DIETARY TRANSITION IN INDIA: AN ANALYSIS BASED ON NSS DATA FOR 1993 AND 2004

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Abstract

Our study examines changes in diets over the period 1993-2004. Diets have shifted away from cereals towards higher consumption of fruits, vegetables, oils and livestock products. Using household data, reduced form demand relations are estimated for nine food commodities. Significant own and cross-price effects that vary over time are confirmed, as also income/expenditure effects. Over and above these effects, more sedentary life styles and less strenuous activity patterns played a significant role in shaping dietary patterns. While changes in life style and activity patterns are irreversible, an important policy insight is that food price stabilization and expansion of livelihood opportunities deserve greater attention.

Key words: Diets, Demand, Prices, Income, Environment, India
JEL Codes: C23, D12, I32

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CONTENTS

1. INTRODUCTION

India is currently undergoing a rapid economic and demographic transformation. Since 1980, average living standards have experienced a sustained and rapid rise. The gross domestic product per capita has risen by 230 percent; a trend rate of 4 percent annually. Life expectancy has risen from 54 years to 69 years while the (crude) birth rate has fallen from 34 to 22 per thousand between 1980 and 2008. Rapid economic growth has been accompanied by rising urbanization. Between 1980 and 2000, the share of the urban population rose from 23 to 28 percent. By 2030, it is likely to be as high as 41 percent.

The growth momentum was accelerated by wide ranging domestic and external liberalization of the Indian economy in the 1990s. A key feature of the economic transformation has been the change in the nature of the Indian diet. As the global markets integrate and communication becomes better, diet transitions are unavoidable. This results in a move away from traditional staples to food products that are more prevalent in western diets. These shifts are reflected in higher consumption of proteins, sugars, fats and vegetables. This dietary transition is a feature not only of India, but other Asian economies as well (Pingali, 2006).

Some of the underlying factors of this dietary transition include expansion of the middle class, higher female participation, the emergence of nuclear two-income families, a sharp age divide in food preferences (with younger age groups more susceptible to new foods advertised in the media), and a rapid growth of supermarkets and fast-food outlets.[2]

The nutritional implications of this dietary transition are, however, worrying.

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. 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 increased.

[2] In a perceptive comment, Timmer (2009) addresses the following questions: impact of supermarkets on poor consumers, supply of staples, price stability, linkages with global markets, and health of consumers. While supermarkets offer greater consumer choice and lower prices, they consolidate the supply chain to only a few producers who are increasingly responsible for compliance with the cost, quality and safety standards. Although supermarkets are increasingly driving the food policy agenda, the state has to play a proactive role in laying down food safety standards, their compliance and in ensuring greater awareness of healthy food habits.

A somewhat stunning result is that if we go by the per capita calorie norms of 2100 for urban areas and 2400 for the rural, the proportions of calorie deficient populations in the urban and rural areas have risen over the period 1993-2004 from about 58 per cent to about 64 per cent in urban areas, and from about 71 per cent to about 80 per cent in rural areas. As a result, at the all-India level, the calorie deficient population rose from about 68 per cent to about 76 per cent (Gaiha, Jha, & Kulkarni, 2010a).

For rural India, in 1993, 71 per cent of all calories consumed were provided by cereals, which fell to about 68 per cent by 2004. The decline in calorie intake from cereals was partially offset by the increase in calorie intake from milk, vegetable oil, fruits and vegetables. Milk and vegetable oil contributed 11.5 per cent of calorie intake in 1993 which increased to 13.8 per cent by 2004. Similar results are found for urban areas. The share of cereals in total calorie consumption decreased from 58.5 per cent (in 1993) to 56.1 per cent (in 2004). Milk and oil had a larger share in the total calorie consumption in 2004 (19.2 per cent) than in 1993 (16.8 per cent) (Gaiha, Jha, & Kulkarni, 2010b).

Whether the extent of undernutrition reflected in these estimates should be taken at face value continues to be debated. In an influential contribution Deaton and Dreze (2009) offer the conjecture that much of the reduction in calorie intake reflects lower calorie 'requirements' due to life style changes (more sedentary life styles), less strenuous activities and improvements in the social epidemiology of disease. They are somewhat dismissive of the role of relative prices in causing dietary changes. The food price index constructed by them, however, suffers from its aggregate nature as the interplay of own and relative prices of different food commodities in shaping diets is ruled out. Our analysis departs from this focus, as indicated below.

1.1. OBJECTIVE

As people demand and consume food commodities, it is important to understand dietary changes and the factors underlying them better before offering a definitive verdict on why undernutrition worsened. The present study aims to do this in a demand theory framework that allows for not just own and cross-price effects and income/expenditure effects but also encompasses the role of changing life styles and activity patterns over time. The period chosen for this analysis is 1993-2004. As this was a period of economic transformation, our analysis is likely to yield useful insights into how diets changed and the underlying factors.

1.2. SCHEME

First, a review of changes in diets in rural and urban samples of the National Sample Survey (NSS) data over the period 1993-2004 is carried out. As these dietary changes are in part a reflection of growth of supermarkets, and ease of eating out, this is followed by a brief review of recent evidence on how prevalent eating out is and amounts spent by different income groups. The next section discusses the methodology used for estimating the demand relations for 9 food commodities. The regression results are discussed in section 3. How our analysis builds on the extant literature is emphasized. The concluding section offers some observations from a broad policy perspective.

1.3. CHANGES IN DIETS

A few salient features of changes in diet composition are discussed below. To avoid cluttering the text, we comment on the median and 75th percentile households. The following table shows the mean per capita food intake (in gms) for both rural and urban Indian in 1993 and 2004. The data has been taken from the 50th and 61st rounds of the NSS (corresponding to 1993-94 and 2004-05, respectively).

Let us first examine the changes in food consumed in rural India. There was a reduction of about 10 per cent in cereal consumption, a reduction of 6 per cent in sugar consumption and a reduction of about 1 per cent in the consumption of milk/milk-products/ghee/butter. Pulses/nuts/dry fruits recorded an implausibly sharp drop of about 45 per cent. By contrast, intake of Vanaspati-oil rose by about 31 per cent. Intake of vegetables, and meat/fish/poultry rose but only slightly. Consumption of fruits, and eggs, on the other hand, rose sharply. Reduction in cereal intake was lower in urban India (about 7 per cent). As in the rural samples, pulses/nuts-dry fruits recorded a somewhat drastic reduction of about 37 per cent. Sugar recorded a reduction of about 10 per cent. The consumption of milk increased in urban areas (by 4 per cent). While meat/fish/poultry, fruits, milk/milk products/ghee/butter, and vegetables recorded small increases, eggs and Vanaspati-oil recorded moderately higher intakes.

