Analysis of Changes in Food Consumption and Energy Intake in India – An Empirical Study

Dissertation submitted to the Jawaharlal Nehru University in partial fulfillment of the requirements for the award of the degree of

MASTER OF PHILOSOPHY

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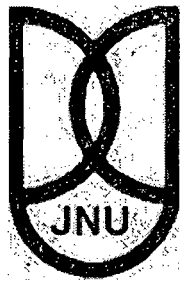

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July 29th, 2013

DECLARATION

This is to certify that the dissertation entitled **"Analysis of Changes in Food Consumption and Energy Intake in India – An Empirical Study"** submitted by me is in partial fulfillment of the requirement for the award of the degree of Master of Philosophy of Jawaharlal Nehru University. This dissertation has not been submitted for the award of any other degree in this University or any other University and is my own work.

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Acronyms

AIDS	Almost Ideal Demand System
BMI	Body Mass Index
CES	Consumption Expenditure Survey
CLI	Cost of Living Index
CPI	Consumer Price Index
CPIAL	Consumer Price Index Agricultural labour
CPIIW	Consumer Price Index Industrial worker
DPL	Direct Poverty Line
EPW	Economic and Political Weekly
FAO	Food and Agricultural Organisation
FGT	Foster - Greer - Thorbecke
GDP	Gross Domestic Product
GOI	Government of India
HCR	Head Count Ratio
HCR-CC	Head Count Ratio – Calorie Consumption
HCROPL	Head Count Ratio – Official Poverty Line
ICMR	Indian Council of Medical Research
Kcal	Kilocalories
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MPCE	Monthly Per Capita Consumption Cxpenditure
NAC	National Advisory Council
N/A	Not Available
NCAER	National Council of Applied Economic Research
NFHS	National Family Health Survey
NNMB	National Nutrition Monitoring Bureau
NSSO	National Sample Survey organization
OPL	Official Poverty Line
PCE	Per Capita Expenditure
PCPD	Per Capita Per Day
PCCC	Per Capita Cereal Consumption
PDS	Public Distribution System
QUAIDS	Quadratic Almost Ideal Demand System

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Chapter 1

Introduction

1.1 Introduction

Demand model estimation draws serious attention on various key issues ranging from behavioural aspects of consumer demand to welfare issues of poverty and inequality (Ray 1999). Moreover, the estimated demand parameters are useful for formulating various policies, especially indirect tax policies[1] (Banks et al. 1997, Ray 1999). It is now a well known fact that India is passing through a phase of structural change at present. Continuous pro-market policies taken up by the government have changed the economy's macro behaviour in all respects. It has been argued by many economists that these pro-market policies have accelerated the process of development, while on the contrary many others think that these policies hinder the goal of development. A successful development process is actually followed by the rise in real incomes of the consumers, changes in the institutional features of the economy and changes in preferences as well - all of these are likely to affect an individual's preference pattern. The recent consumption pattern seen in India supports this hypothesis. This phenomenon is unique not only to India but has been experienced in many developing countries (Huang and Bouis 2001, Ray 2007, Yang et al. 2007).

It has been seen in India that direct consumption of staple food items has decreased over the past four decades with the high growth of Gross Domestic Product (GDP). Household Consumer Expenditure (HCE) data from National Sample Survey (hereafter NSS) shows a negative correlation between per capita cereal consumption and the real per capita income. Along with this decline in consumption of food grains there is another issue of declining nutritional intake as well; the major nutrient components – calorie and protein have decreased while intake of fat has continuously increased over years despite a rise in

[1] Government decides to impose indirect tax on commodities depending on the consumption behaviour of households. Let us assume in an economy over a long period of time households preferred to wine over cereals. This behavioral pattern will induce the policy makers to impose an indirect tax on wine and foster consumption of cereal.

the real monthly per capita expenditure (MPCE). In rural and urban sectors, the average per day per capita (PCPD) calorie intake has gone down from 2,266 kcal and 2,107 kcal in 1972-73 to 2,020 kcal and 1,946 kcal in 2009-10. Recent NSS data indicate that almost three quarters of the total population are living with per capita calorie consumption below the recommended 'minimum requirement' norm of 2400 kcal per day for rural and 2100 kcal per day for urban.

Food grain consumption, mainly cereals, has drifted down while consumption of some particular high value protein and fat items has increased. Over the years, on an average, per capita cereal consumption (PCCC) hovers around 12 kg and 10 kg per month per capita in rural and urban areas, respectively. The decline rates for urban show a milder decline of 9 percent between 1993-94 and 2009-10 compared to rural where the fall is 15 percent during the same period. The same data also exhibit that the decline is higher in the upper income class and lower in the lower income class.

Based on NSS data the relationship between MPCE and PCCC is a little puzzling: for any particular year PCCC has a monotonically increasing trend with MPCE; however, over the years former has been reducing in spite of an increase in the later. In other words,c cross sectional data suggest a positive monotonic relationship between MPCE and PCCC while the time series data show a negative relationship and hence, the 'Puzzle'- a term used by Chandrasekhar and Ghosh (2003), Deaton-Drèze (2009). The puzzle has been around for a long time. The 'quinquennial rounds[2]' of NSS consumer expenditure data show that the falling trend has been observed since the beginning of the NSS rounds.

1.2 Motivation

Cereals are the most necessary and major food grain component for both the rural and the urban people of India. It is important not merely because it is cheaper, but also because of the array of health benefits it offers. Although cereal is an inferior[3] category of food, it is the main source of calorie in India - mainly among the poor people who live in the bottom income deciles. In the course of the last four decades, the average calorie intake from

[2] NSSO collects large sample data in every five years apart from its annual survey. CES data is collected and published as both 'thin round' (annual data) and 'thick round' (in every five year, quinquennial survey data).

[3] Low value crop includes Rice, Wheat, Jaowar, Bajra, Maize, Barley etc.

cereals has declined even as the real per capita income has increased. During 1998-2003, levels became as low as it was in the initial years of World War II (Utsa Pattanaik, 2004). Based on NSS data PCCC for rural has come down from 13.40 kg in 1993-94 to 12.52 kg in 2004-05 and 11.68 kg in 2009-10- an alarming 15% fall in 16 years while the urban sector has witnessed a milder 9% fall (10.63 kg to 9.76 Kg) in the same period.

As per Engel's law, rich people (that is those with higher income) spend proportionately less on inferior (low value foods i.e. staple food) goods than the poor people. In simple terms, as per capita income (PCI) grows, people will tend to diversify their food basket; consumption of staple foods will be substituted by the high value crops. India in the recent past has experienced an upward trend in consumption of Milk and Edible oils. On the contrary, as we have already mentioned, consumption of staples has continuously declined. The question comes that whether this decline (or increase) is taking place because of voluntary food diversification or not. This becomes a cause of concern for economists as well as the nutritionists. As the large body of literature emerges, there are many explanations available behind this change in consumption pattern. It is essential from the policy maker's perspective to decide over the food security for those who are living below the 'cut-off' (poverty) lines. Therefore, a food demand analysis at this stage is crucial in order to estimate the response of the demand parameters of households to the income and price change. Many eminent economists and researchers have done rigorous studies to find out a conclusive solution; nevertheless, the 'Puzzle' is still unresolved. Therefore, it would be productive for a researcher to enter in the world of academia by taking a deep look at this 'puzzle'.

1.3 Key Results

Estimated results suggest that the food 'diversification' argument does not hold for all food items (food groups) in general. We found that expenditure elasticities of staples are falling across expenditure classes and over time. Unlike other high value food groups (Milk, Fruits and Vegetables, Egg-fish-meat etc.) expenditure elasticities of Edible oils and fats are increasing across expenditure classes and over time. In addition to that, we also found own price elasticities are mostly negative.

1.4 Organisation of Chapters

We organise this dissertation in the following chapters:

The second chapter consists of an in-depth review of the existing theoretical and empirical literature. The literatures, focused primarily on the issue of declining nutritional intake and cereal consumption, covers experiences of India as well as other developing countries. The objective of this chapter is to build our knowledge base on this issue. It identifies exactly where this work is adding value to the existing literature.

The third chapter provides a detailed discussion of the data and the methodologies undertaken in this study. First we discuss about the data sources used in this study and then we analyse the methodologies we would be following to meet the objectives.

Chapter Four will show the preliminary results on the pattern of consumption of various food items as well as nutritional intake in India. This chapter also deals with the relation between the nutritional norms and poverty in India.

Chapter Five considers the econometric model for estimating demand parameters of seven aggregated food groups. This chapter specifies the empirical demand model based on the methodologies discussed in chapter Four.

The final chapter, Chapter Six, concludes and summarises the key findings of this study.

Chapter 2

Background Literature, Objective and Research Questions

2.1 Introduction

This chapter will critically review previous studies on this area of research. Broadly, we will focus on two issues. Firstly, we concentrate on studies which have dealt with (the most controversial issue of economic development in India) the 'puzzle'[4] of decline in calorie consumption despite of a steady rise in real per capita income in recent past. This declining trend has found since the beginning of 1970's and has been a major cause of concern for economists as well as the nutritionists in India. This fact has been corroborated by the quinquennial survey results of National Sample Survey Organisation (hereafter NSS)[5]. Secondly, this chapter will give an overview of the studies those analyses the fall in cereal consumption and its consequences on welfare. Cereal, one of the major nutrient components in daily food items of an average consumer has slipped down at a high rate of 0.8 per cent (per capita consumption) per year between 1993-94 and 2004-05. This declining trend continues in the recent NSS quinquennial[6] household (66th round: 2009-10) consumer expenditure survey (hereafter CES) round. The question arises is of course whether this trend is actually development oriented or not. A group of economists and some government officials interpret this decline as a positive development. They claim this fall in consumption of necessary food grains (mainly cereal) as the result of diversification of food basket that comes through the higher rural purchasing power among the rural households. Another group of economists think rural purchasing power has declined in these years because of implementation of deflationary

[4] A term used by Chandrashekhar and Ghosh (2003), possibly first, in a piece written in Hindu Business line.

[5] Over all the NSS survey rounds (starting from 1972-73) calorie consumption has declined in both rural and urban sectors; however, the reduction was more acute in rural areas. The decline rate became higher after 1993-94. In rural, between 1972-73 to 1983, per day per capita (or per head) intake of calorie dropped from 2266 kcal to 2221 kcal (a 2 percent fall in ten years). However, in the same sector in later period 1993-94 to 2004-05 it reduced from 2153 Kcal to 2047 Kcal (around 5 percent in five years).

[6] NSS conducts two types of surveys; one is "thin" round survey and other is "thick" round survey which is also called quinquennial survey. "Thin" round surveys are conducted annually while "thick" rounds are conducted in every five year.

policies by the successive government[7] and people are not entitled to meet their minimum needs, this result in increase in number of people in hunger.

Both issues, declining calorie intake as well as cereal consumption, have attracted broadly in the field of empirical research since late 90's. A lot have debate has already taken place (and still going on) on these issues. As the large body of literature emerges there are mainly three strands.

First strand argues that observed decline in calorie is the result of implementation of deflationary macroeconomic policies, comes through neoliberal policies[8], by the successive governments. In their opinion hunger and deprivation are increasing, especially in agro based rural areas, and people are purchasing fewer calories, mainly cereal calories, as they are not able to afford it. Many prominent researchers like Mehta and Venkataraman (2000), Chandrasekhar and Ghosh (2003), Utsa Patnaik (2004, 2010, 2010a, 2010b) stand by this strand. Utsa Patnaik, the protagonist of this strand, refuses to see this as a 'puzzle'. According to Patnaik, calorie consumption declined as a result of a fall in real income.

Second strand takes the opposite position regarding this 'Puzzle' and refuses to explain this decline as a consequence of absolute impoverishment. In support of their argument, Deaton & Drèze (2009) suggested the 'energy requirement hypothesis'[9] could be a possible candidate to explain this unprecedent fall. The hypothesis says due to improvement in infrastructural development, mechanisation of agriculture (Rao 2000; Deaton & Drèze, 2009, 2010a, 2010b), better health environment, decline in physical activity levels have reduced the requirement of calorie intake, so people can live with less levels of energy consumption.

Third strand alleges that fall in per capita cereal consumption (henceforth PCCC) is nothing but the result of 'diversification' of consumption basket. Rise in real income

[7] Utsa Patanaik in 'Republic of Hunger' (2004) alleged because of the continuous implementation of 'macroeconomic deflationary policies' by the NDA Government, purchasing power has fallen drastically among the rural poor and they are not entitled to consume the required food grains. (see detail discussion in section 2.2.1).

[8] In 1991, India had undertaken neo-liberal policies with the goal of high economic growth.

[9] See Nicholas Li and Shari Eli (2010): "In Search of India's Missing Calories: Energy Requirements and Calorie Consumption", U.C. Berkeley (working paper).

helps to diversify food basket over the years. This group of people believe that this is a part of development process; developing countries have to pass through this phase. So actually, this is nothing but an indication of welfare improvement (development). Another view, came into light very recently, suggests the puzzle can be explained by a combination of some factors like food basket squeezing, decline in consumption of the subsistence, decline of home-grown consumption and diversification of diets (Basu and Basole 2012) which of course does not hold much water. The analysis was done for rural areas. They argue food baskets are squeezing since increased income has absorbed by the increased non-food share (increased expenditure on education, health, transportation etc.) and leads to fall in calorie intake.

In case of India, one can find a huge body of literature dealing with this fact of declining cereal consumption and calorie intake. A good number of studies have compared the Indian case with other developing countries like Vietnam (Ray 2007), China and Bangladesh. Although the fact (of declining food grain consumption and calorie intake) came into light long before but it gained interest of the general mass of academic people after a revolutionary paper written by Prof. Utsa Patnaik: 'The Republic of Hunger'.

2.2 Empirical evidence – Indian Context

Both the issues of India's missing calories and declining food grain consumption alongside a high economic growth have attracted a large attention in the empirical literature. A lot has been written, discussed and debated on this 'puzzle'. We shall discuss the 'puzzle' following the aforesaid three strands.

2.2.1 Studies in support of absolute impoverishment

Utsa Patnaik (2004) wrote an influential paper on this issue. She found that the levels of food grain consumption declined at a very fast rate in India and the rate of decline was highest (more than four fifths of the total decline) in between 1998 and 2003. During this period, consumption level came down from 174 kg to 155 kg per head. She found unlike India, average per capita food grain consumption of USA, China and Mexico was higher

than the India's average consumption even if they have a higher per capita income than India. In the entire analysis she used availability and absorption in similar sense. That means the author tried to distinguish between the market supply and the actual amount of food grains that can be affordable for a consumer i.e. the amount which he/she can effectively consume and thus absorb. She alleges it is very surprising that the government and the majority of academicians have identified this phenomenon as a positive one.

In her opinion this decline is a serious matter of concern as it has occurred because of the continuous fall in rural purchasing power. Her arguments are following. Fall in the consumption level is clearly due to the fall in demand as supply of food grain did not fall rather it increased (since export of food grain has increased). The fall in demand for food grains indicate a fall in rural purchasing power. Then she alleged this fall in the rural purchasing power is a result of neo-liberal policies taken by the successive governments. Trade liberalization has reduced the international price of crops (deflationary policy) and therefore reduced the rural purchasing power. She said both deflationary macroeconomic policy and liberalization policy fit into the broad framework of neo-liberal policy. She, therefore, blamed neo-liberal policies behind the absolute impoverishment of rural people and asked for an immediate correction. Her argument is food grains are available in the market, because she found export of food grain has increased in the same period, but poor people are unable to purchase them. Her claim was that an average household in 2000-01 was consuming 93 kg less of food grains as compared to 1997-98 which amounts to a calorie decline of at least 225 calories per head daily. Patnaik further alleges there might be confusion between the indirect consumption and direct consumption of food grains among the economists and this would mislead Engel's law[10]. She mentioned that Engel was actually referring to the direct consumption of food grains, which does not include the indirect consumption part i.e. the consumption used to feed for livestock. In one line, she claims there is absolute impoverishment in India mainly among the poor and neo-liberal policies are responsible for that.

Mehta and Venkatraman (2000) questioned the methodology used by the planning commission for poverty estimation. They found that there was a huge gap between the

[10] Engel law shows the trade off between income and consumption. The law says that as income grows consumption of inferior goods increases at a lower level and after a certain level of income it declines. In other words at high income level share of inferior goods are less compare to the superior (high value) commodities.

direct and indirect poverty measure i.e. percentage of population below the calorie norms is substantially higher than the percentage of population below the official updated poverty lines. It is a very well known fact for all them who are associated with the issue of poverty as well as the 'Expert Group' but they kept on using the official norm for implication of policies. They also found a similar divergence for urban India. They said identification of poor is the most crucial part for policy formulation. Those who are living below the 'cut-off' lines are the legitimate claimants of the special assistance. So not only in paper but also in reality, the government must realise the actual 'poor'; then only alleviation policies can be implemented.

