A Quantile Regression Analysis of Socio-Economic Determinants of Household Food Security in India

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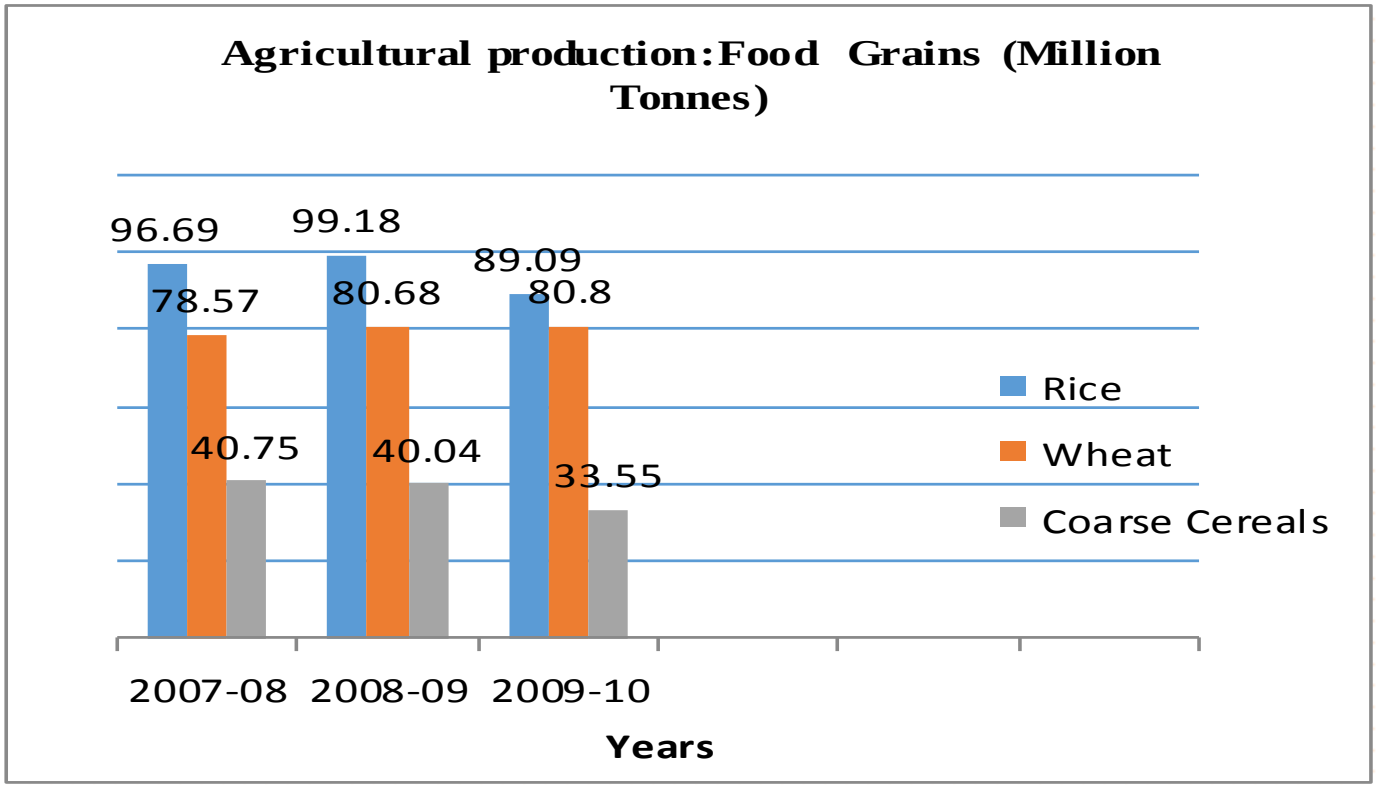
Introduction

- Food Security: Availability, Accessibility, and Utilisation.
- Recent anomaly: Global food price, domestic food price since 2007, and Drought in Indian States.
- Consequence: About 115 million people have added into hunger
- Over one-third of world's wasted and forty-three percent under-five children are underweight in India



- Calorie consumption puzzle: Per-capita calorie intake has been declining (NSS), Substantial increase in total households Monthly Per-capita Expenditure(NSS).
- Possible Explanation: Food budget squeeze, rise in relative food price, dietary diversification, choice of luxuries goods over food items, demographic characteristics, worsening of economic condition of small landholders in rural.
- Per-capita Per-day availability of cereals and pulses have increased from 416.2 grams in 2001 to 453.6 grams in 2011.
- Achievement of Public Distribution System, Integrated Child Development Services, Mid-Day meals to school children.
- Understanding primary determinates are important because it will help policy maker to identify which determinates are playing a significant role in food security.

