Demand for Nutrients in India, 1993–2004

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26 July, 2010

Acknowledgments

This study was funded by the British Government, under the Foresight Global Food and Farming Futures Project. Gaiha would like to thank Bish Sanyal for inviting him to MIT where the first draft was completed. It has benefited from the advice of Lawrence Haddad, Anil Deolalikar and Katsushi Imai. The econometric analysis was carried out competently by Raj Bhatia. We alone, however, are responsible for the views expressed here.

Abstract

In response to the Deaton–Dreze (2009) explanation of a downward shift in the calorie Engel curve in terms of lower requirements due to health improvements and lower activity levels**,** we have developed an alternative explanation of changes in the consumption of calories, protein and fats over the period 1993–2004. This explanation is embedded in a standard demand theory framework, with food prices and expenditure (as a proxy for income) cast in a pivotal role. Based on different experiments, robust demand functions are estimated for each of three nutrients viz. calories, protein and fats, separately for rural and urban areas. Our results show consistently robust food price and expenditure effects. Besides, shifts in food price elasticities over time are captured. Over and above these effects, there are shifts in demands due to factors other than those specified in the demand equation. In the context of calories, for example, it is plausible that part of the reduction in their consumption was due to health improvements and less strenuous activity levels — especially but not necessarily confined to rural areas. So, while the Deaton–Dreze (2009) explanation is not rejected, it is arguable that it is complementary to the demand-based explanations

Key words: Nutrients, Prices, Expenditure, .Demand, Rural, Urban, India.

JEL Codes: C21, D12, I 31, I 32.

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I. Introduction

Various studies point to a puzzle. In India despite rising incomes, there has been a sustained decline in per capita calorie intake. In an important contribution, Deaton and Dreze (2009) offer a detailed analysis of the decline in calorie intake over the period 1983 to 2004. Their principal findings are summarised below.

Average calorie consumption was about 10 per cent lower in rural areas in 2004–05 than in 1983. The proportionate decline was larger among the more affluent sections of the population, and about 0 for the bottom quartile of the per capita expenditure scale. In urban areas, there was a slight change in average calorie intake over this period.

The decline of per capita consumption is not confined to calories. It also applies to proteins and other nutrients, with the exception of fats whose consumption has increased in both rural and urban areas over this period.

As incomes rose over this period, these declines are puzzling. A more contentious view offered by Deaton and Dreze (2009) is that the latter are not attributable to changes in relative prices as an aggregate measure of the price of food — treated synonymous with the price of calories — changed little during the period in question. So the puzzle is essentially this: per capita calorie consumption is lower at a given level of per capita household expenditure, across the expenditure scale, at low levels of per capita expenditure as well as high. In other words, there is a steady downward *shift* of the calorie Engel curve.

Deaton and Dreze (2009) are emphatic that the downward shift of the calorie Engel curve is due to lower calorie requirements, associated mainly with better health and lower activity levels. As the evidence offered is fragmentary and patchy, this explanation is largely conjectural.

The present study seeks to throw more light on the decline in calorie and other nutrients' intakes and the explanations offered but over a shorter period (i.e. 1993–2004). Specifically, we will first examine the changes in the pattern of food consumption and intake of calories, proteins and fats over this period. Next, an attempt will be made to examine whether the

Deaton–Dreze (2009) rejection of the role of relative prices is justified. The analysis is based on unit record data collected for the 50th and 61st rounds of the NSS (corresponding to the years 1993–94 and 2004–05, respectively). It thus builds on an earlier study where the demands for calories and other nutrients were estimated using *state* level data. As the results for urban India were uneven, use of unit record data is likely to yield more robust results.

II. Specification of Demand

In an earlier analysis (Gaiha et al. 2010), demand equations for calories, proteins and fats were estimated using *state* level data for 1993 and 2004. As the number of observations was small, and the results for urban India were uneven, we aim to build on it using unit record data for rural and urban India. We expect the results to be more robust.

A basic demand equation for nutrients (calories, protein, fat) in rural and urban India with pooled data for 1993 and 2004 is given below:

$$\ln C_{it} = \alpha + \ln \mathbf{P_{jt}}\boldsymbol{\beta} + \kappa \ln E_{it} + \mathbf{X}_{it}\boldsymbol{\gamma} + \lambda D_t + \varepsilon_{it} \ldots.(1)$$

where the dependent variable is log of nutrient consumed by ith household in time t, ln P_{jt} is a vector of log of food prices computed from the NSS at the village level (j) and time t, ln E_{it} is the predicted log household per capita expenditure[1] for ith household in time t, X_{it} is a vector of household characteristics some of which are in logs (number of adult males, females, household size) others as dummy variables (caste), D_t is a dummay variable that takes the value 1 for 2004 and 0 otherwise (to allow for changes in factors other than food prices and expenditure over time), and ε_{it} is the error term. This equation is estimated using robust regression. Although a Chow test for a structural shift is not feasible with robust regression, we have employed two refinements: one is the use of a time dummy that could potentially capture the health improvements and less strenuous activity patterns (associated with easier access to drinking water, better transportation facilities); and the other is interactions of food price variables with the time dummy to allow for different price effects over time.

An important point to bear in mind is that the price effects capture both own and cross-price effects through substitutions between food commodities. Briefly, as prices change, demands for commodities change and consequently calorie (and other nutrients') intakes.

[1] The predicted expenditure is determined by household characteristics (number of adult males and females, gender of household head, highest educational attainments of adult males and females, land owned, household type (whether it is self-employed in non-agriculture, self-employed in agriculture, agricultural labour). Details will be furnished on request.

Underlying this (and other similar demand relations for protein and fats) is a presumption that food choices are informed by their nutritional content. As Deaton and Dreze (2009) emphasise, people do not buy calories and other nutrients but food commodities. However, if food choices are informed by their nutritional values, it is meaningful to talk about demands for calories and other nutrients.[2]

III. Results

We will first discuss the separate results for rural and urban samples for 1993 and 2004, and then the pooled results for the aggregate rural and urban samples.

(a) Rural India

The results for rural India are given in Tables 1–3.

Calories

Let us first consider the results on the demand for calories in rural India in 1993, as given in Table 1. The main findings are:[3]

- Cereal price (or rice and wheat) is negatively related to the demand for calories while the coefficient of inferior cereals (comprising jowar, barley, bajra, millets, ragi and other cereals) is not significant.
- Other food prices that reduce calorie demand are those of Vanaspati-oil and vegetables.
- Food prices that are positively associated with calorie demand are those of milk/milk products/ghee/butter, sugar, eggs, pulses/nuts-dry fruits/others.
- As these coefficients are elasticities, they are comparable. Cereal prices have a moderately negative elasticity while sugar has a moderately positive elasticity. Other (absolute values of) elasticities are relatively small.
- Per capita expenditure (as a proxy for income) has a significant positive effect on calories demand, with a high elasticity.
- Household size and composition matter too. The larger the number of adult males and females, the greater is the calorie demand. Controlling for the number of adults, variation in household size reflects variation in number of children. So it is not surprising that the coefficient of household size has a significant negative effect on calorie demand.

[2] See, for example, Pitt (1983), Pitt and Rosenzweig (1985), and Behrman and Deolalikar (1988).
[3] To avoid tedious exposition, commodities refer to their prices throughout the analysis. Some times food prices are explicitly but more often just the commodities whose prices are commented upon.

- Both SC and Others (as a residual caste group) demand more calories than the omitted group of STs.
- Education level matters too. Other things being equal, households in which adult males and females have more than middle level of schooling demand fewer calories than those with lower educational attainments.
- The overall specification is validated by the F-test.

Table 1
Demand for Calories, Rural India, 1993

Robust regression — Number of obs = 16202; F(18, 16183) = 293.07; Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.1652321	0.0131952	-12.52	0.0000
Log prices — Inferior Cereals	0.0014687	0.0021512	0.68	0.4950
Log prices — Milk&Products/Ghee–Butter	0.0266835	0.0048602	5.49	0.0000
Log prices — Vanaspati-oil	-0.0979686	0.0215744	-4.54	0.0000
Log prices — Sugar	0.1319362	0.0160303	8.23	0.0000
Log prices — Eggs	0.0305445	0.0053761	5.68	0.0000
Log prices — Meat/Fish/Poultry	-0.0079984	0.0053976	-1.48	0.1380
Log prices — Pulses/Nuts-DryFruits/others	0.0129751	0.0024551	5.28	0.0000
Log prices — Fruits	0.0000103	0.0038496	0.00	0.9980
Log prices — Vegetables	-0.0868638	0.0073441	-11.83	0.0000
Log Per capita Expenditure (mpce) predicted	0.4304871	0.0132968	32.38	0.0000
Highest Education — Male (1=above middle)	-0.0204151	0.0065786	-3.10	0.0020
Highest Education — Female (1=above middle)	-6.80E-02	0.008152	-8.34	0.0000
Caste – SC	1.68E-02	0.0076516	2.20	0.0280
Caste – Other	0.0218202	0.0066858	3.26	0.0010
Log Number of adult males	7.83E-02	0.0054176	14.46	0.0000
Log Number of adult females	5.58E-02	0.0057828	9.64	0.0000
Log Household size	-1.36E-01	0.0085467	-15.87	0.0000
_cons	5.70E+00	0.1120746	50.83	0.0000
Omitted Caste: ST				

Briefly, as expected, the estimated demand for calories is influenced by food prices and expenditure (as a proxy for income) — especially the latter — conditioned on household characteristics (including numbers of adults and children, educational attainments of the former, and caste affiliations).

