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Abstract

In response to the Deaton and 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 in India, we develop an alternative explanation embedded in a standard demand theory framework, with food price and expenditure effects and shifting food and expenditure elasticities. The analysis is carried out with unit record data for three NSS rounds over the period 1993-2009: 50th, 61st and 66th. There are shifts in demands due to factors other than lower requirements. While an earlier analysis with the 50th and 61st rounds of the NSS over the period 1993-2004 (Gaiha et al.2012) corroborated in part the Deaton-Dreze conjecture of lower requirements, the extended analysis for 1993-2009 reported here undermines this conjecture as time effects weaken over the more recent period (2004-2009). But there is also weakening of food price and expenditure elasticities over this period. Closer scrutiny of food preferences and taste for variety is necessary to understand better nutritional deprivation as also to design more effective policies to ameliorate it.

Key words: calories, protein, fat, food prices, expenditure, India.

JEL codes: C21, D12, I31, I32.

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Demand for Nutrients in India: An Analysis Based on the 50th, 61st and 66th Rounds of the NSS[1]

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), hereafter DD, 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 builds on an earlier critique of DD, by developing a demand theory based explanation of calories and proteins but over a longer period 1993-2009[2]. The most recent

[1] We are grateful to T. Elhaut for guidance in the initial stage, Anil Deolalikar and Raghbendra Jha for valuable advice, and Raj Bhatia for competent data analysis. Although this study was funded by the Asia and Pacific Division of IFAD, the views expressed are personal.
[2] For details, see Gaiha et al. (2012).

round (66th round corresponding to the year 2009-10) of the National Sample Survey (NSS) provides new insights on the consumption and expenditure behaviour of households. This round throws new light on the trends in nutrient intake in the past two decades. The analysis is based mostly on unit record data collected for the 50th, 61st and 66th rounds of the NSS (corresponding to 1993–94, 2004–05, and 2009-10, respectively).

1.1. Nutrient Intakes

Calories

In rural areas, the mean calorie intake reduced from 2156 in 1993 to 2047 in 2004, a decline of about 5 per cent. The reduction in calorie intake was slower between 2004 and 2009 – only 1 per cent. In urban areas, the mean calorie intake reduced from 2074 in 1993 to 2021 in 2004 and 1982 in 2009, i.e. a 3 per cent decline in the first period and a 2 per cent decline in the second.

Until recently, a calorie intake of 2400 per day was considered adequate for a typical adult engaged in physically strenuous work of a certain duration in rural India. More recent

Fig 1: Calorie Distribution in Rural India

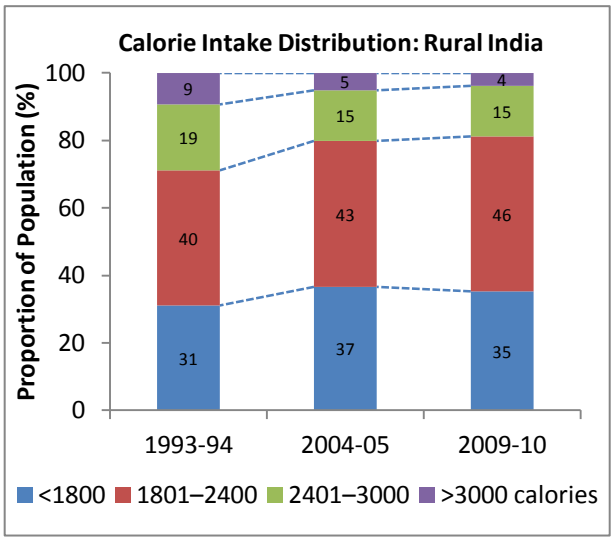
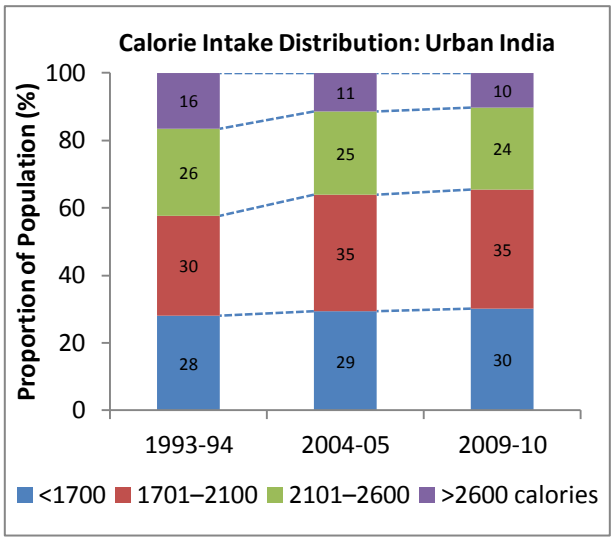


Fig 2: Calorie Distribution in Urban India



assessments have used lower calorie 'requirements' (1800 calories).[3] Figures 1 & 2 show the distribution of calories in rural and urban India between 1993 and 2009. Detailed tables containing the mean calorie intakes are given in the annexure.

Using the higher calorie requirement of 2400, over 71% of the rural households were calorie deprived or more generally undernourished in 1993[4]. With the lower norm of 1800, this proportion falls sharply to about 31%, implying a large concentration of households in the calorie intake range of 1800–2400. The proportion of undernourished rises from 71% to nearly 80% in 2004 and 2009. The proportion below the lower cut-off rose from about 31% in 1993 to close to 37% in 2004, indicating high levels of calorie deprivation. It declined only marginally between 2004 and 2009. The mean calorie intake reduced from 2156 in 1993 to 2047 in 2004 to 2020 in 2009.

In urban India, assuming lower calorie norms of 1700 and 2100 (given less strenuous physical activity in urban areas), about 28 % consumed less than 1700 calories in 1993. About 58 % were below the higher calorie norm of 2100. Worse, this proportion rose to about 64 % in 2004. The proportion of people below the lower cut-off changed only slightly. The proportion of people below the lower and the higher calorie norm changed only slightly between 2004 and 2009. While the mean calorie intake (overall) decreased between 2004 and 2009, it increased for those below the lower calorie norm. Although less alarming than the calorie deprivation increase in rural India, it is nevertheless worrying.

DD drew attention to the downward shift in the calorie Engel curve over the period 1983–2004. We find that for the period 1993-2009 the calorie Engel curves for rural India display a downward shift-especially above extremely low levels of monthly per capita expenditure (MPCE) at 2004 prices (Figures 3 and 4). The proportionate reduction in calorie intake is much higher at higher MPCE. The calorie Engel curve in urban India for 2004 lies above 1993 at lower levels of MPCE. At MPCE >Rs 500, calorie intake was higher in 1993 than in 2004. The proportionate reduction in calorie intake at higher MPCE was larger. Similarly, the calorie Engel curve for 2009 lies above that for 2004 at lower levels and the crossover occurs

[3] Srinivasan (1992) is deeply sceptical of such requirements on the ground that energy expenditure adjusts to intake within a range.

[4] Although calorie deprivation is an aspect of undernutrition, we sometimes use them interchangeably for expositional convenience.

at MPCE of Rs. 500. Thus, there is evidence of a downward shift of the calorie Engel curve in both rural and urban India, especially at higher levels of MPCE.

Fig 3: Calorie Engel Curve for Rural India

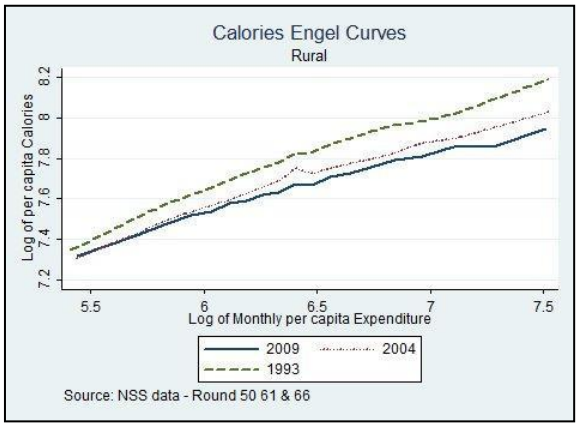
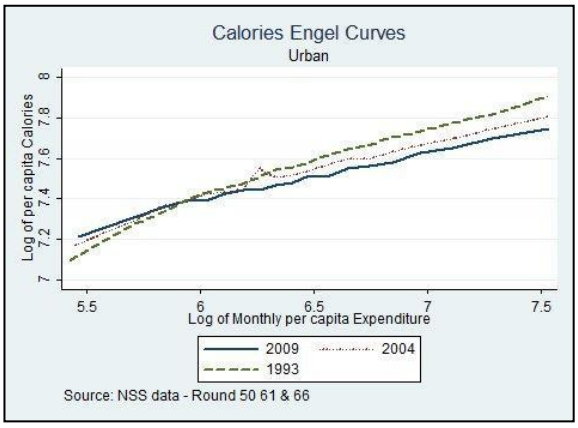


Fig 4: Calorie Engel Curve for Urban India



Protein

The mean protein intakes reduced from 60.3 gms in 1993 to 55.8 gms in 2004, i.e. by 7 per cent. The reduction was slower in the second period – by 3 per cent with mean intake of 54.1 gms in 2009. In urban areas, the mean protein intake reduced from 57.3 gms in 1993 to 55.4 gms in 2004 and 53.4 gms in 2009, i.e. a reduction of about 3-4 per cent in both periods.