There are considerable variations in the consumption of these commodities by the median and 75th percentile households. The decline in consumption of cereals for both the median and 75th percentile households was equal (~10 per cent in rural and ~8 per cent in urban areas). The decline was more for the 75th percentile households than the median households

in case of sugar (in both rural and urban areas). By contrast, while the consumption of pulses/nuts/dry-fruits declined by 54 per cent for the median households in rural areas, the decline was only 9 per cent for the 75th percentile households. In urban areas, the decline was almost equal (~35 per cent). The consumption of vanaspati-oil, fruits and vegetable increased in both rural and urban areas, with little or no variation between the median and the 75th percentile households, as well as for eggs, with a greater variation. In both rural and urban areas, the increase in consumption of milk/milk products/butter/ghee for the median households (~ 12 per cent) was double that of the 75th percentile households (~ 6 per cent). In fact, for rural areas, the average households reported a decline of 1 per cent in milk consumption. While the consumption of meat/fish/poultry decreased for the median households, there is an increase for the 75th percentile households, in both rural and urban areas. Annexure – 1 contains the details of consumption of food commodities by expenditure class for rural and urban India in 1993 and 2004. It is noteworthy that the pattern of dietary change is different for the lower and the higher expenditure classes.

Mean Per Capita Consumption of Food Commodities (Gms), 1993 and 2004

Year	Cereals	Milk Products Ghee/Butter	Vanaspati-Oil	Sugar	Eggs	Meat/Fish /Poultry	Pulses/Nuts /Dry Fruits	Fruits	Vegetables
Rural India									
1993									
Median	456.6	96.5	12.1	24.7	1.2	10.1	368.7	13.5	161.7
75th %-ile	476.0	144.6	14.5	31.0	1.5	12.8	445.1	19.5	177
Total	446.8	113.4	12.4	26.2	1.2	10.5	368.6	16.4	158
2004									
Median	412.4	108.0	16.0	24.2	1.8	9.8	170.3	17.1	170.8
75th %-ile	425.7	152.0	19.1	29.8	2.6	14.1	404.6	24.0	189.8
Total	404	111.7	16.2	24.7	1.9	11.3	203.4	19.6	167.7
Urban India									
1993									
Median	366.3	132.9	18.7	33.0	2.5	13.0	459.5	26.3	164.1
75th %-ile	362.5	181.3	22.2	38.5	3.3	15.5	631.7	36.4	185.7
Total	354.7	143	18.7	32.4	2.9	13.9	520.8	32.4	167.4
2004									
Median	336.0	149.4	23.1	30.4	3.2	12.7	302.4	30.3	178.7
75th %-ile	332.4	193.0	26.9	33.8	4.5	17.2	407.5	43.2	204.2
Total	331.4	149	22.1	29	3.3	14.1	327	33.1	182.4

Thus food composition/diet changed considerably in both rural and urban areas over the period 1993–2004. While consumption of cereals, sugar and pulses has declined, there is an increase in the consumption of high-value commodities such as vanaspati-oil, eggs, fruits and vegetables and, to some extent, of meat as well. As these changes are linked to intakes of calories, proteins and fats with varying importance, an investigation of how food consumption patterns changed in response to changes in income and relative prices is necessary (Gaiha, Jha, & Kulkarni, 2010b).

1.4. EATING OUT

With greater urbanization, demographic changes, increased participation of females in the workforce, and a growing middle class, there has been an increasingly greater prevalence of eating out as well as consumption of snacks, beverages and pre-cooked meals. Moreover, even the more deprived sections have not been left behind by these changes in dietary patterns. An analysis by Gaiha, Jha and Kulkarni (2009), based on a nationwide household survey *India Human Development Survey 2005 (IHDS),*[3] reveals interesting results on the phenomenon of eating out. Eating out is a feature not just of metros and urban areas but also of urban slums and rural areas, but the prevalence is larger for the former category. Further, it is a feature not just of the affluent sections, but also of the poor and other deprived sections. However, the relatively affluent are more likely to eat out and also spend greater amounts. While the incidence of eating out was slightly more common in joint families than among nuclear families, among those who ate out, more than half belonged to nuclear families. The likelihood of households eating out increases with the number of adults (both males and females) in paid employment.

1.5. SUPPLY SHIFTS

That food production changes were largely synchronous with dietary changes is reflected in the following table.

While the production increased at a faster rate for eggs, fruits, milk and vegetables, the increases were slow for cereals, oil crops and meat. The interaction of supply and demand gets manifested in dietary changes through adjustments in relative prices.

[3] Conducted jointly by University of Maryland and National Council of Applied Economic Research (NCAER), covering over 41000 households residing in rural and urban areas, selected from 33 states

Growth Rates of Food Production[4] (1993-2004)

Food Commodity	Growth rate (1990-2009)
Cereals	1.39%
Fruits	4.27%
Oil Crops	1.48%
Pulses	0.30%
Vegetables	3.31%
Meat	1.01%
Eggs	5.38%
Milk	3.93%

2. METHODOLOGY

In this study, we report our findings on changing dietary patterns of Indian households, based on the analysis of the 1993 and 2004 household survey conducted by the NSS. Estimation at the household level is preferred as there is greater variation in expenditure levels than found in grouped data (Pitt, 1983). We estimate the demand equation for nine commodities: cereals, milk and milk products/butter-ghee, vanaspati-oil, sugar, eggs, meat/poultry/fish, pulses/nuts-dry fruits/others, vegetables and fruits.

2.1. THE MODEL

A reduced form demand relation (Gaiha, 1991) is used in which the dependent variable is consumption of food commodity *i*, and the right side variables include all food prices, income, and the general environment. We have pooled the rural and urban samples and over time (1993 and 2004). The demand equation thus allows for rural-urban differences in food demand, changes in price effects over time, income/expenditure effects, and a time dummy that aims to capture lifestyle and dietary changes over time. Time varying effects thus take two forms: one is through time varying price effects; and the second is through lifestyle changes over time (more sedentary and/or less strenuous activities). The time dummy that takes the value 1 for 2004 and 0 otherwise captures the effects of changes in lifestyle and strenuousness of activities. Interaction of this dummy with food prices allows for time varying effects of the latter. State dummies aim to capture time-invariant but state specific unobservable factors (e.g. cultural food preferences) that impinge on diets.

[4] The growth rates of production are calculated using the following model: $Y = a.b^t$, where Y is the production of the commodity (obtained from (FAOSTAT)) and t is the time variable.

The model specification is as follows:

$$C_{ijt} = \alpha + \sum_{j=1}^{9} \beta_j \overline{P}_{j\,t} + \delta E_{it} + \mathbf{S} \cdot \boldsymbol{\gamma} + \eta\, R + \theta\, T + \sum_{j=1}^{9} \kappa_j \overline{P}_{j\,t} \cdot T + \varepsilon_{ijt}$$

where the dependent variable is consumption by ith household of jth food commodity in time t, $\overline{P}_j$ denotes food prices (j=1….9) computed at the village level, E denotes per capita monthly expenditure, S is a vector of state dummy variables (with Jammu and Kashmir as the omitted state), R is a rural-urban dummy (urban=1, 0 otherwise) and T is a time dummy (2004=1, 0 otherwise), $\overline{P}_j \cdot T$ is an interaction of T and $\overline{P}_j$ and ε is the iid error term.