Table 2
Demand for Calories, Rural India, 2004

Robust regression

Number of obs = 18169
F(18, 18150) = 333.46
Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	0.0349949	0.0097342	3.60	0.0000
Log prices — Inferior Cereals	0.0050256	0.0042604	1.18	0.2380
Log prices — Milk-&-Products/ GheeButter	-0.0146751	0.003472	-4.23	0.0000
Log prices — Vanaspati-oil	0.1922367	0.0160925	11.95	0.0000
Log prices — Sugar	0.1014481	0.0141132	7.19	0.0000
Log prices — Eggs	0.0818994	0.0077453	10.57	0.0000
Log prices — Meat/Fish/Poultry	0.009177	0.0050296	1.82	0.0680
Log prices — Pulses/Nuts-DryFruits/others	0.0374158	0.0027607	13.55	0.0000
Log prices — Fruits	-0.0319091	0.0036671	-8.70	0.0000
Log prices — Vegetables	-0.1248807	0.0069474	-17.98	0.0000
Log Per capita Expenditure (mpce) predicted	0.3537156	0.0103559	34.16	0.0000
Highest Education — Male (1=above middle)	-0.0296772	0.0053536	-5.54	0.0000
Highest Education — Female (1=above middle)	-5.83E-02	0.0069239	-8.42	0.0000
Caste — SC	2.41E-02	0.0063219	3.81	0.0000
Caste — Other	0.0293078	0.0051777	5.66	0.0000
Log Number of adult males	5.44E-02	0.0044848	12.14	0.0000
Log Number of adult females	1.98E-02	0.005014	3.96	0.0000
Log Household size	-1.17E-01	0.0069097	-16.99	0.0000
_cons	4.34E+00	0.0977241	44.43	0.0000
Omitted Caste: ST				

There are some striking differences between the results for 1993 and 2004.

- As far as food prices are concerned, a notable difference is the significant but positive coefficient of cereals. However, its elasticity is small. The coefficient of milk/milk products/ghee/butter changes but from positive to negative. The (absolute) elasticity, however, remains low. Vanaspati-oil has a significant positive coefficient in 2004, as opposed to a negative one in 1993. However, the (absolute) elasticity is much larger in 2004. Sugar retains a significant negative coefficient but with a slightly lower value in 2004. Eggs also retain a significant positive coefficient but with a slightly larger value. Meat/fish/poultry have a significant positive coefficient but the value is small. Pulses/nuts-dry fruits/others retain a positive coefficient but the value remains low. Fruits have a significant negative coefficient in 2004 but did not possess a significant one in 1993. The value of the coefficient in 2004, however, is low. Vegetables retain a significant negative coefficient but with a slightly higher (absolute) value.

- Expenditure/income has a positive effect on calorie demand but with a slightly lower value.
- Household size and numbers of adult males and females possess similar coefficients in 2004, as also caste affiliations. Besides, educational attainments of adult males and females have similar effects on calorie demand, as in 1993.
- The overall specification is validated by the F-test.

Briefly, while the demand function for calories is validated by significant food price and expenditure/income effects, there are significant differences in these effects between 1993 and 2004, pointing to a likely shift in the demand function.

Let us look at the results from the pooled data in Table 3. While pooling has certain advantages — especially when there is panel data — a restriction is the equality of coefficients in different time periods. Our analysis of the two cross-sections for 1993 and 2004 suggests significant changes in food price and expenditure elasticities over this period, implying a (likely) shift in the demand function for calories. Accordingly, we experiment with a time dummy that acts as a shift variable and allows us to examine whether there were other changes over time (e.g. health improvements and less strenuous activity patterns) that impacted on calorie demand. This, however, is only a partial resolution of the shift in the demand function. A further refinement is therefore to check whether price elasticities changed over time by interacting the price variable with the time dummy. The results are reported in Table 4.

- The pooled results in Table 3 confirm significant food price effects — negative for cereals, and fruits and vegetables, and positive for inferior cereals, milk/milk products/ghee/butter, Vanaspati-oil, sugar, eggs, pulses/nuts-dry fruits/others.
- The expenditure/income effect on calorie demand is positive and large.
- Similar effects of household size and numbers of adult males and females, their educational attainments, and caste affiliations are obtained, as in the cross-section for 1993.
- Over and above these effects, the time dummy has a significant negative coefficient, with a large (absolute) value, confirming that factors such as health improvements and less strenuous activity patterns may have dampened calorie demand.

Table 3
Demand for Calories in Rural India, Pooled (1993–2004)

Robust regression — Number of obs = 34371; F(19, 34351) = 569.68; Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.0412959	0.0078263	-5.28	0.0000
Log prices — Inferior Cereals	0.0030913	0.0018331	1.69	0.0920
Log prices — Milk-&-Products/ Ghee-Butter	0.0069692	0.0028688	2.43	0.0150
Log prices — Vanaspati-oil	0.090809	0.0127184	7.14	0.0000
Log prices — Sugar	0.0990278	0.0103965	9.53	0.0000
Log prices — Eggs	0.0542478	0.0042553	12.75	0.0000
Log prices — Meat/Fish/Poultry	-0.0004683	0.0036659	-0.13	0.8980
Log prices — Pulses/Nuts-DryFruits/others	0.0243224	0.001774	13.71	0.0000
Log prices — Fruits	-0.0180249	0.0026342	-6.84	0.0000
Log prices — Vegetables	-0.1153165	0.0049589	-23.25	0.0000
Log Per capita Expenditure (mpce) predicted	0.4007834	0.0082916	48.34	0.0000
Time Dummy (0=1993, 1=2004)	-0.3658151	0.0097229	-37.62	0.0000
Highest Education — Male (1=above middle)	-2.83E-02	0.0042069	-6.72	0.0000
Highest Education — Female (1=above middle)	-6.66E-02	0.0053352	-12.49	0.0000
Caste — SC	0.0206074	0.0049208	4.19	0.0000
Caste — Other	2.61E-02	0.0041392	6.30	0.0000
Log Number of adult males	6.41E-02	0.003498	18.32	0.0000
Log Number of adult females	3.56E-02	0.0038286	9.30	0.0000
Log Household size	-1.16E-01	0.0054313	-21.36	0.0000
_cons	5.04E+00	0.0682872	73.81	0.0000
Omitted Caste: ST				

The results in Table 4 point to significant food price interactions with the dummy variable confirming shifts in price effects over time. The shifts are positive for cereals, Vanaspati-oil, eggs, meat/fish/poultry, pulses/nuts-dry fruits/others, and negative for milk/milk products/ghee and butter, sugar, fruits and vegetables. All other effects — especially the large positive effect of expenditure — remain intact. Over and above all these, the time dummy has a significant negative effect, much larger than in the cross-section for 1993. In fact, the dummy's coefficient is larger than any of the individual price and expenditure elasticities (in absolute value). There is thus by implication a confirmation of the Deaton-Dreze (2009) conjecture but without in any way diluting the demand story that we have constructed.

Table 4
Demand Function for Calories with Interactions in Rural India, Pooled (1993–2004)

Number of obs = 34371
Robust Regression F(29, 34341) = 390.62
Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Time Dummy (0=1993, 1=2004)	-1.7202030	0.1074764	-16.01	0.0000
Log prices — Rice & Wheat	-0.1643080	0.0122206	-13.45	0.0000
Time Dummy x Log prices — Rice & Wheat	0.1912146	0.0160706	11.90	0.0000
Log prices — Inferior Cereals	0.0014121	0.0019965	0.71	0.4790
Time Dummy x Log prices — Inferior Cereals	0.0040812	0.0049966	0.82	0.4140
Log prices — Milk-&-Products/ Ghee-Butter	0.0268269	0.0043931	6.11	0.0000
Time Dummy x Log prices — Milk-&-Products/ Ghee–Butter	-0.0415876	0.0056037	-7.42	0.0000
Log prices — Vanaspati-oil	-0.0974666	0.0199761	-4.88	0.0000
Time Dummy x Log prices — Vanaspati-oil	0.2853931	0.026419	10.80	0.0000
Log prices — Sugar	0.1345795	0.0148711	9.05	0.0000
Time Dummy x Log prices — Sugar	-0.0372944	0.0211966	-1.76	0.0790
Log prices — Eggs	0.0303439	0.0049822	6.09	0.0000
Time Dummy x Log prices — Eggs	0.0536936	0.0096437	5.57	0.0000
Log prices — Meat/Fish/Poultry	-0.0068966	0.0050049	-1.38	0.1680
Time Dummy x Log prices — Meat/Fish/Poultry	0.0145125	0.0073598	1.97	0.0490
Log prices — Pulses/Nuts-DryFruits/others	0.0129167	0.0022753	5.68	0.0000
Time Dummy x Log prices — Pulses/Nuts-DryFruits/others	0.0227518	0.0037374	6.09	0.0000
Log prices - Fruits	0.0027890	0.0035553	0.78	0.4330
Time Dummy x Log prices - Fruits	-0.0362391	0.0052745	-6.87	0.0000
Log prices - Vegetables	-0.0854007	0.0068099	-12.54	0.0000
Time Dummy x Log prices - Vegetables	-0.0413706	0.0100546	-4.11	0.0000
Log Per capita Expenditure (mpce) predicted	0.3878064	0.008267	46.91	0.0000
Highest Education - Male (1=above middle)	-0.0239072	0.0041859	-5.71	0.0000
Highest Education - Female (1=above middle)	-0.0622271	0.0053098	-11.72	0.0000
Caste – SC	0.0203524	0.004911	4.14	0.0000
Caste – Other	0.0264889	0.0041445	6.39	0.0000
Log Number of adult males	0.0652757	0.003479	18.76	0.0000
Log Number of adult females	0.0369016	0.0038056	9.70	0.0000
Log Household size	-0.1251275	0.0054197	-23.09	0.0000
_cons	5.9085940	0.0883373	66.89	0.0000
Omitted Caste: ST				

Protein

Table 5 contains the results on the demand function for protein in rural India in 1993. The main findings are:

- There are significant food price effects on protein demand — negative for cereals, Vanaspati-oil, meat/fish/poultry, fruits, and vegetables, and positive for milk/milk products/ghee/butter, sugar, eggs, and pulses/nuts-dry fruits/others.
- The (absolute) values of only two elasticities — cereals, and milk/milk products/ghee/butter — are high while others are small.