To assess the proportion of people who are protein-deprived, a cut-off of 60 (gms) of protein

Fig 5: Protein Intake Distribution in Rural India

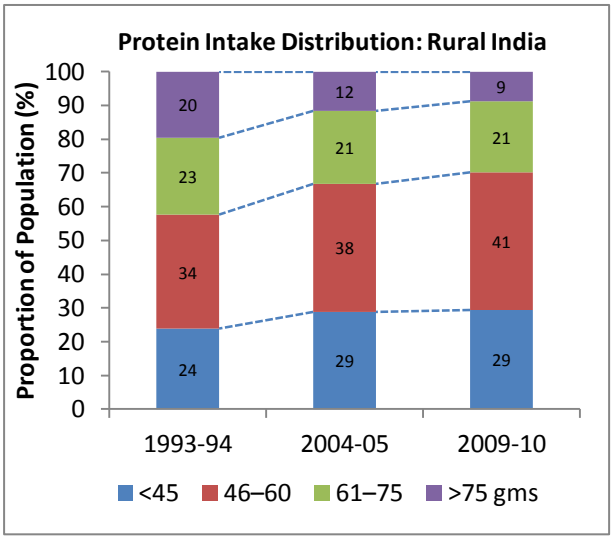
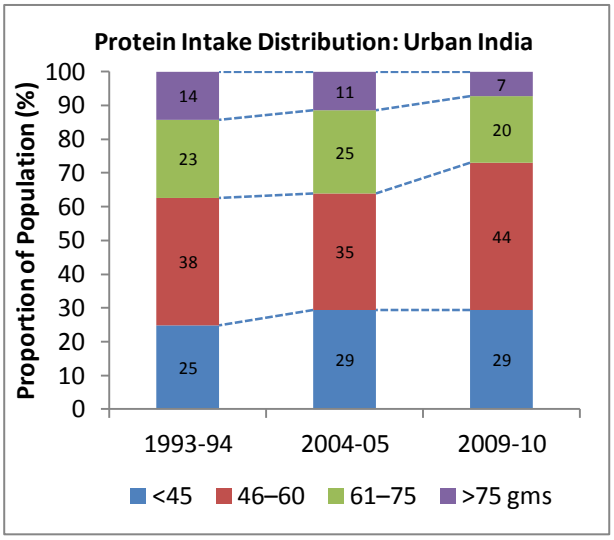


Fig 6: Protein Intake Distribution in Urban India



intake is used[5]. Figures 5 and 6 show the distribution of protein in rural and urban India between 1993 and 2010. Detailed tables containing the mean protein intakes are given in the annexure.

While protein deficiency is in large measure linked to calorie deficiency, we note that well over 57 % of rural households consumed fewer than the required protein intake in 1993. Just under a quarter of the households consumed <45 (gms) of protein. Within both ranges of protein intake, the proportions rose more than moderately (e.g., in the lower range, the proportion of households rose from about 24 % in 1993 to about 29 % in 2004; in the higher range, the proportion rose from 57% in 1993 to 66% in 2004 to 70% in 2009). Although the mean intake of protein for households in the lower range remained unchanged, it reduced from 60 gms in 1993 to 56 gms in 2004 and 54 gms in 2009.

The share of protein-deficient households in urban India (considering the 60 gm cut-off) remained unchanged between 1993 and 2004 but increased substantially between 2004 and 2009. Overall mean protein intakes, however, reduced.

Figures 7 and 8 report protein Engel curves for rural and urban India between 1993–2009. The rural–urban contrast in protein intake is striking. In the rural areas, protein intake was consistently lower across expenditure classes in 2009 than in 2004 which in turn was lower than in 1993. The gap between 1993 and 2004 intakes widens considerably at higher MPCE.

Fig 7: Protein Engel Curves for Rural India

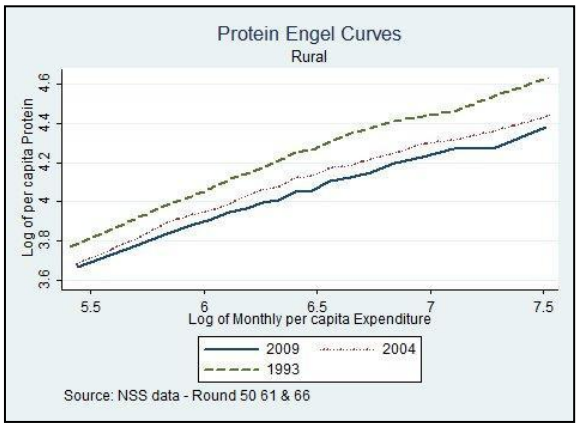
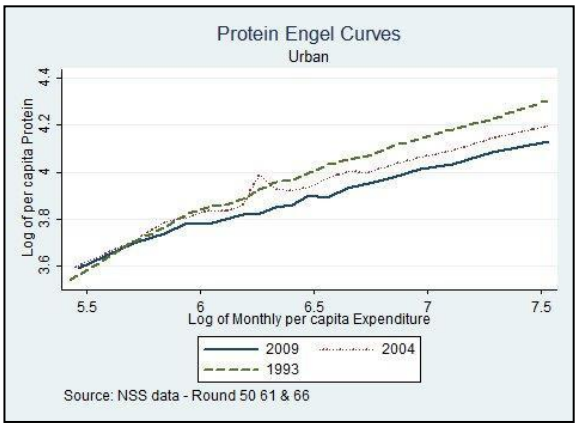


Fig 8: Protein Engel Curves for Urban India



[5] For details, see Gopalan et al. (1971**,** 1992**),** and ICMR (1990).

In urban areas, the 2004 curve was above the 1993 curve at low levels of MPCE and, after the cross-over expenditure of about Rs 500, the former lay below the 1993 curve. The 2009 curve lies above the 2004 curve at lower levels of MPCE and below the 2004 curve at higher levels.

Fats

Mean fat intake increased substantially between 1993-94 and 2004-05. In rural areas, the mean fat intake increased by 12 per cent, from 31.5 gms in 1993 to 35.4 gms in 2004. In urban areas, the mean fat intake increased by 13 per cent, from 42.1 gms in 1993 to 47.5 gms in 2004. The increase in fat intakes in the second period, i.e. 2004-05 and 2009-10 were more moderate. Mean fat intakes increased to 38.2 gms (increase of 8 per cent) in rural areas, and 48.9 gms (increase of 3 per cent) in urban areas.

Although a precise range for fat requirements cannot be specified, a range of 40–60 (gms) of fat intake is desirable[6]. Figures 9 and 10 show the distribution of fat in rural and urban India between 1993 and 2009. Detailed tables containing the mean fat intakes are given in the annexure.

Fig 9: Fat Intake Distributions for Rural India

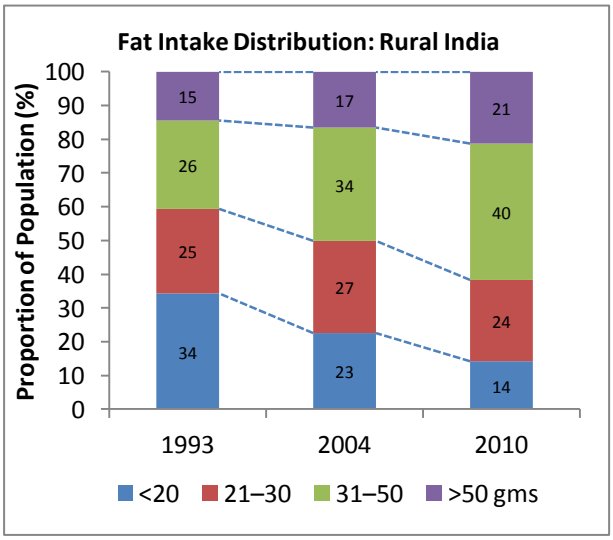
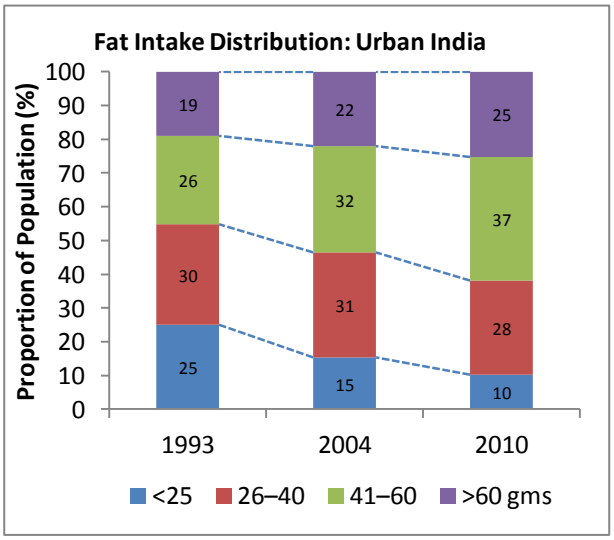