Chandrasekhar and Ghosh (2003) examined the broad patterns of average calorie consumption in India. They found both in rural and urban areas people are consuming less than the minimum requirement norm. In 1999-00, Chandrasekhar et al. have mentioned urban India's estimate of per capita calorie intake was higher than the rural, at 2156 kilocalories (kcal) per day in comparison to 2149 kcal, which is however because of the methodological differences occurred with 55^{th} round and other earlier rounds, they themselves have mentioned it in their article. They argued that increasing penetration of urban life style in rural areas could be the cause behind narrowing down calorie intake. They conclude by suggesting the current state of calorie intake is quite 'appalling' and there is an urgent need to policy attention to secure the substantial food among the poor people.

2.2.2 Studies which argue the requirement of calorie itself has declined

Rao (2000), possibly first, tried to identify the factors causing this decline. Restricting his analysis for cereal, he found using NSS CES[11] data that only for the bottom 30% of the rural population per capita cereal consumption (hereafter PCCC) has increased marginally, however for all other expenditure classes PCCC has declined in both rural and urban sector. The decline rate was more pronounced in rural than in urban. He found 'significant regional' differences in this decline. Some states like West Bengal, Kerala performed better than some others like Punjab, Haryana, although the latter have experienced high rate of mechanisation of agriculture in 1972-73 to 1993-94. Cereal

[11] Rao's study was a cross section analysis based on NSS 55th (1999-2000) round consumer expenditure data.

consumption, as Rao found, had not moved in the same direction with food expenditure and prices. Although price differences between rural and urban increased but rural consumption had not fallen to that extent compare to the urban consumption. This decline, as he alleged, is a positive indication of welfare gain. Due to improvement in rural infrastructure, mechanisation of agriculture less calorie is required than it was in the few decades ago. As the rural workers mainly engaged in high manual or physical labour intensive work, the requirement for food grains for calories is higher than the urban. Improvement in medical facilities has also reduced the need for more calorie intake by improving the efficiency of energy conversion. The author claims because of the restricted market, unimproved and inadequate availability of social overhead capital, food items (precisely what he intend to point out is available food baskets are not as much diversified as it is in urban) are restricted in rural areas and resulting diseconomies of scale in marketing in the long run, which influenced him to identify non-income factors. The present author finds this a bit confusing. First, Rao's study itself has shown cereal price in rural area is lower than the urban price in both two points of time of his analysis (72-73 and 93-94). It is quite likely that as rural sector is the main source of production of cereals, because of less economic cost, the cereal price is likely to be less in rural compare to the urban. Now the obvious question is then rural population (at least the subsistence level people) should consume cereals due to income effect. Precise point is that instead of relatively lower cereal prices in rural, consumption of cereal is declining. Second, if food baskets are not available, the rural consumers' has little option to diversify their preferences. Taking together both the possibilities it indicates cereal consumption has to increase and which is not happening. He further claims increasing monetisation of wages in rural as well as in urban areas could be responsible for the decline in food grain consumption as people will purchase less quantity in money terms in comparison to the cooked food. He has tested for cereal intake with factors such as road length, mechanization of agriculture, prices of cereals and income and found insignificant result. He, however, maintains his claim that the implication of cereal decline in welfare enhancing by showing a statistically significant correlation coefficient between cereal consumption and index of rural infrastructure. Regarding Rao's statistical methodology and results, the present author, would like to mention some points raised by Saha (2000) in the discussion section of the same journal. These are as follows:

He alleges Rao to have used "double standards which has landed him into irreconcilable inconsistency". He points out those correlation coefficients between the rural infrastructure and cereal consumption are significant for all expenditure classes but the regression table shows the lack of any general relationship between these variables. He says that Rao has shown that mechanization does have some negative impact on cereal consumption but this cannot be used to argue that the implications of declining cereal consumption are welfare enhancing. Saha claims that in the present Indian context where cereal consumption is largely a matter of subsistence and the decline in cereal consumption shows nothing but food deficiency among the poor. He points out that there is a continued per capita cereal gap of 3kg/month in 1993-94 between the top 30% and the bottom 30% and this reflects a crude measure of food deficiency. Saha points out to an increasing share of fuel and lighting in per capita expenditure. However, he differs in the interpretation and feels that the substitution of food expenditure by expenditure on fuel and lighting was probably a matter of compulsion and not of changing tastes and preferences. He also disagrees with Rao in his interpretation that it was a result of falling cereal requirements because of better health facilities, improved rural infrastructure or mechanization of agriculture. Saha's own explanation of decline is in terms of cereal specific reasons like monetization of the economy, limited access to the PDS etc.

Deaton and Drèze (2009) wrote a long, complete and exhaustive paper covering all possible issues relating to this fall in calorie intake and executed it quite beautifully- a well documented and synchronised study. They found it puzzling[12] that per capita calorie intake in India is declining since last 25 years even while there is an increase in per capita income. Their study, covering a long period of Indian economy 1983 to 2004-05, has mentioned some points to be taking care of. They have used three large data sets namely National Family Health Survey (NFHS), National Nutrition Monitoring Bureau (NNMB) and NSS data on consumption and nutritional intake. They started by claiming that rich food does not always content good number of calories, there is, in fact no 'tight link' between calories consumed and health status. They have looked at this 'puzzle' from all possible perspectives of Indian economy. Unlike other studies (Chandrasekhar and Ghosh, 2003; Rao, 2000; Sukhtame, 1981) who although have posed the question on

[12] The 'puzzle', as they call it, a term introduced by Chandrasekhar - Ghosh (2003), takes off to another level with Deaton –Drèze's journey and become a cause of concern for the policy makers.

welfare as well as health status but not looked at it properly except showing the broad trends and patterns, this point however, possibly first, meticulously analysed in this study. The study has discussed how this decline in calorie consumption fits into India's high growth rate and malnutrition. According to NNMB data children anthropometric status in comparison to the international standards (used as a reference) suggests a retreat in undernourishment (around 50 percent fall between 1975-79 and 2004-05) instead of a strong prevalence of under-nutrition. Even if there was a fall, the overall child nutrition compare to other countries was very high in that period[13]. Only one good thing is that none of the indices (Height-for-age, Weight-for-age, Weight-for-height and Body mass index (BMI)-for adults), has shown increase in under-nutrition or undernourishment. On the other hand, Deaton–Drèze, following a benchmark on child under-nutrition decline rate proposed by Hadded et al. (2003)[14], calculated weight-for-age index from Indian data and found the decline rate is 20 percent and 10 percent according to NNMB and NFHS data, much lower from the expected rate of 27 percent. One valuable point from this observation is that there were inconsistencies in NFHS and NNMB data, which show contrast between nutrition trends based on different anthropometric indicators. The average calorie consumption in rural sector was around 10% lower in 2004-05 than a decade ago. The proportionate decline turned out to be lower in low expenditure groups and higher in higher expenditure groups. Except for fat, consumption of cereals as well as protein items is declining. Deaton and Drèze claim that many explanations possible for this decline. Some, as they identified, related to the improved health status: better access to the safe drinking water helps to reduce many water borne diseases, better sanitation facility, high child vaccination rates, improved mother's education and health. Another explanation comes from the change in activity levels. They argued with fragmented evidence the work activity levels are switching from 'heavy strenuous activity' to more 'sedentary activity'[15] in rural sector which is because of increasing penetration of capital deepening technology in all sectors. Changing food habits is another reason for this decline. Junk Foods, less nutritious compare to the coarse cereals, are consumed more in

[13] In 2004-05, the evidence Deaton-Drèze (2009) have given, almost fifty percent of Indian children suffer from anaemia and underweight (pp:50)

[14] Hadded et al. (2003) had shown, a study based on weight-for-age using international data, how child under-nutrition could be related with economic growth. They concluded by saying the rate of decline in child under-nutrition tends to be around half of the economic growth. Deaton-Drèze used this bench mark and calculated Indian child under- nutrition rate.

[15] Calorie requirement table in Gopalan's book shows an adult male who is engaged in sedentary work needs less per day in comparison to adult male who is doing heavy manual work.

recent days in both rural and urban sectors, a perfect example of demonstration effect. One major explanation comes from energy requirements hypothesis[16] for this decline in calorie intake. The hypothesis says the requirement of calorie itself has gone down which attributes to simultaneous operation of various factors, some of which have already mentioned and some others lies on infrastructural development, better transport facilities, safe drinking water, and the ownership of effort saving durables. But, they claim that this hypothesis is speculative because of any direct evidence on activity levels and associated calorie requirements. In addition, because there are no concrete reasons available for calorie decline, they find it difficult to assess it impact on welfare. They argue for supplementing intake data with outcome related data despite of those inconsistencies. They conclude that there is an "urgent need for better nutrition monitoring arrangements".

Sen (2005) wrote an interesting paper relating to nutritional intake of poverty line class and below poverty line class of population. The paper mainly addresses about the method of poverty measurement and the nature of criticisms levelled against it. In 1999-00, he found that poverty line people in all states except urban Orissa are consuming fewer calories less than the recommended norms (2400 Kcal and 2100 Kcal for rural and urban respectively) set by the expert group in 1979. According to him the subsistence class of people can still have the purchasing power to afford this recommended norm if they spend their actual food expenditure. He dismissed the argument of declining rural purchasing power (Patanaik, Republic of Hunger, 2004) by documenting the potential calorie intake, and found the potential intake is 'very close to, or even exceeding' the norm. He also refutes the argument of 'squeezing food basket' because of increase in the cost of minimum required non-food basket by showing that poverty line class of people could still have the purchasing power to meet the minimum recommended level of calories if they have the typical food purchasing pattern of the poor. Sen says it's a task of nutritionists to do further research on this subject to establish whether the poverty line people is consuming superior quality food or it's nothing but a mere decline in the nutritional status. He concluded by saying Indian food security policy and poverty

[16] Li Eli (2010), 'In Search of India's Missing Calories: Energy Requirements and Calorie Consumption, Working paper series, U.C. Berkeley.

reduction strategy, albeit some strategies are already working[17], needs a further reconsideration.

Mittal (2009) tested for expenditure and price elasticity of cereal and tried to identify the determinants of cereal consumption in India. The study uses a complete demand system framework. The model she used is an extended version of Almost Ideal demand system (AIDS), frequently used in the demand analysis in recent days[18] in India and in other countries. The study finds the cereal consumption decline is not as a result of decline in rural purchasing power, rural people are still capable of to meet the basic requirement. The study concluded by saying that

2.2.3 The Debate

Although the debate was started a long before but it became a war of words between Patnaik (2004, 2010a, 2010b) and Deaton-Drèze (2009, 2010a, 2010b). It came in Economic and Political weekly journal started with the Deaton-Drèze's article 'Food and Nutrition in India: Facts and interpretations' and continues with a series of articles between Utsa and Deaton-Drèze till 2010.

Core arguments of both sides (Patanaik and Deaton-Drèze) have been discussed in the previous two sections (2.2.1 and 2.2.2). Patnaik's opinion of absolute impoverishment, which is involuntarily chosen, as she claimed, challenged by his oppnents. Empirical evidence from NSS data, as her (Patnaik) counter part presented, invariably showing the decline in calorie is larger in the higher income class between 1972-73 and 2004-05,[19] this however arise confliction and questions with NSS results. Patnaik (2010a) in reply to Deaton-Drèze (2009) said that they have taken Consumer Price Index (CPI) to show the cost of living index (CLI) which is not the correct thing to do. She claims that deflating expenditures level using CPI (AL and IW) is not tenable over long periods and has been giving seriously misleading results. She argues that CPI is increasingly understating the

[17] Various schemes such as- Integrated child Development schemes (ICDS), Antyodaya Anna Yojana (AAY), Mid-day Meal Scheme (MMS), Targeted Public Distribution System (TPDS) and Annapurna Scheme are helped substantially to reduce the cost of necessary food basket of the poor.

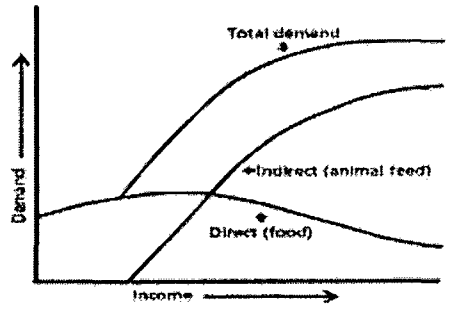
[18] M M Dey (2000) used the same model to estimate demand parameters of fish in Bangladesh. (mention other international studies like mutton,)

[19] Deaton & Dreze (2009), pp 54. When we extend this result for 2009-10, the similar trend continues.

actual cost of living. As she claimed implicit deflators are not reliable in estimating real figures, she herself proposed an alternative 'nutrition invariant deflator' based on direct poverty lines (DPL)[20]. Real per capita expenditure, applying alternative (DPL) deflators, found to be declining in the same period where Deaton-Drèze found it increasing. She also charges Deaton and Drèze with ignoring evidences such as rising unemployment rates, falling foodgrains availability per capita, stagnant income in agriculture, loss of land and livelihood. She claims all these squeeze the purchasing power of the masses that is not captured by the CPI, which can capture only change in prices.

Again, Deaton and Drèze (2010a) replied to this. They charge Patnaik with not presenting any evidence that the CPI underestimates increases in the cost of living. They also claim that Patnaik has only assumed that her "nutrition invariant deflator" is correct and hence she has solved the puzzle only by designing the index in a particular way.

Patnaik (2010) continues the debate and argues that cereal consumption includes both food and feed for livestock and should rise as average income rises. She shows with 50 years of data from the Food and Agricultural Organisation (FAO) that this has been the international experience. She refers to work by Pan Yotopolous in presenting this argument. She alleges that they might have failed to distinguish between indirect and direct consumption.



Source: P.A Yotopolus

She claims that there is a positive monotonic relationship between real income and cereal consumption, which she uses interchangeably with calorie intake. She feels that Deaton and Drèze argument of diversification is not correct as it suffers from fallacy of

[20] Originally she proposed this alternative index based on direct poverty line in another paper on 'Neoliberalism and rural poverty in India. For detail see Patanaik, 2007.

composition i.e. while calorie intake is declining for high expenditure group; it is falling for a majority of the population. She also charge them with a fallacy of non sequitur i.e. they infer from the rise in real income and diet diversification that the fall in average cereal consumption is to be expected but this inference does not follow. She cites the Indian Council of Medical Research draft report, which says that there are only marginal changes in levels of energy changes from the ones originally adopted in 1968. She claims that 1998-2002 saw massive stock build-ups and she attributes them to demand deflation. She claims that no sooner when MNERGA had started to show some positives signs, global financial meltdown has put the things off track again.

Deaton and Drèze (2010b) conclude the debate, though unresolved in their last paper. Here they dismiss the fallacies pointed out by Utsa Patnaik and charge her with same fallacies. They say that their argument was not at all wrong as their analysis based not on total consumption, which comprises both direct and indirect consumption, but only on direct consumption. They show that NSS data suggests that the per capita cereal intake curve in rural areas is flattening over time in rural areas. In case of urban areas, it is becoming a hump-shaped curve. They claim that there is no obvious relationship between cereal intake and per capita income.

There is still an ongoing discussion on this debatable issue. Several other economists looked at this 'puzzle' from various other angels.

Meenakshi and Ray (1999) examined regional heterogeneity in India's food expenditure pattern by taking account of prices and cultural preferences. Their argument is other than income, cultural preferences as well as demographic factors like household composition also play an important role in determining consumption pattern of households. They used NSS consumer expenditure survey data (for five rounds 1972-73, 1973-74, 1977-78, 1983 and 1987-88) and Consumer price (food sub group) index in their analysis. They found that substitution of cereals for high value foods has occurred in all sections of households for all the income quartiles; however the level of decrease was highest for the poorest section and lowest for the richest section. Actually it almost stood stagnant in the richest section over the years. They found during 1972-73 and 1987-88, poor households' cereal share decreased more relative to the rich in both rural and urban areas, and interestingly the decline occurred at a time when cereals were cheaper than substituted food items.

Their analysis was based on quadratic Almost Ideal demand system (QUAIDS)[21]. By extending AIDS[22], further for demographic variables, they found household composition and demographic variables have significant impact on household's consumption. They note that subsistence budget share of cereal and cereal substitutes are significantly higher in rural than in urban. They also found cereal and cereal substitutes share shows a downward trend while for all other food items it shows an upward trend in both the areas. They concluded by saying that in developing countries like India, non-economic factors are crucial in determining food expenditure and thus the government must undertake prominent state specific policies such as 'income augmenting and price reduction policies'.

