | | | | | | | |
| Household chars. | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Season | No | No | Yes | Yes | Yes | Yes | No |
| State*Year | No | No | No | Yes | Yes | No | Yes |
| District | No | No | No | No | Yes | Yes | Yes |
| Observations | 22564 | 22564 | 22564 | 22564 | 22564 | 22564 | 22564 |
| Adjusted $R^2$ | 0.000 | 0.076 | 0.077 | 0.192 | 0.250 | 0.236 | 0.248 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$,*** $p < 0.01$

# Cobb Douglas Utility Function

$f = ((1-\alpha)x_i + y_i)^{1/2} z_i^{1/2}$

- Solution to the household's problem is:

$$y_i^* = \frac{M_i - Q(2-\alpha-\delta)p_y}{2p_y}, z_i^* = \frac{M_i + Q(\delta-\alpha)p_y}{2p_z}, x_i^* = Q$$

conditional on:

$Q < \frac{M_i}{(2-\alpha-\delta)p_y}$ *(Quota < threshold value)*

$\alpha < \delta$ *(Transaction costs < discount)*

- The total food consumption ($F_i^* = y_i^* + Q$) is:

$$F_i^* = \frac{M_i + Q(\delta-\alpha)p_y}{2p_y}$$

where $\frac{\partial F_i*}{\partial Q} > 0$ , $\frac{\partial F_i*}{\partial \delta} > 0$ and $\frac{\partial F_i*}{\partial \alpha} < 0$

Back

# Previous work on the PDS

- Kochar 2005 : Variation in value of subsidy by BPL status in 1993 & 1999
  - Imputed, not observed leading to errors of misclassification
  - BPL status also gives access to other forms of government assistance
  - Current program more generous, higher participation rates
- Tarozzi 2005 : Variation in exposure to PDS price rise in 1992
  - Actual receipt of benefit not observed, short length of exposure (1-3 months)
  - Pre-targeted program, no change in quota
- Khera 2011 : 300 households from 1 state
  - Uses BPL status only, no variation in value of subsidy

Back

# NSSO 64th Round

*Schedule 1.0:* 6

**[5] consumption of food, pan, tobacco and intoxicants during the last *30* days ended on ……**

| item | code | quantity@ (0.000) | value (Rs: whole no.) | source code$ |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| rice – PDS | 101 | | | 1 |
| rice – other sources | 102 | | | |
| chira | 103 | | | * |
| khoi, lawa | 104 | | | * |
| muri | 105 | | | * |
| other rice products | 106 | | | * |
| wheat/ atta – PDS | 107 | | | 1 |
| wheat/ atta – other sources | 108 | | | |
| maida | 110 | | | |
| suji, rawa | 111 | | | * |
| sewai, noodles | 112 | | | * |
| bread (bakery) | 113 | | | * |
| other wheat products | 114 | | | * |
| jowar & its products | 115 | | | |
| bajra & its products | 116 | | | |
| maize & products (excl. cornflakes) | 117 | | | |
| cornflakes | 118 | | | * |
| barley & its products | 120 | | | |
| small millets & their products | 121 | | | |
| ragi & its products | 122 | | | |
| other cereals | 123 | | | |
| **cereal: sub-total (101-123)** | **129** | | | |

Back

# Expenditure elasticity for the full sample

| Dependent variable: | Log caloric intake | | Log food expenditure | | Log Rs per calorie | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log monthly exp. per capita | 0.375*** | | 0.731*** | | 0.357*** | |
| | (0.00914) | | (0.00834) | | (0.00873) | |
| Log rice subsidy per capita | | 0.146*** | | 0.149*** | | 0.00808 |
| | | (0.0117) | | (0.0139) | | (0.00586) |
| Observations | 16799 | 16799 | 16799 | 16799 | 16799 | 16799 |
| Adjusted $R^2$ | 0.405 | 0.154 | 0.807 | 0.386 | 0.674 | 0.527 |

Standard errors in parentheses. $p < 0.10$, ** $p < 0.05$, $p < 0.01$

Back

# Falsification test: Non-PDS Users

| Dependent variable: | Cereal consumption | Log cereal consumption | Caloric intake | Log caloric intake |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Rice subsidy per capita | -0.0706 | | 0.462 | |
| | (0.115) | | (0.772) | |
| Log rice subsidy per capita | | -0.0141* | | -0.00863 |
| | | (0.00750) | | (0.00686) |
| Observations | 26494 | 26494 | 26494 | 26494 |
| Adjusted $R^2$ | 0.256 | 0.261 | 0.045 | 0.152 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back