Fig 10: Fat Intake Distributions for Urban India



[6] Gopalan et al. (1971) observe: 'The quantity of fat that should be included in a well balanced diet is not known with any degree of certainty. However, it appears desirable in the present state of knowledge that the daily intake of fat should be such that it contributes no more than 15 to 20 % of the calories in the diet. A total of about 40 to 60 gms of fat can therefore be safely consumed daily, and in order to obtain the necessary amounts of essential fatty acids, the fat intake should include at least 15 gms of vegetable oils' (pg. 8). Also see ICMR (1990).

Even considering the first three ranges of fat intake, an astonishingly high estimate for fat deficient households for rural India (over 85%) is obtained for 1993. Well over one-third of households were under the lowest range of <20 (gms). The corresponding household share with fat intakes <50 gms fell to over 83% in 2004 and 79% in 2009. The share of households consuming <20 gms of fat fell sharply (from over 34% in 1993 to well over 22% in 2004 and 14% in 2009). Mean fat intakes increased over the period 1993 to 2009.

Using higher ranges of fat intake for urban areas, fat deprivation was pervasive (about 81% of the households consumed <60 gms of fats in 1993). About a quarter consumed <25 gms. Over the period 1993–2009, the reduction in the proportion of fat- deprived was slight (from 81% in 1993 to 78% in 2004 to 75% in 2009). However, as in rural India, the proportion consuming fats <25 gms fell sharply. Mean fat intake increased.

Figures 11 and 12 show the Engel curves for fat. In rural areas, the fat Engel curves for 1993 lay below that for 2004 at lower levels of MPCE. The 2009 curve lies above the 2004 curve at lower levels of MPCE. The crossover is at approximately Rs.650. In urban areas, the crossover is at Rs.1000. The curves converge beyond this.

Fig 11: Fat Engel Curves for Rural India

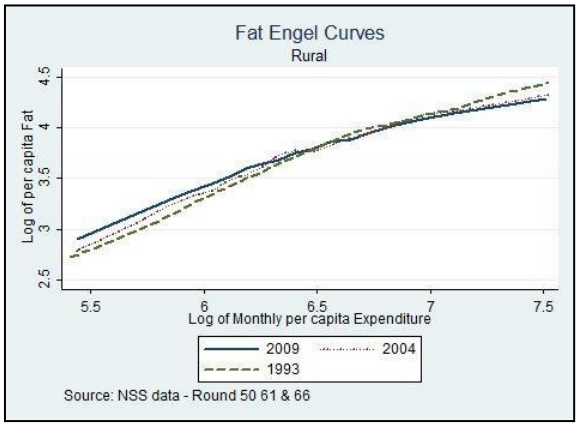
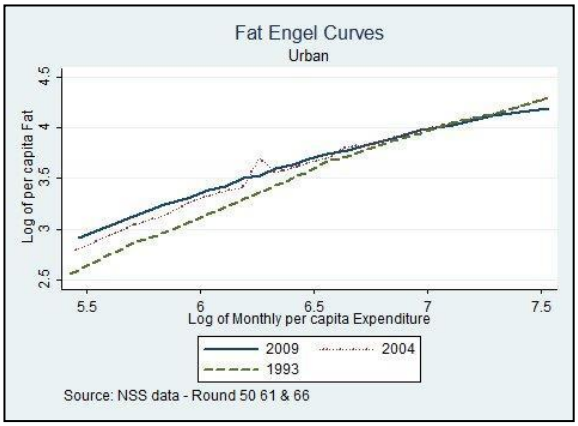


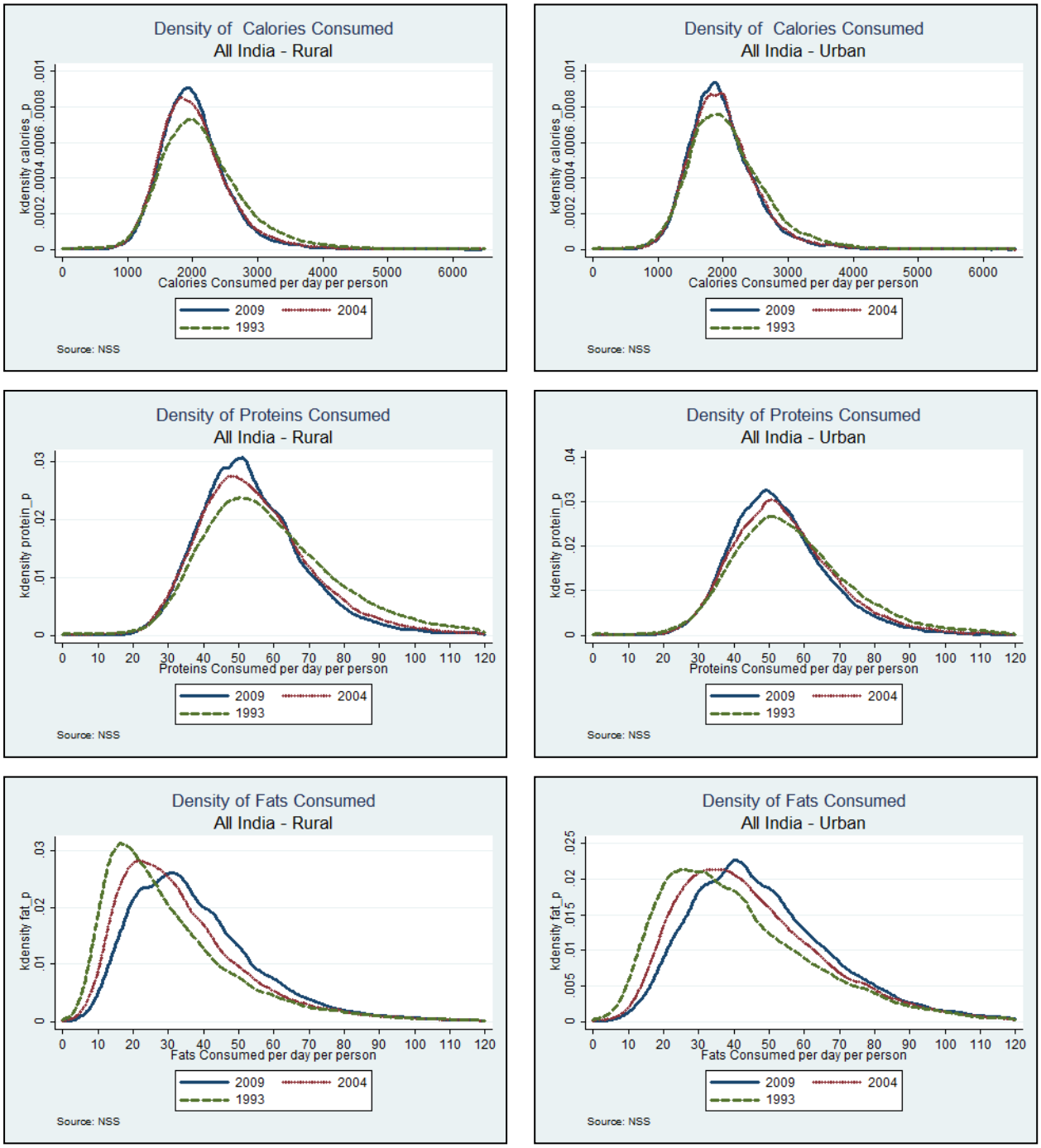
Fig 12: Fat Engel Curves for Urban India



Thus, taking nutritional norms as valid, the overall picture of nutritional deprivation worsened considerably over the period 1993–2009. The following Kernel density functions (figure 13) clearly show a leftward shift in calorie and protein intake distributions and a rightward shift in the fat intake distribution in both rural and urban areas between 1993 and 2009[7].

[7] For an admirably clear exposition of kernel density functions, see Deaton (1995).