Standard regression procedures are not appropriate for estimating the demand equations when the dependent variable i.e. consumption of a good may be zero for a non-negligible number of households (e.g. meat/poultry/fish). If the dependent variable is essentially continuous over strictly positive values but takes on zero with positive probability, using a linear model would give inconsistent and biased estimates. In such a case, Tobit approximation (Tobin, 1958) provides a better estimation of the demand equation by expressing the observed response in terms of an underlying latent variable, implying non-negative predicted values for the dependent variable.

Let *y* be the observed response. The Tobit model expresses the observed response as:

$$y^{\uparrow} * = \beta_{\downarrow} 0 + \mathbf{x}\boldsymbol{\beta} + \mu, \mu|\mathbf{x} \sim \mathbf{Normal}\ (\mathbf{0}, \sigma^{\uparrow} 2)$$

$$y = \max(0, \mathbf{y}^{*})$$

The latent variable *y** has a normal, homoscedastic distribution with a linear conditional mean, thus satisfying the classical linear model assumptions. The above equation implies that the observed variable *y* equals the latent variable when the latter is non negative, and equals zero when the latter is negative. Since *y** is normally distributed, the observed variable *y* has a continuous distribution over strictly positive values. Further, the density of *y*|**x** is the same as the density of *y**|**x**. $\boldsymbol{\beta}$ and $\boldsymbol{\sigma}$ are estimated using maximum likelihood.

In Tobit Models, there are two methods of computing the expected value of *y* as a function of **x**. First is the conditional expectation, E(*y*|*y* > 0, **x**), which is conditional on *y* > 0. This conditional expectation tells us, for given values of **x,** the expected value of *y* for the

subpopulation where *y* is positive. The other is the unconditional expectation, E(*y*|**x**). Given the conditional expectation, the unconditional expectation can be computed as follows.[5]

$$E(y|\mathbf{x}) = P(y > 0|\mathbf{x}) \cdot E(y|y > 0, \mathbf{x})$$

In our analysis, we have used the former, i.e. the conditional expectation.

The Tobit specification is used for estimating demand functions for different food commodities when appropriate. As most of the commodities that we analyze (except cereals) are not consumed by a non-negligible subset of the sample households, a tobit specification is used. For cereals, we use robust regression estimates. Four distinctive features of the demand functions estimated are: (i) use of own and cross-price effects; (ii) state fixed effects to allow for unobservable state specific features impinging on food consumption patterns, over and above those explainable in terms of price and income effects; (iii) an urban dummy that allows for difference in food consumption between rural and urban areas; and (iv) time related changes such as reduced activity levels associated with changes in food consumption patterns, through a time dummy, and the changes in price effects overtime through the interaction of time dummy with food prices.

3. REGRESSION RESULTS

We will discuss the pooled results for 1993 and 2004 commodity wise. The results are for the aggregate rural and urban samples.

Cereals

Let us first consider the results on the demand for cereals for India in 1993 and 2004, as given in Table 1. The main findings are:

- The own price elasticity for cereals is negative and significant, consistent with demand theory.
- The prices of sugar and fruits are positively associated with demand for cereals. Since the cross price elasticity is positive, these are substitute goods.
- The cross price elasticity between cereals and pulses/nuts/dry-fruits/others, vanaspati-oil, meat/fish/poultry and vegetables is found to be negative and significant. These are, hence, complementary goods.
- Per capita expenditure has a positive impact on the demand for cereals.

[5] For further details, see (Wooldridge, 2006)

- There is a lower intake of cereals in 2004 as compared to 1993, captured by the time dummy. So the effect of time is negative, after accounting for all other effects.
- While the demand function for cereals is validated by significant own and cross-price effects as well as the income effect, there are significant differences in the former between 1993 and 2004, captured by the interaction between time dummy and prices of various commodities. The shifts in price effects are positive for vanaspati-oil, meat/fish/poultry, pulses/nuts/dry-fruits/others and own price, and negative for sugar.
- The dummy for urban households has a negative coefficient.
- The overall specification is validated by the F-test.

Table 1: Demand Equation for Cereals: Robust Regression Estimates

No. of Observations	=	163867				
F (55, 163811)	=	1045				
Prob > F	=	0.000				
Consumption of Cereal	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	-111.997	(-20.99)	***	-0.158	(-20.99)	***
Price - Milk & Products/ Ghee-Butter	-0.008	(-0.85)	-	0.000	(-0.85)	-
Time Dummy X Price - Milk & Products	0.003	(0.34)	-	0.000	(0.34)	-
Price - Vanaspati Oil	-1.869	(-14.98)	***	-0.224	(-14.98)	***
Time Dummy X Price - Vanaspati Oil	2.144	(16.19)	***	0.171	(16.19)	***
Price – Sugar	0.763	(2.79)	***	0.029	(2.79)	***
Time Dummy X Price – Sugar	-0.534	(-1.8)	*	-0.014	(-1.8)	*
Price – Eggs	0.015	(1.87)	*	0.001	(1.87)	*
Time Dummy X Price – Eggs	0.048	(2.46)	**	0.002	(2.46)	**
Price - Meat/Fish/Poultry	-0.182	(-5.12)	***	-0.026	(-5.12)	***
Time Dummy X Price - Meat/Fish/Poultry	0.291	(7.9)	***	0.028	(7.9)	***
Price - Pulses/Nuts-Dry Fruits/Others	-0.290	(-4.5)	***	-0.010	(-4.5)	***
Time Dummy X Price - Pulses/Nuts/Others	0.490	(7.09)	***	0.013	(7.09)	***
Price – Fruits	0.268	(3.89)	***	0.011	(3.89)	***
Time Dummy X Price – Fruits	-0.224	(-3.03)	***	-0.006	(-3.03)	***
Price – Vegetables	-3.465	(-12.47)	***	-0.066	(-12.47)	***
Time Dummy X Price – Vegetables	1.788	(6.27)	***	0.024	(6.27)	***
Price – Cereals	-10.307	(-26.86)	***	-0.216	(-26.85)	***
Time Dummy X Price – Cereals	1.212	(2.98)	***	0.017	(2.98)	***
Per Capita Expenditure (mpce)	0.030	(113.83)	***	0.054	(113.5)	***
Sector Dummy (0=rural, 1=urban)	-42.730	(-69.65)	***	-0.048	(-69.57)	***
Constant	600.130	(116.1)				

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

Milk and Milk Products / Butter and Ghee

Table 2 contains the results on the demand function for Milk and Milk Products, Butter and Ghee. The key findings are:

- The own price elasticity for milk and milk products is negative and significant.

- The cross-price effects on the demand for milk and milk products are positive for vanaspati-oil, sugar, meat/fish/poultry, pulses/nuts-dryfruits/others, vegetables and cereals. These are, hence, substitutes. The cross-price elasticity is largest for cereals.
- Per capita expenditure has a significant positive elasticity.
- There is a larger intake of milk and milk products in 2004 as compared to 1993, captured by the time dummy.
- There are significant changes in price effects over time. These changes are positive for the price of milk/milk-products/butter/ghee, and negative for prices of vanaspati-oil, sugar, meat/fish/poultry, pulses/nuts-dryfruits/others, vegetables and cereals.
- The urban dummy has a significant positive effect on consumption of milk/milk products/ghee/butter.
- The overall specification is validated by the chi-square test.