# Sensitivity to Specification

| Dependent variable: | Log caloric intake | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Log rice subsidy (avg. family size) | 0.134*** | | | | |
| | (0.00763) | | | | |
| Log rice subsidy (household level) | | 0.131*** | | | |
| | | (0.0147) | | | |
| Size of the household | | 0.134*** | | | |
| | | (0.00243) | | | |
| Log rice subsidy (per person) | | | 0.202*** | | |
| | | | (0.00992) | | |
| Log rice subsidy (median prices) | | | | 0.119*** | |
| | | | | (0.0103) | |
| Log rice subsidy per capita (state*survey wave) | | | | | 0.148*** |
| | | | | | (0.0107) |
| Observations | 22564 | 22564 | 22564 | 22543 | 22564 |
| Adjusted $R^2$ | 0.173 | 0.613 | 0.200 | 0.159 | 0.168 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back

# All India vs. Rice Favoring States

| Dependent variable: | Log cereal consumption | | | Log caloric intake | | |
|---|---|---|---|---|---|---|
| States: | All | Rice | Non Rice | All | Rice | Non Rice |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log rice subsidy per capita | 0.0796*** | 0.123*** | 0.0439*** | 0.101*** | 0.144*** | 0.0666** |
| | (0.00677) | (0.00963) | (0.00664) | (0.00701) | (0.0103) | (0.00675) |
| Observations | 33231 | 22564 | 10667 | 33231 | 22564 | 10667 |
| Adjusted $R^2$ | 0.263 | 0.270 | 0.255 | 0.197 | 0.166 | 0.255 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of hh head and spouse, age and age squared of hh head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in columns (1) - (3) is log of daily cereal consumption per capita, dependent variable in columns (4)-(6) is log of daily caloric intake per capita. 4. The rice favoring states are: Andhra Pradesh, Assam, Karnataka, Kerela, Orissa, Jharkhand, Chattisgarh and West Bengal. The non-rice favoring states are: Bihar, Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Punjab, Rajasthan and Uttar Pradesh.

Back

# Impact of the Wheat Subsidy

| Dependent variable: | Log cereal consumption (1) | Log caloric intake (2) |
|---|---|---|
| Log rice subsidy per capita | 0.138*** | 0.156*** |
| | (0.0110) | (0.0125) |
| Log wheat subsidy per capita | 0.0172*** | 0.0270*** |
| | (0.00549) | (0.00519) |
| Observations | 12235 | 12235 |
| Adjusted $R^2$ | 0.275 | 0.193 |

Standard errors in parentheses. * $p < 0.10$, **$p < 0.05$, ** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of hh head and spouse, age and age squared of hh head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in column (1) is log of daily cereal consumption per capita, dependent variable in column is log of daily caloric intake per capita.