Table 5
Demand For Protein in Rural India, 1993

Robust regression

Number of obs = 16201
F(18, 16182) = 361.94
Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.4144874	0.0144424	-28.70	0.0000
Log prices — Inferior Cereals	-0.0012396	0.0023542	-0.53	0.5990
Log prices — Milk-&-Products/ Ghee-Butter	0.0438473	0.0053189	8.24	0.0000
Log prices — Vanaspati-oil	-0.0670658	0.0236105	-2.84	0.0050
Log prices — Sugar	0.2514721	0.0175439	14.33	0.0000
Log prices — Eggs	0.055289	0.0058834	9.40	0.0000
Log prices — Meat/Fish/Poultry	-0.0232264	0.0059072	-3.93	0.0000
Log prices — Pulses/Nuts-DryFruits/others	0.0419435	0.0026871	15.61	0.0000
Log prices — Fruits	-0.0126005	0.004213	-2.99	0.0030
Log prices — Vegetables	-0.0955047	0.0080372	-11.88	0.0000
Log Per capita Expenditure (mpce) predicted	0.4884375	0.0145536	33.56	0.0000
Highest Education — Male (1=above middle)	-0.0229871	0.007201	-3.19	0.0010
Highest Education — Female (1=above middle)	-7.08E-02	0.0089213	-7.93	0.0000
Caste — SC	2.65E-02	0.0083737	3.17	0.0020
Caste — Other	0.0230939	0.0073169	3.16	0.0020
Log Number of adult males	6.99E-02	0.005929	11.79	0.0000
Log Number of adult females	4.36E-02	0.0063289	6.89	0.0000
Log Household size	-9.49E-02	0.0093547	-10.14	0.0000
_cons	1.68E+00	0.1226603	13.67	0.0000
Omitted Caste: ST				

- Expenditure, however, has a significantly positive and high elasticity.
- Turning to household characteristics, the larger the numbers of adult males and females, the higher was the protein demand while household size has a significantly negative effect. In all these cases, however, the elasticities are negligibly small.
- The caste affiliations (SCs and Others relative to STs) have significant positive effects but the coefficients are negligibly small.

- Households with adult males and females possessing above middle schooling have lower protein demands than those with lower educational attainments. Of some significance is the fact that the effect of adult males with above middle schooling is much lower than that of adult females.
- The overall specification is validated by the F-test.

In sum, there is robust confirmation of a demand function with significant price and expenditure effects, conditioned on various household characteristics.

Let us now turn to the results in Table 6 for 2004. There are some notable differences between these and the 1993 results.

Table 6
Demand For Protein in Rural India, 2004

Robust regression

Number of obs = 18169
F(18, 18150) = 340.90
Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.0250002	0.0113291	-2.21	0.0270
Log prices — Inferior Cereals	-0.0019284	0.0049584	-0.39	0.6970
Log prices — Milk-&-Products/ Ghee-Butter	0.0111411	0.0040408	2.76	0.0060
Log prices — Vanaspati-oil	0.2231285	0.0187292	11.91	0.0000
Log prices — Sugar	0.2196352	0.0164256	13.37	0.0000
Log prices — Eggs	0.1545145	0.0090144	17.14	0.0000
Log prices — Meat/Fish/Poultry	0.0153979	0.0058536	2.63	0.0090
Log prices — Pulses/Nuts-DryFruits/others	0.0684735	0.003213	21.31	0.0000
Log prices — Fruits	-0.0420855	0.0042679	-9.86	0.0000
Log prices — Vegetables	-0.1610375	0.0080857	-19.92	0.0000
Log Per capita Expenditure (mpce) predicted	0.4218002	0.0120527	35.00	0.0000
Highest Education — Male (1=above middle)	-0.0318314	0.0062308	-5.11	0.0000
Highest Education — Female (1=above middle)	-6.24E-02	0.0080583	-7.74	0.0000
Caste — SC	4.11E-02	0.0073577	5.59	0.0000
Caste — Other	0.0334209	0.006026	5.55	0.0000
Log Number of adult males	4.33E-02	0.0052196	8.30	0.0000
Log Number of adult females	6.70E-03	0.0058355	1.15	0.2510
Log Household size	-6.33E-02	0.0080418	-7.87	0.0000
_cons	-4.40E-01	0.1137359	-3.87	0.0000
Omitted Caste: ST				

- While the effect of price of cereals retains a negative coefficient, there is marked reduction in the (absolute) value of the coefficient. This is a perplexing result. While milk/milk products/ghee/butter retain a high positive coefficient, its value is smaller.

Another striking difference is the change in the coefficient of Vanaspati-oil from a negative value to a large positive value. Sugar retains a significant positive coefficient with a slightly lower value, as also eggs but with a larger value. The coefficient of meat/fish/poultry changes from a negative value to a positive value. The latter, however, is very small. Pulses/nuts-dry fruits/others retain a positive coefficient but with a slightly higher value. Both fruits and vegetables have negative coefficients, with the latter taking on a larger (absolute) value.

- The expenditure elasticity is significantly positive but has a lower value.
- Household characteristics — demographic, educational and caste affiliations — have similar effects, as in 1993.
- The overall specification is validated by the F-test.

In brief, the changes in the price and expenditure effects point to a (likely) shift of the demand curve. So we turn to the first set of results in Table 7 with pooling of the cross-sections for 1993 and 2004.

- With the pooling of the two cross-sections, the price effects are mostly similar (relative to, say, the 1993 results). There are, however, two notable differences. The coefficient of cereals is negative but has a much lower (absolute) value. Another change is that the coefficient of meat/fish/poultry ceases to be significant.
- The expenditure elasticity is positive but about the same as in 1993.
- The effects of household characteristics — including demographic, educational and caste affiliations — are largely similar to those obtained with the 1993 cross-section.
- The effect of the time dummy is significantly negative, pointing to a shift of the protein demand curve over the period 1993–2004.

In brief, while most of the price and expenditure effects are similar to those obtained from the 1993 cross-section, the demand function shifted. This is further probed in Table 8.

The refinement is that food price variables are interacted with the time dummy to check whether the price effects varied over time in a rigorous way.

- The following interactions are significant: cereals (positive), milk/milk products/ghee/ butter (negative), Vanaspati-oil (positive), sugar (negative and weakly significant), eggs (positive), meat/fish/poultry (positive), pulses/nuts-dry fruits/others (positive), fruits (negative), and vegetables (negative). Thus most price effects changed over time.
- The expenditure elasticity is positive and large, as in earlier analyses.
- Household characteristics — including demographic, educational, caste affiliations — have the same signs but their (absolute) magnitudes are larger.

- Over and above these effects, the time dummy has a significant negative effect and considerably larger in (absolute) value than reported earlier. It is also larger than any of the individual price and expenditure elasticities (in absolute value).

So the conclusion is that the protein demand curve shifted as a result of price and expenditure changes — especially the former — but also because of changes in the price coefficients over time. But these effects were set against the effects of other factors that impinged on protein demand but were unrelated to price and expenditure changes.

Table 7
Demand For Protein in Rural India, Pooled (1993–2004)

Robust regression

Number of obs = 34370
F(19, 34350) = 622.28
Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.1790865	0.0088785	-20.17	0.0000
Log prices — Inferior Cereals	0.0001889	0.0020795	0.09	0.9280
Log prices — Milk-&-Products/ Ghee-Butter	0.0323019	0.0032544	9.93	0.0000
Log prices — Vanaspati-oil	0.1375513	0.0144277	9.53	0.0000
Log prices — Sugar	0.2076844	0.0117938	17.61	0.0000
Log prices — Eggs	0.0908123	0.0048272	18.81	0.0000
Log prices — Meat/Fish/Poultry	-0.0040467	0.0041586	-0.97	0.3310
Log prices — Pulses/Nuts-DryFruits/others	0.0583698	0.0020124	29.00	0.0000
Log prices — Fruits	-0.0328529	0.0029883	-10.99	0.0000
Log prices — Vegetables	-0.1402378	0.0056254	-24.93	0.0000
Log Per capita Expenditure (mpce) predicted	0.473198	0.0094066	50.30	0.0000
Time Dummy (0=1993, 1=2004)	-0.4749878	0.0110296	-43.06	0.0000
Highest Education — Male (1=above middle)	-3.27E-02	0.0047728	-6.86	0.0000
Highest Education — Female (1=above middle)	-7.31E-02	0.0060522	-12.07	0.0000
Caste — SC	0.0312698	0.0055821	5.60	0.0000
Caste — Other	2.52E-02	0.0046956	5.37	0.0000
Log Number of adult males	5.27E-02	0.0039682	13.29	0.0000
Log Number of adult females	2.22E-02	0.0043432	5.11	0.0000
Log Household size	-6.17E-02	0.0061617	-10.02	0.0000
_cons	6.19E-01	0.077467	8.00	0.0000
Omitted Caste: ST				

Table 8
Demand Function for Protein in Rural India with Interactions, Pooled (1993–2004)

Robust regression Numberof obs = 34370
F(29, 34340) = 442.77
Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Time Dummy (0=1993, 1=2004)	-2.3897880	0.1212555	-19.71	0.0000
Log prices — Rice & Wheat	-0.4126008	0.0137894	-29.92	0.0000
Time Dummy x Log prices — Rice & Wheat	0.3811929	0.0181325	21.02	0.0000
Log prices — Inferior Cereals	-0.0012420	0.0022525	-0.55	0.5810
Time Dummy x Log prices — Inferior Cereals	-0.0000280	0.0056373	0.00	0.9960
Log prices — Milk-&-Products/ Ghee-Butter	0.0440507	0.0049564	8.89	0.0000
Time Dummy x Log prices — Milk-&-Products/ Ghee-Butter	-0.0344662	0.0063222	-5.45	0.0000
Log prices — Vanaspati-oil	-0.0644036	0.0225372	-2.86	0.0040
Time Dummy x Log prices — Vanaspati-oil	0.2845437	0.0298061	9.55	0.0000
Log prices — Sugar	0.2543264	0.0167785	15.16	0.0000
Time Dummy x Log prices — Sugar	-0.0385292	0.0239148	-1.61	0.1070
Log prices — Eggs	0.0554921	0.005621	9.87	0.0000
Time Dummy x Log prices — Eggs	0.1004689	0.0108801	9.23	0.0000
Log prices — Meat/Fish/Poultry	-0.0216201	0.0056466	-3.83	0.0000
Time Dummy x Log prices — Meat/Fish/Poultry	0.0356499	0.0083035	4.29	0.0000
Log prices — Pulses/Nuts-DryFruits/others	0.0421080	0.0025672	16.40	0.0000
Time Dummy x Log prices — Pulses/Nuts-DryFruits/others	0.0248658	0.0042167	5.90	0.0000
Log prices — Fruits	-0.0103735	0.0040113	-2.59	0.0100
Time Dummy x Log prices — Fruits	-0.0332216	0.0059508	-5.58	0.0000
Log prices — Vegetables	-0.0933777	0.007683	-12.15	0.0000
Time Dummy x Log prices — Vegetables	-0.0700799	0.0113437	-6.18	0.0000
Log Per capita Expenditure (mpce) predicted	0.4520022	0.0093274	48.46	0.0000
Highest Education — Male (1=above middle)	-0.0263162	0.004723	-5.57	0.0000
Highest Education — Female (1=above middle)	-0.0659891	0.0059906	-11.02	0.0000
Caste – SC	0.0334083	0.0055406	6.03	0.0000
Caste – Other	0.0285943	0.0046759	6.12	0.0000
Log Number of adult males	0.0555380	0.0039251	14.15	0.0000
Log Number of adult females	0.0241433	0.0042937	5.62	0.0000
Log Household size	-0.0770508	0.0061149	-12.60	0.0000
_cons	1.8273650	0.0996647	18.34	0.0000
Omitted Caste: ST				