The previous paper does not address the status of nutritional deprivation in India. Meenakshi et al. (2003) in another paper addressed the calorie deprivation issue for rural India. They found income poverty has declined during 1983 to 2000 in rural India; however calorie deprivation has increased. By using Foster-Greer-Thorbecke class of indices, they have checked the extent of calorie deprivation in different Indian states. They claimed that the nutrition norms both set by FAO, NNMB need to be renewed. The major conclusion come out from the analysis is that the normative basis of the official poverty line estimate needed to be re-examined.

Oldgies (2012) has analysed this puzzle by taking two different data sources. One is per capita income data taken from the Indian human development Survey (IHDS) and another is NSS consumption expenditure (CES) data for the year 2004-2005. He comes up with the result that there is no such co-relation between PCI and PCCC. PCCC remains almost same with different levels of income. He found that instead of being correlated with the PCI, PCCC is correlated with some non-income variables like education levels, household size and occupational pattern.

[21] an extension of Almost Ideal demand system (AIDS) given by Deaton and Mulleabuer in 1980

[22] They have extended the original model (AIDS) introducing non-linear relationship, model called QAI, between budget share and food expenditure following Pollak and Wales' (1981) suggestion of 'translation'. Further they have extended QAI to EQAI and GQAI by varying different demand parameters.

2.3 Empirical evidence – Other Developing World

Knudsen and Scandizzo (1982) looked at the determinants of calorie intakes for a set of developing countries namely Bangladesh, India, Indonesia, Morocco, Pakistan and Sri Lanka using aggregate data from household surveys. They estimated price and expenditure elasticities of demand for calories using a characteristic demand function. They found in developing countries for the poor consumers price elasticity lies around 0.60 and it is much lower in case of higher income group. They concluded by saying that nutritional status does not hamper if the income growth is focused on the poor. In contrast, if the participation of the poor is less than the rest of the population, nutritional status of the poor may deteriorate proportionally more in comparison to others.

Ray (2007) has done a comparative study on Indian experience in nutrition intake and undernourishment with that of Vietnamese. Vietnam and India both countries have pursued similar kind of reforms in mid 1980's[23] and 1990's respectively. Unlike India, where calorie consumption has descended steadily, Vietnamese has faced a sharp increase in the same in late 1990's. Along with that, share of protein rich food items and status of undernourishment has also improved. They found calorie contribution from rice, although over years declined, continued to be higher in rural areas whereas, share of wheat in calorie is more in urban sector. They argued food baskets in urban India are more diversified compare to rural, because of even distribution of calorie content of rice and wheat among the urban population and, surprisingly, they noted calorie share is relatively insignificant for meat fish and egg compare to fruits and vegetables. This result is robust across all expenditure groups. Vietnamese experience, in compare to India is completely different and far promising in context of development. Their (Vietnamese) average increase in calorie consumption, for the whole population, was around 24% and 30% for rural and urban respectively, whereas in India there is a mere fall of 5% and 2% in these sectors in the period 1992-93 (1993-94, for India) to 2004-05. Similar trend found in under-nourishment rate. He noted, even the top 10 percent of the households could not meet the requirement norm, this raises, as the author claimed, further policy issues and needs comprehensive measures to sort out. On policy perspective, he suggested public

[23] Vietnamese had initiated 'Doi Moi' reform in 1986 aiming to establish a 'socialist-oriented market economy', whereas India started liberalization policy in 1990.

distribution system (PDS) in India playing a very crucial role and it needs to be more universal rather than targeted – a similar argument put forward by Himanshu (2006).

2.4 Aim of the study

The review of the literature helps us to visualise the exact picture of calorie puzzle. This is clear that India is passing through an unprecedented stage of calorie decline and it is still not clear whether this decline helps to improve welfare or not. This raised questions on methodology of India's poverty estimate based on the normative calorie intake by age-sex-occupation class[24]. A common national poverty line would tend to underestimate (overestimate) poverty in regions with higher (lower) prices than the national average. Indian poverty line is thus adjusted for each state by using state-specific price relatives. The procedure of estimating poverty line involves calculation of the average calorie intake of every expenditure class, identify the lowest expenditure class that consumed the calorie norm, and use the per capita total expenditure of that class as the poverty line. Therefore, calorie intake decline is something that directly entrenches on the poverty line. So this decline is a sufficient cause of concern.

Now the obvious question is how we look at the puzzle. There are two ways of looking at it. One of course is to look at the expenditure share[25]. Therefore, it is possible to do a state wise analysis on distribution of expenditure share i.e. to examine how household's expenditure share distributed among the consumption basket and how the pattern changes over the time. To address this, a particular demand function will be used which is an extension of 'Almost Ideal Demand System' (AIDS). The demand function, based on the budget share, named as 'Quadratic Almost Ideal Demand System' (QUAIDS)[26]. The function relaxes the assumption of linearity and assumes a non-liner relationship between income and expenditure. Two, this study will focus on deprivation indices. As some economists suggests this decline in calorie is due to fall in purchasing power among the poor and in these successive years because of decline in calorie intake, number of people

[24] First in 1972-23 NSSO has used CES data to estimate poverty line. Detail of estimation method is available in the report and in a background paper prepared by Planning commission, GOI, named 'Report of The Task Force on Projections of Minimum needs and Effective consumption demand'.

[25] As NSSO data does not collect income data expenditure figures will be used.

[26] Recently some economists like Dey (2000), Kumar and Dey (2004) and Kumar et al (2005) applied this model for fisheries, Meenakshi and Ray (1999) has used this for India food model.

in hunger has increased. Deprivation indices will be used to look at the status of poverty and prevalence of under nutrition in these years.

In short, we will focus on these:

- To study the effect of decline in cereal and calorie consumption on welfare.
- To examine the pattern of food consumption in different states.
- Is it really the case that the steady decline in calorie intake has increased the extent of under-nutrition in India?

Research Questions

- What is the pattern of nutritional intake and consumption expenditure in rural and urban areas?
- What has been happening to the nutrition level? Do the indices show higher level of deprivation?
- What are the demand side factors that determine demand parameters of food consumption? Is that only income[27] factors or other non-income factors are also affecting.
- What does the expenditure and price elasticities show? Is it showing any direction of food diversification?

2.5 Summary

In this section we have a brief sum up of the review of literature and existing gap in the empirical studies dealing with this issue of declining energy intake. Researchers have put forward diversified reasons behind this decline in calorie intake and cereal consumption. Some have seen this decline as a positive welfare gain and others have not. Those who have seen this as a welfare gain identified the following broad reasons behind it: mechanisation of products, improved infrastructure, structural change, change in activity level, improved health facilities. In contrast, the opposite strand sees this puzzle as an

[27] Due to unavailability of proper income data in India, researchers, in general, consider expenditure figures as a proxy of income.

absolute impoverishment which is involuntarily chosen. According to them, people are consuming less not because their requirement has fallen but only because their entitlement to food has declined. Although, several researchers have discussed on this calorie-income 'puzzle' but surprisingly the results appear to be inconclusive.

This study, however, focuses on India and intends to find out how far income and non-income factors can explain this declining consumption of food grains and what is the expenditure and price response behind this change in recent food consumption pattern.

Chapter 3

Data and Methodology

3.1 Introduction

Changes in both calorie intake and dietary diversifications are readily attributable to the changes in households' income[28] (or in other words expenditure) assuming other factors remains constant. The present study, primarily, seeks to estimate the demand parameters response to changes in per capita total expenditure, prices and demographic variables. There are number of ways by which one can estimate the expenditure elasticity and price elasticity (Sinha, 1966; Swamy and Binswanger, 1983). However, theoretically it would be more appropriate to follow a specific demand system to estimate the expenditure and price elasticity[29]. The present study meticulously follows a specific demand system which is often characterised as a complete demand system. We require specific income and non-income variables for estimating parameters of this demand system. We consider household budget data as the unit of observation for our analysis. Unlike other developing countries, India has a very authentic source of long term time series expenditure data (with certain limitations, of course) which is necessary for 'sophisticated demand parameter estimation' (Meenakshi and Ray, 1999). This study also tries to look at the linkages between calorie deprivation (measured based on the recommended calorie norm) and poverty.

In the next section we shall give a detailed discussion on the kind of data we have used in this study.

3.2 Data

In India, the most authentic data source on consumption and consumption expenditure is the Household Consumer Expenditure Surveys (CES) conducted by the National Sample

[28] This is almost next to impossible to work with income data since until now no such reliable income data source is available in India. In a crude assumption, which economists often do, we take total expenditure as proxy of total income and in the background we assume a linear monotonic relationship between this two.
[29] Detailed have discussed in the section below.

Survey Organisation (NSSO). NSSO conducts household CES both for rural and urban areas separately. NSSO conducts two types of surveys on regular basis as part of its 'rounds'- one is small sample survey, called 'thin' rounds, conducted annually and other is quinquennial survey, a large sample survey called 'thick' rounds, conducted once in every five years. The present study uses household unit level data of three 'thick' rounds of the NSS CES data (Schedule 1.0) – 50th, 61st and 66th rounds pertaining to the periods 1993-94, 2004-05 and 2009-10. NSSO collects household CES data at the national level (in the form of various 'rounds') by adopting stratified, two stage random sample survey techniques, with villages (in case of urban it is blocks) are selected in the first stage and households are selected in the second. These rounds provide household consumer expenditure data in terms of quantity and value[30] of food and non-food items by expenditure class, rural-urban locations and by states. However, the present study requires food item wise[31] total quantity and value figures of consumption.

The study considers 19 major states, namely Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand, and West Bengal. However there were some issues relating to re-organisation of states between 1993-94 and 2004-05. In this period new states had formed. In 2000, three new states were formed by the then Government. These states are Chhattisgarh, Jharkhand and Uttarakhand which were previously a part of Madhya Pradesh, Bihar and Uttar Pradesh. Household CES data for these three newly formed states were not available in NSS 50th round. Another issue is, later NSS rounds become incomparable with 50th round since the regions defined in 61st and 66th round are different from the regions defined in 50th round. To make it comparable throughout all NSS rounds, we recoded the state-region[32] variable following the classification of NSS region. This has been a common practise for researchers who work with time series NSS data. Chhattisgarh figure is calculated for 50th round by taking out NSS region 131 from the

[30] quantity includes home grown quantity and total consumption quantity separately; value[30] (includes home grown value and total consumption value separately)

[31] More or less items considered in various NSS rounds remained same, however, contents of food item within a group has changed many times.

[32] There was some re-organisation within NSS regions as well. Since exact district codes are not available, we have left with no option to go for an approximation. As for example, Hardwar belongs to Uttarakhand in 61st and 66th rounds. However, it was not into NSS region 251 which have been taken out to create Uttarakhand from its parental state Uttar Pradesh.

parental state Madhya Pradesh. Now Madhya Pradesh has six regions with NSS region code 132 to137. Jharkhand figures have created by splitting NSS region 051 from Bihar. Rest NSS regions 052 and 053 used for the calculation of figures for Bihar. Similar methods have applied for creating Uttarakhand figures. By taking out NSS region 251 from Uttar Pradesh, Uttarakhand is created and remaining four regions, 252 to 255, defines the new geographical location of Uttar Pradesh. After doing this whole exercise the 50^{th} round figures are comparable with the 61^{st} and 66^{th} round.

Per capita intake of calories, proteins and fats are calculated by applying 'pre-specified' conversion factors to quantity figures of NSS consumption expenditure data. These conversion factors are taken from 'Nutritive values of Indian foods', a pioneering work by Gopalan[33] et al. in 1980. For some items such as 'ice cream' or 'other vegetables', NSS HCE data does not provide quantity figures. Conversion factors for those items are regularly updated (by adjusting rural- urban inflation rate separately) by National Institute of Nutrition, Hyderabad; otherwise the coefficients are more or less fixed over time. Per capita per day intakes of nutrients are derived by adjusting meals[34] taken outside or served to the others. Total calories have calculated by adding calorie figures from disaggregated food groups.

Prices for rural and urban areas are computed implicitly by dividing total expenditures by the quantities consumed by each household in each round. Logarithms of household prices have been used as the market price for disaggregated food groups. From the expenditure and quantity data expenditure shares are calculated for each household. For the purpose of analysis seven food sub-groups are created for both rural and urban sectors. The disaggregated food sub-groups are as follows: cereal and cereal substitutes, pulses, milk, oil and fats, egg-fish-meat, fruits and vegetables and miscellaneous. Miscellaneous group contains beverages, sugar and spices.

Apart from the consumer expenditure data, this study uses Indian poverty lines for three respective years 1993-94, 2004-05 and 2009-10 defined by the planning commission,

[33] See Goplan et al. (1980), 'Nutritive values of India foods', Indian Council of Medical Research.
[34] See NSS Nutritional Intake report no. 540 or 513 or 405 for detail discussion on 'Adjusted calorie intake method' and 'Direct method'. However, we didn't find any remarkable difference between calories computed using these two methods separately.

Government of India (GOI). The poverty lines for 2004-05[35] and 2009-10[36] have been taken from the press release of poverty estimates by planning commission. For 1993-94 it has been collected from GOI (1996).

3.3 Methodology

To address the objectives mentioned in the previous chapter we have followed some distinct indices and demand models.

3.3.1 Measure of Poverty and Calorie deprivation

To examine the extent of prevalence of deprivation or under nutrition and poverty, (based on recommended calorie norm and official poverty line) Head count ratios (henceforth HCR) and Foster-Greer-Thorbecke (FGT) indices have been used in this study. HCR is actually belongs to the FGT class of indices.

The index is denoted as FGT and defined as follows:

$$FGT = \frac{1}{H}\sum_{i=1}^{h}\left(\frac{g^h}{z}\right)^{\alpha} \quad , i = 1(1)h \ldots\ldots\ldots\ldots (I)$$

Where $g^h = (z - m^h)$, z is the recommended calorie norm. H is the total population. h is the number of calorie deprived people in the total population. α represents the severity of the index and m^h is the actual calorie intake of h^{th} person, consuming less than the recommended calories.

Note that when $\alpha = 0$, the index turns to the famous Head Count Ratio (HCR) which indicates the proportion of people with insufficient calorie intake. When $\alpha = 1$, FGT index measures the average gap between the recommended calorie norm (i.e. 2400 kcal for rural 2100 kcal for urban) and the actual calorie intake of a deprived household weighted by the proportion of deprived population, which can be termed as calorie-gap

[35] See 'Poverty estimates for 2004-05', PIB, GoI, New Delhi.
[36] See 'Poverty estimates for 2009-10', PIB, GoI, New Delhi.

ratio (Meenakshi & Vishwanathan, 2003). When $\alpha = 2$, the index imposes higher weights to more deprived people, thus measures the severity of the deprivation. A higher value of FGT index represents high percentage of calorie deprivation, opposite to the lower value. FGT index suggests other thing remaining constant an increase in the total population (H) would reduce the value of this index (i.e. a decline in deprivation). Moreover, keeping H and h constant, an increase in the calorie gap $(Z- m^h)$ increases the depth of the deprivation. This index shall also be used in the next Chapter to look at severity and depth of poverty using updated official state specific poverty lines.

3.3.2 The Demand Model

We have followed a complete demand system framework to estimate the expenditure and price elasticities of the food groups. Methodologically, there are a number of ways for estimating the demand parameters. A better approach would be to follow the guidelines of the theory of demand for the choice of functional forms and variables to be included for estimation of the demand parameters. Almost Ideal Demand System is one of them which gained importance in recent years in empirical research.

Almost Ideal Demand System (hereafter AIDS) was introduced by Deaton and Muellbauer (1980) and has been used widely thereafter, in empirical estimation of demand parameters. The word 'Almost' conveys that this system has limited validity. The word 'Ideal' suggests the theoretical modelling is very close to the empirical estimation. The criticisms against this demand system (is the linearity assumption of famous Engel curve) will be discussed in the later sections. Blundell et. al. (1997) extended the AIDS model by allowing non-linear relationship between the budget share and the total real expenditure. The two models are described below.

3.3.2.1 Almost Ideal Demand System (AIDS)

Fundamentally, Almost Ideal Demand System comes from a basic Cobb-Douglas utility function which reflects additive preferences between a subsistence level and an above subsistence level of consumption. In a single good framework let us assume 'a' is the subsistence level and 'b' is the above subsistence level consumption. The Cobb- Douglas direct utility function can be written as the following:

$$V(q) = a(q)^{1-u}\, b(q)^{u} \ldots\ldots\ldots\ldots\ldots (1)$$

Where V(q) is the demand function. q is the quantity consumed. u is the utility level and u lies between 0 and 1. Utility (u) zero signifies "subsistence" while it is "bliss" when u is 1 (Deaton and Muellbauer, 1980). In equation (1) it is needless to say *(1-u)* and u shows the proportion of 'subsistence' and 'bliss' levels of consumption respectively.