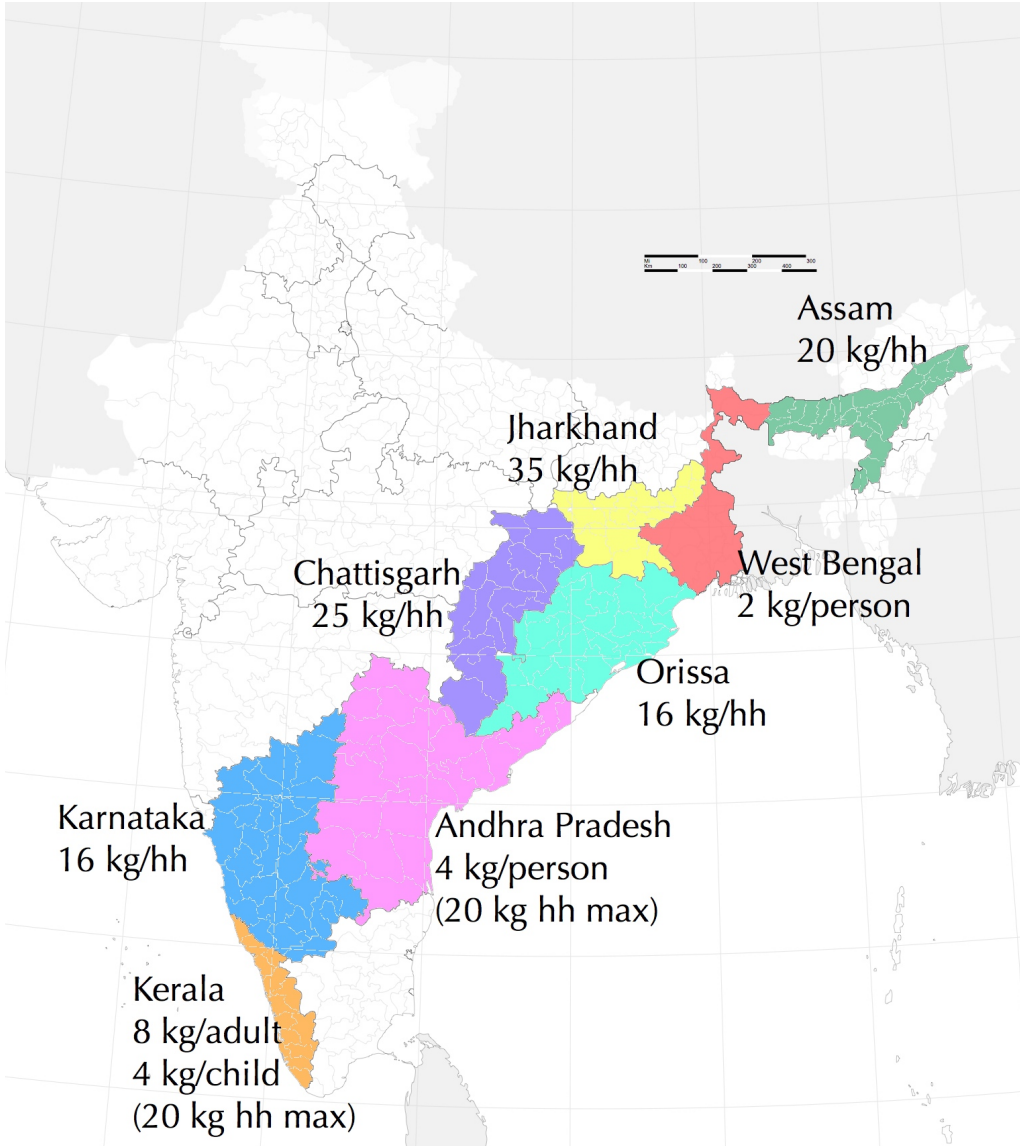
Back

# PDS Rice users: IHDS and NSSO

| Data: | IHDS | NSSO |
|---|---|---|
| Monthly expenditure per capita | 625.1 | 596.7 |
| | (442.2) | (362.4) |
| Monthly income per capita (Rs) | 587.5 | |
| | (567.3) | |
| PDS rice price (Rs/kg) | 4.546 | 5.237 |
| | (1.612) | (1.627) |
| Market rice price (Rs/kg) | 10.48 | 10.56 |
| | (1.906) | (2.122) |
| PDS rice qty (kg) | 19.16 | 18.54 |
| | (7.253) | (8.785) |
| Market rice qty (kg) | 24.52 | 27.97 |
| | (23.03) | (21.37) |
| Daily cereal consumption per capita (kg) | 0.434 | 0.475 |
| | (0.158) | (0.129) |
| Rice subsidy per capita (Rs) | 25.46 | 24.17 |
| | (11.18) | (11.37) |
| Observations | 3962 | 4255 |