Fats

Our analysis of changes in fat demand is given in Tables 9–12. Let us first consider the results obtained from the data for 1993. The main findings are:

Table 9
Fat Demand in Rural India, 1993

Robust regression

Number of obs = 16202
F(18, 16183) = 562.52
Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.5663196	0.0238054	-23.79	0.0000
Log prices — Inferior Cereals	-0.0132362	0.003881	-3.41	0.0010
Log prices — Milk — & — Products/ Ghee — Butter	-0.045602	0.0087683	-5.20	0.0000
Log prices — Vanaspati — oil	0.0727439	0.0389225	1.87	0.0620
Log prices — Sugar	0.5160426	0.0289204	17.84	0.0000
Log prices — Eggs	0.0674279	0.009699	6.95	0.0000
Log prices — Meat/Fish/Poultry	0.0478798	0.0097379	4.92	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.1072344	0.0044293	24.21	0.0000
Log prices — Fruits	0.0226411	0.0069451	3.26	0.0010
Log prices — Vegetables	0.177799	0.0132495	13.42	0.0000
Log Per capita Expenditure (mpce) predicted	1.002303	0.0239888	41.78	0.0000
Highest Education — Male (1=above middle)	0.0294701	0.0118685	2.48	0.0130
Highest Education — Female (1=above middle)	-5.48E-02	0.0147071	-3.73	0.0000
Caste — SC	1.25E-01	0.0138042	9.06	0.0000
Caste — Other	0.1856268	0.0120619	15.39	0.0000
Log Number of adult males	1.59E-02	0.0097739	1.63	0.1040
Log Number of adult females	3.05E-02	0.0104327	2.92	0.0030
Log Household size	-8.81E-03	0.0154192	-0.57	0.5680
_cons	-3.66E+00	0.2021943	-18.10	0.0000
Omitted Caste: ST				

- The price of cereals has a negative effect on fat demand, and the (absolute) value is large.
- So do inferior cereals but the (absolute) value is low.
- Milk/milk products/ghee/butter have a significant negative coefficient but the (absolute) value is small.
- Vanaspati-oil has a significant positive effect with a moderate value of the coefficient.
- Sugar has a significant positive effect and the elasticity is high.
- Eggs too have a significant positive effect but the value is small.
- Meat/fish/poultry have a positive effect but the coefficient is small.

- Pulses/nuts-dry fruits/others have a significant positive coefficient and its value is moderate.
- Fruits have a positive coefficient but the value is small, as also vegetables, but the coefficient of the latter is larger.
- The elasticity of expenditure is much larger than that for calories.
- Household size has no significant effect but numbers of adult males and females have significant positive effects. The coefficients, however, are negligibly small.
- Castes (SC and Others relative to ST) have significant positive effect but the coefficients are negligible.
- While households with adult males possessing above middle education have higher fat demand, there is a reversal of this effect with adult females. The coefficient of the latter, however, is negligible.
- The overall specification is validated by the F-test.

In brief, the existence of a demand function with strong food price and expenditure effects is corroborated, conditioned on various household characteristics.

Table 10
Fat Demand in Rural India, 2004

Robust regression

Number of obs = 18169
F(18, 18150) = 626.10
Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	0.0656626	0.0178348	3.68	0.0000
Log prices — Inferior Cereals	0.0543126	0.0078057	6.96	0.0000
Log prices — Milk — & — Products/ Ghee — Butter	-0.1921637	0.0063613	-30.21	0.0000
Log prices — Vanaspati — oil	-0.3539407	0.0294843	-12.00	0.0000
Log prices — Sugar	0.1659336	0.025858	6.42	0.0000
Log prices — Eggs	0.1655881	0.0141909	11.67	0.0000
Log prices — Meat/Fish/Poultry	0.1136594	0.0092151	12.33	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.1764761	0.005058	34.89	0.0000
Log prices — Fruits	0.0191444	0.0067188	2.85	0.0040
Log prices — Vegetables	0.0538175	0.0127289	4.23	0.0000
Log Per capita Expenditure (mpce) predicted	0.7480096	0.0189739	39.42	0.0000
Highest Education — Male (1=above middle)	0.0027541	0.0098089	0.28	0.7790
Highest Education — Female (1=above middle)	-5.13E-02	0.0126858	-4.04	0.0000
Caste — SC	1.38E-01	0.0115828	11.94	0.0000
Caste — Other	0.2167362	0.0094865	22.85	0.0000
Log Number of adult males	2.75E-02	0.0082169	3.35	0.0010
Log Number of adult females	-1.11E-02	0.0091866	-1.21	0.2280
Log Household size	-5.42E-02	0.0126598	-4.28	0.0000
_cons	-1.77E+00	0.1790485	-9.89	0.0000
Omitted Caste: ST				

There are some notable differences between the 1993 and 2004 food price effects.

- Cereals have a significant positive coefficient in 2004 while in 1993 it was negative with a large (absolute) value; there is also a sign reversal for inferior cereals, with a positive coefficient in 2004, but the value of the coefficient is small; the sign of milk/milk products/ghee/butter remains negative but the (absolute) value is much larger, as also of Vanaspati-oil; sugar retains a positive coefficient but with a considerably smaller value; eggs, by contrast, retain a positive coefficient but with a larger value; meat/fish/poultry retain a positive coefficient but with a larger value, as also pulses/nuts-dry fruits/others; fruits, by contrast, retain a positive but smaller coefficient, as also vegetables.
- The expenditure elasticity is positive but smaller than in 1993.
- All household characteristics (including household size which did not possess a significant coefficient in 1993) except adult males with over middle level schooling (significant in 1993) and number of adult females (significant in 1993). In most cases, however, the coefficients are negligibly small except Others as the residual caste group.
- In brief, the evidence points to a (likely) shift in the demand curve for fats.

Let us now compare the pooled results in Table 11 with those for 1993 in Table 9.

- Beginning with the food price effects, cereal price has a negative coefficient but the value is considerably smaller; inferior cereals cease to have a significant coefficient; milk/milk products/ghee/butter retain a negative coefficient but with a larger (absolute value); Vanaspati-oil, by contrast, retains a negative coefficient but with a larger (absolute) value; sugar retains a positive coefficient but with a smaller value; eggs also retain a positive coefficient but with a slightly larger value; meat/fish/poultry retain a positive but slightly larger coefficient, as also pulses/nuts-dry fruits/others; and fruits retain a positive coefficient but with little change in its value, as also vegetables.
- The elasticity of expenditure remains significantly positive but the value is lower.
- While all household characteristics other than the number of adult females have significant coefficients, the values are negligible.
- Over and above these effects, the dummy has a significant negative coefficient, suggesting a downward shift of the fat demand curve due to factors other than those specified in the demand function over time. The important point is that the value of the coefficient is large.

Table 11
Demand Function for Fats in Rural India, Pooled (1993 and 2004)

Robust regression

Number of obs = 34371
F(19, 34351) = 1112.68
Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.1678912	0.0143393	-11.71	0.0000
Log prices — Inferior Cereals	-0.0022715	0.0033587	-0.68	0.4990
Log prices — Milk — & — Products/ Ghee — Butter	-0.1449307	0.0052562	-27.57	0.0000
Log prices — Vanaspati — oil	-0.176208	0.0233027	-7.56	0.0000
Log prices — Sugar	0.3457179	0.0190484	18.15	0.0000
Log prices — Eggs	0.0948969	0.0077965	12.17	0.0000
Log prices — Meat/Fish/Poultry	0.0832928	0.0067166	12.40	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.1499524	0.0032503	46.14	0.0000
Log prices — Fruits	0.0186936	0.0048264	3.87	0.0000
Log prices — Vegetables	0.1444178	0.0090858	15.89	0.0000
Log Per capita Expenditure (mpce) predicted	0.8707671	0.0151919	57.32	0.0000
Time Dummy (0=1993, 1=2004)	-0.7262409	0.0178143	-40.77	0.0000
Highest Education — Male (1=above middle)	1.59E-02	0.0077079	2.06	0.0400
Highest Education — Female (1=above middle)	-4.94E-02	0.0097751	-5.06	0.0000
Caste — SC	0.1373133	0.0090158	15.23	0.0000
Caste — Other	2.10E-01	0.0075839	27.70	0.0000
Log Number of adult males	2.50E-02	0.0064091	3.90	0.0000
Log Number of adult females	9.75E-03	0.0070147	1.39	0.1650
Log Household size	-2.64E-02	0.0099513	-2.65	0.0080
_cons	-2.34E+00	0.1251158	-18.72	0.0000
Omitted Caste: ST				

Let us now examine the results with another refinement in the specification of the demand function— interactions of food prices and the time dummy. The results are given in Table 12.

- All food prices and time dummy interactions are significant, implying changes in price elasticities over the period 1993–2004.
- Negative interactions are found for milk/milk products/ghee/butter, Vanaspati-oil, sugar and vegetables. On the other hand, positive interactions, are observed for cereals, inferior cereals, eggs, meat/fish/poultry, and pulses/nuts-dry fruits/others.
- The expenditure elasticity is positive and high.
- The effect of number of adult males is positive, while that of household size is negative.
- Number of adults with over middle level schooling is positive while that of females is negative. All these effects are, however, small. Castes, on the other hand, have significant positive effects (relative to STs).
- The effect of the time dummy is positive and large.