Now the indirect cost function comprising the utility levels derived from the consumption can be written as follows:

$$c(u,p) = a(p)^{1-u} b(p)^{u} \ldots\ldots\ldots\ldots\ldots (2)$$

Here p is the price vector, $a(p)$ and $b(p)$ can be interpreted as the cost incurred to attain 'subsistence' and 'bliss' level utility respectively. Equation (2), the new cost function holds the linear homogeneity condition in functions $a(p)$ and $b(p)$ which are homogeneous in prices too. Again, if $a(p)$ and $b(p)$ are linearly homogeneous in prices, the demand function derived from equation (2) will be homogeneous of degree zero in prices. The linear homogeneity condition is ties up well with the Cobb- Douglas utility function. The cost function derived from Cobb-Douglas type of utility function, because of their inherited linear nature, is sometimes called as the 'general linear cost function'. Since expenditure shares are linear in prices in this type of cost function, sometimes it is called as 'price-independent general linear cost function'. By taking logarithms, which is nothing but a mere monotonic transformation, we can get the PIGLOG function[37]:

$$\log c(u, p) = (1-u) \log\{a(p)\} + u \log\{b(p)\} \ldots\ldots\ldots\ldots\ldots (3)$$

where log{a(p)} and log{b(p)} posses a specific functional form with sufficient parameters such that first order approximation of any demand function can be represented as AIDS system.

[37] Price independent, general linear log function (PIGLOG) is the Minimum expenditure necessary to meet subsistence level consumption basket.

$$log\{a(p)\} = \alpha_0 + \sum_{i=1}^{n} \alpha_i logp_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} logp_i logp_j \ \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$\log\{b(p)\} = \log\{a(p)\} + \beta_0 \prod_i p_i^{\beta_i} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Equation (4) is the Translog price index. $\alpha_i, \beta_i, \gamma_{ij}$ are parameters and p_i's are the respective prices of i^{th} item. Combining equation (4) and equation (5) we get the AIDS cost function.

$$log\ c(u,p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i logp_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} logp_i logp_j + u\beta_0 \prod_i p_i^{\beta_i} \ \ldots\ldots (6)$$

By using Shepard's lemma[38] in equation 6 we get the demand function and with some adjustments in both left hand and right hand side we can have the budget form equation.

$$\frac{\partial c(u,p)}{\partial p_i} = q_i \ \ldots\ldots\ldots (7)$$

$$\frac{\partial c(u,p)}{\partial p_i} * \frac{p_i}{c(u,p)} = \frac{p_i q_i}{c(u,p)} = W_i \ \ldots\ldots\ldots (8)$$

W_i is the budget share of item i. A rational utility maximising consumer will always pay according to his/her budget constraint. Then total expenditure, say X is equal to the cost $c(u,p)$. If that is true, then by indirect utility theorem this equality can be inverted to give u as function of p and x. Therefore the AIDS function in budget share form can be written as follows:

$$W_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(X/P) + \varepsilon_i \ \ldots\ldots\ldots\ldots (9)$$

[38] Shepard's lemma states that at a given utility level u and prices p, demand for a particular good (say i) is equal to the first derivative of the expenditure function with respect to price (say i) i.e. controlling other variables, one percent change in the price of commodity i will change the expenditure and that can only comes through the change in demand for good i.

Equation (9) can be estimated empirically with some econometric restrictions which will be discussed in the next section.

The serious drawback of AIDS, identified by Deaton and Muellbauer (1980), is that it assumes a linear relationship between expenditure share and the total real expenditure. Income varies across households and income elasticity varies across commodities, the income effect for households at different points of income distribution must be carefully captured in order to know the demand responses to the changes in disposable income. Another serious criticism is that the system has a limited ability in analysing the effect of the socio-economic and demographic variables on expenditure.

3.3.2.2 The Quadratic Almost Ideal System (QUAIDS)

Therefore the Quadratic extension of AIDS, named as Quadratic Almost Ideal Demand System (hereafter QUAIDS) has been selected for this study. The model allows goods to be luxuries at some income levels and necessities at others. QUAIDS model was proposed by Banks et al in 1997. The model has the ability to capture the effects of other socio-economic characteristics apart from income and prices of commodities on the expenditure shares of households (Banks et al., 1997). QUAIDS model also becomes appropriate for analyzing household food demand system as a result of some empirical studies in both developed and developing countries. Abdulai (2002) applied QUAIDS to the food expenditure data from Switzerland; Banks et al. (1997) applied to the expenditure data on broad consumption goods from the UK. A number of studies in developing countries such as Abdulai and Aubert (2004) using Tanzanian food expenditure data, Meenakshi and Ray (1999) using Indian food expenditure data, Dey (2000) for Bangladesh and Kumar et al. (2004, 2005) for India.

The QUAIDS model assumes household preferences belong to a specific quadratic logarithmic family of cost functions which is specified as follows,

$$log\ c(u,p) = log\ \{a(p)\} + \frac{u\ b(p)}{1 - \lambda\ b(p)u} \ldots\ldots\ldots (10)$$

Where $c(u,p)$ is the total cost function of the PIGLOG class, u is the utility, p is the vector of prices, $a(p)$ and $b(p)$ are two price functions which are homogeneous of degree 1 and degree 0 in prices, respectively. The corresponding indirect utility function is expressed as follows:

$$log\ V = \left\{\left[\frac{log\ X^R}{b(p)}\right]^{-1} + \lambda(p)\right\}^{-1} \ldots\ldots\ldots\ldots (11)$$

Where X is the total expenditure and X^R is the real expenditure deflated by the price index.

$$log\ X^R = logX - log\ a(p) \ldots\ldots\ldots\ldots (11a)$$

$a(p)$ is the translog price index, specified similar to the equation number (4)

$$log\ a(p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i logp_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} logp_i logp_j \ldots\ldots\ldots\ldots (12)$$

$$b(p) = \beta_0 \prod_i p_i^{\beta_i}\ , \qquad \text{where } \sum \beta_i = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

and $\lambda(p) = \sum_{i=1}^{n} \lambda_i log\ p_i$ where $\sum \lambda_i = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$

Applying Shepard's lemma or Roy's identity the QUAIDS model can be written in expenditure share form.

$$W_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(X/P) + \lambda_i \{\log(X/P)\}^2 + \varepsilon_i \ldots\ldots\ldots (15)$$

Notice that if λ_i is equal to zero, the QUAIDS model turns to Deaton- Mullebauer's 'Almost ideal demand system'. X is the aggregate money expenditure on the group of goods being analysed, P is the price index for the group, p_j is the price of j^{th} good. W_i is the share of i^{th} good in total expenditure. Theoretical restrictions imposed on the demand parameters are as follows:

Additivity: $\sum_{i=1}^{n} \alpha_i = 0; \sum_{i=1}^{n} \beta_i = 0; \sum_{i=1}^{n} \gamma_{ij} = 0; \sum_{i=1}^{n} \lambda_i = 0$ ..... (16)

Homogeneity: $\sum_{i=1}^{n} \gamma_{ij} = 0;$ ..... (17)

Symmetry: $\gamma_{ij} = \gamma_{ji};$ ..... (18)

If the above restrictions (16, 17 and 18) hold, the expenditure share equation (equation no. 15) represents a system of demand function where the budget shares are adding up to unity, $\sum W_i = 1$. Therefore the QUAIDS model becomes homogeneous of degree zero in prices and it would satisfy the additivity and Slutsky symmetry condition. The QUAIDS model indicates i^{th} (item) expenditure share of i^{th} commodity depends on its own price, price of other commodities and on total real expenditure. The demand parameters can be interpreted as following, α_i is the minimum budget share of an item i at 'subsistence' level i.e. when $u = 0$ at base year prices. In other words, if relative prices and real expenditures are held constant, α_i equals the i^{th} budget share W_i, indicates change in W_i would be equal to change in α_i. The effect of changes in real expenditure on changes in expenditure share of i^{th} commodity has two components. The first component is independent of the value of real expenditure and represented by β_i. The second component depends on the value of real expenditure and represented by $2\lambda_i \log(X/P)$. Therefore, λ_i allows non-monotonic relation between budget shares and real total expenditure.

3.3.2.3 Empirical Specification of QUAIDS

It is now appropriate time to delineate the empirical model to be estimated using the consumption data and statistical tools. One valuable condition for demand estimation is that the demand function should have the flexible functional form with sufficient number of parameters. A demand system should be flexible to allow income elasticities to vary across the income spectrum; because sometimes it is found income elasticities of food demand to fall with increase in income. The present model drops the linearity assumption and allows non-linearity (quadratic as a special case in the model specified in equation 15) between income changes and the food consumption. QUAIDS model, unlike AIDS, takes care of the possibility of a 'luxurious' item to 'necessities' and vice versa across

expenditure class. The QUAIDS model described below provides the framework within which one can estimate demand parameters. Major food groups, in this study, include cereal, pulses, milk, oil, egg-fish-meat, fruits and vegetable and a group of miscellaneous goods. The sum of expenditures on each of the items mentioned above equals total expenditure. Hence, the QUAIDS model is regarded here as the system of demand equations derived from the household preference ordering for the major food items. The system of equations to be estimated here, thus, takes the following form:

$$W_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(X/P^*) + \lambda_i \{\log(X/P^*)\}^2 + \varepsilon_i \ldots\ldots\ldots\ldots (19)$$

where $W_i = \frac{p_i q_i}{X_i}$ - budget share of good i., i = 1(1)7

$X = \sum p_i q_i$ – total expenditure

γ_{ij} – effect on the budget of item i of 1 percent change in the prices of items in group j. effect of 1 percentage changes in price of j^{th} item on total changes in the budget share of i^{th} item

The estimation of the QUAIDS model can be carried out by substituting equation (12) in (15) but it requires a large number of parameters to be estimated and, hence, the use of the Translog price index in the context of the QUAIDS model often raises empirical difficulties.

Most of the literature suggests if the prices are collinear, it is better to use linear approximation of price index. Deaton and Muellbauer (1980) pointed out that Translog price index sometimes creates difficulties in empirical estimation. They suggested that if the prices are closely collinear, it would be possible to approximate P as proportional to some known index P* and they suggested Stone's (1954b) index:

$$log\ P^* = \sum W_i \log p_i \ldots\ldots\ldots\ldots\ldots (20)$$

If P is approximately proportional to P* (i.e., $P \cong \phi P^*$), then the model can be written as equation (19) by using the linear approximation of Stone price index.

In this study we use Stone geometric index as the price index to obtain total expenditure in real terms as used by other researchers (Mittal 2007, 2010; Dey, 2000; Kumar et al. 2011).

3.3.2.4 Compensated and Uncompensated Price and Expenditure Elasticity in QUAIDS

The present study is interested in looking at expenditure responses and price responses across disaggregated food groups. Price elasticity is the percentage change in quantity demand for a good (say milk) with respect to the change in price of that good (milk) (called own price elasticity) or of another good (say rice) (called cross-price elasticity). Income elasticity or expenditure elasticity is the percentage change in good demanded with respect to the changes in income or expenditure. Mathematically,

Own price elasticity $(e_p) = \frac{\partial q_i}{\partial p_i} * \frac{p_i}{q_i}$

Cross Price elasticity $(e_{pj}) = \frac{\partial q_i}{\partial p_j} * \frac{p_j}{q_i}$

Expenditure elasticity $(e_i) = \frac{\partial q_i}{\partial X} * \frac{X}{q_i}$

p_i, q_i is the price and quantity of ith good and $p_j$is the price of jth good.

Price elasticities are generally derived from the Marshallian and Hicksian demand function. Note that a Marshllian demand function is derived by maximising utility subject to a budget constraint while a Hicksian demand function is obtained by minimising expenditure at a given utility level. Elasticities derived from the Marshallian demand function are called uncompensated elasticities and elasticities derived from the Hicksian demand function are called the compensated elasticities. Marshalian price elasticity considers both substitution and income effect while Hicksian price elasticity considers only substitution effect. So, in case of Marshallian elasticity the purchasing power will change for a change in price level. However, Hicksian elasticity only consider that the

changes in the relative value of a commodity due to changes in the price of that commodity.

Expenditure and price elasticity of QUAIDS can be obtained by differentiating equation (15) with respect to expenditure (X) and prices - p_i's (own price elasticity) and p_j's (cross price elasticity).

Expenditure elasticity:

$$e_i = 1 + \left(\beta_i + \frac{2\lambda_i log\ X}{W_i}\right)$$

Uncompensated elasticity:

Marshallian price elasticity is calculated as

$$\eta_{ij} = \delta_{ij} + \frac{1}{w_i} * \frac{\partial w_i}{\partial log p_j} \dots\dots\dots\dots\dots\dots (21)$$

Differentiating the final budget share equation stated above (equation 19) with respect to $logp_j$ and substituting in equation (21), we get the following:

$$\eta_{ij} = \left(\frac{\gamma_{ij}}{w_i}\right) + (\beta_i + 2\lambda_i log\ X)\left(\frac{w_j}{w_i}\right) - \delta_{ij} \dots\dots\dots\dots\dots (22)$$

Where δ_{ij} is Kronecker delta. δ_{ij} is one for own price elasticity and zero for cross price elasticity, i.e. in equation $\delta_{ij} = 1\ if\ i = j$ and $\delta_{ij} = 0\ if\ i \neq j$. w_i is the budget share of i^{th} items/groups. Once the expenditure and uncompensated price elasticities are estimated, the compensated own and cross-price elasticities can be computed using the Slutsky equation in elasticity form.

$$\eta_{ij}{}^{c} = \eta_{ij} + W_j\, e_i$$

where $\eta_{ij}{}^{c}$ is the compensated (Hicksian) price elasticity.

3.4 Data Limitation

There are some serious data limitations in our study. First, NSS does not provide price data. Therefore, to compute price of a particular item (say rice), we need to use aggregated quantity and value figure. Price calculation in this manner fails to capture qualitative variation of similar items. The present study requires prices of aggregated food groups such as cereals, pulses, milk etc which is not available at present. Therefore, even if we recognise methodological fault, at present, we do not have readily available solution.

Second, Per capita values could not be appropriate if there is a substantial variation within households. As for example, consider a household with five members – 3 adults and 2 children. Suppose one adult member is a strict vegetarian. However, when we calculate per capita figure, we distribute total consumption among all others. Therefore even if he/she is not consuming non vegetarian food items, calculation reflects this item has been equally shared by each person. This 'equality', certainly, raises another question of quantity of consumption. Notice, although the vegetarian person has zero consumption of non-vegetarian items, the computed per capita figure shows he/she is sharing equal amount with rest of the members.

Third, Stone geometric price index is not free from units of measurement. Therefore, those items (such as lemon, banana etc) which are not available in gm/kg (since majority of the food items are available in this unit) have to be left out from total food expenditure. Again, for similar reason, items whose quantity figures are not available (ice cream), are also excluded from total food expenditure.

3.5 Summary

This chapter has explained how we propose to examine the decline in calorie consumption. In the beginning, we discussed data used for this analysis. We have also discussed how we have calculated nutrition intakes using conversion factor.

In the following section we defined FGT index which will be used empirically to see the status of under nutrition in India. We have mathematically shown how the index turns to famous HCR with degree of severity, 'α', equals to zero.

In the last section, we discuss the theoretical AIDS and QUAIDS model. This section also discusses about the specific QUAIDS model for empirical estimation and explains why Stone geometric index is better than the Translog index with existence of price co-linearity. We define Marshallian and Hicksian price elasticity and show the specific form of expenditure and price elasticity from QUAIDS model. We will use this model to estimate the expenditure and price elasticities for different food groups.

Chapter 4

Food consumption, Nutrition Intake and Poverty – An overview of Trends and Patterns

4.1 Introduction

There are mainly three major nutrient intakes that are available in an average consumer's diet - calorie, protein and fat. Although there are several micro-nutrients present in this food items, the discussion, in general, is restricted to these three in the literature. As per the recommendations of the Indian Council for Medical Research (ICMR), a proper balanced diet of 2738.60 kcal energy should comprise of 467.53 gms of carbohydrate, 66.6 gms of protein and 66.9 gms of fat (Gopalan et al. 1999). This chapter tries to examine how far these recommendations are met in recent time in India.

In the previous chapter we have discussed the methodology and the kind of data base we are going to use in this study. As we already stated, our analysis is restricted to three NSS quiquennial rounds, 50th (1993-94), 61st (2004-05) and 66th (2009-10). This chapter tries to capture major trends of nutrient intake and food grain consumption in India with respect to various indicators. We will also try to discuss on poverty nutrition trade off using the existing data sources.