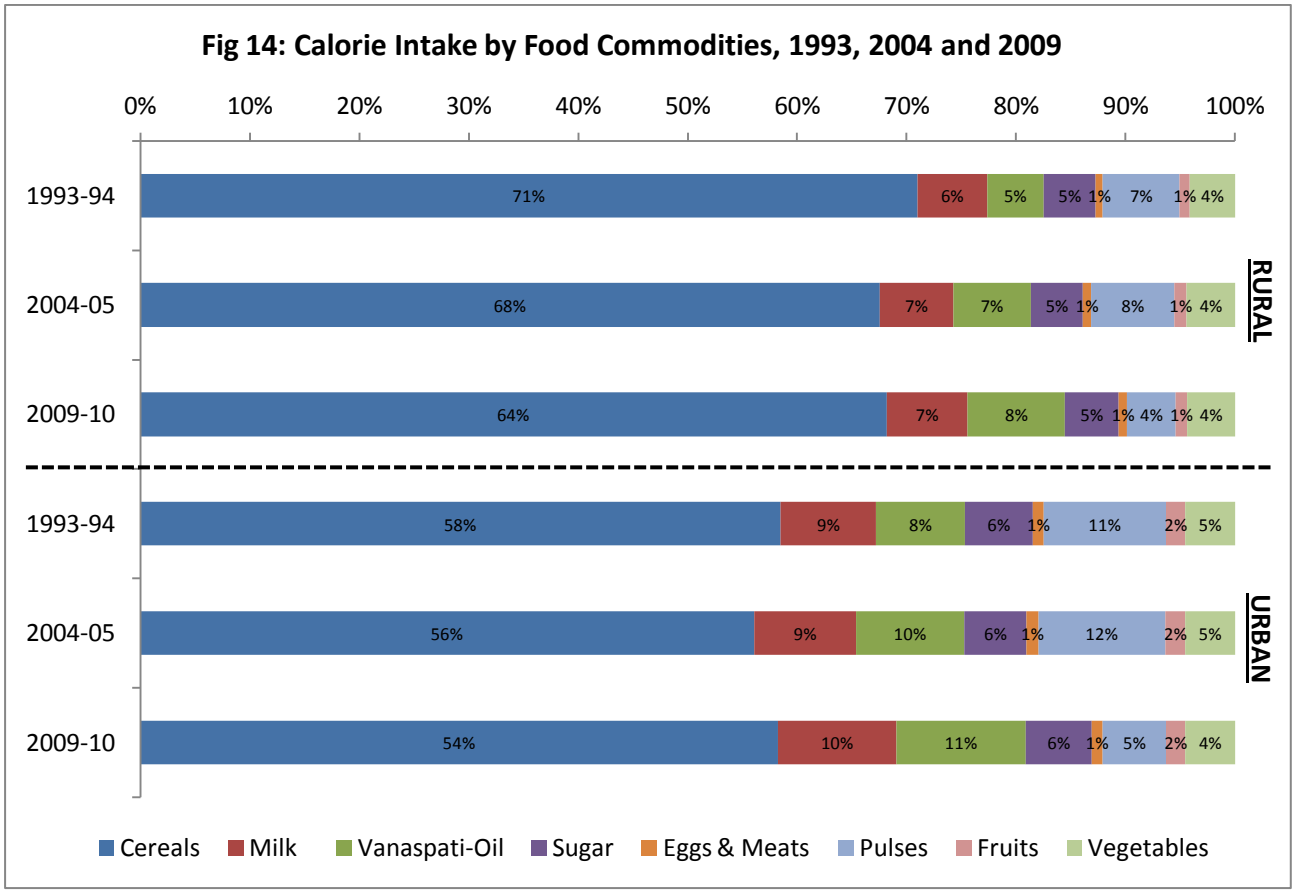
Fig 13: Kernel Density Functions for Calories, Proteins and Fats consumed – Rural and Urban India (1993 – 2009)



1.2. Factors Underlying Changes in Diets and Nutrition

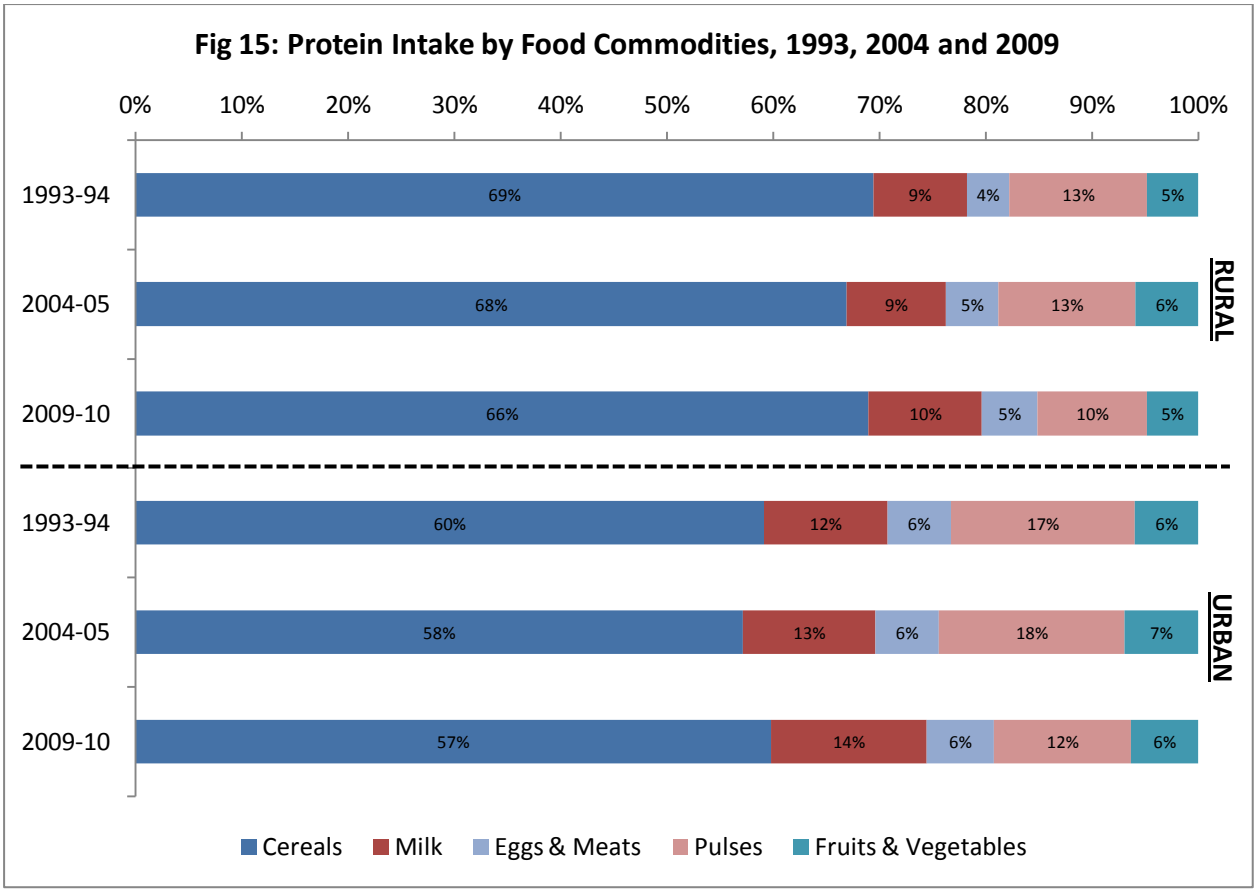
We build on the DD analysis (2009) of food commodities that contributed to reduction in calories, protein and increase in fat consumption.

Figure 14 shows the distribution of calorie, protein and fat intake by food commodities for rural and urban areas between 1993 and 2009. Detailed tables containing mean per capita intake of nutrients from the various food items are given in the annexure.