Table 2: Demand Equation for Milk/Milk Products/Butter/Ghee: Tobit Estimates

No. of Observations	=	162605				
LR Chi-square (55)	=	49603				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	-894863				
Consumption of Vanaspati-Oil	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	122.736	(15.07)	***	0.254	(15.07)	***
Price - Milk & Products/ Ghee-Butter	-0.206	(-5.8)	***	-0.013	(-5.8)	***
Time Dummy X Price - Milk & Products	0.179	(4.98)	***	0.008	(4.98)	***
Price - Vanaspati Oil	1.207	(6.66)	***	0.195	(6.66)	***
Time Dummy X Price - Vanaspati Oil	-1.527	(-7.68)	***	-0.173	(-7.68)	***
Price – Sugar	2.220	(5.26)	***	0.116	(5.26)	***
Time Dummy X Price – Sugar	-4.078	(-8.89)	***	-0.151	(-8.89)	***
Price – Eggs	-0.060	(-4.03)	***	-0.006	(-4.03)	***
Time Dummy X Price – Eggs	0.015	(0.57)	-	0.001	(0.57)	-
Price - Meat/Fish/Poultry	0.576	(11.74)	***	0.111	(11.74)	***
Time Dummy X Price - Meat/Fish/Poultry	-0.361	(-7.1)	***	-0.051	(-7.1)	***
Price - Pulses/Nuts-Dry Fruits/Others	3.329	(33.75)	***	0.165	(33.68)	***
Time Dummy X Price - Pulses/Nuts/Others	-2.403	(-22.91)	***	-0.094	(-22.89)	***
Price – Fruits	-0.139	(-1.38)	-	-0.007	(-1.38)	-
Time Dummy X Price – Fruits	-0.075	(-0.7)	-	-0.003	(-0.7)	-
Price – Vegetables	3.862	(8.99)	***	0.096	(8.99)	***
Time Dummy X Price - Vegetables	-4.101	(-9.13)	***	-0.074	(-9.13)	***
Price – Cereals	9.294	(16.63)	***	0.259	(16.62)	***
Time Dummy X Price – Cereals	-1.380	(-2.38)	**	-0.027	(-2.38)	**
Per Capita Expenditure (mpce)	0.038	(349.6)	***	0.086	(518.26)	***
Sector Dummy (0=rural, 1=urban)	13.906	(15.55)	***	0.016	(15.53)	***
Constant	2.535	(0.3)				
/sigma	140.1					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

Vanaspati-Oil

Next, we consider the results on the demand for vanaspati-oil as given in Table 3. The main findings are:

- The own price elasticity for vanaspati-oil is negative and significant, consistent with demand theory.
- The prices of sugar, meat/fish/poultry, pulses, vegetables and cereals are positively associated with demand for vanaspati-oil. Since the cross-price elasticity between vanaspati-oil and fruits and cereals is positive, these are substitutes.
- The cross-price elasticity between vanaspati-oil and fruits is found to be negative and significant. These are, hence, complements.
- Per capita expenditure has a positive and significant impact on the demand for vanaspati-oil.

Table 3: Demand Equation for Vanaspati-Oil: Tobit Estimates

No. of Observations	=	162605				
LR Chi-square (55)	=	12578				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	-756516				
Consumption of Vanaspati-Oil	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	14.727	(12.69)	***	0.211	(12.69)	***
Price - Milk & Products/ Ghee-Butter	-0.010	(-1.83)	*	-0.004	(-1.83)	*
Time Dummy X Price - Milk & Products	0.009	(1.76)	*	0.003	(1.76)	*
Price - Vanaspati Oil	-0.083	(-3.21)	***	-0.093	(-3.21)	***
Time Dummy X Price - Vanaspati Oil	-0.095	(-3.37)	***	-0.074	(-3.37)	***
Price – Sugar	0.411	(6.94)	***	0.149	(6.94)	***
Time Dummy X Price – Sugar	-0.356	(-5.55)	***	-0.092	(-5.55)	***
Price – Eggs	-0.002	(-0.96)	-	-0.001	(-0.96)	-
Time Dummy X Price – Eggs	0.002	(0.62)	-	0.001	(0.62)	-
Price - Meat/Fish/Poultry	0.050	(7.19)	***	0.066	(7.18)	***
Time Dummy X Price - Meat/Fish/Poultry	-0.031	(-4.36)	***	-0.030	(-4.36)	***
Price - Pulses/Nuts-Dry Fruits/Others	0.135	(9.64)	***	0.046	(9.64)	***
Time Dummy X Price - Pulses/Nuts/Others	-0.088	(-5.93)	***	-0.024	(-5.93)	***
Price – Fruits	-0.039	(-2.8)	***	-0.015	(-2.8)	***
Time Dummy X Price – Fruits	0.052	(3.45)	***	0.014	(3.45)	***
Price – Vegetables	0.492	(8.08)	***	0.085	(8.08)	***
Time Dummy X Price - Vegetables	-0.466	(-7.3)	***	-0.058	(-7.3)	***
Price – Cereals	0.792	(10.02)	***	0.153	(10.02)	***
Time Dummy X Price – Cereals	-0.274	(-3.31)	***	-0.037	(-3.31)	***
Per Capita Expenditure (mpce)	0.003	(176.53)	***	0.047	(187.38)	***
Sector Dummy (0=rural, 1=urban)	1.627	(12.75)	***	0.013	(12.74)	***
Constant	6.055	(4.96)				
/sigma	20.4					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

- There is a larger intake of vanaspati-oil in 2004 as compared to 1993, captured by the time dummy. In fact, the dummy's coefficient is larger than any of the individual price and expenditure elasticities (in absolute value).
- While the demand function for vanaspati-oil is validated by significant own-and-cross price effects as well as the income effect, there are significant differences in the former between 1993 and 2004, captured by the interaction between time dummy and prices of various commodities. The shifts in price effects are positive for fruits, and negative for sugar, meat/fish/poultry, pulses, vegetables, cereals and vanaspati-oil.
- The urban dummy has a significant positive effect. However, the elasticity is small.
- The overall specification is validated by the chi-square test.

Sugar

Table 4 contains the results for the demand equation for sugar. The main findings are:

- The elasticity with respect to own price is positive and the elasticity with respect to the square of own price is negative. The combined effect of the price on consumption, however, is negative, consistent with demand theory.[6]

Table 4: Demand Equation for Sugar: Tobit Estimates

No. of Observations	=	162605				
LR Chi-square (55)	=	39555				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	-740662				
Consumption of Sugar	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	-8.675	(-23.66)	***	-0.120	(-23.64)	***
Price - Milk & Products/ Ghee-Butter	-0.001	(-2.55)	**	0.000	(-2.55)	**
Price - Vanaspati Oil	0.079	(6.84)	***	0.085	(6.84)	***
Price – Sugar	0.278	(6.86)	***	0.097	(6.86)	***
Price – Sugar (Squared)	-0.004	(-8.74)	***	-0.024	(-8.74)	***
Price – Eggs	-0.003	(-1.52)	-	-0.002	(-1.52)	-
Price - Meat/Fish/Poultry	0.031	(10.32)	***	0.039	(10.32)	***
Price - Pulses/Nuts-Dry Fruits/Others	0.195	(33.4)	***	0.065	(33.37)	***
Price – Fruits	-0.006	(-0.91)	-	-0.002	(-0.91)	-
Price – Vegetables	0.055	(1.65)	*	0.009	(1.65)	*
Price – Cereals	-0.422	(-10.75)	***	-0.078	(-10.75)	***
Per Capita Expenditure (mpce)	0.005	(300.57)	***	0.070	(368.85)	***
Sector Dummy (0=rural, 1=urban)	1.257	(9.62)	***	0.009	(9.61)	***
Constant	12.076	(12.73)				
/sigma	21.0					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

[6] The own price elasticity is positive. This is counter-intuitive, hence, warrants further investigation in terms of a quadratic equation.