Thus there is additional support for a shift in the demand function for fats in rural India.

Calories

The results on the demand for calories in urban India are given in Tables 13–16.
Let us first consider the results in Table 13.

With the exceptions of Vanaspati-oil and meat/fish/poultry, all other prices had significant demand effects.

- These include a negative effect of cereals but small in (absolute) value; inferior cereals had a weakly significant effect but the (absolute) value was negligible; milk/milk products/ghee/butter had a positive effect but the coefficient was small; sugar had a moderately positive effect; eggs had a positive but small effect; pulses/nuts-dry fruits/others had a small positive effect; and both fruits and vegetables had negative effects but small in (absolute) values — especially that of fruits.
- The expenditure elasticity was positive and high.
- Out of the household characteristics, except for the caste variables, all others were significant but small in values.

In brief, the evidence in support of a demand function for calories in urban India in 1993 is robust, with significant price and expenditure effects.

Table 12
Demand Function for Fats in Rural India with Interactions, Pooled (1993-2004)

Robust regression

Number of obs = 34371
F(29, 34341) = 772.70
Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Time Dummy (0=1993, 1=2004)	0.6514215	0.1959197	3.32	0.0010
Log prices — Rice & Wheat	-0.5654257	0.022277	-25.38	0.0000
Time Dummy x Log prices — Rice & Wheat	0.6104391	0.0292953	20.84	0.0000
Log prices — Inferior Cereals	-0.0122516	0.0036395	-3.37	0.0010
Time Dummy x Log prices — Inferior Cereals	0.0662702	0.0091084	7.28	0.0000
Log prices — Milk & Products/ Ghee–Butter	-0.0421762	0.0080083	-5.27	0.0000
Time Dummy x Log prices — Milk & Products/ Ghee–Butter	-0.1511594	0.010215	-14.80	0.0000
Log prices — Vanaspati — oil	0.0877120	0.0364147	2.41	0.0160
Time Dummy x Log prices — Vanaspati-oil	-0.4553163	0.0481594	-9.45	0.0000
Log prices — Sugar	0.5312542	0.0271087	19.60	0.0000
Time Dummy x Log prices — Sugar	-0.3883773	0.0386395	-10.05	0.0000
Log prices — Eggs	0.0677962	0.0090822	7.46	0.0000
Time Dummy x Log prices — Eggs	0.0954238	0.0175797	5.43	0.0000
Log prices — Meat/Fish/Poultry	0.0512251	0.0091234	5.61	0.0000
Time Dummy x Log prices — Meat/Fish/Poultry	0.0626973	0.0134163	4.67	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.1095345	0.0041476	26.41	0.0000
Time Dummy x Log prices — Pulses/Nuts–DryFruits/others	0.0618681	0.0068129	9.08	0.0000
Log prices — Fruits	0.0258502	0.0064811	3.99	0.0000
Time Dummy x Log prices — Fruits	-0.0092038	0.0096149	-0.96	0.3380
Log prices — Vegetables	0.1832199	0.0124138	14.76	0.0000
Time Dummy x Log prices — Vegetables	-0.1323459	0.0183286	-7.22	0.0000
Log Per capita Expenditure (mpce) predicted	0.8579431	0.01507	56.93	0.0000
Highest Education — Male (1=above middle)	0.0213344	0.0076305	2.80	0.0050
Highest Education — Female (1=above middle)	-0.0496761	0.0096793	-5.13	0.0000
Caste – SC	0.1317894	0.0089523	14.72	0.0000
Caste – Other	0.2064936	0.0075551	27.33	0.0000
Log Number of adult males	0.0225940	0.006342	3.56	0.0000
Log Number of adult females	0.0090995	0.0069373	1.31	0.1900
Log Household size	-0.0329007	0.0098796	-3.33	0.0010
_cons	-2.9490290	0.1610309	-18.31	0.0000
Omitted Caste: ST				

Table 13
Demand Function for Calories in Urban India, 1993

Robust regression

Number of obs = 24803
F(19, 24783) = 612.87
Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.081323	0.0090872	-8.95	0.0000
Log prices — Inferior Cereals	-0.0037026	0.0017427	-2.12	0.0340
Log prices — Milk — & — Products/ Ghee — Butter	0.0142068	0.0046121	3.08	0.0020
Log prices — Vanaspati — oil	0.1113023	0.0145152	7.67	0.0000
Log prices — Sugar	0.0830065	0.0128851	6.44	0.0000
Log prices — Eggs	0.0665754	0.0063967	10.41	0.0000
Log prices — Meat/Fish/Poultry	0.0068689	0.0041883	1.64	0.1010
Log prices — Pulses/Nuts — DryFruits/others	0.0136206	0.0024884	5.47	0.0000
Log prices — Fruits	-0.0216459	0.003794	-5.71	0.0000
Log prices — Vegetables	-0.0748709	0.0059188	-12.65	0.0000
Log Per capita Expenditure (mpce) predicted	0.2760088	0.0117338	23.52	0.0000
Time Dummy (0=1993, 1=2004)	-0.2933795	0.0114092	-25.71	0.0000
Highest Education — Male (1=above middle)	-5.10E-03	0.0055534	-0.92	0.3580
Highest Education — Female (1=above middle)	-2.37E-02	0.0057737	-4.10	0.0000
Caste — SC	-0.0058128	0.008385	-0.69	0.4880
Caste — Other	-8.13E-03	0.0071639	-1.13	0.2560
Log Number of adult males	8.44E-02	0.0038899	21.69	0.0000
Log Number of adult females	4.07E-02	0.004199	9.69	0.0000
Log Household size	-1.96E-01	0.0088211	-22.20	0.0000
_cons	5.69E+00	0.0940561	60.53	0.0000
Omitted Caste: ST				

There are some striking changes in the price effects.

- Cereals retain a negative coefficient with little change in its value; inferior cereals cease to be significant, as also milk/milk products/ghee/butter; Vanaspati-oil has a significant positive coefficient with a moderately high elasticity (not significant in 1993); sugar retains a positive (weakly significant) coefficient but lower in value; eggs retain a positive coefficient with a much larger value; meat/fish/poultry had a significant positive coefficient but small in value (not significant in 1993); pulses/nuts-dry fruits retain a positive but small coefficient; fruits retain a negative coefficient with a small (absolute) value; and vegetables, by contrast, retain a negative coefficient but larger in (absolute) value.

- The expenditure elasticity is positive but lower.
- Household size has a negative coefficient while numbers of adult males and females have positive coefficients. However, these effects are negligible. Both educational variables have significant negative coefficients, with that of adult males small in (absolute) value and that of adult females negligible.

Table 14
Demand Function for Calories in urban India, 2004

Robust regression

Number of obs = 11526
F(18, 11507) = 294.56
Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.0726517	0.0121065	-6.00	0.0000
Log prices — Inferior Cereals	-0.0053433	0.0041363	-1.29	0.1960
Log prices — Milk — & — Products/ Ghee — Butter	0.0013852	0.007044	0.20	0.8440
Log prices — Vanaspati — oil	0.2224486	0.01846	12.05	0.0000
Log prices — Sugar	0.0277217	0.0175106	1.58	0.1130
Log prices — Eggs	0.1372974	0.0125183	10.97	0.0000
Log prices — Meat/Fish/Poultry	0.0102576	0.0059604	1.72	0.0850
Log prices — Pulses/Nuts — DryFruits/others	0.0184524	0.0037093	4.97	0.0000
Log prices — Fruits	-0.0373793	0.0057416	-6.51	0.0000
Log prices — Vegetables	-0.1154054	0.0090827	-12.71	0.0000
Log Per capita Expenditure (mpce) predicted	0.2583597	0.0137667	18.77	0.0000
Highest Education — Male (1=above middle)	-0.0118694	0.007328	-1.62	0.1050
Highest Education — Female (1=above middle)	-1.69E-02	0.0074006	-2.29	0.0220
Caste — SC	1.27E-02	0.0112842	1.12	0.2610
Caste — Other	0.0023839	0.009879	0.24	0.8090
Log Number of adult males	7.00E-02	0.0055192	12.69	0.0000
Log Number of adult females	2.77E-02	0.0060462	4.59	0.0000
Log Household size	-1.72E-01	0.0112253	-15.33	0.0000
_cons	5.09E+00	0.1246068	40.84	0.0000
Omitted Caste: ST				

Table 15
Demand Function for Calories in urban India, Pooled (1993-2004

Robust regression

Number of obs = 24803
F(19, 24783) = 612.87
Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.081323	0.0090872	-8.95	0.0000
Log prices — Inferior Cereals	-0.0037026	0.0017427	-2.12	0.0340
Log prices — Milk — & — Products/ Ghee — Butter	0.0142068	0.0046121	3.08	0.0020
Log prices — Vanaspati — oil	0.1113023	0.0145152	7.67	0.0000
Log prices — Sugar	0.0830065	0.0128851	6.44	0.0000
Log prices — Eggs	0.0665754	0.0063967	10.41	0.0000
Log prices — Meat/Fish/Poultry	0.0068689	0.0041883	1.64	0.1010
Log prices — Pulses/Nuts — DryFruits/others	0.0136206	0.0024884	5.47	0.0000
Log prices — Fruits	-0.0216459	0.003794	-5.71	0.0000
Log prices — Vegetables	-0.0748709	0.0059188	-12.65	0.0000
Log Per capita Expenditure (mpce) predicted	0.2760088	0.0117338	23.52	0.0000
Time Dummy (0=1993, 1=2004)	-0.2933795	0.0114092	-25.71	0.0000
Highest Education — Male (1=above middle)	-5.10E-03	0.0055534	-0.92	0.3580
Highest Education — Female (1=above middle)	-2.37E-02	0.0057737	-4.10	0.0000
Caste — SC	-0.0058128	0.008385	-0.69	0.4880
Caste — Other	-8.13E-03	0.0071639	-1.13	0.2560
Log Number of adult males	8.44E-02	0.0038899	21.69	0.0000
Log Number of adult females	4.07E-02	0.004199	9.69	0.0000
Log Household size	-1.96E-01	0.0088211	-22.20	0.0000
_cons	5.69E+00	0.0940561	60.53	0.0000
Omitted Caste: ST				

There is thus a robust confirmation of the demand function for calories in urban India in 2004. As before, our comments are confined to a comparison of the pooled results with those for 1993.