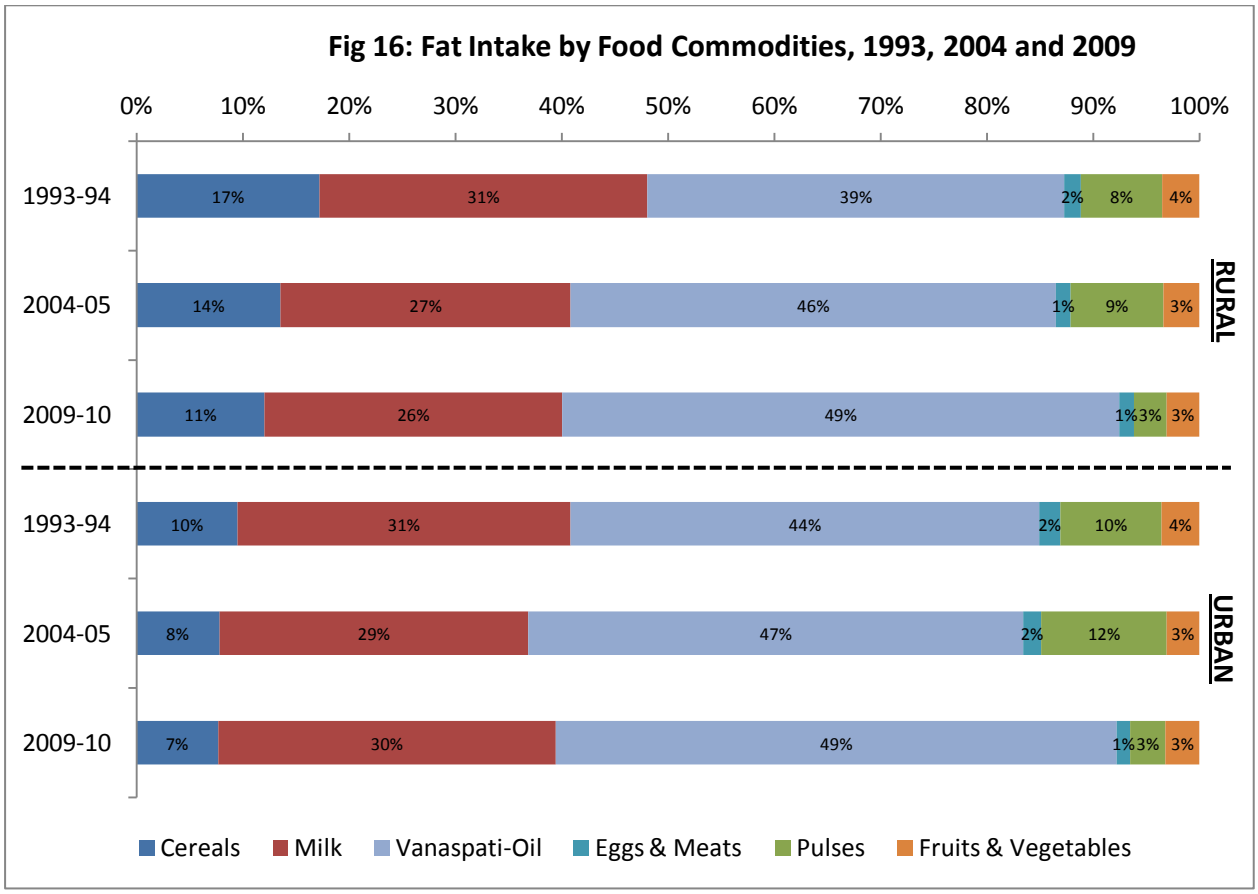
In rural India, calorie intakes declined between 1993 and 2009. Most of it is attributable to the decline in calories from cereals, and pulses to some extent. Calories from cereals reduced from 1530 in 1993 to 1383 in 2004 and 1296 in 2009. The contribution of milk/milk products, sugar, fruits and vegetables remained largely unchanged between 1993 and 2009. The contribution of vanaspati oil to the calorie intake increased substantially. Calories obtained from oil increased from 111 in 1993 to 145 in 2004 and 169 in 2009.

Similar results are found for urban areas as well. The reduction in the contribution of pulses to calorie intakes was more drastic in urban areas between 2004 and 2009.



In both rural and urban areas, protein intake declined between 1993 and 2009 (Figure 15). Much of it is reflected in a reduction in protein intake from cereals and pulses. In rural areas, the protein intake from these commodities decreased from 50 gms in 1993 to 45 gms in 2004 and 40 gms in 2009. The corresponding numbers for urban areas are 44 gms (1993), 42 gms (2004) and 37 gms (2009). Intake from dairy products (milk, eggs and meats) increased moderately. Proteins from other sources are a very small fraction and largely remained unchanged between 1993 and 2009.

Between 1993-2009 fat intake rose in both rural and urban areas. Vanaspati-oil has the maximum share in total fat intakes, and its contribution rose over the period 1993 and 2009. In rural areas, fat intake from vanaspati-oil rose from 12 gms in 1993 to 16 gms in 2004 and 19 gms in 2009. In urban areas, the share of vanaspati-oil rose from 19 gms in 1993 to 22 gms in 2004 and 24 gms in 2009. The other significant contributor to fat intake are cereals, pulses and milk products (including ghee and butter), but their contribution reduced between 1993 and 2009. Declining intake of fats from these commodities were more than offset by the increased intake of fat from vanaspati-oil.



1.3. Demand Theory Based Explanation of Changes in Nutrient Intake

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 less strenuous activity levels**,** and more sedentary life-styles**,** we have developed an alternative explanation of changes in the consumption of calories, protein and fats over the period 1993–2009. This explanation is embedded in a standard demand theory framework, with food prices[8] and expenditure (as a proxy for income) cast in a pivotal role. Based on different experiments, robust demand functions are estimated for each of the three nutrients viz. calories, protein and fats (Tables 1-3). Our results show consistently robust food price and expenditure effects, thus raising further doubts about the adequacy of the DD explanation. The analysis is based

[8] 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. Underlying this 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

on unit record data collected for the 50th, 61st and 66th rounds of the NSS (corresponding to the years 1993–94, 2004–05, and 2009-10, respectively). We will discuss separately the results for rural and urban samples.

(a) Demand Function

A basic demand equation for nutrients (calories, protein, fats) in rural and urban India with pooled data for 1993 2004 and 2009 is given below:

$$\ln C_{it} = \alpha + \boldsymbol{P_{jt}\beta} + \gamma E_{it} + \boldsymbol{X_{it}\delta} + \lambda_1 D1_t + \lambda_2 D2_{t+k} + \varepsilon_{it} \qquad (1)$$

where the dependent variable is log of nutrient consumed by ith household in time t, $\mathbf{P}_{jt}$ is a vector of food prices computed from the NSS at the village level (j) and time t, E_{it} is household per capita expenditure for ith household in time t, $\mathbf{X}_{it}$ is a vector of household characteristics (e.g. number of adult males, females, household size) and a few others specified as dummy variables (caste), $D1_t$ is a dummy 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), $D2_{t+k}$ is the second time dummy that takes the value 1 for 2009 and 0 otherwise, 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 and expenditure effects over time[9].

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, for example, calorie (and other nutrients') intakes.

[9] While these effects yield insights into changing consumer demands, a more detailed analysis along the lines of Behrman and Deolalikar (1989) and Jha et al. (2009) would further deepen our understanding consumer preferences and tastes for variety.

(b) Results

We first consider the calorie demand function. For both rural and urban areas, each of the price effects has a significant negative coefficient, with the exception of price of fruits and vegetables whose coefficient in not significant. Moreover, the price effects on the demand for calories have in many cases weakened, as captured by the coefficients of the interaction term (i.e. interaction between the price and the time dummies). A case in point is price of cereals and pulses. Rising incomes have a positive impact on calorie demand, and so does the proportion of adults in the household. The former effect, however, weakened over time. As household size increases, calorie demand decreases. Education of adult female has a negative impact on calorie demand, as this may be attributed to consumption of a more balanced diet, rich in protein and vitamins and reduced dependence on cereals, which is a major source of calories. By contrast, education of adult male is not significant in rural areas but positive in urban areas. SCs have lower demands for calories in both rural and urban areas while that of Others is positive in rural areas and negative in urban areas relative to STs. The effect of time alone is reduced consumption of calorie between 1993 and 2004. However, somewhat surprisingly, the residual time effect is not significant between 2004-09. That this undermines the DD explanation emphasising lower calorie requirements due to improvements in the epidemiology of the disease environment, less strenuous physical activities and more sedentary life styles cannot be ruled out.

In case of protein demand in both rural and urban areas, there is a positive influence of the price of fruits and vegetables, whereas the elasticity of protein demand with respect to all other food prices is negative. As in the case of calorie demand, several price effects weakened over over time, as captured by the interaction term (between food prices and the time dummies). A case in point is price of milk and milk products, eggs and meats. Higher income/expenditure increase protein demand but less so over time. Increasing household size reduces protein demand, whereas rising proportion of adults in the household increases it. The impact of education of adult female is negative, and that of education of adult male is not significant. SCs have lower demand for protein while Others have higher demand relative to STs. The residual effect of time after accounting for the interaction is significant with a negative coefficient suggesting a lower demand for protein in 2009 and 2004 as compared to 1993.