- There are significant cross-price effects as well – negative for cereals, and positive for vanaspati-oil, meat/fish/poultry and pulses/nuts-dryfruits/others, implying cereals are complements, and vanaspati-oil, meat/fish/poultry and pulses/nuts-dryfruits/others are substitutes for sugar.
- Per capita expenditure has a positive and significant impact on the demand for sugar.
- There is a smaller intake of sugar in 2004 as compared to 1993, captured by the time dummy, after accounting for all other effects.[7]
- The urban dummy has a positive and significant coefficient. However, the magnitude is small.
- The overall specification is validated by the chi-square test.

Eggs

Table 5 shows the results for the demand equation for Eggs. The key findings are:

- The price of eggs has a negative effect on its demand, consistent with demand theory.
- Price of fruits has a significant negative coefficient. These are complements to eggs.
- Vanaspati-oil, meat/fish/poultry, pulses/nuts-dryfruits/others, vegetable and cereals have a significant positive effect. These are, hence, substitutes. The cross-price elasticity is highest for vanaspati-oil.
- Food price variables are interacted with the time dummy to check whether the price effects varied over time. The following interactions are significant and have a negative coefficient: cereals, vanaspati-oil, meat/fish/poultry, pulses/nuts-dryfruits/others, and vegetables.
- The expenditure elasticity is positive and significant.
- Over and above these effects, the time dummy has a significant positive effect. It is also larger than any of the individual price and expenditure elasticities (in absolute value).
- The urban dummy has a positive and significant coefficient. However, the magnitude is small.
- The overall specification is validated by the chi-square test.

[7] We have omitted the interactions of the time dummy with the prices in this model as the results were somewhat implausible.

Table 5: Demand Equation for Eggs: Tobit Estimates						
No. of Observations	=	162605				
LR Chi-square (55)	=	19160				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	-379555				
Consumption of Eggs	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	13.251	(19.86)	***	0.360	(19.86)	***
Price - Milk & Products/ Ghee-Butter	-0.005	(-1.54)	-	-0.004	(-1.54)	-
Time Dummy X Price - Milk & Products	0.005	(1.56)	-	0.003	(1.56)	-
Price - Vanaspati Oil	0.141	(9.71)	***	0.300	(9.7)	***
Time Dummy X Price - Vanaspati Oil	-0.178	(-11.18)	***	-0.265	(-11.18)	***
Price – Sugar	-0.048	(-1.43)	-	-0.033	(-1.43)	-
Time Dummy X Price – Sugar	0.014	(0.37)	-	0.007	(0.37)	-
Price – Eggs	-0.017	(-10.2)	***	-0.023	(-10.2)	***
Time Dummy X Price – Eggs	0.002	(0.68)	-	0.002	(0.68)	-
Price - Meat/Fish/Poultry	0.010	(2.55)	**	0.025	(2.55)	**
Time Dummy X Price - Meat/Fish/Poultry	-0.013	(-3.26)	***	-0.024	(-3.26)	***
Price - Pulses/Nuts-Dry Fruits/Others	0.097	(12.13)	***	0.063	(12.13)	***
Time Dummy X Price - Pulses/Nuts/Others	-0.097	(-11.43)	***	-0.050	(-11.43)	***
Price – Fruits	-0.036	(-4.46)	***	-0.026	(-4.46)	***
Time Dummy X Price – Fruits	-0.007	(-0.76)	-	-0.003	(-0.76)	-
Price – Vegetables	0.520	(15.47)	***	0.170	(15.47)	***
Time Dummy X Price - Vegetables	-0.403	(-11.4)	***	-0.095	(-11.4)	***
Price – Cereals	0.601	(13.5)	***	0.220	(13.5)	***
Time Dummy X Price – Cereals	-0.316	(-6.81)	***	-0.082	(-6.81)	***
Per Capita Expenditure (mpce)	0.001	(272.62)	***	0.035	(409.58)	***
Sector Dummy (0=rural, 1=urban)	0.302	(4.33)	***	0.004	(4.33)	***
Constant	-17.555	(-25.64)				
/sigma	9.9					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

Meat/Poultry/Fish

Table 6 contains the results for the demand equation for meat/poultry/fish. The main findings are:

- The own price elasticity for meat/poultry/fish is negative.
- The cross-price effects are positive and significant for vanaspati-oil, vegetables and cereals. Hence, these are substitutes.
- Per capita expenditure has a positive and significant impact on the demand for meat/poultry/fish.
- The coefficient of time dummy is not statistically significant.
- The differences between own-and-cross price effects between 1993 and 2004 as captured by the interaction between time dummy and prices of various commodities show that the shifts in price effects are positive for meat/fish/poultry and negative for cereals and vegetables.

- The urban dummy has a negative coefficient, however, the magnitude is small.
- The overall specification is validated by the chi-square test.

Table 6: Demand Equation for Meat / Poultry / Fish: Tobit Estimates

No. of Observations	=	162605				
LR Chi-square (55)	=	28462				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	694075				
Consumption of Meat/Poultry/Fish	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	0.001	(0)	-	0.000	(0)	-
Price - Milk & Products/ Ghee-Butter	0.026	(2.12)	**	0.004	(2.12)	**
Time Dummy X Price - Milk & Products	-0.026	(-2.11)	**	-0.003	(-2.11)	**
Price - Vanaspati Oil	0.128	(1.91)	*	0.056	(1.91)	*
Time Dummy X Price - Vanaspati Oil	0.089	(1.21)	-	0.027	(1.21)	-
Price – Sugar	0.129	(0.84)	-	0.018	(0.84)	-
Time Dummy X Price – Sugar	-0.123	(-0.74)	-	-0.012	(-0.74)	-
Price – Eggs	0.017	(3.27)	***	0.005	(3.27)	***
Time Dummy X Price – Eggs	-0.020	(-1.98)	**	-0.004	(-1.98)	**
Price - Meat/Fish/Poultry	-0.655	(-36.02)	***	-0.339	(-36.02)	***
Time Dummy X Price - Meat/Fish/Poultry	0.300	(15.81)	***	0.113	(15.81)	***
Price - Pulses/Nuts-Dry Fruits/Others	0.054	(1.44)	-	0.007	(1.44)	-
Time Dummy X Price - Pulses/Nuts/Others	0.053	(1.34)	-	0.006	(1.34)	-
Price – Fruits	0.023	(0.62)	-	0.003	(0.62)	-
Time Dummy X Price – Fruits	0.103	(2.64)	***	0.011	(2.64)	***
Price – Vegetables	1.455	(9.17)	***	0.098	(9.17)	***
Time Dummy X Price - Vegetables	-1.235	(-7.42)	***	-0.060	(-7.42)	***
Price – Cereals	1.709	(8.27)	***	0.128	(8.27)	***
Time Dummy X Price – Cereals	-0.933	(-4.32)	***	-0.049	(-4.32)	***
Per Capita Expenditure (mpce)	0.004	(213.2)	***	0.026	(213.2)	***
Sector Dummy (0=rural, 1=urban)	-1.930	(-5.81)	***	-0.006	(-5.81)	***
Constant	-15.656	(-4.89)				
/sigma	49.6					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