Hypothesis

- **Hypothesis 1**

- a) Monthly per-capita expenditure, (b) cereal and non-cereal price ratio, (c) share of medical expenditure, (d) share of education expenditure, and (f) diet diversification will adversely and (e) land per-capita will positively affect household food security.

- **Hypothesis 2**

- The greater of MPCE lower will be household food security along different distribution.

Findings

- Share of medical expenditure and share of education expenditure are important determinants of food in-security.

- MPCE has positive effect on household food security for different quantile in India.

Data

- **Data used:** NSS (2004 (61st), 2009(66th) and 2012 (68th))

- **Dependent variable**

$$C_i = \frac{1}{N_i}\left(\sum_{j=1}^{m} R_j X_{ji} + 500 * N_{6i} + 450 * N_{pi} + 700 * N_{up} + 1200 * N_{others}\right) - - - eq(1)$$

C_i Per-capita calorie, N_i Household size, R_j Per-unit calorie of jth commodity, X_{ji} Quantity of *jth* commodity for *ith* household, N_{6i} is number meals consumed by children below six years , N_{pi} is the number meals consumed by children below primary, and N_{up} is the number meals consumed by children in upper primary school, N_{others} is the number of meals consumed from out of home either on free or payment basis.

Covariates

- **Social:** Household Size, square of household size, household head age, square of household head age, Child dependency, caste, religion, schooling of household head, male-female household head, household with/without regular salary, **household with/without ration card.**
- **Economic: Cereal and non-cereal price ratio, diversification index, share of medical expenditure, share of education expenditure, land per capita,** livelihood of households, national occupation and industrial classification, and source of cooking energy.

Descriptive Statistics

Table 1 Summary statistics of dependent variable

VARIABLES	2004-05	2009-10	2011-12	2004-12
Log Per-capita calorie intake	7.63	7.53	7.57	7.58
	(.332)	(.522)	(.468)	(.442)
Skewness	-1.06	-6.55	-6.62	-6.02
Kutosis	30.77	71.76	81.54	79.96
Jerque-Bera (JB) χ^2 statics	50472.60***	122765.43***	125581.05***	384504.20***

Mean values are un-weight and standard errors in parentheses

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

Table 2 Covariates used in analysis by years: Means, Standard deviations

VARIABLES	2004-05	2009-10	2011-12	2004-2012
Log MPCE	6.56	7.10	7.40	6.99
	(0.0017)	(0.0019)	(0.0019)	(0.0012)
Log Per-capita Durable	3.81	0.811	1.18	2.07
	(0.0070)	(0.0045)	(0.0049)	(0.0041)
Dummy Commercial Cooking Sources(%)				
Cereal and Non-Cereal Price Ratio	0.24	0.018	0.017	0.10
	(0.0967)	(0.00019)	(.00027)	(0.0368)
Share of Medical Expenditure	20.87	0.188	21.66	14.74
	(0.125)	(0.0012)	(0.1288)	(0.064)
Share of Education Expenditure	14.48	0.15	16.17	10.59
	(0.091)	(0.0010)	(0.1079)	(0.049)
Diversification Index	0.646	0.877	0.873	0.788
	(0.00035)	(0.00039)	(.0003)	(.00028)
Land Per-Capita	0.185	0.137	0.130	0.153
	(0.018)	(0.0013)	(0.0012)	(0.0071)
Dummy household without ration card(%)	23.46	32.36	20.38	25.25

Mean values are un-weight and standard errors in parentheses

Estimation technique

- OLS and quantile regression (QR)
- Possibility of endogeneity
- Bootstrapped method has used for standard error.

Control function

$$y_i = x_i'\beta_1 + x_j'\beta_2 + u_1$$

$$x_i = x_j'\pi_2 + v_2$$

y_i, is log per-capita calorie intake. x_i, is endogenous variable MPCE. x_j, is exogenous sub-vector of socio-economic variable including constant and satisfy $E(x_j, u_1) = 0$. Similar to the 2SLS, reduced form for x_i (i.e. linear projection with all exogenous covariates) is

$$y_i = x_i'\beta_1 + x_j'\beta_2 + \rho_1 v_2 + e_1$$

The OLS or quantile estimates from above equation are control function estimates.