In case of fats too in both rural and urban areas , there are significant price and expenditure effects – positive in the case of price of cereals, oil and fruits and vegetables, and negative in case of milk products and sugar. The positive price elasticity of fats with respect to edible oil price is somewhat surprising, although the price effect has weakened over time. MPCE has positive Unlike in the case of calorie and protein, highest education of adult female has a positive impact on fat demand, suggesting that households with females having higher than middle level of education tend to eat diets rich in fats, shifting away from diets rich in calories and proteins. Moreover, highest education of adult male also has a positive and significant effect. As in the case of calorie and protein, household size has a negative impact and proportion of adults in a household has a positive impact on demand for fats. SCs and Others have higher demands relative to STs. The effect of time alone is to increase the fat demand in 2009 and 2004, as compared to 1993.

2. Concluding Observations

The main findings of our analysis are summarised below from a policy perspective.

An important insight from the comparison of three rounds of the NSS over the period 1993-2009 points to a slowing down of the reduction in the calorie intake in both rural and urban areas in 2004-09 relative to 1993-2004. A similar slowing down occurred in protein intake over the more recent period (2004-09). While fat intake continued to rise over this period but at a lower rate.

A demand theory based explanation of changes in demands for these nutrients reaffirmed the important roles of food price and expenditure changes. A new insight, however, is that in several cases food price effects weakened over time, as also expenditure effects. While the residual time effect weakened for both calories and protein over the period 1993-2004, it slowed down over the more recent period. The effect of time on fat demand was, however, positive and strengthened over the more recent period. Altogether thus the DD explanation of lower calorie and protein demands over time as a result of lower requirements is further undermined.

From a policy perspective, the important roles of food price stabilisation and expansion of livelihood opportunities remain key to ameliorating nutritional deprivation *despite* lowering of nutritional requirements. A closer scrutiny of dietary preferences and tastes is crucial for

both understanding sources of nutritional deprivation and for designing effective policies for mitigating it.

Table 1: Robust Regression Estimates: Demand for Calories, 1993-2009

	RURAL						URBAN					
Dependent Variable: Log of Per capita consumption of calories	No. of Obs. = 193785						No. of Obs. = 124481					
	F(60,193724) = 11926.31						F(60,124420) = 3705.11					
	Prob. > F = 0						Prob. > F = 0					
	Coefficient			Elasticity			Coefficient			Elasticity		
Price: Cereals & Pulses	-0.012	(-25.24)	***	-0.166	(-25.24)	***	-0.006	(-10.2)	***	-0.090	(-10.2)	***
---*interaction T1 (2004)*	0.011	(20.72)	***	0.049	(20.72)	***	0.001	(0.96)	-	0.003	(0.96)	-
---*interaction T2 (2009)*	0.010	(20.05)	***	0.071	(20.05)	***	0.004	(6.99)	***	0.037	(6.99)	***
Price: Milk, Milk Products, Eggs & Meats	-0.003	(-64.21)	***	-0.098	(-64.21)	***	-0.001	(-12.53)	***	-0.035	(-12.53)	***
---*interaction T1 (2004)*	0.002	(42.88)	***	0.026	(42.88)	***	0.000	(3.29)	***	0.003	(3.29)	***
---*interaction T2 (2009)*	0.002	(49.83)	***	0.040	(49.83)	***	0.001	(9.04)	***	0.013	(9.04)	***
Price: Oil	-0.008	(-26.67)	***	-0.086	(-26.67)	***	-0.004	(-10.1)	***	-0.048	(-10.1)	***
---*interaction T1 (2004)*	0.004	(11.75)	***	0.015	(11.75)	***	0.001	(1.89)	*	0.003	(1.89)	*
---*interaction T2 (2009)*	0.006	(19.34)	***	0.031	(19.34)	***	0.004	(9.94)	***	0.024	(9.94)	***
Price: Sugar	-0.002	(-12.7)	***	-0.124	(-12.7)	***	-0.004	(-12.09)	***	-0.183	(-12.09)	***
---*interaction T1 (2004)*	0.002	(11.36)	***	0.050	(11.36)	***	0.003	(10.29)	***	0.061	(10.29)	***
---*interaction T2 (2009)*	0.001	(7.04)	***	0.027	(7.04)	***	0.002	(5.16)	***	0.033	(5.16)	***
Price: Fruits & Vegetables	-0.001	(-1.16)	-	-0.010	(-1.16)	-	0.001	(1.94)	*	0.026	(1.94)	*
---*interaction T1 (2004)*	0.001	(2.75)	***	0.010	(2.75)	***	0.000	(0.26)	-	0.001	(0.26)	-
---*interaction T2 (2009)*	-0.001	(-1.74)	*	-0.007	(-1.74)	*	-0.003	(-3.92)	***	-0.027	(-3.92)	***
Monthly per capita expenditure	0.001	(401.95)	***	0.418	(401.95)	***	0.000	(225.49)	***	0.240	(225.49)	***
---*interaction T1 (2004)*	0.000	(-116.0)	***	-0.054	(-116.0)	***	0.000	(-23.86)	***	-0.011	(-23.86)	***
---*interaction T2 (2009)*	0.000	(-171.2)	***	-0.063	(-171.2)	***	0.000	(-50.97)	***	-0.022	(-50.97)	***
Household Size	-0.006	(-30.76)	***	-0.033	(-30.76)	***	-0.021	(-68.4)	***	-0.096	(-68.4)	***
Proportion of Adults in the household	0.202	(91.39)	***	0.137	(91.39)	***	0.235	(81.83)	***	0.169	(81.83)	***
Education Dummy: Males	0.000	(-0.23)	-	0.000	(-0.23)	-	0.012	(8.05)	***	0.008	(8.05)	***
Education Dummy: Females	-0.025	(-21.5)	***	-0.008	(-21.5)	***	-0.013	(-9.52)	***	-0.007	(-9.52)	***
Time Dummy (2004)	-0.159	(-18.93)	***	-0.061	(-18.93)	***	-0.105	(-8.29)	***	-0.036	(-8.29)	***
Time Dummy (2009)	-0.007	(-0.69)	-	-0.002	(-0.69)	-	0.006	(0.45)	-	0.002	(0.45)	-
Caste Dummy (SC)	-0.011	(-5.86)	***	-0.002	(-5.86)	***	-0.017	(-4.98)	***	-0.002	(-4.98)	***
Caste Dummy (Others)	0.010	(6.16)	***	0.006	(6.16)	***	-0.005	(-1.77)	*	-0.004	(-1.77)	*
Constant	7.569	(890.23)	***				7.712	(592.82)	***			
***, ** and * refer to significance at the 1%, 5% and 10% level, respectively.												
State Dummies are omitted and details will be furnished on request; Education Dummy: If highest level of education is middle or lower, then dummy = 0, else=1; Omitted Time period: 1993; Omitted caste: ST												