From the Gopalan's study (1980) we get the conversion factor which specifies the calorie, fat and protein content in per unit of the food item which is used to convert the quantities of food consumed (in some cases we use the expenditure directly where the quantity-energy linkage not available) into energy intakes. Normative calorie requirement figures (daily per capita) were estimated by following the age-sex-activity specific calorie allowances recommendation of Nutrition Expert Group (1968). 'Minimum requirement' (per capita per day 2400 kcal[39] for rural and 2100 kcal for urban) thresholds were worked out by the 'Task Force' (GOI 1979). However, since the starting 'rounds' of NSS survey, estimated average per day per capita calorie intake for an average consumer never exceeded the recommended figures. Table 4.1 (See tables at the end of this chapter),

[39] The exact minimum requirement figures were 2435 kcal in rural and 2095 kcal in urban.

provides a snapshot of all India figures of calories, proteins and fats over three survey rounds. The average per capita per day (PCPD) intakes of calorie and protein in both rural and urban sectors has unambiguously declined over the years. Unlike calorie and protein, intakes of fat per capita have increased over the time. It is worth noticing that taking all three years together, in none of the year's calorie figures had exceeded the recommended norm; rather it stayed far below the actual norm in both rural and urban sector.

4.2 Changes in Food consumption

Let us first consider the changes in food consumption in rural and urban India over the period of 1993-94, 2004-05 and 2009-10. Table 4.2 summaries mean level consumption of major food items in India. The table shows the degree of change in consumption within several food groups.

The figures in Table 4.2 shows the monthly per capita consumption of major food items and there percentage of changes in consumption over the years. In rural India, there was a steady decline in cereal consumption from 13.4 kg in 1993-94 to 11.34 kg in 2009-10, an average fall of around 1 percent per annum[40]. However in the later period, between 2004-05 and 2009-10, per annum decline rate was 1.3 percent, higher than the previous period. The decline is more severe in case of cereal substitutes. Annual decline rate was around 3 percent in 1993-2004 which increased to almost 5 percent in the later period 2004-2009. Consumption of pulses also decreased from per capita intake of 0.80 kg in 1993-94 to 0.66 kg in 2009-10, i.e. a fall of 1.09 per cent per annum. In contrast, intake of milk and edible oil recorded a moderate rise of 5.4 percent and 16.7 percent respectively during 2004-05 to 2009-10. During 1993-94 to 2004-05, per capita consumption of egg-fish-meat, vegetables and fruits increased. However, it declined in the later period 2004-05 to 2009-10.

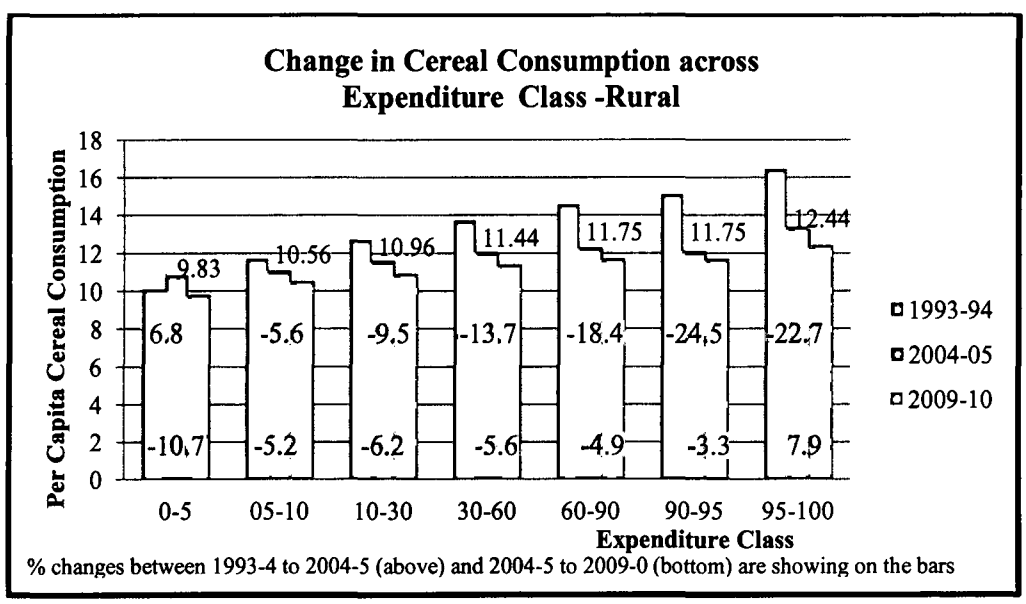
In urban, even if the rate was lower than rural, cereal consumption was decreasing at an increasing rate. Annual rate of decline was 0.75 per cent in 1993 – 2004 which increased to 1.1 per cent in 2004 – 2009 periods. Consumption of cereal substitute recorded a mere 50 percent fall over the entire period. Similarly, intake of pulses and grams also declined

[40] Per annum figures are calculated by dividing total percentage changes by length of time.

in all the periods taken into account. Milk consumption in this sector rose moderately over the periods; increasing at a rate of 0.4 percent per annum in 1993-2004 followed by a 1.14 percent per annum increase in the last five years from 2004-2009. Intake of edible oil increased substantially from 0.36 kg per capita per month in 1993-94 to 0.72 kg per capita per month. Over the whole period, growth rate of the consumptions of eggs and fruits-vegetables was positive but it declines in the last five years.

There has been a considerable dietary change in India over the years. The table 4.2 also indicates a shift in the average consumption pattern from low value food items such as cereals, cereal substitutes and pulses to high value food items such as milk, eggs, edible oils etc in both rural and urban areas during the period from 1993-94 to 2009-10. Cereal, a major source of nutrition (calories and protein) intake in India has declined at a very high rate of 5 to 10 percent in rural as well as in urban. Now it would be essential to look at the distribution of cereal consumption across all expenditure classes, along with that we will also look at the time trend from the available NSS CES data. Rural cereal consumption across MPCE classes has shown in figure 4.1[41]. Figure 4.2 shows time series trend.

Figure 4.1: Average per capita Cereal consumption across MPCE category (Rural)

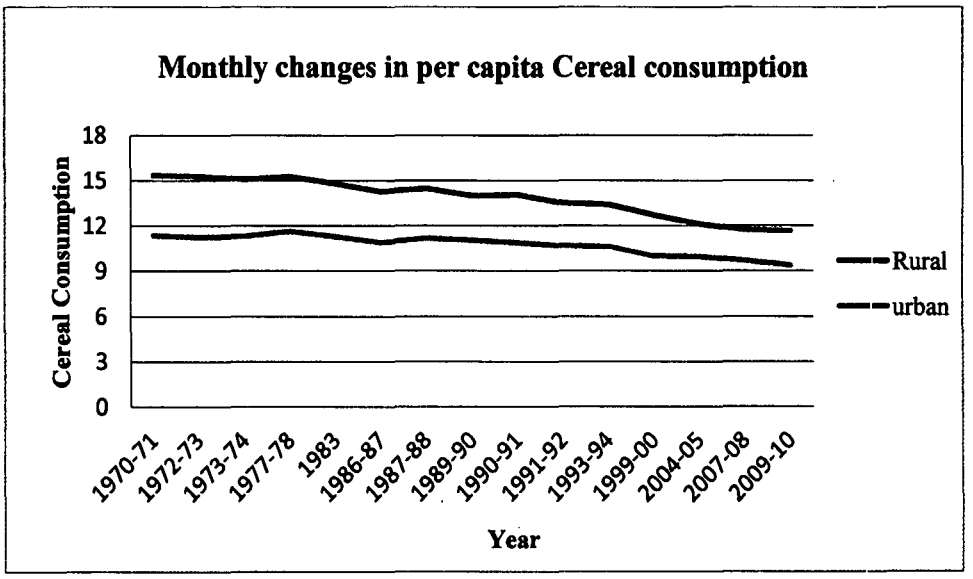


Source: As in Table 4.1.

[41] See Appendix for urban figure.

Per capita monthly cereal consumption has been plotted against MPCE classes[42]. It is clear that decline is not homogeneous across seven different MPCE classes in both rural and urban sector between 1993-94 and 2009-10. The topmost values represent the average level of cereal consumption for each expenditure class in 2009-10. The highest decline occurred among the top MPCE classes, with decline up to 24.5 per cent, between 1993-94 and 2009-10. The decline shows a positive trend across poor to rich MPCE class. Surprisingly, a cross-section trend shows that there is an increase in per capita cereal consumption from bottom income class to the higher income class. However, in contrast the time series trend shows a mere decline for a given expenditure class (except only one time period, 1993-94 to 2004-05, where the bottom class has experienced an increase). So there is a positive correlation between MPCE and per capita cereal consumption for a given year whereas it is negatively related with time series data. In urban the trend is more or less similar except in the bottom class, again, there was an increase in the period between 1993-94 and 2004-05.

Figure 4.2: Sector wise trends in per capita Cereal consumption over time (1970 – 2009)



Source: As in Table 4.1.

[42] MPCE classes have been classified in seven quantiles based on monthly per capita expenditure (MPCE). For Bottom 10% class people it has been categorized in two expenditure quantile, 0-5% and 5-10%. Similarly top income class also divided in two categories comprising 5 percent income. Middle income group has divided in three groups containing 10 percent of the income in each group.

Urban curve lies below the rural curve over all the years. Rural and urban curves are parallel to each other, which signify that the decreasing rates are more or less uniform over time. The decline rate has clearly increased after liberalisation period and the line shows the decline was very sharp in between 1993-94 and 2004-05, after that it hovers around 12 Kg per month. Patanaik[43] found, over four fifths of the total fall has occurred between this period alone, it decreased from 177 kg in 1993 to 154 kg in 1998. She alleged it is entirely a result of an implementation of neo-liberal policies which caused the increase in absolute poverty and hunger. Now this issue of increase in absolute poverty can be attributed directly to the status of nutritional intake of the households. Now, we will move to see the share of calorie, protein and fat consumption from major food items in rural and urban India covering the period 1993-94 and 2009-10. However we shall return to the issue of welfare loss (or gain) again in the next chapter where we shall look at how the demand parameters have responded with respect to the changes in economic variable by using a complete demand system framework.

4.3 Changes in Nutritional intake across food groups

This section will deal with the changes in calorie, protein and fat intake across several food groups. We have considered all the food items except pan, tobacco and intoxicants surveyed in the three 'thick' rounds (50^{th}, 61st and 66^{th}) of household consumer expenditure survey of NSS. There are eight food groups in the Table 4.3. Each food group[44] comprises of major food items and their products, such as cereal and cereal substitutes consists of rice and rice products, wheat and wheat products, jowar, bajra, maize, barley, small millets, ragi and their product items.

Table 4.3, 4.4 and 4.5 illustrates calorie, protein and fat intakes from the major food groups in rural and urban India. We have already discussed in Chapter 3 how the consumption figure has been converted to nutrition intakes. So it is need less to say since there is a positive monotonic relation between the food consumption and nutrition intake, direction of changes in nutrition intake across food groups are expected to be similar as the changes in food consumption.

[43] Patnaik, Utsa (2004): 'The Republic of Hunger', Social Scientist, September-October, pp 9-35.
[44] Miscellaneous group comprises of spices and salt.

4.3.1 Changes in Calorie intake

Table 4.3 shows the calorie intake figures for different food groups. In all three years, in both rural and urban areas, cereal calories have recorded highest share[45] in total calorie intake albeit the fact that it has witnessed a sharp decline over time. Cereal calorie recorded highest decline among all other food groups. In rural (urban) the share of cereal calorie was 71.2% (58.8%) in 1993-94 which declined to 67.7% (56.2%) in 2004-05 and further declined to 64.3% (54.1%) in 2009-10. The annual average rate of decline was around 0.89 percent between 1993-94 and 2004-05 which has increased to 1.3 percent in the later period between 2004-05 and 2009-10. This declining trend in nutritional intake can be checked with the trend in cereal consumption (Figure 4.2), and as we said, the trends are similar. Per day per capita consumption of pulses has also slipped down from 91.68 kcal to 75.84 kcal over 1993-94 to 2009-10. Unlike cereal, consumption of beverages, milk, sugar and edible oil has increased over time in both rural and urban India. Highest increase has been observed in case of beverages in both rural and urban sector. In rural areas, surprisingly, calories from beverages have increased continuously at an annual rate of 15.33 per cent through the whole periods taken under consideration. Alone in the period between 2004-05 and 2009-10, in rural (urban), per day per capita intake has jumped from 33.41 kcal (83.41 kcal) to 100.58 kcal (124.79 kcal), an overall increase of 201.04 (49.6) per cent. Consumption of milk and milk products accounted for a continuous increase in both sectors- the increase is around 3 percent and 10 per cent in rural and urban respectively between 1993-94 and 2099-10. Similarly, per capita per day consumption of sugar and edible oil has recorded a substantial increase of 22.1 per cent in rural and 10.5 per cent in urban between the same period.

4.3.2 Changes in Protein intake

Similar as calorie overall protein consumption (Table 4.4) has declined over time. Cereal, again, contributes highest share in protein intake in all three years. However, consumption of cereals (and cereal substitutes) fell continuously from 41.85 to 35.68 (in rural) and 34.04 to 30.17 (in urban) during 1993-94 in 2009-10. Similarly consumption of pulses has also declined at a very high pace from 6.12 to 4.98 (in rural) and 6.92 to 6.05

[45] Although it has declined over years but still cereal stands as the major food item in the daily diets of an average consumer in India.

(in urban) during the same period. In this period (1993-94 and 2009-10), for some food items protein intake has increased slightly such as – milk, egg-fish-meat and again beverages. Here also, the increase is highest in case of beverages which rose from 0.57 (1.88) to 2.05 (2.52) in rural (urban) sector, more than 250 per cent increase in 16 years. In recent quinquennial, 2004-05 to 2009-10, in both the sectors, there is a mere fall in per day per capita protein intake across all food groups except for beverages, milk and miscellaneous.

4.3.3 Changes in Fat intake

Overall trend, as we have already seen in the beginning of this chapter, in per capita per day fat intake has shown a steady increase over time. From the table 4.5, it is clear that except cereal, which declined continuously, change in average fat intake was not homogeneous across all food groups in both rural and urban sector. Highest contributor in this rising intake was sugar and edible oil. The share of fat from sugar and oil in total intake rose from 29 per cent in 1993-94 to 45 per cent in 2009-10 in rural areas. In urban the corresponding figures were 44 per cent and 57 per cent, respectively. In urban (rural), intakes from milk rose from 13.22 gm (9.72 gm) in 1993-94 to 14.48 gm (9.98 gm) in 2009-10. Again, intakes from beverages increased continuously at a very high rate (12.5 per cent per annum between 1993-94 and 2009-10) in rural however, in urban, in the later period, annual growth rate was 6.6 per cent. Intakes from egg-fish-meat in rural sector increased from 0.46 gm to 0.51 gm in the first period (i.e. 1993-2004) but decreased to 0.46 gm in the later period in 2004 to 2009.

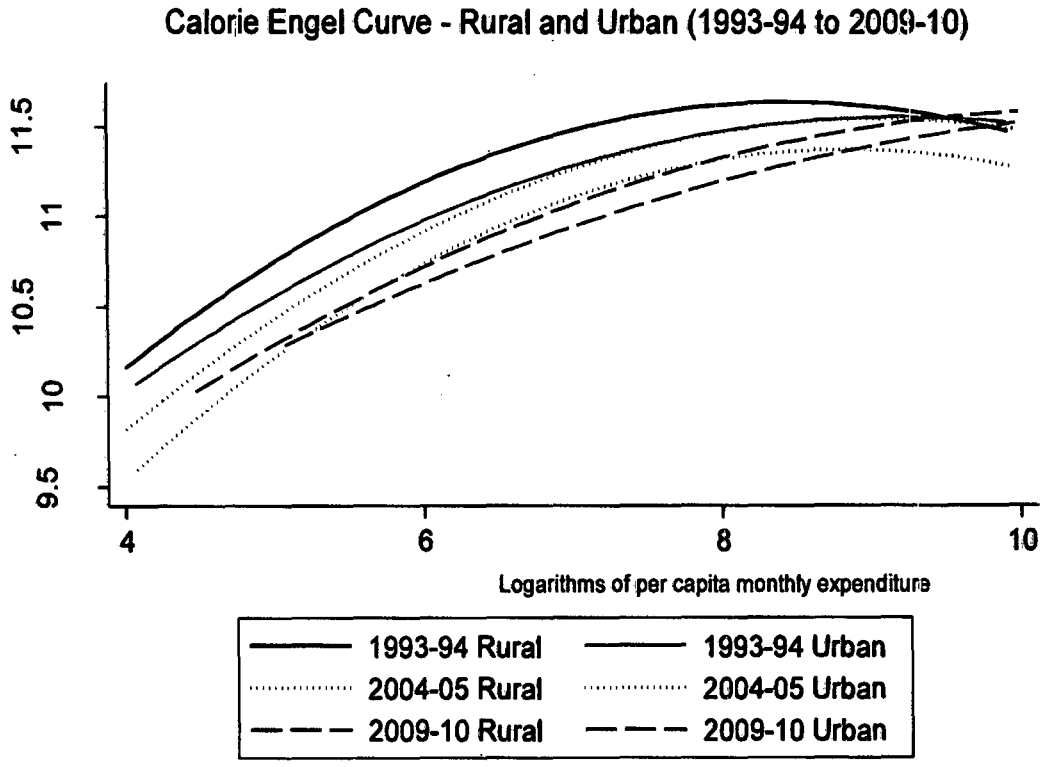
4.4 Calorie Engel curve[46]

The Engel curve portrays the relationship between the commodity expenditure and income. It is a well regularity, described by Engel's law, that high income group people spends proportionately less on the food than the lower income group. Empirical application of Engel's law within food group expenditure renders that with an increase in income, proportionate spending on the inferior food items (like cereal, pulses, grams) increase initially but decline after a certain level of income. Calorie-Engel curve, here in

[46] The term 'Calorie-Engel curve' has used in many studies. See for example Palmer-Jones & Sen, 2001 and Deaton & Dreze, 2009.

the figure 4.3 below, depicts a non-linear relationship between per capita expenditure and per capita calorie consumption. The figure intends to capture for a given expenditure level how the calorie consumption has changed along the entire expenditure spectrum. We assume there is no linear one to one relationship between calorie intake and per capita expenditure (or more precisely income), where the implicit assumption is all goods are normal (which is not true always). As we have already revealed in the previous chapter, this study seeks to estimate expenditure and price responses on consumption by using a quadratic demand system, keeping that in mind, we allow a quadratic relation (as a special case of non-linear) between per capita calorie consumption and per capita expenditure.