Pulses/Nuts/Others

Table 7 shows the results for the demand equation for pulses/nuts-dryfruits/others. The key findings are:

- The price of pulses/nuts has a significant and negative effect on its demand, consistent with the demand theory.
- The cross-price effects are positive for sugar, fruits and vegetables, implying these are substitutes to pulses/nuts-dryfruits/others.
- Food price variables are interacted with the time dummy to check whether the price effects varied over time. The following interactions are significant: fruits (negative), vegetables (negative), and own price (positive).

- The expenditure elasticity is positive and significant, but small.
- The coefficient of time dummy is not statistically significant.
- The urban dummy has a positive coefficient. However, the magnitude is small.
- The overall specification is validated by the chi-square test.

Table 7: Demand Equation for Pulses/Nuts-Dryfruits/Others: Tobit Estimates

No. of Observations	=	162605				
LR Chi-square (55)	=	2618				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	-1583248				
Consumption of Pulses/Nuts-Dryfruits/Others	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	-161.575	(-0.96)	-	-0.015	(-0.96)	-
Price - Milk & Products/ Ghee-Butter	-0.398	(-0.55)	-	-0.001	(-0.55)	-
Time Dummy X Price - Milk & Products	0.403	(0.55)	-	0.001	(0.55)	-
Price - Vanaspati Oil	-1.278	(-0.34)	-	-0.009	(-0.34)	-
Time Dummy X Price - Vanaspati Oil	-3.914	(-0.96)	-	-0.020	(-0.96)	-
Price – Sugar	21.167	(2.47)	**	0.050	(2.47)	**
Time Dummy X Price – Sugar	-4.468	(-0.48)	-	-0.008	(-0.48)	-
Price – Eggs	0.049	(0.16)	-	0.000	(0.16)	-
Time Dummy X Price – Eggs	0.400	(0.73)	-	0.001	(0.73)	-
Price - Meat/Fish/Poultry	0.518	(0.52)	-	0.005	(0.52)	-
Time Dummy X Price - Meat/Fish/Poultry	-0.968	(-0.93)	-	-0.006	(-0.93)	-
Price - Pulses/Nuts-Dry Fruits/Others	-54.536	(-26.93)	***	-0.123	(-26.9)	***
Time Dummy X Price - Pulses/Nuts/Others	37.310	(17.31)	***	0.066	(17.3)	***
Price – Fruits	4.472	(2.2)	**	0.011	(2.2)	**
Time Dummy X Price – Fruits	-6.230	(-2.85)	***	-0.011	(-2.85)	***
Price – Vegetables	40.446	(4.6)	***	0.046	(4.59)	***
Time Dummy X Price - Vegetables	-34.804	(-3.78)	***	-0.029	(-3.78)	***
Price – Cereals	-3.444	(-0.3)	-	-0.004	(-0.3)	-
Time Dummy X Price – Cereals	18.218	(1.53)	-	0.016	(1.53)	-
Per Capita Expenditure (mpce)	0.139	(16.81)	***	0.014	(16.8)	***
Sector Dummy (0=rural, 1=urban)	83.392	(4.5)	***	0.004	(4.5)	***
Constant	689.666	(3.91)				
/sigma	2955.7					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

Fruits

Table 8 contains the results for the demand equation for fruits. The main findings are:

- The own price elasticity for fruits is negative and significant, consistent with the demand theory.
- The cross-price effects are negative and significant for pulses/nuts-dryfruits/others.[8] Hence, these are complementary goods.

[8] Note that all the price effects are calculated as the sum of the price elasticity and the interaction term (at the mean of time dummy – 0.59).

- The cross price effects are positive for vanaspati-oil, sugar, meat/fish/poultry, vegetables and cereals. Hence, these are substitute goods.
- Per capita expenditure has a positive and significant impact on the demand for fruits.
- There is a higher intake of fruits in 2004 as compared to 1993, captured by the time dummy, after accounting for all other effects.
- The differences between own-and-cross price effects between 1993 and 2004 as captured by the interaction between time dummy and prices of various commodities show that the shifts in price effects are positive for fruits, and negative for vanaspati-oil, sugar, meat/fish/poultry, pulses/nuts-dryfruits/others, vegetables and cereals.
- The coefficient of urban dummy is positive, but the magnitude is small.
- The overall specification is validated by the chi-square test.

Table 8: Demand Equation for Fruits: Tobit Estimates

No. of Observations	=	162605				
LR Chi-square (55)	=	16179				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	-821074				
Consumption of Fruits	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	86.668	(20.44)	***	0.336	(20.43)	***
Price - Milk & Products/ Ghee-Butter	-0.018	(-0.89)	-	-0.002	(-0.89)	-
Time Dummy X Price - Milk & Products	0.024	(1.2)	-	0.002	(1.2)	-
Price - Vanaspati Oil	0.349	(3.71)	***	0.106	(3.71)	***
Time Dummy X Price - Vanaspati Oil	-0.591	(-5.73)	***	-0.126	(-5.73)	***
Price – Sugar	3.062	(14.03)	***	0.301	(14.02)	***
Time Dummy X Price – Sugar	-2.557	(-10.81)	***	-0.178	(-10.8)	***
Price – Eggs	-0.025	(-3.2)	***	-0.005	(-3.2)	***
Time Dummy X Price – Eggs	-0.025	(-1.67)	*	-0.003	(-1.67)	*
Price - Meat/Fish/Poultry	0.095	(3.75)	***	0.034	(3.75)	***
Time Dummy X Price - Meat/Fish/Poultry	-0.151	(-5.73)	***	-0.040	(-5.73)	***
Price - Pulses/Nuts-Dry Fruits/Others	0.110	(2.13)	**	0.010	(2.13)	**
Time Dummy X Price - Pulses/Nuts/Others	-0.227	(-4.13)	***	-0.017	(-4.13)	***
Price – Fruits	-1.422	(-26.7)	***	-0.143	(-26.67)	***
Time Dummy X Price – Fruits	0.364	(6.41)	***	0.026	(6.41)	***
Price – Vegetables	2.661	(11.96)	***	0.124	(11.96)	***
Time Dummy X Price - Vegetables	-1.322	(-5.66)	***	-0.045	(-5.66)	***
Price – Cereals	6.623	(22.81)	***	0.347	(22.79)	***
Time Dummy X Price – Cereals	-4.712	(-15.54)	***	-0.174	(-15.53)	***
Per Capita Expenditure (mpce)	0.014	(243.38)	***	0.060	(276.34)	***
Sector Dummy (0=rural, 1=urban)	4.329	(9.35)	***	0.009	(9.34)	***
Constant	-81.628	(-18.31)				
/sigma	72.3					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