Table 2: Robust Regression Estimates: Demand for Protein, 1993-2009

	RURAL						URBAN					
Dependent Variable: Log of Per capita consumption of protein	No. of Obs. = 193784						No. of Obs. = 124481					
	F(60,193723) = 11445.86						F(60,124420) = 3914.91					
	Prob. > F = 0						Prob. > F = 0					
	Coefficient			Elasticity			Coefficient			Elasticity		
Price: Cereals & Pulses	-0.013	(-23.92)	***	-0.169	(-23.92)	***	-0.009	(-15.08)	***	-0.144	(-15.08)	***
---*interaction T1 (2004)*	0.013	(21.53)	***	0.055	(21.53)	***	0.005	(6.62)	***	0.019	(6.62)	***
---*interaction T2 (2009)*	0.012	(21.87)	***	0.084	(21.87)	***	0.009	(13.86)	***	0.079	(13.86)	***
Price: Milk, Milk Products, Eggs & Meats	-0.003	(-74.97)	***	-0.123	(-74.97)	***	0.000	(-3.73)	***	-0.011	(-3.73)	***
---*interaction T1 (2004)*	0.002	(49.93)	***	0.032	(49.93)	***	0.000	(-1.96)	*	-0.002	(-1.96)	*
---*interaction T2 (2009)*	0.003	(58.15)	***	0.050	(58.15)	***	0.000	(2.64)	***	0.004	(2.64)	***
Price: Oil	-0.010	(-32.16)	***	-0.112	(-32.16)	***	-0.007	(-17.09)	***	-0.088	(-17.09)	***
---*interaction T1 (2004)*	0.005	(16.23)	***	0.022	(16.23)	***	0.003	(6.58)	***	0.012	(6.58)	***
---*interaction T2 (2009)*	0.007	(22.18)	***	0.038	(22.18)	***	0.006	(15.62)	***	0.041	(15.62)	***
Price: Sugar	-0.002	(-10.85)	***	-0.114	(-10.85)	***	-0.003	(-8.44)	***	-0.139	(-8.44)	***
---*interaction T1 (2004)*	0.002	(9.41)	***	0.045	(9.41)	***	0.001	(3.37)	***	0.022	(3.37)	***
---*interaction T2 (2009)*	0.001	(2.49)	**	0.010	(2.49)	**	0.000	(0.82)	-	0.006	(0.82)	-
Price: Fruits & Vegetables	0.002	(4.2)	***	0.040	(4.2)	***	0.002	(2.44)	**	0.036	(2.44)	**
---*interaction T1 (2004)*	0.000	(0.84)	-	0.003	(0.84)	-	-0.001	(-0.81)	-	-0.004	(-0.81)	-
---*interaction T2 (2009)*	-0.003	(-6.52)	***	-0.030	(-6.52)	***	-0.003	(-3.66)	***	-0.027	(-3.66)	***
Monthly per capita expenditure	0.001	(391.84)	***	0.438	(391.84)	***	0.000	(219.12)	***	0.254	(219.12)	***
---*interaction T1 (2004)*	0.000	(-100.4)	***	-0.051	(-100.4)	***	0.000	(-15.27)	***	-0.008	(-15.27)	***
---*interaction T2 (2009)*	0.000	(-138.9)	***	-0.058	(-138.9)	***	0.000	(-37.05)	***	-0.017	(-37.05)	***
Household Size	-0.005	(-23.68)	***	-0.027	(-23.68)	***	-0.018	(-55.26)	***	-0.084	(-55.26)	***
Proportion of Adults in the household	0.198	(82.93)	***	0.134	(82.93)	***	0.226	(72.47)	***	0.163	(72.47)	***
Education Dummy: Males	0.001	(1.16)	-	0.001	(1.16)	-	0.012	(7.43)	***	0.008	(7.43)	***
Education Dummy: Females	-0.025	(-20.31)	***	-0.008	(-20.31)	***	-0.014	(-9.47)	***	-0.008	(-9.47)	***
Time Dummy (2004)	-0.210	(-23.15)	***	-0.081	(-23.15)	***	-0.050	(-3.6)	***	-0.017	(-3.6)	***
Time Dummy (2009)	-0.031	(-2.84)	***	-0.009	(-2.84)	***	-0.047	(-3.07)	***	-0.015	(-3.07)	***
Caste Dummy (SC)	-0.007	(-3.64)	***	-0.001	(-3.64)	***	-0.007	(-1.87)	*	-0.001	(-1.87)	*
Caste Dummy (Others)	0.011	(6.23)	***	0.007	(6.23)	***	0.005	(1.43)	-	0.004	(1.43)	-
Constant	3.952	(431.44)	***				4.101	(289.87)	***			
***, ** and * refer to significance at the 1%, 5% and 10% level, respectively.												
State Dummies are omitted and details will be furnished on request; Education Dummy: If highest level of education is middle or lower, then dummy = 0, else=1; Omitted Time period: 1993; Omitted caste: ST												

Table 3: Robust Regression Estimates: Demand for Fats, 1993- 2009

	RURAL						URBAN					
Dependent Variable: Log of Per capita consumption of Fats	No. of Obs.	=	193784				No. of Obs.	=	124481			
	F(60,193723)	=	18957.78				F(60,124420)	=	7662.01			
	Prob. > F	=	0				Prob. > F	=	0			
	Coefficient			Elasticity			Coefficient			Elasticity		
Price: Cereals & Pulses	0.016	(20.33)	***	0.218	(20.33)	***	0.012	(14.62)	***	0.193	(14.62)	***
---*interaction T1 (2004)*	-0.005	(-5.98)	***	-0.023	(-5.98)	***	-0.008	(-8.71)	***	-0.035	(-8.71)	***
---*interaction T2 (2009)*	-0.009	(-10.67)	***	-0.062	(-10.67)	***	-0.006	(-6.61)	***	-0.052	(-6.61)	***
Price: Milk, Milk Products, Eggs & Meats	-0.013	(-192.4)	***	-0.478	(-192.4)	***	-0.009	(-76.98)	***	-0.327	(-76.98)	***
---*interaction T1 (2004)*	0.008	(105.09)	***	0.106	(105.09)	***	0.005	(35.37)	***	0.056	(35.37)	***
---*interaction T2 (2009)*	0.010	(133.13)	***	0.172	(133.13)	***	0.007	(55.87)	***	0.121	(55.87)	***
Price: Oil	0.002	(4.45)	***	0.023	(4.45)	***	0.007	(13.64)	***	0.097	(13.64)	***
---*interaction T1 (2004)*	-0.001	(-2.51)	**	-0.005	(-2.51)	**	-0.003	(-5.71)	***	-0.014	(-5.71)	***
---*interaction T2 (2009)*	-0.002	(-4.29)	***	-0.011	(-4.29)	***	-0.004	(-8.01)	***	-0.029	(-8.01)	***
Price: Sugar	-0.004	(-13.65)	***	-0.217	(-13.65)	***	-0.003	(-7.5)	***	-0.170	(-7.5)	***
---*interaction T1 (2004)*	0.001	(3.06)	***	0.022	(3.06)	***	0.001	(1.23)	-	0.011	(1.23)	-
---*interaction T2 (2009)*	-0.001	(-1.69)	*	-0.011	(-1.69)	*	-0.002	(-4.2)	***	-0.040	(-4.2)	***
Price: Fruits & Vegetables	0.011	(14.18)	***	0.206	(14.18)	***	0.006	(6.15)	***	0.125	(6.15)	***
---*interaction T1 (2004)*	-0.010	(-12.27)	***	-0.070	(-12.27)	***	-0.006	(-5.56)	***	-0.037	(-5.56)	***
---*interaction T2 (2009)*	-0.011	(-13.92)	***	-0.097	(-13.92)	***	-0.008	(-7.4)	***	-0.076	(-7.4)	***
Monthly per capita expenditure	0.001	(443.65)	***	0.753	(443.65)	***	0.000	(288.58)	***	0.462	(288.58)	***
---*interaction T1 (2004)*	0.000	(-127.9)	***	-0.098	(-127.)	***	0.000	(-18.96)	***	-0.014	(-18.96)	***
---*interaction T2 (2009)*	-0.001	(-210.0)	***	-0.126	(-210.0)	***	0.000	(-84.14)	***	-0.054	(-84.14)	***
Household Size	-0.019	(-55.56)	***	-0.097	(-55.56)	***	-0.039	(-84.97)	***	-0.179	(-84.97)	***
Proportion of Adults in the household	0.165	(45.84)	***	0.112	(45.84)	***	0.188	(43.68)	***	0.135	(43.68)	***
Education Dummy: Males	0.056	(32.04)	***	0.029	(32.04)	***	0.086	(38.25)	***	0.060	(38.25)	***
Education Dummy: Females	0.031	(16.7)	***	0.010	(16.7)	***	0.086	(40.86)	***	0.048	(40.86)	***
Time Dummy (2004)	0.299	(21.75)	***	0.115	(21.75)	***	0.161	(8.45)	***	0.055	(8.45)	***
Time Dummy (2009)	0.564	(33.91)	***	0.165	(33.91)	***	0.360	(16.97)	***	0.114	(16.97)	***
Caste Dummy (SC)	0.052	(17.4)	***	0.009	(17.4)	***	0.040	(7.64)	***	0.005	(7.64)	***
Caste Dummy (Others)	0.135	(52.78)	***	0.090	(52.78)	***	0.108	(23.07)	***	0.086	(23.07)	***
Constant	3.023	(217.87)	***				3.474	(177.76)	***			
***, ** and * refer to significance at the 1%, 5% and 10% level, respectively.												
State Dummies are omitted and details will be furnished on request; Education Dummy: If highest level of education is middle or lower, then dummy = 0, else=1; Omitted Time period: 1993; Omitted caste: ST												

Annexure 1: Distribution of Nutrient Intake (1993 – 2009)

The following tables show the distribution of nutrient intake (proportion of population in each category) in rural and urban areas between 1993 and 2009. Figures in parenthesis indicate the mean nutrient intake in each range.