Figure 1Percent of household using commercial source of energy for cooking

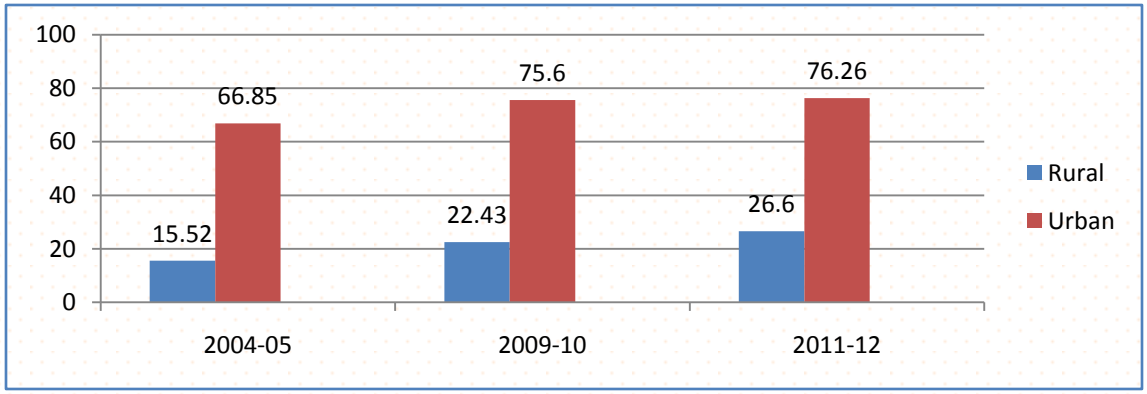


Figure 1 Percentage composition of durable goods (URP)

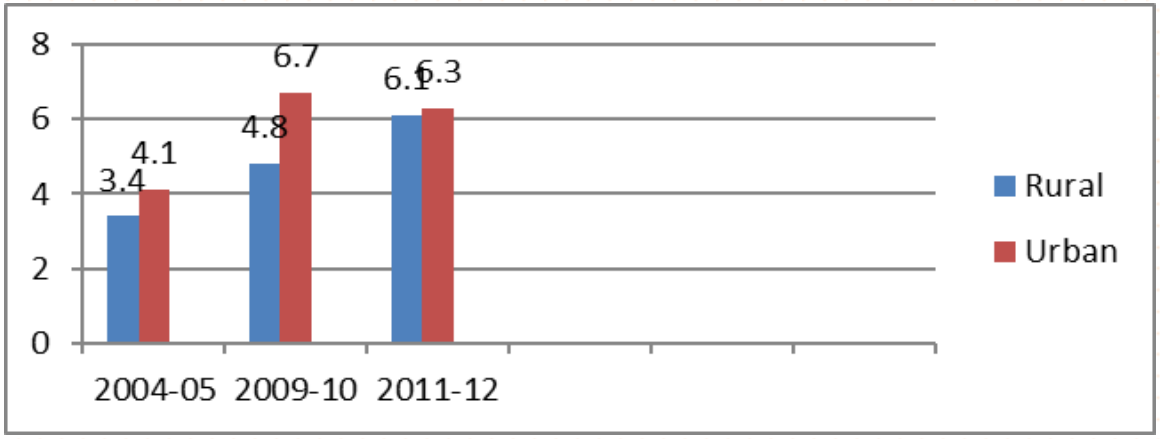


Table 3 Results of First Stage Regression (Rural)