- One notable difference is that all price effects are significant in 2004. Both cereals and inferior cereals have negative coefficients but small in (absolute) value; milk/milk products/ghee/butter retain a positive coefficient but with a low value; Vanaspati-oil has a positive effect with a moderately higher coefficient; sugar retains a positive coefficient with a similar value; eggs also retain a positive coefficient with a slightly larger value; meat/fish/poultry have a weakly significant coefficient with a small value; pulses/nuts-dry fruits/others retain a small positive coefficient; and fruits have a negative coefficient but small in (absolute) value, as also vegetables.
- The expenditure elasticity is positive, but much lower.
- Excluding the caste variables, all other household characteristics have significant coefficients but they are negligible in value.
- Over and above these effects, the time dummy has a significant negative coefficient. As the (absolute) value is large, it follows that there were shift factors not unlike those conjectured for rural India.

In brief, the demand function shifted over time.

Turning to the results with food price and time interactions in Table 16, there is ample evidence of a shift in the demand curve for calories.

- Except for inferior cereals, meat/.fish/poultry, and fruits, all other food prices had significant interaction effects, implying changes in price elasticities over time. These include cereals (negative), milk (negative), Vanaspati-oil (positive), sugar (negative), eggs (positive), fruits (negative), and vegetables (negative).
    - The time dummy has a significant negative effect with a large (absolute) value. In fact, it is much larger (in absolute value) than any individual price and expenditure elasticities.
- The expenditure elasticity is moderately high.
- Except for the caste variables and education of adult males, all other household characteristics have significant but small coefficients.

In brief, the demand curve shifted over time.

Table 16
Demand Function for Calories with Interactions in urban India, Pooled (1993–2004)

Robust regression

Number of obs = 24803
F(29, 24773) = 409.12
Prob > F = 0.0000

Log Per capita Calories Intake	Coef.	Std. Err.	t	P>t
Time Dummy (0=1993, 1=2004)	-0.9195787	0.1190358	-7.73	0.0000
Log prices — Rice & Wheat	-0.0507352	0.0132674	-3.82	0.0000
Time Dummy x Log prices — Rice & Wheat	-0.0364669	0.0182183	-2.00	0.0450
Log prices — Inferior Cereals	-0.0028333	0.0018964	-1.49	0.1350
Time Dummy x Log prices — Inferior Cereals	-0.0037751	0.0047698	-0.79	0.4290
Log prices — Milk — & — Products/ Ghee — Butter	0.0229197	0.0058593	3.91	0.0000
Time Dummy x Log prices — Milk & Products/ Ghee–Butter	-0.0234831	0.0092065	-2.55	0.0110
Log prices — Vanaspati — oil	-0.0096175	0.0229671	-0.42	0.6750
Time Dummy x Log prices — Vanaspati-oil	0.2258828	0.0301314	7.50	0.0000
Log prices — Sugar	0.1074968	0.018126	5.93	0.0000
Time Dummy x Log prices — Sugar	-0.0839290	0.02589	-3.24	0.0010
Log prices — Eggs	0.0338505	0.0073154	4.63	0.0000
Time Dummy x Log prices — Eggs	0.1050475	0.0150977	6.96	0.0000
Log prices — Meat/Fish/Poultry	0.0001105	0.005595	0.02	0.9840
Time Dummy x Log prices — Meat/Fish/Poultry	0.0073838	0.008409	0.88	0.3800
Log prices — Pulses/Nuts — DryFruits/others	0.0142654	0.00324	4.40	0.0000
Time Dummy x Log prices — Pulses/Nuts – DryFruits/others	0.0035167	0.0050589	0.70	0.4870
Log prices — Fruits	-0.0074601	0.0048532	-1.54	0.1240
Time Dummy x Log prices — Fruits	-0.0309567	0.007751	-3.99	0.0000
Log prices — Vegetables	-0.0379003	0.0076518	-4.95	0.0000
Time Dummy x Log prices — Vegetables	-0.0788958	0.0122692	-6.43	0.0000
Log Per capita Expenditure (mpce) predicted	0.2820716	0.0117622	23.98	0.0000
Highest Education — Male (1=above middle)	-0.0075396	0.0055565	-1.36	0.1750
Highest Education — Female (1=above middle)	-0.0272972	0.0057865	-4.72	0.0000
Caste – SC	-0.0056799	0.0083835	-0.68	0.4980
Caste – Other	-0.0082267	0.0071583	-1.15	0.2500
Log Number of adult males	0.0835158	0.0038817	21.52	0.0000
Log Number of adult females	0.0420094	0.0041871	10.03	0.0000
Log Household size	-0.1933290	0.0088469	-21.85	0.0000
_cons	5.9775790	0.1175861	50.84	0.0000
Omitted Caste: ST				

Protein

The results on the demand equation for protein in urban India for 1993 are given in Table 17.

- All price effects are significant.
- Cereals have a negative effect, as also inferior cereals, with the coefficient of the former much larger in (absolute) value.
- Milk/milk products/ghee/butter have a small positive effect.
- Sugar has a moderately high positive effect, as also eggs but with a small coefficient.
- Meat/fish/poultry have a negative effect but with a small (absolute) value.
- Pulses/nuts-dry fruits/others have a positive bur small effect.
- Fruits have a negative effect with a small (absolute) value, as also vegetables.
- The expenditure elasticity is high.
- Except for the caste variables, all other household characteristics have significant effects. Household size and numbers of adult males and females have significant effects but the values are negligible. While educational levels of adult males and females have significant effects, that of the former is small while that of the latter is negligible.
- The overall validity of the specification is confirmed by the F-test.

Thus the demand function for protein in urban India in 1993 is robust given the significant price and expenditure effects.

Let us now compare the results for 2004 (Table 18) with those for 1993.

- All food price effects for 2004 are significant. Cereals have a negative coefficient but smaller in (absolute) value; inferior cereals also have a negative coefficient but the (absolute) value is very small; milk/milk products/ghee/butter retain a positive coefficient but with a slightly lower value; Vanaspati-oil has a significant positive coefficient with a high value (not significant in 1993); sugar has a positive coefficient but smaller in value; eggs retain a positive coefficient but the value is larger; meat/fish/poultry have a negative coefficient but with a small (absolute) value; pulses/nuts-dry fruits/others retain a positive coefficient with a similar value; and both fruits and vegetables retain negative coefficients with the (absolute) value of the latter larger.
- The expenditure elasticity is positive but much lower.
- Out of the household variables, all (except Others as the second caste variable) have significant coefficients but, in most cases, these are either very small or negligible.

In brief, the evidence suggests significant changes in food price and expenditure effect.

Table 17
Demand Function for Protein in Urban India, 1993

Robust regression — Number of obs = 13277; F(18, 13258) = 324.55; Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.2449109	0.0151943	-16.12	0.0000
Log prices — Inferior Cereals	-0.0054879	0.0021534	-2.55	0.0110
Log prices — Milk — & — Products/ Ghee — Butter	0.0438662	0.0067616	6.49	0.0000
Log prices — Vanaspati — oil	0.027874	0.0261158	1.07	0.2860
Log prices — Sugar	0.2556746	0.0206113	12.40	0.0000
Log prices — Eggs	0.0559757	0.0083117	6.73	0.0000
Log prices — Meat/Fish/Poultry	-0.0468375	0.0063927	-7.33	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.0372801	0.0037098	10.05	0.0000
Log prices — Fruits	-0.0186991	0.0055244	-3.38	0.0010
Log prices — Vegetables	-0.0222365	0.0086996	-2.56	0.0110
Log Per capita Expenditure (mpce) predicted	0.4378521	0.0230895	18.96	0.0000
Highest Education — Male (1=above middle)	-0.0399086	0.0095078	-4.20	0.0000
Highest Education — Female (1=above middle)	-7.76E-02	0.0104137	-7.45	0.0000
Caste — SC	2.12E-02	0.013543	1.56	0.1180
Caste — Other	0.0052748	0.0111765	0.47	0.6370
Log Number of adult males	7.78E-02	0.0059381	13.11	0.0000
Log Number of adult females	4.43E-02	0.0062934	7.04	0.0000
Log Household size	-1.19E-01	0.0158751	-7.50	0.0000
_cons	1.23E+00	0.1819479	6.76	0.0000
Omitted Caste: ST				

In order to confirm that there was a shift in the demand curve, we experiment with a time dummy. The results are given in Table 19. These are compared with the results for 1993.

- Cereal price retains a negative coefficient but the (absolute) value is lower; inferior cereals retain a negative coefficient but with a slightly larger (absolute) value; milk/milk products/ghee/butter retain a positive coefficient with a similar value; Vanaspati-oil has a significant coefficient with a moderately high value (not significant in 1993); sugar retains a positive coefficient but the value is slightly lower; eggs retain a positive coefficient but with a slightly larger value; meat/fish/poultry retain a negative coefficient with a small (absolute) value; pulses retain a small positive coefficient; fruits retain a negative coefficient with a small (absolute) value; and vegetables, by contrast, retain a negative coefficient but with a slightly larger (absolute) value.

- The expenditure elasticity is high but lower.
- Except for SCs (with a small positive coefficient), all other household variables have significant coefficients but negligible in value.
- The time dummy has a negative coefficient, and it is large in (absolute) value, implying a shift in the demand curve.