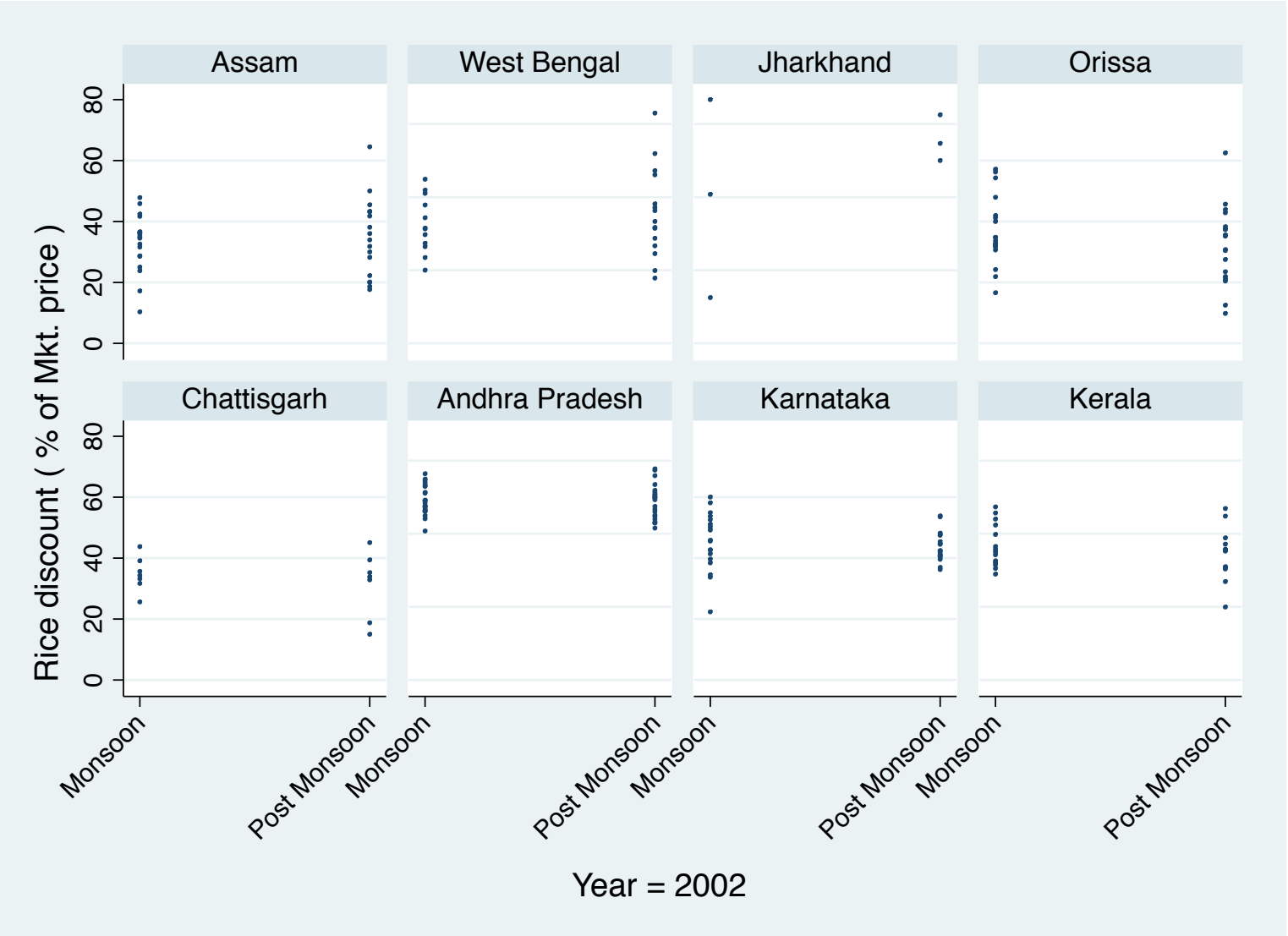
Back

# Variation in State Quotas

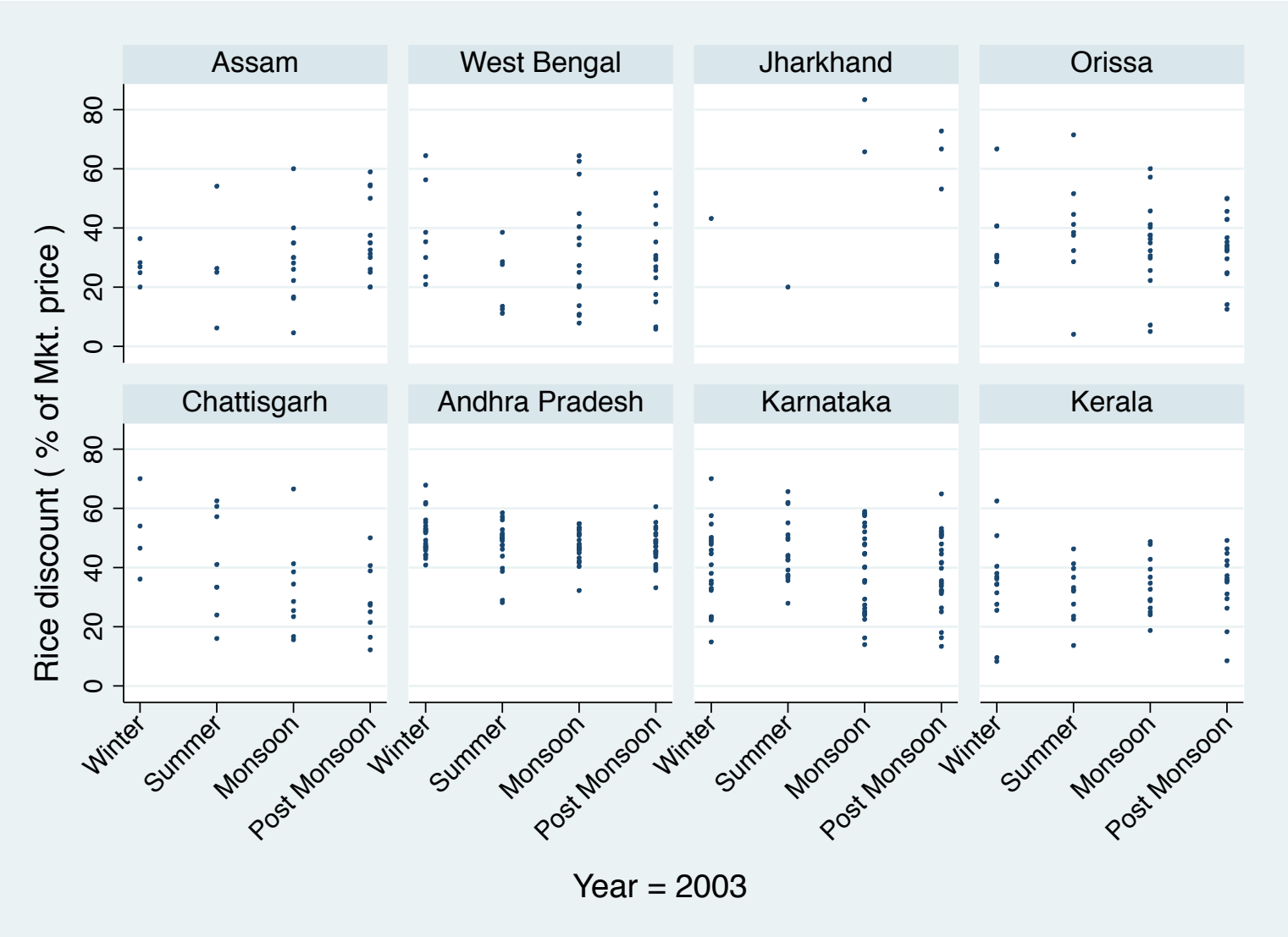



Back

# Variation in Rice Discount for 2002

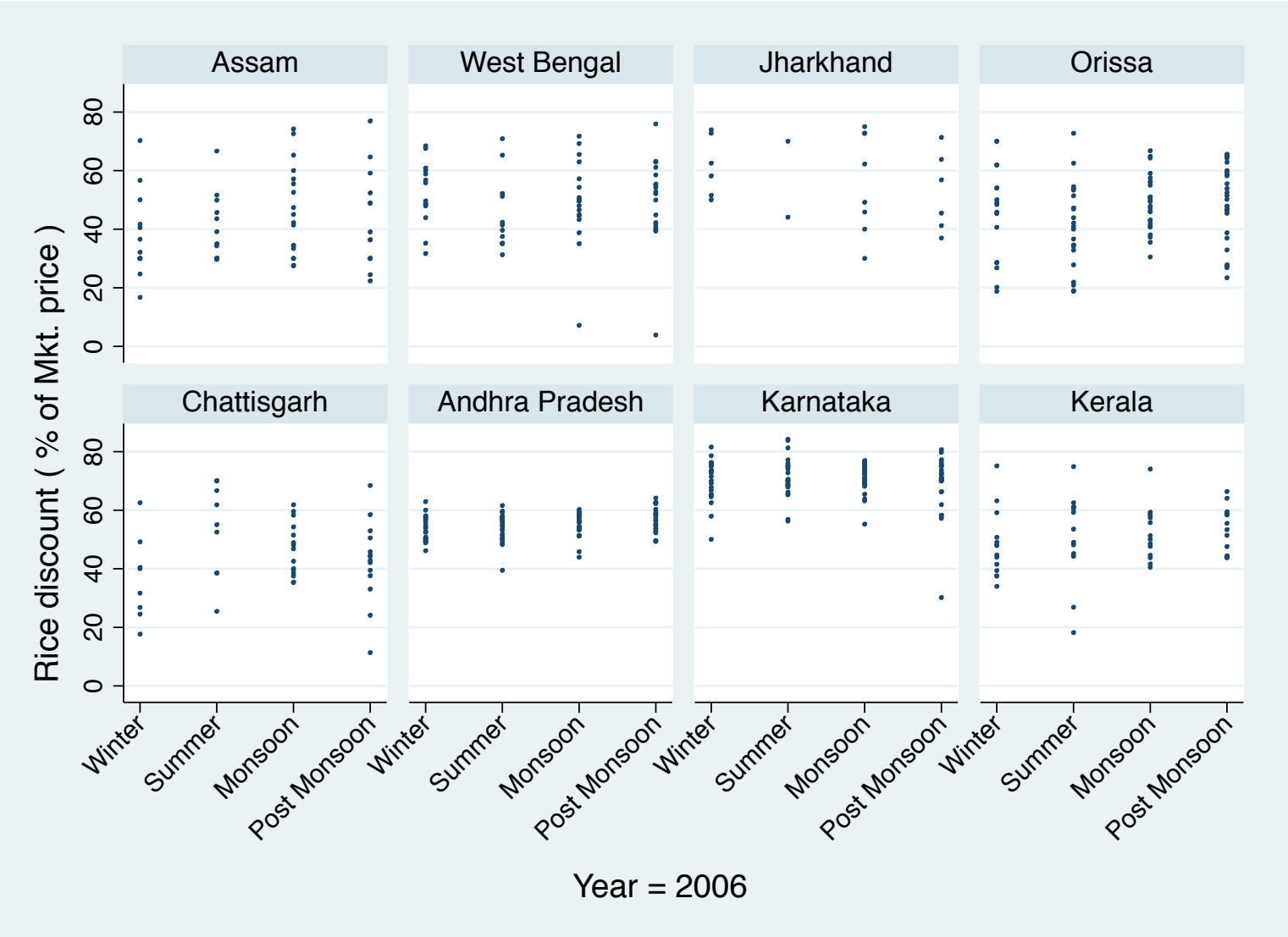


# Variation in Rice Discount for 2003

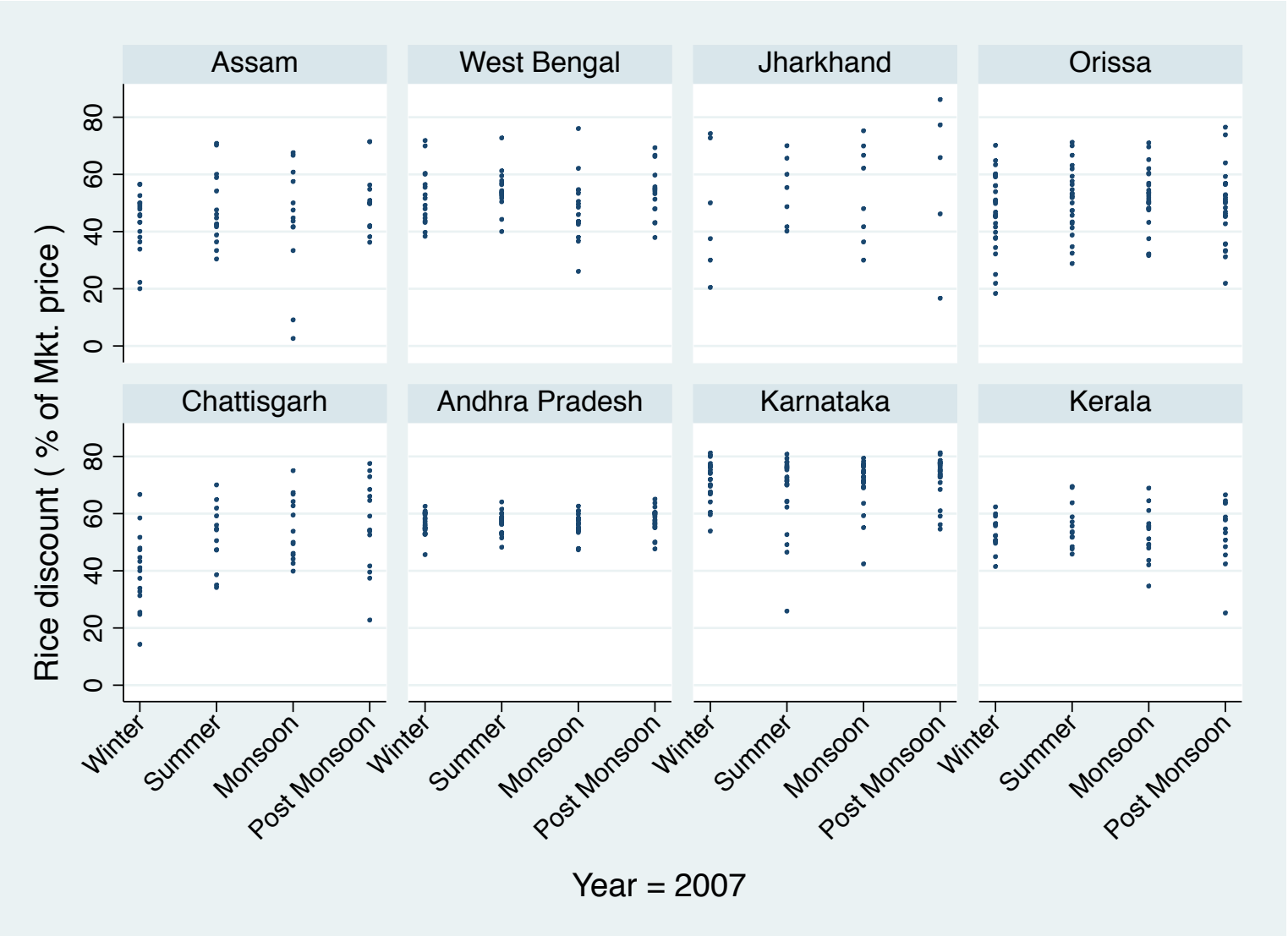


# Variation in Rice Discount for 2004

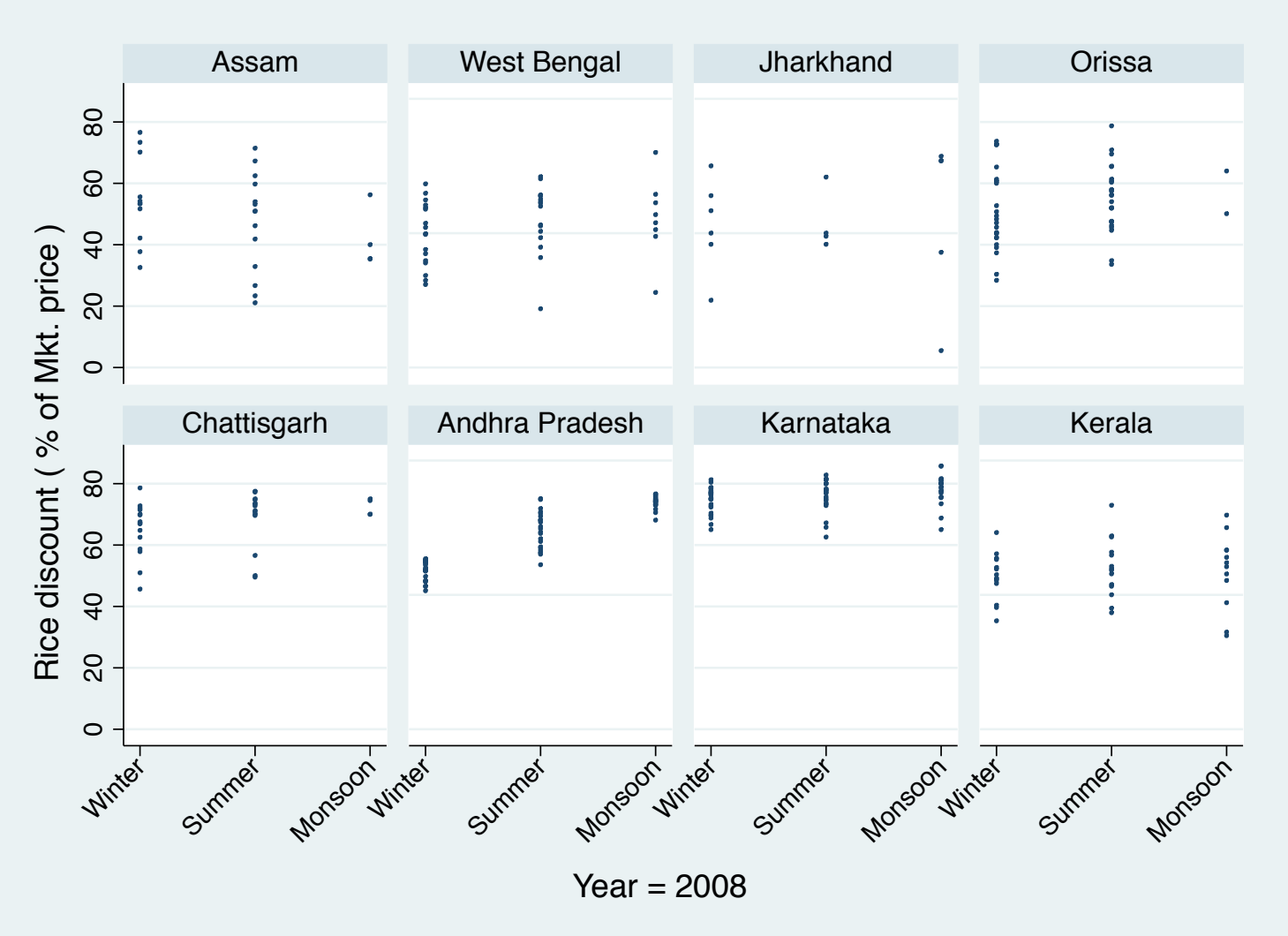
# Variation in Rice Discount for 2006



# Variation in Rice Discount for 2007



# Variation in Rice Discount for 2008




Rice Discount

# Identifying variation

**Remaining sources of variation, conditional on controls**

- Across district-season-year cell