VARIABLES	OLS	Q(05)	Q(25)	Q(50)	Q(75)
Log Per-capita Durable	.0873***	.1002***	.0847***	.0790***	.0781***
	(.0006642)	(.0011957)	(.0009641)	(.0008033)	(.0008273)
Dummy Commercial Cooking Sources	.2424***	.2130***	.2155***	.2274***	.2454***
	(.0019374)	(.0039072)	(.002354)	(.0019807)	(.0030772)
Cereal and Non-Cereal Price Ratio	-.0000436	-.0001086	-.0001909	.0000163	-.0000253
	(.0467256)	(.2344559)	(.4234055)	(.4955243)	(.2471199)
Share of Medical Expenditure	.0013***	.0009***	.0012***	.0014***	.0017***
	(.0000303)	(.0000457)	(.0000364)	(.00003)	(.0000409)
Share of Education Expenditure	.0011***	.0008***	.0011***	.0012***	.0013***
	(.0000415)	(.0000522)	(.0000429)	(.0000463)	(.0000521)
Diversification Index	-.0783***	.3622***	.1439***	-.0225295	-.1928***
	(.0152801)	(.0231584)	(.0203389)	(.019461)	(.0198606)
Land Per-Capita	.0007825	.0001665	.0210188	.0691*	.1048***
	(.0158584)	(.0150681)	(.0299504)	(.0391877)	(.0217269)
Dummy household without ration card	-.0287***	-.0377***	-.0323***	-.0277***	-.0221***
	(.0020045)	(.0035862)	(.0025259)	(.0025236)	(.0028613)
dum_2012	1.011***	.9496***	.9671***	.9807***	1.007***
	(.00478)	(.0072737)	(.004967)	(.0053105)	(.0054782)
dum_2010	.8176***	.7549***	.7637***	.7826***	.8168***
	(.0053688)	(.0078128)	(.0055938)	(.0052422)	(.0059543)
Constant	6.179***	5.089***	5.708***	6.168***	6.586***
	(.0148106)	(.0306662)	(.0272612)	(.0288079)	(.0230675)
R-squared	0.7049	0.4483	0.4746	0.4792	0.4753

Standard errors in parentheses

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

Table 4 First Stage Regression (Urban)

VARIABLES	OLS	Q(05)	Q(25)	Q(50)	Q(75)
Log Per-capita Durable	.1048***	.1299***	.1128***	.1023***	.0966***
	(.0005909)	(.0009027)	(.0007669)	(.0005935)	(.0009105)
Dummy Commercial Cooking Sources	.2532***	.2292***	.2461***	.2527***	.2493***
	(.0025369)	(.0047111)	(.0063311)	(.0025636)	(.0022665)
Cereal and Non-Cereal Price Ratio	-.00014**	.00035***	-.0000255	-.0001667	-.00026**
	(.0000576)	(.0000578)	(.0000683)	(.0001502)	(.0001333)
Share of Medical Expenditure	.00146***	.00112***	.0013***	.0014***	.0015***
	(.0000524)	(.0000845)	(.0000736)	(.0000706)	(.0000395)
Share of Education Expenditure	.00139***	.00101***	.00139***	.00149***	.00159***
	(.0000607)	(.0000468)	(.0000601)	(.0000478)	(.000072)
Diversification Index	-.51649***	-.0076472	-.35205***	-.55181***	-.71038***
	(.0163247)	(.0407803)	(.0294977)	(.0175526)	(.0175956)
Land Per-Capita	.0117064	.0077741	.059202	.08701**	.11869***
	(.055846)	(.0500014)	(.041725)	(.0393547)	(.0330572)
Dummy household without ration card	-.01208***	-.03762***	-.02533***	-.01515***	-.00858*
	(.001765)	(.0049681)	(.0028987)	(.0024843)	(.0045921)
dum_2012	1.105***	1.113***	1.116***	1.105***	1.097***
	(.0061042)	(.0136911)	(.0065859)	(.0035531)	(.0058446)
dum_2010	.9260***	.9059***	.9421***	.9397***	.9373***
	(.0060278)	(.0128106)	(.0079489)	(.0042374)	(.0056702)
Constant	7.069***	5.685***	6.535***	7.087***	7.600***
	(.0151776)	(.0340905)	(.0311649)	(.0193928)	(.0265341)
R-squared	0.6901	0.4142	0.4598	0.4699	0.4658

Standard errors in parentheses

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

Table 5 Results of Reduced Form Regression (Rural)