Figure 4.3: Calorie-Engel curves for Rural and Urban sectors



Source: As in Table 4.1.

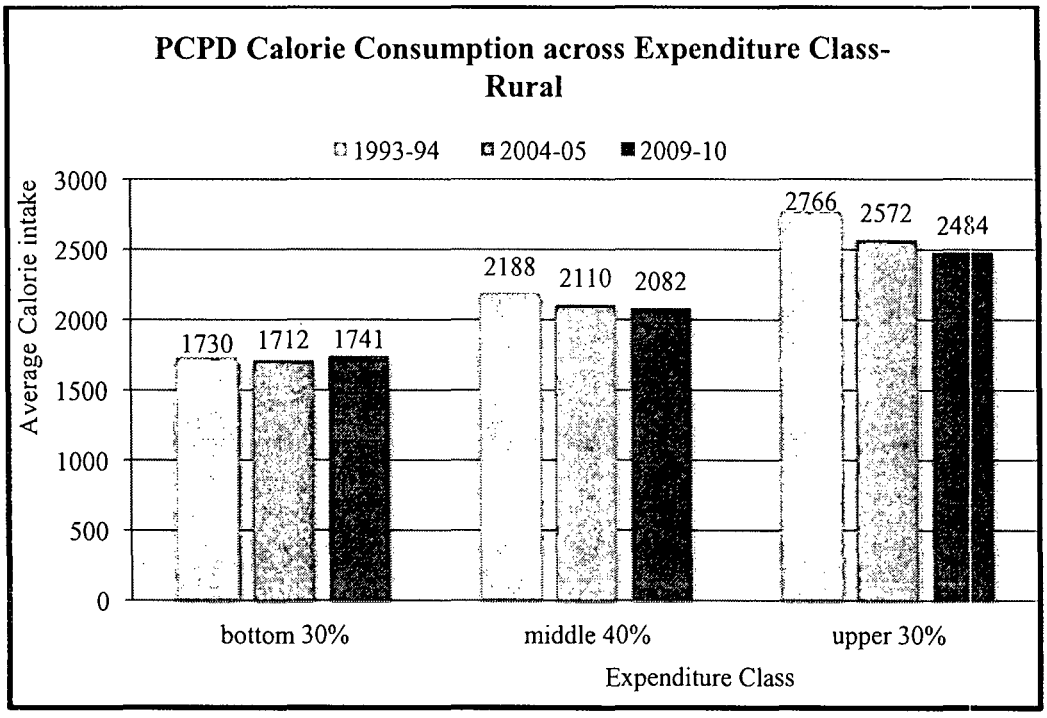
In the figure 4.3, the continuous line (red for rural and grey for urban), the dotted line (blue for rural and orange for urban) and the dash line (brown for rural and navy blue for

urban) is plotted by taking account of three thick rounds of NSS- 1993-94, 2004-05 and 2009-10. Those curves clearly show that calorie consumption has fallen over time for a given level of per capita monthly total expenditure. However, an opposite result can be found if we look across households' calorie intake and their total expenditure. In a cross-section data, one can always find a positive correlation between these two. From the figure above this is quite clear. Almost in every year the general curvature the Engel curve is more or less similar, it first increases for the lower and middle income level and then decreases at a very high income level. Let's look at the topmost Calorie-Engel[47] curve in the figure which plots logarithms[48] of per capita monthly calorie intake against per capita monthly total expenditure for rural areas in 2009-10. Households who are living at the bottom expenditure class consuming less (calories) than the upper class people. At the lower income group, the curve depicts a strict upward trend which clearly means for an increase in income at the lower end, calorie intake will increase. This positive upward trend continues up to a certain point and then it has fallen for at a very high income level. Now if we look at the time series trend, as expected, at any given expenditure level, the rural as well as the urban Calorie Engel curve has drifted down over time. In both rural and urban, the amount of decrease (the gap between the rural-rural (and urban-urban) curves for a given level of income over time) is less in the later period (between 2004-05 and 2009-10) compare to the previous.

Another important observation is the rural – urban gap in calorie intake. Notice, over time rural – urban gap is also shrinking, rural monthly consumption is gradually converging to the urban. Compare 1993-94 rural – urban curves with 2009-10, for the middle income level the gap is much larger in 1993-94 than 2009-10. Parallel rural curves explain that calorie intake across all expenditure class has uniformly declined over time. Again, the fall is more pronounced at the higher income class people than the lower income class – this will be clearer if we look at the figure 4.4 and 4.5 which shows the change in kilocalories across three expenditure classes - bottom 30%, middle 40% and upper 30% in rural and urban areas.

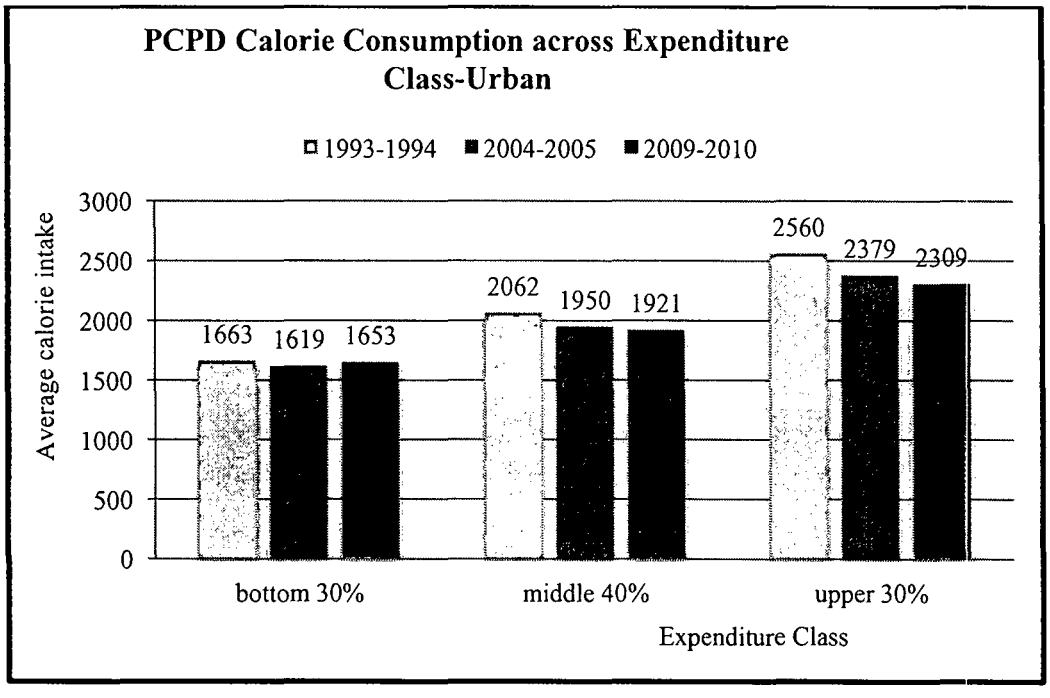
[47] See Protein-Engel curve and Fat-Engel curve in the appendix.
[48] We have taken a monotonic transformation by taking natural logarithm of total expenditure and per capita calorie intake.

Figure 4.4: Average PCPD Calorie intake across expenditure classes – Rural



Source: As in Table 4.1.

Figure 4.5: Average PCPD Calorie intake across expenditure classes – Urban



Source: As in Table 4.1.

Bottom class consumption has marginally increased in both rural and urban sector in the last five years (2004-05 to 2009-10). However, in both middle and top income class per day per capita calorie intake has decline continuously over time. The decline is more sharp in top income class. However, altogether higher income class is still consuming more calories than bottom class.

4.5 Some other observations: Changes in Calorie intake across socio-economic and demographic variables

This section supplements the above analysis by some other findings on the relationship between calorie consumption and various socio-economic and demographic factors. We have taken social groups and religious groups as the socio-economic variable and household size and education as the demographic variable to look into the changes in calories with respect to these factors.s

4.5.1 Social groups

Schedule Castes (SC) and Schedule Tribes (ST) are the most deprived groups in India, especially in rural areas. Another group of socially and educationally backward people are known as 'Other Backward classes' (OBC) or 'Backward classes' (BCs). Considering estimates of NSS survey, in 2009-10[49], the majority of the total population is occupied by the 'OBCs' (42%, rural+urban) followed by the 'Others' (which is the 'General' category class -29%), 'SCs' (20%) and 'STs' (9%). The major proportion of SCs and STs are engaged either in agricultural sector or in petty services, that means mainly they belongs to the lower income class. Since NSS data shows a positive relationship between per capita expenditure and calorie intake for the bottom class of people, it is expected calorie intake should be higher among these groups of people compare to all others.

The picture does not seem clear from the Table 4.6. In case of ST, urban sector, on an average, consuming higher than the rural but that does not help to make any conclusive statement. Per capita intake, in case of 'Others' and 'OBCs' have decreased continuously in both rural and urban areas while for 'SCs' and 'STs' it has increased in the last five years (2004-05 to

[49] See NSS report no. 544 (66/1.0/5), 'Household Consumer Expenditure Across Socio- Economic Groups', MOSPI, GoI, 2009-10.

2009-10) following a decrease in the previous period. Calorie figures are lowest in case of 'STs' in rural while in urban lowest figures appear for 'SCs' in all three years, respectively. These figures are substantially low in comparison to the all India average (See Table 4.1). Therefore, in context of calorie intakes, figures suggest the condition of so called deprived groups is even worse compare to all others.

4.5.2 Religious groups

India is a diversified country with mixed cultures. These cultures are attributed to their religious affiliation or belief. Dietary intakes are sometimes restricted following the customs of different religions. Table 4.7 shows the per capita intakes of calories across different religious groups. From table 4.7 it can be seen that the Hindus are consuming more than the Muslims and Christians in almost all years except 2009-10, where in urban consumption is higher among the Christians. Over the years the consumption has declined continuously for Hindus; however, it was more or less fluctuating for Christian and Muslim group of people.

4.5.3 Household size

Household composition does affect the household purchase decisions and that sometimes leads to change in the calorie intake. Deaton and Praxson (1998) found a negative relationship between per capita calorie intake and household size. This finding seems to be against the conventional expectation. This means that large households have worst nutritional outcome. In the Table 4.8, we have tried to capture the changes in calories across different size of households. However, we do not find any unambiguous declining trend with respect to the changes in household size. Over years, for a given class of households (with same number of household members), per capita intakes are showing an overall decline with some exception in 2009-10. The similar declining trend does not stand for all the years and each sector if we go along the household size for a particular year.

4.5.4 Education level

We found an interesting relationship with calorie consumption and level of education. It can be seen from the Table 4.9, for a given year calorie consumption has increased with

high level of education. It seems highly educated people have exceptionally higher nutritional outcome and it continues in ever year. This result can be explained in two ways. One, higher education leads to higher level of income which may be the reason for higher calorie outcome. Two, a higher level of education expected to be positively related with healthy dietary habits which can results in a higher calorie intake. Unlike the cross section result, time series trend indicates a mere decline in intake for each level of education. Highest decline has taken place among those who has the highest level of education, that is among the 'graduate and above' group. One can see the rate of decline has a clear trend across education level in both rural and urban sector over years – the decline is higher for higher education level and lower for lower education level.

The above findings, in most of the cases, do not show any conclusive results. Thus, we would now like to look at the relationship between calorie intake and various socio-economic and demographic factors across three expenditure classes. The results are presented in Table 4.10, 4.11, 4.12 and 4.13. For a cross section year calorie consumption exhibits a clear upward trend across expenditure classes (i.e. from bottom expenditure class to top expenditure class following middle expenditure class). On the other hand, time series trend for any expenditure class does not show any particular direction of change.

4.6 Linkages between Poverty line and Calorie norm in India

The definition and measurement of Indian poverty line mainly aimed at the goal of formulating strategy for poverty reduction over successive years. After ten years of independence the question of defining Indian poverty line was raised in the Indian labour conference in 1957. Subsequently, a working group consisting of some eminent economists, nutritionists, statisticians and government officials was set up by the Planning Commission, Government of India in 1962. The group outlined the question of what should be the essential minimum expenditure to attain minimum per capita consumption of different goods and services (food and non food items) to reach a desirable level of nutritional requirement (for food items) in terms of calories per capita

per diem. The group suggested, following the recommendations (of balanced diet[50]) of the Nutrition Advisory Committee of the Indian Council of Medical Research (ICMR), national minimum consumption expenditure per household (with 5 persons, 4 adult consumer units) should not be less than Rs.100 per month or Rs.20 per capita per month in 1960-61 prices. For urban areas the minimum was slightly higher, Rs.25 per capita per month because of the higher cost of living. Accordingly, for the rural people the minimum expenditure was set to Rs.18.9 per capita per month. Although there was much confusion on the specification of an arbitrary Rs. 20 as the minimum norm, it was nationally accepted among the researchers till 1971.

Dandekar and Rath, in 1971, possibly first attempted to define an expenditure norm for poverty in respect to the average daily intake of per capita calorie and suggested an intake of 2250 kilocalories per capita per day could be sufficient for both rural and urban areas under Indian conditions[51]. Dandekar's study using NSS consumer expenditure data prescribed an annual average per capita expenditure of Rs.170.8 or equivalently Rs.14.2 per capita per month at 1960-61 prices would be sufficient for the rural areas to meet the calorie requirements. Another notable study by Rudra (See Ashoke Rudra 1974) which came in 1974 had tried to find out the reason behind the arbitrariness of this setting of Rs.20 as the minimum norm but the study could not find out any relation between the normative prescription (by ICMR) and the monetary setting (by Working group 1962). Following many other eminent economists (Amatya Sen, Pranab Bardhan, Suresh Tendulkar and many others) prescription a distinguished 'Task Force' (GOI 1979) was set up by the planning commission (Government of India) to project 'Minimum needs and Effective consumption demand' on 30th July 1979. The committee had looked into age-sex-activity specific nutritional needs per day for an average Indian household and ended up with national nutritional minimum requirement norms of 2400 kcal[52] and 2100 kcal (followed by the recommendations of Nutrition Expert Group (1968)) for rural and urban areas respectively. To meet these nutritional requirements the minimum monthly monetary expense, or in other words the poverty line, was estimated at Rs.49.09 for rural

[50] A proper balanced diet 2738.60 kcal energy should comprised of, according to the recommendation of the Indian Council for Medical Research (ICMR), 467.53 gms of carbohydrate, 66.6 gms of protein and 66.9 gms of fat (See Gopalan 1999)

[51] See Report of the Task Force, (GOI, 1979)

[52] Precisely the figures they estimated were, on the average, around 2435 Kcal and 2095 kcal for rural and urban areas respectively. The study used 28th round NSS data on consumer expenditure to compute the monetary counterpart of this norm, (See GOI, Report of the Task Force, 1979)

and Rs.56.64 for urban along with some minimum non-food expenditure at 1972-73 prices. The procedure involved for estimating the poverty line is as follows. Corresponding to a given base year, average calorie intakes are calculated separately for rural and urban population across expenditure class using calorie conversion coefficients given by Gopalan et al. (1980). By inverse interpolation the lowest per capita expenditure class identified which consumed the minimum calorie norm. Interpolated per capita expenditure value corresponding to this class is taken as the all India poverty line for respective sectors. The major criticism against this measure of 'Task Force' is: in a large country like India with fragmented markets, prices will obviously differ from region to region. Therefore a common national poverty line would obviously underestimate or overestimate state specific poverty in states with higher or lower prices (Sen, 2005). Although the prices are regularly updated for state specific poverty lines, the consumption basket of 1973-74 remained same over the years despite of the radical changes in prices, income and tastes and preferences. Other line of criticism is that the calorie norm should change with change in age, sex and occupational patterns. So it needs serious attention to see whether the official poverty lines are still correspond to the recommended calorie norms or not.