  - market prices fluctuate due to random weather phenomenon, controls on the movement of goods, imperfectly integrated markets

  - PDS prices are not linked to market prices, resulting in variation in the discount

- Within a district-season-year cell

  - variation in per person quota by family size

Specification

# Heterogeneous effects

| Dependent variable: | Cereal consumption per capita | | | Caloric intake per capita | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Rice subsidy per capita | 1.979*** | 1.830*** | 1.960*** | 12.41*** | 11.55*** | 12.28*** |
| | (0.172) | (0.173) | (0.159) | (1.214) | (1.309) | (1.142) |
| Urban*Rice subsidy | 0.240 | | | 0.772 | | |
| | (0.241) | | | (1.054) | | |
| Lowest expenditure quartile | | -52.27*** | | | -334.8*** | |
| | | (6.058) | | | (29.14) | |
| Lowest quartile*Rice subsidy | | -0.106 | | | -2.961** | |
| | | (0.205) | | | (1.169) | |
| Home grown rice | | | -15.73* | | | -41.21 |
| | | | (8.247) | | | (39.68) |
| Home grown*Rice subsidy | | | 1.300*** | | | 5.893*** |
| | | | (0.328) | | | (1.609) |
| Observations | 22564 | 22564 | 22564 | 22564 | 22564 | 22564 |
| Adjusted $R^2$ | 0.250 | 0.274 | 0.251 | 0.124 | 0.183 | 0.126 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, $p < 0.01$

Back

# Impact on rice producers

| Dependent variable: | Cereal consumption | Caloric intake |
|---|---|---|
| | (1) | (2) |