Table 18
Demand Function for Protein in Urban India, 2004

Robust regression — Number of obs = 11526; F(18, 11507) = 268.23; Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.1214784	0.0135041	-9.00	0.0000
Log prices — Inferior Cereals	-0.019716	0.0046137	-4.27	0.0000
Log prices — Milk — & — Products/ Ghee — Butter	0.025981	0.0078572	3.31	0.0010
Log prices — Vanaspati — oil	0.2891786	0.020591	14.04	0.0000
Log prices — Sugar	0.1613523	0.019532	8.26	0.0000
Log prices — Eggs	0.1971182	0.0139634	14.12	0.0000
Log prices — Meat/Fish/Poultry	-0.0210609	0.0066485	-3.17	0.0020
Log prices — Pulses/Nuts — DryFruits/others	0.0434548	0.0041375	10.50	0.0000
Log prices — Fruits	-0.0572912	0.0064045	-8.95	0.0000
Log prices — Vegetables	-0.1441678	0.0101312	-14.23	0.0000
Log Per capita Expenditure (mpce) predicted	0.2918056	0.0153559	19.00	0.0000
Highest Education — Male (1=above middle)	-0.0192269	0.008174	-2.35	0.0190
Highest Education — Female (1=above middle)	-1.85E-02	0.008255	-2.24	0.0250
Caste — SC	3.83E-02	0.0125869	3.04	0.0020
Caste — Other	0.0174895	0.0110194	1.59	0.1130
Log Number of adult males	7.00E-02	0.0061563	11.38	0.0000
Log Number of adult females	1.65E-02	0.0067441	2.45	0.0140
Log Household size	-1.29E-01	0.0125211	-10.29	0.0000
_cons	5.85E-01	0.1389914	4.21	0.0000
Omitted Caste: ST				

To further probe the shift in the demand curve for protein in urban India, we experiment with food price interactions with the time dummy. The results are given in Table 20.

- Except for pulses/nuts-dry fruits/others, all other food prices' interactions with time were significant, implying changes in food price elasticities over time. Briefly, the

interactions were significant for cereals (positive), inferior cereals (negative), milk/milk products/ghee/butter (negative), Vanaspati-oil (positive), sugar (negative), eggs (positive), meat/fish/pultry (positive), fruits (negative), and vegetables (negative).

- The time dummy has a negative coefficient much larger (in absolute value) than that reported in Table 19. Also, it is larger (in absolute) value than individual price or expenditure elasticities.

- There is no change in the expenditure elasticity.

In sum, the shift in the demand curve for protein reflected changes in food price elasticities and other factors that changed over time.

Table 19
Demand Function for Protein in Urban India, Pooled (1993-2004)

Robust regression

Number of obs = 24803
F(19, 24783) = 573.46
Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.1958928	0.0099924	-19.60	0.0000
Log prices — Inferior Cereals	-0.0079207	0.0019163	-4.13	0.0000
Log prices — Milk — & — Products/ Ghee — Butter	0.0370626	0.0050716	7.31	0.0000
Log prices — Vanaspati — oil	0.1671064	0.0159611	10.47	0.0000
Log prices — Sugar	0.2287787	0.0141686	16.15	0.0000
Log prices — Eggs	0.1088881	0.0070339	15.48	0.0000
Log prices — Meat/Fish/Poultry	-0.0322299	0.0046055	-7.00	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.0396755	0.0027363	14.50	0.0000
Log prices — Fruits	-0.0374928	0.0041719	-8.99	0.0000
Log prices — Vegetables	-0.0755604	0.0065083	-11.61	0.0000
Log Per capita Expenditure (mpce) predicted	0.3272069	0.0129027	25.36	0.0000
Time Dummy (0=1993, 1=2004)	-0.3900294	0.0125457	-31.09	0.0000
Highest Education — Male (1=above middle)	-1.69E-02	0.0061066	-2.77	0.0060
Highest Education — Female (1=above middle)	-3.22E-02	0.0063488	-5.08	0.0000
Caste — SC	0.0212165	0.0092202	2.30	0.0210
Caste — Other	6.65E-03	0.0078775	0.84	0.3990
Log Number of adult males	7.70E-02	0.0042773	17.99	0.0000
Log Number of adult females	2.94E-02	0.0046173	6.37	0.0000
Log Household size	-1.44E-01	0.0096998	-14.84	0.0000
_cons	1.32E+00	0.1034253	12.79	0.0000
Omitted Caste: ST				

Table 20
Demand Function for Protein with Interactions in Urban India , Pooled (1993-2004)

Robust regression

Number of obs = 24803
F(29, 24773) = 384.72
Prob > F = 0.0000

Log Per capita Protein Intake	Coef.	Std. Err.	t	P>t
Time Dummy (0=1993, 1=2004)	-1.3404630	0.1307789	-10.25	0.0000
Log prices — Rice & Wheat	-0.2323449	0.0145762	-15.94	0.0000
Time Dummy x Log prices — Rice & Wheat	0.0948073	0.0200155	4.74	0.0000
Log prices — Inferior Cereals	-0.0049454	0.0020834	-2.37	0.0180
Time Dummy x Log prices — Inferior Cereals	-0.0156808	0.0052403	-2.99	0.0030
Log prices — Milk — & — Products/ Ghee — Butter	0.0497516	0.0064373	7.73	0.0000
Time Dummy x Log prices — Milk — & — Products/ Ghee — Butter	-0.0259222	0.0101148	-2.56	0.0100
Log prices — Vanaspati — oil	0.0319340	0.0252328	1.27	0.2060
Time Dummy x Log prices — Vanaspati — oil	0.2522655	0.0331039	7.62	0.0000
Log prices — Sugar	0.2575827	0.0199142	12.93	0.0000
Time Dummy x Log prices — Sugar	-0.1017468	0.028444	-3.58	0.0000
Log prices — Eggs	0.0573184	0.0080371	7.13	0.0000
Time Dummy x Log prices — Eggs	0.1424423	0.0165871	8.59	0.0000
Log prices — Meat/Fish/Poultry	-0.0410108	0.0061469	-6.67	0.0000
Time Dummy x Log prices — Meat/Fish/Poultry	0.0163334	0.0092386	1.77	0.0770
Log prices — Pulses/Nuts — DryFruits/others	0.0392033	0.0035597	11.01	0.0000
Time Dummy x Log prices — Pulses/Nuts — DryFruits/others	0.0033843	0.005558	0.61	0.5430
Log prices — Fruits	-0.0175685	0.005332	-3.29	0.0010
Time Dummy x Log prices — Fruits	-0.0412068	0.0085157	-4.84	0.0000
Log prices — Vegetables	-0.0186533	0.0084067	-2.22	0.0270
Time Dummy x Log prices — Vegetables	-0.1274451	0.0134795	-9.45	0.0000
Log Per capita Expenditure (mpce) predicted	0.3268444	0.0129225	25.29	0.0000
Highest Education — Male (1=above middle)	-0.0178538	0.0061047	-2.92	0.0030
Highest Education — Female (1=above middle)	-0.0334281	0.0063573	-5.26	0.0000
Caste – SC	0.0229852	0.0092106	2.50	0.0130
Caste – Other	0.0085668	0.0078644	1.09	0.2760
Log Number of adult males	0.0770608	0.0042646	18.07	0.0000
Log Number of adult females	0.0310969	0.0046002	6.76	0.0000
Log Household size	-0.1468966	0.0097197	-15.11	0.0000
_cons	1.8234880	0.1291862	14.12	0.0000
Omitted Caste: ST				

Fats

The analysis of demand for fats using state level data in Gaiha et al. (2010) did not yield satisfactory results. With household data, the results are stronger, and are given in Tables 21–24.

Table 21
Demand Function for Fats in Urban India, 1993

Robust regression

Number of obs = 13276
F(18, 13257) = 720.37
Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.300744	0.0235325	-12.78	0.0000
Log prices — Inferior Cereals	0.0014244	0.0033348	0.43	0.6690
Log prices — Milk — & — Products/ Ghee — Butter	-0.0395977	0.010471	-3.78	0.0000
Log prices — Vanaspati — oil	0.2092443	0.0404446	5.17	0.0000
Log prices — Sugar	0.4949459	0.0319188	15.51	0.0000
Log prices — Eggs	0.0292968	0.0128715	2.28	0.0230
Log prices — Meat/Fish/Poultry	0.0224924	0.0099	2.27	0.0230
Log prices — Pulses/Nuts — DryFruits/others	0.156615	0.0057451	27.26	0.0000
Log prices — Fruits	-0.0003903	0.0085578	-0.05	0.9640
Log prices — Vegetables	0.2912621	0.0134723	21.62	0.0000
Log Per capita Expenditure (mpce) predicted	0.9455252	0.0357566	26.44	0.0000
Highest Education — Male (1=above middle)	-0.022402	0.014724	-1.52	0.1280
Highest Education — Female (1=above middle)	-1.12E-01	0.0161275	-6.92	0.0000
Caste — SC	2.63E-01	0.0209728	12.55	0.0000
Caste — Other	0.2912929	0.0173082	16.83	0.0000
Log Number of adult males	1.89E-02	0.0091961	2.06	0.0400
Log Number of adult females	3.72E-02	0.0097461	3.82	0.0000
Log Household size	3.20E-02	0.0245845	1.30	0.1930
_cons	-4.53E+00	0.2817725	-16.08	0.0000
Omitted Caste: ST				

Let us first comment on the food price effects on the demand for fats in urban India in 1993.

- Cereal price has a negative effect on fat demand, and the value of the coefficient is large.
- Milk/milk products/ghee/butter have a negative effect with a small (absolute) value of the coefficient.

- Vanaspati-oil has a positive effect with a moderately large coefficient.
- Sugar too has a positive effect with a large value of the coefficient.
- Eggs, by contrast, have a positive effect but the coefficient is small.
- Meat/fish/poultry have a positive effect but the size is small.
- Pulses/nuts-dry fruits/others also have a positive effect but the size is moderate.
- Vegetables have a positive effect and the size is large.
- The expenditure elasticity is high.
- While all household variables — except household size — have significant effects, the effect associated with Others as a residual caste group is positive and large.
- The overall specification is validated by the F-test.

In brief, strong food price and expenditure effects corroborate a robust demand function for fats in urban India in 1993.

The results for 2004 are given in Table 22

There are some striking differences between the 1993 and 2004 results.

- Cereal price ceases to have a significant effect while that of inferior cereals have a negative effect (not significant in 1993) with a small (absolute) value; milk/milk products/ghee/butter retain a negative coefficient with a larger (absolute) value; Vanaspati-oil changes sign from positive to negative and the coefficient has a moderate (absolute) value; sugar retains a positive coefficient but with a smaller value; eggs, however, retain a positive coefficient but with a considerably larger value; meat/fish/poultry also retain a positive coefficient but with a slightly larger value; pulses/nuts-dry fruits/others retain a positive coefficient but with a considerably lower value;
- The expenditure elasticity drops sharply.
- All household variables have significant coefficients but only two are small (education of adult males) or large (Others as a residual caste group).
- The overall specification is validated by the F-test.