Table 4.14 and Table 4.15 are showing state wise PCPD (mean and median) calorie intake in India for both rural and urban sectors. There is an overall decrease in calorie intake at all India level in both rural and urban sectors; however the state intakes do not depict the same. Even if the all India trend shows a decrease in calorie intake, it has been found that calorie consumption has increased in rural parts of some states like Maharashtra (5.4%), Himachal Pradesh (3.4%) and Tamil Nadu (2.1%) between 1993-94 and 2009-10. In urban, during the same period, the increase has taken place in Tamil Nadu (3.6%), Andhra Pradesh (1.3%), Kerala (0.5%), Karnataka (0.3%) and Punjab (0.1%). Average intake was well below the recommended norm (2400 kcal in rural) in all states except Haryana, Punjab and Rajasthan in 1993-94 and Himachal Pradesh in 2009-10. In case of urban, average intake in many states crossed the recommended norm (2100 kcal) in 1993-94, namely Assam, Bihar, Haryana, Himachal Pradesh, Orissa, Punjab, Rajasthan, Uttar Pradesh, West Bengal, Jharkhand, Chhattisgarh and Uttarakhand. However, in the same sector it declined from the actual consumption level in some states like Himachal Pradesh, Orissa and Punjab in 2009-10. Median calories are lower than the

mean intake at all levels in both sectors. Taking together all three years, in urban, the intake was highest in Jharkhand (in 2004-05) and, on the other hand in rural, it was highest in Haryana (in 1993-94). Notice, per capita per day calorie consumption (both mean and median) is higher in rural in all three years. This higher level of average intake in rural can partly be explained by the level of high strenuous activity (Rao 2000) in rural areas. The decline is more pronounced in rural than in urban areas. In addition to that it is observed the decline is higher in high income group people (see figure 4.4 and 4.5) than the lower income group.

Table 4.16 and 4.17 show the Head count ratios. Head count ratio (HCR)[53] or poverty ratio is defined as the percentage of people living below to a specified level of expenditure (or precisely income). Here, we have used two types of HCR to explain at the current poverty scenario -

(a) HCR using recommended calorie norm, 2400 kcal for rural and 2100 kcal for urban, named as the HCR-CC and

(b) HCR using official poverty line named as the HCR-OPL[54].

The computed values of HCR-CC clearly show an increase in percentage of people consuming less than the recommended calorie in rural as well as in urban India (for some states such as Andhra Pradesh, Gujarat, Himachal, Maharashtra, Madhya Pradesh in rural and Karnataka, Maharashtra, Tamil Nadu in urban it shows a slight decline between 2004-05 and 2009-10). Figures suggest urban is in a better situation regarding calorie deprivation. Although the figures are lower, it shows a steady increase at all India level. If we look at state wise HCR-CC for the rural sector, in both 1993-94 and 2009-10, Assam has the highest percentage of calorie deprived people (85.6 per cent and 86.6 per cent, respectively) while in 2004-05, it was Karnataka (89.8 per cent) in the same sector. In urban it was Tamil Nadu (67.9 per cent), Maharashtra (76.1 per cent) and Madhya Pradesh (73.1 per cent) in consecutive years (1993-94, 2004-05 and 2009-10). Both in

[53] Suppose total population is N and p is the number of people living below poverty line. HCR, denoted by H, is measured as H = (p/N) and expressed as percentage form.

[54] HCR-OPL for 1993-94 and 2004-05 has been taken from 'Report of the Expert Group to Review the Methodology for Estimation of Poverty' (GOI, 2009). For 2009-10, we have used 'Press Note on Poverty Estimates' (GOI, 2012).

rural and urban, HCR-CC shows a steady increase between 1993-94 and 2009-10. Unlike HCR-CC, HCR-OPL has decreased in urban from 31.8 percent in 1993-94 to 20.9 percent in 2009-10 at all India level. A similar falling trend has also found in rural India. In 1993-94 all India HCR-OPL was 50.1 per cent in rural which came down to 41.8 per cent, a mere 1.80 percent fall per annum between 1993-94 and 2004-05. It further falls to 33.8 percent by 2009-10 – an even higher decline rate 4.73 per cent per annum. Therefore, official (Tendulkar committee) HCR's suggest poverty is reducing at an increasing rate over the years.

It's very alarming that while the official poverty line (indirect measure of poverty) has shown a reduction in the number of below poverty people consistently over time, the direct measure based on a specific calorie norm has produced a sharp increase in poverty (deprivation) level. The gap between HCR-CC and HCR-OPL in both rural and urban has increased over years. In rural (urban) the gap was 21.2 (26.1) percent in 1993-94 followed by 38 (38.8) percent in 2004-05 and 47.1 (44.4) percent in 2009-10. So the percentage of people below calorie norms is substantially larger than percentage of people below official poverty lines. This is a well known fact to the researchers as well as to planning division (Mehta and Venkatraman, 2000; Ray and Lancaster, 2005).

Although economists use HCR for poverty measure purpose at a very large scale, there are some major criticisms against it[55]. I. HCR does not give the magnitude of shortfall of income from the poverty line or in other words this measure is incapable of capturing the severity of poverty. II. It does not satisfy the axiom of redistributive monotonicity from lower income to upper income group.

4.7 Calorie deprivation index

A more sophisticated index to measure deprivation was given by the Foster-Greer-Thorbecke (here after FGT). We compute state wise FGT index, expressed as percentage form, to look at the intensity and vulnerability to poverty measured with respect to the calorie norm covering three 'thick' rounds of NSS. The index is used to measure the extent of calorie deprivation. The index can measure the severity and depth of poverty

[55] These drawbacks were identified by Prof. Amartya Sen.

prevailing in an economy. It has been used widely in many countries including India for poverty estimation.

The index is denoted as FGT and defined as follows:

$$FGT = \frac{1}{H}\sum_{i=1}^{h}\left(\frac{g^h}{z}\right)^{\alpha} \ldots\ldots\ldots\ldots(a)$$

Where $g^h = (z - m^h)$, Z is the recommended calorie norm in rural and urban sectors. H is the total population. h is the number of calorie deprived people in the total population. α represents the severity of the index and $i = 1(1)h$. In the previous chapter we have already discussed the distinct characteristics of this index.

Table 4.18 illustrates the inequality in calorie deprivation across major states and rural - urban sectors. State wise computed calorie gap ratio does not exhibit any particular pattern over years. If we compare rural alone, over years, states like Andhra Pradesh, Gujarat, Himachal Pradesh, Kerala, Maharashtra and Tamil Nadu depicts a continuous decline in the same sector. However, if we look at the HCR in table 4.16, all of them were not showing a mere decline. It seems from this finding the depth of calorie deprivation has declined over years for some major states but not for all. In urban along with Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu two other states Haryana and Rajasthan have also experienced a steady fall in calorie gap ratio. One interesting observation we can make from the figures of calorie gap ratio and HCR-CC (table 4.18 and 4.16) that in rural as well as in urban the depth of deprivation is lower than the percentages of deprived heads. From HCR-CC it is quite clear that the percentage of people consuming less than the calorie norm is increasing; however the calorie gap ratio does not show any definite trend. Now the noticeable fact is that both in Tamil Nadu and Andhra Pradesh calorie deprivation is clearly falling over time. Rural and urban figures depict HCR-CC also have decreased between 2004-05 and 2009-10. Interestingly in both the states public distribution system (PDS) is running very successfully and not only that, Tamil Nadu is the only state which has a universal PDS with almost zero leakages (Himanshu & Sen, 2011).[56] Therefore, PDS may have an important contribution towards reduction in

[56] There is a huge political and social dilemma going on in recent times. Even though National Advisory Council (NAC) has approved a food security bill in favour of universal PDS but Government of India has

poverty. In rural areas, Maharashtra has witnessed highest deprivation point - 24.12 per cent, while Rajasthan has the lowest - 10.06 per cent in 1993-94. In 2009-10 Jharkhand (19.02 per cent) and Himachal Pradesh (7.14 per cent) held the same position for rural areas. Notice the highest and the lowest values of calorie deprivation itself have declined in rural areas. The states in the west region – Assam, Bihar, Jharkhand and West Bengal has recorded an increase in the deprivation in the last five years 2004-05 to 2009-10, however among those four states West Bengal experienced a continuous upward trend in deprivation. Table 4.19 illustrates poverty gap ratio using official updated state specific poverty lines. Similar to the previous findings, here also, we found official poverty measure shows depth of deprivation is less in comparison to direct measure using specific calorie norm.

As we have already mentioned FGT (2) will give the severity of the index by weighing more to the bottom class of people. In general, over the years, in both rural and urban sectors, it does not follow any fixed pattern. Again states like Andhra Pradesh, Maharashtra and Tamil Nadu have recorded a continuous decline in deprivation in rural India. Maharashtra is the best performing state (more than 50 per cent decline) among all other states. Andhra Pradesh, Tamil Nadu (a marginal increase between 2004-05 and 2009-10), Punjab and West Bengal exhibit a decline in inadequacy of calorie intake. In urban, decline occurred for eight states - Andhra Pradesh, Haryana, Himachal Pradesh, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal and Jharkhand. Now, interesting fact is that performance of the states has varied with different level of α. So three measures of calorie deprivation – HCR-CC, FGT (1) and FGT (2) does not give a similar pattern. In case of HCR-CC, all the states were indicating a continuous increase in inadequacy of calorie intake whereas in contrast, calorie deprivation measured by using FGT index have shown better picture. So in general we can say that overall poverty based on calorie norm has increased (from HCR) but severity and deprivation has increased for some states while for others it has decreased. Table 4.21 shows the severity of the income poverty which does not portray any specific trend. Thus, we found trends in calorie deprivation are sensitive to the choice of FGT index while it is invariant in case of income poverty.

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not implemented the same in all states following Tendulkar committee's recommendations. Exception is Tamil Nadu which continues with universal PDS has the highest number of people accessing PDS and the leakage is almost zero. Andhra Pradesh, to some extent has a 'near universal' PDS with an accessibility of around 80 per cent of the BPL card holders.

4.8 Summary

This chapter reexamined the general patterns of calorie, protein and fat consumption. We found, similar as others, calorie and protein intake has declined while intakes of fat has increased. On the other hand consumption of cereals and pulses has reduced while consumption of milk and edible oils has increased. Even if there is a drastic fall in staples, cereals are still continued to maintain highest share among all other food groups in all three years. Since there is a monotonic relationship between quantity figures and calorie intakes, cereal calories exhibit similar patterns of consumption. Direct poverty measures show higher percentage of deprived people while indirect measure shows the opposite. Although the trends confirm the decline but it could not confirm the reason behind it. To address that we shall estimate expenditure and price elasticities of food sub groups using a complete demand system framework in the next chapter.

Table 4.1: Per day per capita Calorie, Protein and Fat intake - Rural and Urban

Year	Rural			Urban		
	Calorie intake (in Kcal)	Protein intake (in gm)	Fat intake (in gm)	Calorie intake (in Kcal)	Protein intake (in gm)	Fat intake (in gm)
1993-94	2153.46	60.25	31.45	2071.54	57.28	42.09
2004-05	2046.53	55.81	35.41	2020.28	55.40	47.42
2009-10	2020.40	54.15	38.22	1982.31	53.38	48.89

Source: Own calculation from NSS unit level data of respective rounds.

Table 4.2: Average consumption of major food items – Rural and Urban

Year/Food Groups	Per capita per month consumption (in Kg unless otherwise specified)							
	Cereal	Cereal Substitute	Pulses	Milk (in lit.)	Edible oil	Egg (in no.)	Fish and Meat	Fruits and Veg
Rural								
1993-94	13.40	0.06	0.80	3.93	0.37	0.64	0.31	4.79
2004-05	12.11	0.04	0.71	3.86	0.48	1.00	0.34	5.64
2009-10	11.34	0.03	0.66	4.07	0.56	0.95	0.32	4.87
Urban								
1993-94	10.82	0.04	0.91	4.89	0.56	1.48	0.42	5.18
2004-05	9.93	0.03	0.82	5.10	0.66	1.72	0.42	6.53
2009-10	9.38	0.02	0.80	5.39	0.72	1.59	0.39	5.37
Percentage Change								
Rural								
1993-2004	-9.6	-33.3	-11.3	-1.8	29.7	56.3	9.7	17.7
2004-2009	-6.4	-25.0	-7.0	5.4	16.7	-5.0	-5.9	-13.7
1993-2009	-15.4	-50.0	-17.5	3.6	51.4	48.4	3.2	1.7
Urban								
1993-2004	-8.2	-25.0	-9.9	4.3	17.9	16.2	0.0	26.1
2004-2009	-5.5	-33.3	-2.4	5.7	9.1	-7.6	-7.1	-17.8
1993-2009	-13.3	-50.0	-12.1	10.2	28.6	7.4	-7.1	3.7

Source: As in Table 4.1.

Table 4.3: Trends in PCPD Calorie intake across different food groups

Year/Food Groups	Calorie (in Kcal)					
	Rural			Urban		
	1993-94	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Cereal and Cereal substitute	1533.48	1385.22	1298.12	1215.35	1135.33	1072.35
Pulses	91.68	80.81	75.84	104.76	94.62	91.99
Milk	136.63	136.66	140.79	180.68	188.87	198.58
Sugar and oil	214.33	243.21	261.74	296.16	313.92	327.16
Egg fish meat	14.59	15.59	14.74	21.16	21.19	19.66
Fruits and Veg.	110.75	126.68	106.83	137.46	161.87	125.47
Beverages	29.13	33.41	100.58	92.65	83.41	124.79
Miscellaneous	22.87	24.96	21.75	23.32	21.07	22.30

Source: As in Table 4.1.

Table 4.4: Trends in PCPD Protein intake from different food groups

Year/Food Groups	Protein (in gm)					
	Rural			Urban		
	1993-94	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Cereal and Cereal substitute	41.85	37.89	35.68	34.04	32.05	30.17
Pulses	6.12	5.40	4.98	6.92	6.27	6.05
Milk	5.31	5.29	5.51	6.68	7.03	7.41
Sugar and oil	0.06	0 .03	0 .03	0.05	0 .03	0.03
Egg fish meat	2.21	2.27	2.22	3.03	3.12	2.99
Fruits and Veg.	3.25	3.50	2.90	3.79	4.45	3.38
Beverages	0.57	0 .66	2.05	1.88	1.67	2.52
Miscellaneous	0 .88	0 .76	0.78	0 .89	0.77	0.82

Source: As in Table 4.1.

Table 4.5: Trends in PCPD Fat intake from different food groups

Year/Food Groups	Fat (in gm)					
	Rural			Urban		
	1993-94	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Cereal and Cereal substitute	5.44	4.76	4.30	3.97	3.73	3.47
Pulses	0.50	0 .44	0 .45	0 .61	0 .55	0.55
Milk	9.72	9.74	9.98	13.22	13.76	14.48
Sugar and oil	12.33	16.15	18.73	18.61	22.10	24.11
Egg fish meat	0.46	0 .51	0 .46	0 .81	0.75	0.67
Fruits and Veg.	1.65	2.22	1.73	2.29	3.93	2.48
Beverages	0.63	0.78	1.89	1.92	1.87	2.50
Miscellaneous	0 .72	0.81	0 .68	0 .66	0 .72	0.63

Source: As in Table 4.1.

Table 4.6: Sector wise PCPD calorie intake among Social groups

Social Groups/Year	Rural			Urban		
	1993-94	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Schedule Tribe	1998	1901	1935	2028	1966	2003
Schedule Caste	2027	1953	1954	1923	1873	1888
OBC	2232	2058	2024	2137	1996	1951
Others	2217	2164	2115	2098	2093	2042

Source: As in Table 4.1.

Table 4.7: Sector wise PCPD calorie intake among the Religious groups

Religion/Year	Rural			Urban		
	1993-94	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Hinduism	2164	2051	2033	2104	2035	2003
Islam	2046	1977	1908	1907	1913	1856
Christianity	1994	2039	1960	2048	2060	2032
Others*	2312	2193	2169	2084	2155	2058

Source: As in Table 4.1.