Vegetables

Table 9 shows the results for the demand equation for Vegetables. The key findings are:

- The price of vegetables has a negative and significant effect on its demand.
- The prices of sugar, meat/fish/poultry, cereals and pulses have a significant positive effect. These are, hence, substitutes to vegetables.
- Food price variables are interacted with the time dummy to check whether the price effects varied over time. The following interactions are significant: cereals (negative), meat/fish/poultry (negative), pulses/nuts-dryfruits/others (negative) and vegetables (positive).
- The expenditure elasticity is positive and significant.
- Over and above these effects, the time dummy has a significant positive effect.
- The coefficient of the urban dummy is positive and statistically significant; however, the magnitude is small.
- The overall specification is validated by the chi-square test.

Table 9: Demand Equation for Vegetables: Tobit Estimates

No. of Observations	=	162605				
LR Chi-square (55)	=	21208				
Prob > Chi-Square	=	0.000				
Log Likelihood	=	-1093630				
Consumption of Vegetables	Coefficient			Elasticity		
Time Dummy (0=1993, 1=2004)	59.248	(6.26)	***	0.104	(6.26)	***
Price - Milk & Products/ Ghee-Butter	-0.043	(-1.05)	-	-0.002	(-1.05)	-
Time Dummy X Price - Milk & Products	0.039	(0.96)	-	0.002	(0.96)	-
Price - Vanaspati Oil	0.151	(0.72)	-	0.021	(0.72)	-
Time Dummy X Price - Vanaspati Oil	0.453	(1.97)	**	0.043	(1.97)	**
Price – Sugar	2.078	(4.3)	***	0.092	(4.3)	***
Time Dummy X Price – Sugar	-0.853	(-1.63)	-	-0.027	(-1.63)	-
Price – Eggs	0.006	(0.36)	-	0.001	(0.36)	-
Time Dummy X Price – Eggs	-0.017	(-0.55)	-	-0.001	(-0.55)	-
Price - Meat/Fish/Poultry	0.321	(5.67)	***	0.052	(5.67)	***
Time Dummy X Price - Meat/Fish/Poultry	-0.217	(-3.68)	***	-0.026	(-3.68)	***
Price - Pulses/Nuts-Dry Fruits/Others	0.998	(8.73)	***	0.042	(8.73)	***
Time Dummy X Price - Pulses/Nuts/Others	-1.161	(-9.55)	***	-0.038	(-9.55)	***
Price – Fruits	-0.049	(-0.42)	-	-0.002	(-0.42)	-
Time Dummy X Price – Fruits	0.242	(1.96)	**	0.008	(1.96)	**
Price – Vegetables	-16.702	(-33.56)	***	-0.352	(-33.51)	***
Time Dummy X Price - Vegetables	2.067	(3.97)	***	0.032	(3.97)	***
Price – Cereals	12.478	(19.33)	***	0.294	(19.32)	***
Time Dummy X Price – Cereals	-7.745	(-11.48)	***	-0.129	(-11.48)	***
Per Capita Expenditure (mpce)	0.024	(167.07)	***	0.046	(174.97)	***
Sector Dummy (0=rural, 1=urban)	6.546	(6.28)	***	0.006	(6.28)	***
Constant	140.706	(14.12)				
/sigma	166.5					

***, ** and * refer to significance at the 1%, 5% and 10% level of significance, respectively.
State Dummies have been omitted in the above table and shall be available on request

3.1. DISCUSSION

Our demand relations are robust with significant own and cross-price effects, and income effects that vary considerably across the food commodities studied. As hypothesized, the price effects in most cases vary with time. Arguably, these variations reflect changing food preferences over time - preferences for variety. There are also significant differences between urban-rural samples, pointing to urban lifestyles driving dietary changes (fatty and starchy convenience foods).

To estimate the extent of diversity in consumption of food, one approach is to count the number of different food items consumed. As this does not allow for their **relative** importance in food expenditure, we have followed a different approach in which a ratio of value of cereals to that of non-cereals is used. The results are given in the following table.[9]

Table 10: Diversity in Consumption of Food

	Rural		Urban	
	1993	**2004**	**1993**	**2004**
Non Poor	0.65	0.49	0.35	0.32
Poor	1.26	0.88	0.76	0.62

Source: NSS

In both the rural and urban samples, the consumption of cereals with respect to consumption of all other food commodities is greater (almost twice) for the poor than the non poor. The ratio (value of cereal consumption to value of consumption of all other food commodities) is lower for urban than for rural areas, and decreases over time. In rural areas, the ratio declined by 24 per cent for the non-poor and by 30 per cent for the poor. In urban areas too, the decline was greater for the poor (19 per cent) than for the non-poor (7 per cent). Thus, the more deprived section, in both urban and particularly in rural areas are not immune to the lifestyle and dietary changes, and the convenience and cheapness of variety in food.

Over and above these changes, dietary patterns have also evolved over time as a result of less strenuous activity patterns and more sedentary life styles in both rural and urban areas. As noted by Deaton and Dreze (2009), and corroborated by our analysis, these changes over time

[9] The food diversity index is calculated as the ratio of total value of consumption of cereals to the total value of consumption of all other food commodities.

have shaped dietary patterns in a decisive way. Our point of departure, however, is that this explanation is part of a demand theory based explanation and not an alternative to it.

4. CONCLUDING OBSERVATIONS

Recent studies show that, despite rising incomes in India, there has been a sustained decline in per capita calorie intake over the period 1983–2004 primarily due to lower calorie requirements. The reductions in calorie requirements are attributed mainly to better health environment and less strenuous activity levels. Departing from this focus but encompassing it in an alternative demand theory based explanation of dietary changes, the present study analysed dietary changes associated with their own and other food prices, their time varying effects, income/expenditure changes, rural-urban location, and environmental changes reflected in lifestyle and activity patterns. The results show the presence of significant own-price and cross-price effects as well as income/expenditure effects. There is also robust confirmation of how changes in the environment over time have shaped dietary patterns. While these environmental effects in both rural and urban areas are *irreversible*, an important policy insight of our analysis is that prices and income also shape dietary patterns in important ways. As nutrient deprivation has worsened in recent decades, and may further worsen as a consequence of the rapid food price surge in recent months and sluggish employment growth, food price stabilization and expansion of livelihood opportunities are important policy priorities.