While a demand function is corroborated by significant food price and expenditure effects, the changes over time are of some importance, as our subsequent analysis suggests.
Let us now compare the pooled sample results in Table 23 with those for 1993 in Table 21.

Table 22
Demand Function for Fats in Urban India, 2004

Robust regression

Number of obs = 11526
F(18, 11507) = 481.74
Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	0.0192224	0.0207374	0.93	0.3540
Log prices — Inferior Cereals	-0.028383	0.007085	-4.01	0.0000
Log prices — Milk — & — Products/ Ghee — Butter	-0.1093122	0.0120657	-9.06	0.0000
Log prices — Vanaspati — oil	-0.1243846	0.0316204	-3.93	0.0000
Log prices — Sugar	0.2315198	0.0299941	7.72	0.0000
Log prices — Eggs	0.2524021	0.0214428	11.77	0.0000
Log prices — Meat/Fish/Poultry	0.0662985	0.0102096	6.49	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.1194714	0.0063537	18.80	0.0000
Log prices — Fruits	0.0031582	0.0098349	0.32	0.7480
Log prices — Vegetables	0.1735978	0.0155579	11.16	0.0000
Log Per capita Expenditure (mpce) predicted	0.6885088	0.0235812	29.20	0.0000
Highest Education — Male (1=above middle)	-0.0374467	0.0125523	-2.98	0.0030
Highest Education — Female (1=above middle)	-3.88E-02	0.0126767	-3.06	0.0020
Caste — SC	3.43E-01	0.0193289	17.75	0.0000
Caste — Other	0.3399875	0.0169218	20.09	0.0000
Log Number of adult males	4.72E-02	0.0094539	4.99	0.0000
Log Number of adult females	2.78E-02	0.0103565	2.69	0.0070
Log Household size	-6.28E-02	0.0192279	-3.27	0.0010
_cons	-2.81E+00	0.2134405	-13.17	0.0000
Omitted Caste: ST				

There are again some striking differences.

- Cereal price retains a negative coefficient but with a smaller (absolute) value; inferior cereals have a weakly significant negative coefficient (not significant in 1993) and the (absolute) value is negligible; milk/milk products/ghee/butter retain a negative coefficient but with a slightly larger (absolute) value; Vanaspati-oil retains a positive coefficient but with a considerably lower value; sugar retains a positive coefficient but with a slightly lower value; eggs also retain a positive coefficient but with a larger value; meat/fish/poultry retain a positive coefficient with a slightly larger value; pulses/nuts-dry fruits/others retain an unchanged positive coefficient; vegetables retain a positive coefficient with a slightly lower value.

The expenditure elasticity is high but considerably lower than in 1993.

- All household variables, with the exception of SCs, have significant effects but negligible in value. SCs demand more fats relative to STs.
- That the demand function shifted is reflected in the negative coefficient of the time dummy. The (absolute) value of the coefficient is large.

Table 23
Demand Function for Fats in Urban India, Pooled (1993–2004)

Robust regression

Number of obs = 24802
F(19, 24782) = 1109.94
Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Log prices — Rice & Wheat	-0.1827241	0.0154541	-11.82	0.0000
Log prices — Inferior Cereals	-0.004583	0.0029636	-1.55	0.1220
Log prices — Milk — & — Products/ Ghee — Butter	-0.0766601	0.0078432	-9.77	0.0000
Log prices — Vanaspati — oil	0.0609814	0.024684	2.47	0.0130
Log prices — Sugar	0.4479154	0.0219116	20.44	0.0000
Log prices — Eggs	0.0901839	0.0108779	8.29	0.0000
Log prices — Meat/Fish/Poultry	0.051496	0.0071225	7.23	0.0000
Log prices — Pulses/Nuts — DryFruits/others	0.1456439	0.0042317	34.42	0.0000
Log prices — Fruits	-0.0050164	0.006453	-0.78	0.4370
Log prices — Vegetables	0.25982	0.0100652	25.81	0.0000
Log Per capita Expenditure (mpce) predicted	0.7378554	0.019954	36.98	0.0000
Time Dummy (0=1993, 1=2004)	-0.9039403	0.0194022	-46.59	0.0000
Highest Education — Male (1=above middle)	-2.36E-03	0.009444	-0.25	0.8030
Highest Education — Female (1=above middle)	-3.98E-02	0.0098188	-4.05	0.0000
Caste — SC	0.2901412	0.014259	20.35	0.0000
Caste — Other	3.13E-01	0.0121825	25.70	0.0000
Log Number of adult males	3.75E-02	0.0066151	5.66	0.0000
Log Number of adult females	3.00E-02	0.0071407	4.20	0.0000
Log Household size	-5.96E-02	0.0150008	-3.97	0.0000
_cons	-2.89E+00	0.1599484	-18.05	0.0000
Omitted Caste: ST				

To further probe the shift in the demand function for fats, let us examine the price and time interaction effects in Table 24.

- All price and time interaction effects, except for fruits, are significant, implying that price elasticities changed over the period 1993–2004.

- Specifically, the interaction effects are: cereals (positive), inferior cereals (negative), milk/milk products/ghee/butter (negative), Vanaspati-oil (negative), sugar (negative), eggs (positive), meat/fish/poultry (positive but weakly significant), pulses/nuts-dry fruits/others (negative), and vegetables (negative).
- The time dummy coefficient sign changes from negative to positive, implying a shift due to factors not specified in the demand function (e.g. eating out). Also it is large.
- The expenditure elasticity is positive (and about the same as with the pooled sample without interactions).

So the demand function shifted over time.

IV. Concluding Observation

In an influential study, Deaton and Dreze (2009) drew attention to a puzzle: despite rising incomes there has been a sustained decline in per capita calorie intake over the period 1983–2004 — especially in rural areas. Specifically, per capita consumption of calories is lower at a given level of per capita household expenditure, across the expenditure scale, at low levels of per capita expenditure as well as high. In other words, there is a steady downward shift of the calorie Engel curve. Further, the decline is not confined to calories. It applies to protein and other nutrients, with the exception of fats whose consumption has increased in both rural and urban areas. They are emphatic that the downward shift of the calorie Engel curve is due to lower calorie requirements, associated mainly with better health and lower and less strenuous activity levels.

We have developed an alternative explanation of changes in the consumption of calories, protein and fats over the more recent period, 1993–2004. This explanation is embedded in a standard demand theory framework, with food prices and expenditure (as a proxy for income) cast in a pivotal role. Based on different experiments, robust demand functions are estimated for each of three nutrients viz. calories, protein and fats, separately for rural and urban areas. Our results show consistently robust food price and expenditure effects. Besides, shifts in food price elasticities over time are significant. Over and above these effects, there are shifts in demands due to factors other than those specified in the demand equations. In the context of calories, for example, it is plausible that part of the reduction in their consumption was due to health improvements and less strenuous activity levels — especially but not necessarily confined to rural areas.

In conclusion, while the Deaton–Dreze (2009) explanation is not rejected, it is arguable that it is complementary to the demand-based explanations.

Table 24
Demand Function for Fats with Interactions in Urban India, Pooled (1993-2004)

Robust regression — Number of obs = 24802; F(29, 24772) = 740.76; Prob > F = 0.0000

Log Per capita Fat Intake	Coef.	Std. Err.	t	P>t
Time Dummy (0=1993, 1=2004)	0.6632609	0.2021832	3.28	0.0010
Log prices — Rice & Wheat	-0.2708864	0.0225369	-12.02	0.0000
Time Dummy x Log prices — Rice & Wheat	0.2530201	0.0309451	8.18	0.0000
Log prices — Inferior Cereals	0.0016204	0.003221	0.50	0.6150
Time Dummy x Log prices — Inferior Cereals	-0.0302963	0.0081013	-3.74	0.0000
Log prices — Milk — & — Products/ Ghee Butter	-0.0245274	0.009952	-2.46	0.0140
Time Dummy x Log prices — Milk & Products/ Ghee Butter	-0.1026627	0.0156372	-6.57	0.0000
Log prices — Vanaspati — oil	0.2294921	0.0390107	5.88	0.0000
Time Dummy x Log prices — Vanaspati — oil	-0.3761180	0.0511787	-7.35	0.0000
Log prices — Sugar	0.5031684	0.0307869	16.34	0.0000
Time Dummy x Log prices — Sugar	-0.2911443	0.0439737	-6.62	0.0000
Log prices — Eggs	0.0299960	0.012425	2.41	0.0160
Time Dummy x Log prices — Eggs	0.2227686	0.0256431	8.69	0.0000
Log prices — Meat/Fish/Poultry	0.0355529	0.0095032	3.74	0.0000
Time Dummy x Log prices — Meat/Fish/Poultry	0.0228248	0.0142827	1.60	0.1100
Log prices — Pulses/Nuts — DryFruits/others	0.1642324	0.0055032	29.84	0.0000
Time Dummy x Log prices — Pulses/Nuts DryFruits/others	-0.0463050	0.0085925	-5.39	0.0000
Log prices — Fruits	0.0031531	0.0082456	0.38	0.7020
Time Dummy x Log prices — Fruits	-0.0018646	0.0131665	-0.14	0.8870
Log prices — Vegetables	0.2998260	0.0129966	23.07	0.0000
Time Dummy x Log prices — Vegetables	-0.1275774	0.020839	-6.12	0.0000
Log Per capita Expenditure (mpce) predicted	0.7482488	0.0199778	37.45	0.0000
Highest Education — Male (1=above middle)	-0.0069429	0.0094378	-0.74	0.4620
Highest Education — Female (1=above middle)	-0.0467460	0.0098286	-4.76	0.0000
Caste – SC	0.2929578	0.0142393	20.57	0.0000
Caste – Other	0.3106362	0.0121582	25.55	0.0000
Log Number of adult males	0.0366607	0.0065932	5.56	0.0000
Log Number of adult females	0.0320686	0.0071117	4.51	0.0000
Log Household size	-0.0536000	0.0150264	-3.57	0.0000
_cons	-3.5360580	0.1997231	-17.70	0.0000
Omitted Caste: ST				

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