VARIABLES	OLS	Q(05)	Q(25)	Q(50)	Q(75)
Log MPCE	.2277***	.2038***	.2121***	.2187***	.2263***
	(.0024783)	(.006046)	(.0027723)	(.003542)	(.0023607)
Cereal and Non-Cereal Price Ratio	.0000241	.0000581	-.0000147	-0.00001	.0000587
	(.0031803)	(.4600751)	(.0295957)	(.0000429)	(.0000485)
Share of Medical Expenditure	-.0003***	-.0006***	-.0004***	-.0003***	-.00013***
	(.000013)	(.0000302)	(.0000163)	(.0000172)	(.0000122)
Share of Education Expenditure	-.0001***	-.000052	-.00009***	-.00008***	-.00007**
	(.0000201)	(.0000327)	(.0000155)	(.0000195)	(.0000307)
Diversification Index	.3357***	.7075***	.2006***	.0907***	.0030496
	(.0216981)	(.0303642)	(.0111101)	(.005903)	(.0076758)
Land Per-Capita	.0002965	0.000003	.0026811	.0104179	.0250***
	(.0040551)	(.0004261)	(.0033413)	(.0028226)	(.00711)
Dummy household without ration card	-.0103***	-.0151***	-.0061***	-.0052***	-.0037***
	(.0016054)	(.0025312)	(.0010939)	(.0009935)	(.0012759)
dum_2012	-.3088***	-.3425***	-.2446***	-.2280***	-.2212***
	(.0072795)	(.009673)	(.0023747)	(.0030126)	(.0035193)
dum_2010	-.2660***	-.3296***	-.2170***	-.1918***	-.1761***
	(.0068577)	(.0083588)	(.0016208)	(.0034652)	(.0026929)
Error	.1337***	.1036***	.1324***	.1473***	.1621***
	(.0024772)	(.0078268)	(.0031444)	(.0035102)	(.0038481)
Constant	5.872***	5.147***	5.848***	6.151***	6.412***
	(.0318086)	(.0442127)	(.014889)	(.0288043)	(.0151204)
R-squared	0.4005	0.2387	0.2735	0.2865	0.3039

Standard errors in parentheses

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

Table 6 Results of Reduced Form Regression (Urban)

VARIABLES	OLS	Q(05)	Q(25)	Q(50)	Q(75)
Log MPCE	.2338***	.2702***	.2325***	.2075***	.1944***
	(.0024221)	(.0058255)	(.0033832)	(.003113)	(.003411)
Cereal and Non-Cereal Price Ratio	.00061***	.00137***	.00052***	.00025***	.00013**
	(.0000448)	(.0001855)	(.0000828)	(.0000632)	(.0000636)
Share of Medical Expenditure	-.00026***	-.00039***	-.00041***	-.00033***	-.00017***
	(.0000217)	(.0000281)	(.0000322)	(.0000289)	(.00002)
Share of Education Expenditure	-.00013***	-.00011**	-.00021***	-.00020***	-.00019***
	(.0000199)	(.0000423)	(.0000315)	(.0000279)	(.0000399)
Diversification Index	1.168***	3.133***	.80178***	.20132***	.02593**
	(.021216)	(.0619911)	(.0351795)	(.0134222)	(.0116786)
Land Per-Capita	.0035006	.0020155	.0088909	.03193**	.06129***
	(.0245474)	(.009282)	(.0182593)	(.0148142)	(.0099848)
Dummy household without ration card	-.0150***	-.0244***	-.0071***	-.0047***	-.0006***
	(.0022822)	(.004616)	(.0018115)	(.0013554)	(.0011065)
dum_2012	-.5534***	-.8361***	-.3884***	-.2431***	-.2002***
	(.0062219)	(.0084784)	(.006674)	(.0045124)	(.003505)
dum_2010	-.4777***	-.7872***	-.3571***	-.2140***	-.1664***
	(.0048369)	(.0105547)	(.0087146)	(.0040734)	(.0039103)
Error	.0339***	-.0137***	.0142***	.0525***	.0805***
	(.0041729)	(.0090628)	(.0029566)	(.0027406)	(.0044562)
Constant	5.142***	2.712***	5.195***	6.084***	6.553***
	(.0315678)	(.0438092)	(.0363573)	(.0240019)	(.0364224)
R-squared	0.2922	0.3007	0.2265	0.2515	0.2781

Standard errors in parentheses

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

Conclusion

- Share of medical and education expenditure have adversely impact on calorie intake.
- Relative price does not have significant adverse effect on calorie intake.
- Diversification from cereal to non-cereal items have no role of declining calorie intake and rejects the hypothesis of food habit transformation declines calorie intake; however, only highest quantile Q (95) supports.
- Targeted public distribution system was launched in June 1997, of course, it has a long history, to enhance food security in India. Despite several criticism and leakages in PDS, our results suggested that households having ration card are more food secure than their counterpart. Therefore, shifting to direct cash-transfer from PDS may not a desirable policy option for India.

Thank You