| Rice quota per capita | -14.15 | -38.18 |
| | (18.56) | (84.41) |
| Market price* quota per capita | 4.483** | 19.52** |
| | (1.792) | (7.896) |
| PDS price* quota per capita | -0.989 | -5.916 |
| | (1.976) | (8.667) |
| PDS price | 3.226 | 38.62 |
| | (10.98) | (49.72) |
| Market price | -17.15* | -52.60 |
| | (8.760) | (40.03) |
| Observations | 2111 | 2111 |
| Adjusted $R^2$ | 0.231 | 0.241 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back

# Impact by expenditure quartile

**Panel A: Cereal consumption**

| Dependent variable: | Log cereal consumption per capita | | | |
|---|---|---|---|---|
| Expenditure quartile: | Lowest | | | Highest |
| | (1) | (2) | (3) | (4) |
| Log rice subsidy per capita | 0.0689*** | 0.0895*** | 0.109*** | 0.175*** |
| | (0.0138) | (0.0147) | (0.0137) | (0.0180) |
| Observations | 5677 | 5709 | 5696 | 5482 |
| Adjusted $R^2$ | 0.320 | 0.362 | 0.330 | 0.272 |

**Panel B: Caloric Intake**

| Dependent variable: | Log caloric intake per capita | | | |
|---|---|---|---|---|
| Expenditure quartile: | Lowest | | | Highest |
| Log rice subsidy per capita | 0.0682*** | 0.0933*** | 0.111*** | 0.196*** |
| | (0.0135) | (0.0132) | (0.0129) | (0.0182) |
| Observations | 5677 | 5709 | 5696 | 5482 |
| Adjusted $R^2$ | 0.251 | 0.294 | 0.279 | 0.177 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Back