5. ANNEXURES

5.1. MEAN PER CAPITA CONSUMPTION OF FOOD COMMODITIES (GMS) BY EXPENDITURE CLASSES

Rural India (1993 & 2004)

Year	Cereals	Milk Products Ghee/Butter	Vanaspati-Oil	Sugar	Eggs	Meat/Fish /Poultry	Pulses/Nuts /Dry Fruits	Fruits	Vegetables
1993									
MPCE at 2004									
0 – 235	344.7	15.0	6.2	10.0	0.2	4.0	154.6	4.2	95.1
235 – 270	394.0	28.6	7.7	13.0	0.4	4.9	204.6	6.2	119.2
270 – 320	414.3	43.7	8.7	16.1	0.6	6.3	235.3	7.7	130.6
320 – 358	435.6	57.4	9.8	18.6	0.7	7.8	286.4	9.4	142.1
358 – 410	445.1	77.3	11.0	21.5	1.0	8.8	329.7	11.6	149.6
410 – 455	456.6	96.5	12.1	24.7	1.2	10.1	368.7	13.5	161.7
455 – 510	467.1	119.2	13.1	27.7	1.3	11.1	430.4	16.5	167.7
510 – 580	476.0	144.6	14.5	31.0	1.5	12.8	445.1	19.5	177
580 – 690	484.7	181.9	15.7	35.9	1.7	14.6	502.9	23.9	185.7
690 – 890	493.4	241.0	17.7	43.0	2.2	17.0	535.4	30.9	199.2
890 – 1155	502.6	290.1	19.6	49.5	2.8	19.4	589.9	41.9	216
> 1155	543.4	373.1	27.8	69.5	4.4	25.7	770.4	58.6	255.6
Total	446.8	113.4	12.4	26.2	1.2	10.5	368.6	16.4	158
2004									
MPCE at 2004									
0 – 235	329.4	11.6	7.9	8.5	0.5	3.7	61.4	8.3	99.1
235 – 270	362.5	24.7	9.7	12.0	0.6	4.5	88.1	9.3	121.6
270 – 320	377.6	34.9	11.5	14.5	1.1	5.7	103.8	8.3	133.6
320 – 365	390.1	51.4	12.6	17.1	1.2	6.7	130.1	10.6	145.6
365 – 410	399.3	69.6	14.0	20.0	1.4	7.9	150.9	12.7	155
410 – 455	405.4	82.8	15.0	22.1	1.7	9.0	163.1	15.2	164.8
455 – 510	412.4	108.0	16.0	24.2	1.8	9.8	170.3	17.1	170.8
510 – 580	420.4	127.8	17.5	27.2	2.1	11.6	187.2	20.0	179.8
580 – 690	425.7	152.0	19.1	29.8	2.6	14.1	404.6	24.0	189.8
690 – 890	423.9	195.8	20.4	34.7	2.8	18.0	262.9	29.6	198.1
890 – 1155	425.5	259.6	23.2	41.9	3.4	19.4	304.0	39.3	212.3
> 1155	449.9	296.0	29.9	52.9	5.0	33.2	457.9	61.3	245.2
Total	404	111.7	16.2	24.7	1.9	11.3	203.4	19.6	167.7

Urban India (1993 & 2004)

Year	Cereals	Milk Products Ghee/Butter	Vanaspati-Oil	Sugar	Eggs	Meat/Fish /Poultry	Pulses/Nuts /Dry Fruits	Fruits	Vegetables
1993									
MPCE at 2004									
0 – 335	303.2	30.3	7.9	16.0	0.6	5.5	224.4	6.6	92.4
335 – 395	344.4	46.4	10.3	19.5	1.0	8.0	289.6	9.6	114.3
395 – 485	353.8	62.4	12.0	22.2	1.4	9.8	338.2	13.1	128.4
485 – 540	360.2	77.9	14.0	25.5	1.7	11.1	398.7	16.0	140.5
540 – 675	363.3	101.5	15.8	29.0	2.0	12.2	435.0	20.0	151
675 – 790	366.3	132.9	18.7	33.0	2.5	13.0	459.5	26.3	164.1
790 – 930	364.4	150.5	20.3	35.6	3.0	14.4	515.3	31.2	176
930 – 1100	362.5	181.3	22.2	38.5	3.3	15.5	631.7	36.4	185.7
1100 –1380	358.0	213.1	24.8	40.4	3.8	17.5	647.5	47.0	202.8
1380 –1880	346.7	257.1	26.6	43.7	5.0	19.6	797.6	65.1	221.3
1880 –2540	345.4	298.6	29.9	49.6	6.5	23.4	1001.0	83.1	246.5
>2540	340.6	372.1	32.5	50.4	9.6	27.8	1080.3	113.7	271.7
Total	354.7	143	18.7	32.4	2.9	13.9	520.8	32.4	167.4
2004									
MPCE at 2004									
0 – 335	308.4	31.4	10.9	14.8	1.1	6.4	142.4	8.0	114.6
335 – 395	334.7	55.4	13.4	19.2	1.5	7.9	157.4	10.8	132.9
395 – 485	336.3	68.3	15.5	21.3	2.0	10.4	188.7	14.3	141.5
485 – 580	341.3	91.6	17.6	24.5	2.3	11.2	212.4	17.4	161.3
580 – 675	337.4	109.5	19.6	26.1	2.9	12.5	265.1	23.4	161.4
675 – 790	341.6	127.4	20.6	28.5	2.9	13.9	279.1	25.5	172
790 – 930	336.0	149.4	23.1	30.4	3.2	12.7	302.4	30.3	178.7
930 – 1100	336.4	168.1	24.8	32.3	3.4	14.3	325.4	34.4	194.8
1100 –1380	332.4	193.0	26.9	33.8	4.5	17.2	407.5	43.2	204.2
1380 –1880	321.2	233.8	28.9	36.1	4.5	18.0	475.5	53.3	234.7
1880 –2540	316.7	282.6	31.2	39.1	5.5	21.9	562.8	66.2	241
>2540	303.2	329.9	32.8	40.5	6.8	26.6	770.1	93.0	263.2
Total	331.4	149	22.1	29	3.3	14.1	327	33.1	182.4

There are considerable differences in the changes in consumption of these commodities by expenditure classes. In rural areas, while the total milk consumption reduced by 1 per cent, it increased by 12 per cent and 5 per cent, respectively, for the median and the 75th percentile households. The consumption of vegetables reduced among the upper expenditure classes (1 – 4 per cent) and increased among the lower expenditure classes (by 2 - 4 per cent). The variations in the consumption of fruits are even greater. While the consumption of fruits

among the two lowest expenditure classes increased by 98 per cent and 50 per cent, respectively, the higher expenditure classes witnessed a decline of 5-6 per cent. The consumption of pulses, sugar and cereals declined for all expenditure classes (with little variation) and the consumption of eggs and vanaspati-oil increased for all expenditure classes (with somewhat higher variations). The consumption of meat reduced for the lower expenditure classes and increased for the higher expenditure classes. The consumption of cereals, sugar and pulses for urban areas, as in the case of rural areas, declined across expenditure classes, and increased for vanaspati oil (with a more moderate variation). The consumption of milk products increased among the lower expenditure classes and reduced among the higher expenditure classes. Similar result is found in case of eggs. However, the reduction is larger and among greater number of households than in the case of milk/milk products/ghee/butter. The consumption of fruits and vegetables increased among the lower expenditure classes and decreased among the higher expenditure classes, though the decline in case of vegetables is much considerably lower.

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