Table 1: Calorie Intake Distributions in Rural India, 1993, 2004 and 2009

Year	Range of Calorie Intake Per Capita Per Day				Total
	<1800	1801–2400	2401–3000	>3000	
1993	31.09 (1491)	40.07 (2084)	19.42 (2650)	9.42 (3636)	100 (2156)
2004	36.68 (1516)	43.11 (2071)	15.07 (2629)	5.14 (3925)	100 (2047)
2010	35.28 (1531)	45.91 (2071)	14.92 (2622)	3.89 (3545)	100 (2020)

Table 2: Calorie Intake Distributions in Urban India, 1993, 2004 and 2009

Year	Range of Calorie Intake Per Capita Per Day				Total
	<1700	1701–2100	2101–2600	>2600	
1993	28.12 (1426)	29.62 (1900)	25.76 (2320)	16.49 (3107)	100 (2074)
2004	29.40 (1440)	34.52 (1900)	24.67 (2313)	11.41 (3252)	100 (2021)
2010	30.10 (1456)	35.34 (1896)	24.36 (2312)	10.19 (3043)	100 (1982)

Table 3: Protein Intake Distributions in Rural India, 1993, 2004 and 2009

Year	Range of Protein Intake Per Capita Per Day (Gms)				Total
	<45	46–60	61–75	>75	
1993	23.81 (37.1)	33.79 (52.4)	22.79 (66.8)	19.61 (94.4)	100 (60.3)
2004	28.81 (37.4)	38.05 (52.2)	21.46 (66.3)	11.68 (93.9)	100 (55.8)
2010	29.35 (38.0)	40.81 (52.1)	21.05 (66.1)	8.79 (89.2)	100 (54.1)

Table 4: Protein Intake Distributions in Urban India, 1993, 2004 and 2009

Year	Range of Protein Intake Per Capita Per Day (Gms)				Total
	<45	46–60	61–75	>75	
1993	24.90 (37.1)	37.77 (52.4)	23.11 (66.5)	14.23 (90.7)	100 (57.3)
2004	29.40 (37.8)	34.50 (52.3)	24.69 (66.2)	11.40 (94.9)	100 (55.4)
2010	29.44 (38.3)	43.66 (52.1)	19.61 (66.1)	7.29 (87.6)	100 (53.4)

Table 5: Fat Intake Distributions in Rural India, 1993, 2004 and 2009

Year	Range of Fat Intake Per Capita Per Day (Gms)				Total
	<20	21–30	31–50	>50	
1993	34.30 (14.0)	25.08 (24.7)	26.09 (38.3)	14.54 (72.1)	100 (31.5)
2004	22.59 (15.0)	27.21 (24.9)	33.58 (38.3)	16.62 (74.6)	100 (35.4)
2010	14.20 (15.4)	24.05 (25.1)	40.49 (38.8)	21.25 (67.2)	100 (38.2)

Table 6: Fat Intake Distributions in Urban India, 1993, 2004 and 2009

Year	Range of Fat Intake Per Capita Per Day (Gms)				Total
	<25	26–40	41–60	>60	
1993	25.04 (18.2)	29.84 (32.3)	26.15 (48.6)	18.97 (80.2)	100 (42.1)
2004	15.39 (19.4)	31.02 (32.6)	31.56 (48.9)	22.04 (85.8)	100 (47.4)
2010	10.32 (19.8)	27.88 (33.0)	36.61 (49.0)	25.19 (78.1)	100 (48.9)

Source: Authors' calculations based on the 50th, 61st and 66th rounds of the NSS

Annexure 2: Distribution of Nutrient Intake by Food Commodities (1993 -2009)

The following tables show the distribution of nutrient (calorie, protein and fat) intake from nine food commodity groups for rural and urban areas between 1993 and 2009.

Table 1. Mean Per Capita Calorie Intake by Food Commodities, 1993, 2004 and 2009

Year	Cereals	Milk Products Ghee/Butter	Vanaspati-Oil	Sugar	Eggs	Meat/Fish /Poultry	Pulses/Nuts /Dry Fruits	Fruits	Vegetables	Total
Rural India										
1993-94	**1530**	**137**	**111**	**103**	**2**	**12**	**151**	**20**	**89**	**2156**
Share	71.0%	6.4%	5.1%	4.8%	0.1%	0.6%	7.0%	0.9%	4.1%	
2004-05	**1383**	**137**	**145**	**98**	**3**	**12**	**156**	**23**	**90**	**2047**
Share	67.6%	6.7%	7.1%	4.8%	0.1%	0.6%	7.6%	1.1%	4.4%	
2009-10	**1296**	**141**	**169**	**93**	**3**	**12**	**84**	**20**	**83**	**2020**
Share	64.2%	7.0%	8.4%	4.6%	0.1%	0.6%	4.2%	1.0%	4.1%	
Urban India										
1993-94	**1213**	**181**	**168**	**129**	**5**	**16**	**231**	**37**	**94**	**2074**
Share	58.5%	8.7%	8.1%	6.2%	0.2%	0.8%	11.1%	1.8%	4.5%	
2004-05	**1133**	**189**	**199**	**115**	**6**	**16**	**235**	**36**	**92**	**2021**
Share	56.1%	9.4%	9.8%	5.7%	0.3%	0.8%	11.6%	1.8%	4.6%	
2009-10	**1071**	**199**	**217**	**110**	**5**	**14**	**106**	**33**	**83**	**1982**
Share	54.0%	10.0%	10.9%	5.5%	0.3%	0.7%	5.3%	1.7%	4.2%	

Table 2. Mean Per Capita Protein Intake by Food Commodities, 1993, 2004 and 2009

Year	Cereals	Milk Products Ghee/Butter	Vanaspati-Oil	Sugar	Eggs	Meat/Fish /Poultry	Pulses/Nuts /Dry Fruits	Fruits	Vegetables	Total
Rural India										
1993-94	**41.8**	**5.3**	**0**	**0**	**0.2**	**2**	**7.8**	**0.2**	**2.9**	**60.3**
Share	69.3%	8.8%	0.0%	0.0%	0.3%	3.3%	12.9%	0.3%	4.8%	
2004-05	**37.9**	**5.3**	**0**	**0**	**0.3**	**2**	**7.3**	**0.3**	**2.8**	**55.8**
Share	67.9%	9.5%	0.0%	0.0%	0.5%	3.6%	13.1%	0.5%	5.0%	
2009-10	**35.6**	**5.5**	**0**	**0**	**0.3**	**2**	**5.3**	**0.2**	**2.5**	**54.1**
Share	65.8%	10.2%	0.0%	0.0%	0.6%	3.7%	9.8%	0.4%	4.6%	
Urban India										
1993-94	**34.1**	**6.7**	**0**	**0**	**0.4**	**2.6**	**10**	**0.4**	**3.1**	**57.3**
Share	59.5%	11.7%	0.0%	0.0%	0.7%	4.5%	17.5%	0.7%	5.4%	
2004-05	**32**	**7**	**0**	**0**	**0.5**	**2.7**	**9.8**	**0.4**	**3.1**	**55.4**
Share	57.8%	12.6%	0.0%	0.0%	0.9%	4.9%	17.7%	0.7%	5.6%	
2009-10	**30.2**	**7.4**	**0**	**0**	**0.4**	**2.6**	**6.5**	**0.4**	**2.7**	**53.4**
Share	56.6%	13.9%	0.0%	0.0%	0.7%	4.9%	12.2%	0.7%	5.1%	

Table 3. Mean Per Capita Fat Intake by Food Commodities, 1993, 2004 and 2009

Year	Cereals	Milk Products Ghee/Butter	Vanaspati-Oil	Sugar	Eggs	Meat/Fish /Poultry	Pulses/Nuts /Dry Fruits	Fruits	Vegetables	Total
Rural India										
1993-94	**5.4**	**9.7**	**12.3**	**0**	**0.2**	**0.3**	**2.4**	**0.7**	**0.4**	**31.5**
Share	17.1%	30.8%	39.0%	0.0%	0.6%	1.0%	7.6%	2.2%	1.3%	
2004-05	**4.8**	**9.7**	**16.2**	**0**	**0.3**	**0.2**	**3.1**	**0.8**	**0.4**	**35.4**
Share	13.6%	27.4%	45.8%	0.0%	0.8%	0.6%	8.8%	2.3%	1.1%	
2009-10	**4.3**	**10**	**18.7**	**0**	**0.3**	**0.2**	**1.1**	**0.8**	**0.3**	**38.2**
Share	11.3%	26.2%	49.0%	0.0%	0.8%	0.5%	2.9%	2.1%	0.8%	
Urban India										
1993-94	**4**	**13.2**	**18.6**	**0**	**0.4**	**0.4**	**4**	**1.1**	**0.4**	**42.1**
Share	9.5%	31.4%	44.2%	0.0%	1.0%	1.0%	9.5%	2.6%	1.0%	
2004-05	**3.7**	**13.8**	**22.1**	**0**	**0.5**	**0.3**	**5.6**	**1.1**	**0.4**	**47.5**
Share	7.8%	29.1%	46.5%	0.0%	1.1%	0.6%	11.8%	2.3%	0.8%	
2009-10	**3.5**	**14.5**	**24.1**	**0**	**0.4**	**0.2**	**1.5**	**1.1**	**0.4**	**48.9**
Share	7.2%	29.7%	49.3%	0.0%	0.8%	0.4%	3.1%	2.2%	0.8%	

Source: Authors' calculations based on the 50th, 61st and 66th rounds of the NSS

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