*others include Sikhism, Jainism, Buddhism, Zoroastrianism and other religions

Table 4.8: Sector wise PCPD calorie intake across Household size

Household size	Rural			Urban		
	1993-94	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
1-5	2236	2128	2116	2210	2138	2098
6-10	2074	1968	1922	1919	1861	1793
11-15	2093	1979	1796	1868	1763	1692
16-20	2234	1997	2034	1725	1876	1809
21-26	2325	1884	1967	1830	1921	2126

Source: As in Table 4.1.

Table 4.9: Sector wise PCPD calorie intake with respect to Education level

Education Level/Year	Rural			Urban		
	1993-94	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Not literate	2094	1978	1959	1928	1860	1835
Below primary	2143	2001	2002	1987	1915	1890
Below graduate	2282	2136	2074	2148	2060	2014
Graduate and above	2523	2379	2237	2452	2341	2202

Source: As in Table 4.1.

Table 4.10: Sector wise and expenditure class wise Calorie consumption across various Socio-Economic variables –Rural

	1993-94			2004-05			2009-10		
	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%
Social Group									
Schedule Tribe	1734	2156	2608	1758	2062	2258	1750	2089	2416
Schedule Caste	1706	2184	2698	1819	2029	2313	1739	2090	2441
OBC	1624	1995	3872	1857	2076	2400	1745	2087	2475
Others	1741	2194	2787	1884	2134	2461	1727	2065	2519
Religion									
Hinduism	1740	2203	2788	1847	2098	2413	1755	2100	2500
Islam	1695	2138	2609	1754	1978	2313	1671	2017	2385
Christianity	1565	1922	2448	1785	2075	2282	1617	1869	2301
Others	1604	2064	2815	1795	2068	2582	1678	1968	2527
Education Level									
Not Literate	1733	2210	2797	1821	2047	2340	1720	2089	2531
Below Primary	1721	2168	2708	1796	2044	2363	1762	2111	2465
Below Graduate	1726	2156	2756	1885	2127	2455	1759	2067	2468
Graduate and above	1718	2201	2801	2015	2273	2540	1720	2017	2471
Poverty									
APL	1881	2204	2777	2061	2163	2433	1944	2088	2490
BPL	1711	1996	N/A	1610	1729	1691	1686	1811	N/A

Source: As in Table 4.1.

Table 4.11: Sector wise and expenditure class wise Calorie consumption across Socio-Economic variables – Urban

	1993-94			2004-05			2009-10		
	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%
Social Group									
Schedule Tribe	1695	2073	2645	1638	1958	2371	1722	2010	2330
Schedule Caste	1641	2088	2508	1602	1915	2301	1622	1942	2335
OBC	1358	1805	2817	1641	1977	2450	1672	1938	2308
Others	1668	2058	2561	1597	1938	2363	1633	1887	2306
Religion									
Hinduism	1676	2076	2581	1627	1947	2381	1665	1925	2314
Islam	1644	2025	2477	1604	1989	2354	1633	1904	2284
Christianity	1470	1917	2487	1535	1822	2340	1576	1917	2245
Others	1600	2000	2402	1591	1899	2418	1557	1906	2321
Education Level									
Not Literate	1668	2072	2512	1618	1934	2275	1639	1902	2244
Below Primary	1644	2027	2475	1608	1947	2254	1655	1917	2215
Below Graduate	1667	2068	2571	1622	1951	2386	1669	1932	2318
Graduate and above	1707	2085	2633	1678	2019	2466	1568	1897	2345
Poverty									
APL	1933	2081	2530	1695	1957	2379	1799	1932	2319
BPL	1636	1839	N/A	1489	1758	N/A	1621	1678	N/A

Source: As in Table 4.1

Table 4.12: Sector wise and expenditure class wise Calorie consumption across various Demographic variables – Rural

	1993-94			2004-05			2009-10		
	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%
Household Size									
1-5	1734	2199	2811	1926	2316	2793	1786	2120	2512
6-10	1725	2176	2695	1614	1951	2397	1725	2041	2411
11-15	1742	2178	2695	1174	1711	2113	1579	1944	2392
16-20	1844	2184	2919	N/A	1273	2039	1757	2159	2444
21-26	1658	2484	3099	N/A	N/A	1884	1749	2070	3161
Age									
0-6	1664	2096	2562	1647	1952	2218	1661	1987	2277
7-15	1742	2188	2702	1772	2050	2386	1781	2123	2443
16-30	1741	2194	2773	1851	2113	2422	1725	2057	2466
31-60	1767	2230	2853	1932	2139	2493	1769	2112	2546
61 and above	1742	2223	2895	2037	2127	2461	1762	2093	2550
Marital Status									
Unmarried	1715	2166	2697	1762	2051	2369	1739	2080	2435
Currently Married	1749	2203	2809	1883	2113	2433	1740	2079	2505
Widowed	1741	2251	2916	2010	2132	2552	1782	2136	2620
Divorced/ Separated	1680	2205	2904	2052	2099	2315	1744	2092	2618

Source: As in Table 4.1

Table 4.13: Sector wise and expenditure class wise Calorie consumption across various Demographic variables – Urban

	1993-94			2004-05			2009-10		
	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%	bottom 30%	middle 40%	upper 30%
Household Size									
1-5	1681	2104	2633	1635	1990	2434	1712	1973	2362
6-10	1656	2015	2364	1611	1911	2178	1621	1833	2081
11-15	1649	2019	2330	1580	1778	2324	1548	1806	1968
16-20	1499	1912	2182	1695	2000	2085	1697	1890	2431
21-26	1513	2175	1972	1555	2072	2326	1790	1904	2751
Age									
0-6	1590	1936	2305	1547	1835	2113	1567	1796	2091
7-15	1664	2042	2461	1618	1950	2311	1691	1921	2226
16-30	1684	2085	2602	1632	1951	2410	1644	1928	2343
31-60	1693	2105	2625	1655	1986	2432	1683	1953	2342
61 and above	1700	2108	2642	1628	2004	2389	1654	1942	2351
Marital Status									
Unmarried	1652	2042	2506	1610	1941	2353	1651	1912	2285
Currently Married	1677	2078	2601	1632	1957	2396	1651	1921	2319
Widowed	1684	2130	2635	1618	1982	2415	1697	1990	2404
Divorced/ Separated	1649	2094	2830	1547	1978	2627	1651	2022	2533

Source: As in Table 4.1

Table 4.14: State wise PCPD Calorie intakes - Rural

	Mean Calorie Intake Per Capita Per Day (Kcal)			Median Calorie Intake Per Capita Per Day (in Kcal)		
State	**1993-94**	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Andhra Pradesh	2052.3	1995.2	2047.6	1884.9	1931.9	2006.0
Assam	1984.0	2066.9	1976.3	1912.8	2039.3	1964.6
Bihar	2144.8	2048.9	1931.6	2018.3	2016.0	1892.6
Gujarat	1994.7	1922.9	1982.3	1829.6	1848.3	1911.2
Haryana	2491.2	2225.7	2180.0	2177.2	1847.6	1919.4
Himachal Pradesh	2324.9	2325.7	2407.8	2160.0	2121.2	2100.7
Karnataka	2073.2	1845.0	1903.7	1886.1	2196.5	2310.7
Kerala	1965.8	2014.4	1964.6	1774.2	1946.1	1876.4
Madhya Pradesh	2192.5	1929.3	1939.0	2007.8	1777.2	1854.4
Maharashtra	1939.9	1933.1	2051.1	1767.3	1865.9	1849.1
Orissa	2199.1	2022.9	2126.6	2053.0	1840.8	1856.8
Punjab	2418.6	2239.7	2223.4	2176.0	1820.3	2006.4
Rajasthan	2470.2	2179.5	2191.5	2285.5	1968.3	2094.9
Tamil Nadu	1884.3	1842.2	1925.5	1695.8	2131.0	2112.4
Uttar Pradesh	2306.0	2200.2	2064.1	2083.4	2074.4	2131.1
West Bengal	2211.3	2069.8	1927.5	2039.3	1776.4	1886.4
Jharkhand	2021.9	1960.7	1900.7	1877.7	2073.6	1997.9
Chhattisgarh	2096.5	1941.5	1925.9	1977.9	2093.3	2138.5
Uttarakhand	2337.7	2160.2	2179.7	2181.6	1982.5	1870.4
All India	**2153.5**	**2046.5**	**2020.4**	**1932.1**	**1956.4**	**1961.5**

Source: As in Table 4.1

Table 4.15: State wise PCPD Calorie intakes - Urban

	Mean Calorie Intake Per Capita Per Day (Kcal)			Median Calorie Intake Per Capita Per Day (in Kcal)		
State	**1993-94**	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Andhra Pradesh	1992.7	1999.9	2018.9	1834.3	1921.6	1937.2
Assam	2108.2	2143.3	2043.3	1937.0	2080.6	2040.0
Bihar	2176.0	2190.6	2027.9	2022.2	2054.5	1972.3
Gujarat	2027.8	1991.0	2018.6	1844.6	1943.2	1957.6
Haryana	2141.0	2032.8	1975.7	1926.1	1969.9	1964.0
Himachal Pradesh	2416.2	2389.0	2293.5	2209.5	2322.2	2132.7
Karnataka	2026.2	1944.2	2029.6	1824.6	1897.9	1968.1
Kerala	1966.1	1996.0	1976.1	1756.0	1871.6	1856.9
Madhya Pradesh	2055.8	1954.2	1878.4	1890.1	1903.2	1794.2
Maharashtra	1989.7	1847.2	1943.4	1806.5	1795.5	1887.5
Orissa	2261.5	2139.3	2132.2	2013.1	2060.8	2084.1
Punjab	2089.9	2149.8	2091.7	1934.3	2053.7	2011.7
Rajasthan	2184.8	2116.3	2040.2	1989.9	1976.3	1966.6
Tamil Nadu	1922.8	1935.0	1993.8	1732.4	1857.6	1920.5
Uttar Pradesh	2106.8	2123.9	1950.6	1908.5	2009.7	1877.9
West Bengal	2131.4	2010.6	1899.5	1942.7	1944.3	1840.8
Jharkhand	2205.9	2457.8	2073.2	2000.9	2194.0	1980.6
Chhattisgarh	2189.8	2087.3	1966.8	2014.2	2051.9	1935.2
Uttarakhand	2282.7	2204.9	2007.1	2141.6	2121.9	1973.2
All India	**2071.5**	**2020.2**	**1982.3**	**1841.4**	**1939.2**	**1918.5**

Source: As in Table 4.1

Table 4.16: State wise HCRCC and HCROPL - Rural

	Head Count Ratio (HCRCC) based on the PCPD Calorie Norm (2400 Kcal)			Head Count Ratio based on official Poverty Line (HCROPL)		
State	**1993-94**	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Andhra Pradesh	78.1	83.3	79.9	48.1	32.3	22.8
Assam	85.6	84.1	86.6	54.9	36.4	39.9
Bihar	70.5	78.2	86.0	62.3	55.7	55.3
Gujarat	79.8	84.3	83.0	43.1	39.1	26.7
Haryana	57.5	67.3	68.3	40.0	24.8	18.6
Himachal Pradesh	62.1	65.9	56.8	36.7	25.0	9.1
Karnataka	73.9	89.8	86.4	56.6	37.5	26.1
Kerala	79.9	79.6	83.0	33.9	20.2	12.0
Madhya Pradesh	68.2	87.1	82.7	49.0	53.6	42.0
Maharashtra	83.6	86.6	82.2	59.3	47.9	29.5
Orissa	67.5	77.6	74.6	63.0	60.8	39.2
Punjab	57.7	67.1	70.2	20.3	22.1	14.6
Rajasthan	51.5	73.7	72.2	40.8	35.8	26.4
Tamil Nadu	83.4	88.2	85.5	51.0	37.5	21.2
Uttar Pradesh	63.4	73.0	80.1	50.9	42.7	39.4
West Bengal	69.7	77.7	85.5	42.5	38.2	28.8
Jharkhand	78.3	85.5	85.9	65.9	51.6	41.6
Chhattisgarh	76.2	84.1	85.4	55.9	55.1	56.1
Uttarakhand	59.2	74.3	70.0	36.7	35.1	14.9
All India	**71.3**	**79.8**	**81.1**	**50.1**	**41.8**	**33.8**

Sources: Own calculation, Tendulkar committee report (GOI, 2009), PIB 2012

Table 4.17: State wise HCRCC and HCROPL – Urban

	Head Count Ratio (HCRCC) based on the PCPD Calorie Norm (2100 Kcal)			Head Count Ratio based on official Poverty Line (HCROPL)		
State	**1993-94**	**2004-05**	**2009-10**	**1993-94**	**2004-05**	**2009-10**
Andhra Pradesh	62.4	67.1	63.0	35.2	23.4	17.7
Assam	55.1	53.6	55.2	27.7	21.8	26.1
Bihar	47.9	54.3	62.3	44.7	43.7	39.4
Gujarat	61.0	63.4	61.9	28	20.1	17.9
Haryana	54.9	61.9	61.7	24.2	22.4	23
Himachal Pradesh	31.5	29.0	47.1	13.6	4.6	12.6
Karnataka	59.9	69.7	62.4	34.2	25.9	19.6
Kerala	65.8	63.1	69.6	23.9	18.4	12.1
Madhya Pradesh	58.5	68.0	73.1	31.8	35.1	22.9
Maharashtra	63.9	76.1	67.3	30.3	25.6	18.3
Orissa	41.6	52.8	52.0	34.5	37.6	25.9
Punjab	57.8	53.5	58.2	27.2	18.7	18.1
Rajasthan	48.4	58.1	61.5	29.9	29.7	19.9
Tamil Nadu	67.9	69.9	66.7	33.7	19.7	12.8
Uttar Pradesh	56.1	58.1	68.1	38.3	34.1	31.7
West Bengal	53.1	65.1	71.6	31.2	24.4	22
Jharkhand	48.3	41.9	57.7	41.8	23.8	31.1
Chhattisgarh	49.3	55.5	66.5	28.1	28.4	23.8
Uttarakhand	40.4	47.4	60.4	18.7	26.2	25.2
All India	**57.9**	**64.5**	**65.3**	**31.8**	**25.7**	**20.9**

Sources: Own calculation and Tendulkar committee report (GOI, 2009)

Table 4.18: State wise and Sector wise Calorie gap ratio (deprivation) computed using recommended calorie norm [FGT index ($\alpha = 1$)]

States	1993-94		2004-05		2009-10	
	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh	19.64	14.78	17.40	14.01	15.73	9.86
Assam	20.17	10.03	15.11	7.83	17.01	10.11
Bihar	16.36	8.34	15.41	8.81	17.45	9.68
Gujarat	16.69	9.47	18.85	10.07	18.85	11.86
Haryana	22.77	16.27	19.53	12.55	16.80	11.40
Himachal Pradesh	12.09	12.75	12.91	11.12	13.42	9.68
Karnataka	12.79	5.33	8.84	4.65	7.14	6.13
Kerala	19.69	8.87	17.47	7.89	19.02	9.46
Madhya Pradesh	18.49	13.79	21.73	14.46	18.66	9.50
Maharashtra	21.32	15.31	18.56	15.66	18.14	13.57
Orissa	16.92	13.32	19.31	12.45	18.97	13.36
Punjab	24.12	15.27	20.63	14.18	14.65	10.76
Rajasthan	14.26	8.09	17.79	10.78	13.83	7.44
Tamil Nadu	12.49	11.73	11.38	9.35	12.55	9.52
Uttar Pradesh	10.06	9.77	13.10	8.95	11.99	7.90
West Bengal	23.45	17.55	21.23	15.23	18.18	10.77
Jharkhand	13.62	11.89	13.57	10.24	14.96	10.77
Chhattisgarh	11.06	7.81	12.25	6.48	11.92	8.36
Uttarakhand	14.86	9.70	16.28	12.25	18.75	12.63

Source: As in Table 4.1

Table 4.19: State wise and Sector wise Poverty gap ratio computed using official Poverty line [FGT index (α = 1)]

States	1993-94		2004-05		2009-10	
	Rural	Urban	Rural	Rural	Urban	Rural
Andhra Pradesh	2.9	9.3	2.7	5.2	3.9	3.0
Assam	8.3	0.9	3.3	0.3	6.4	5.0
Bihar	14.2	9.7	7.1	4.3	10.9	7.7
Gujarat	N/A	N/A	7.7	3.8	10.4	5.9
Haryana	4.1	6.2	2.8	0.7	4.0	2.8
Himachal Pradesh	5.6	3.1	1.9	2.0	3.2	3.6
Karnataka	5.6	1.3	1.2	0.2	1.0	1.3
Kerala	N/A	N/A	8.4	2.5	7.5	6.2
Madhya Pradesh	6.3	11.4	2.5	1.9	3.6	3.1
Maharashtra	5.6	5.5	2.4	2.4	1.5	1.5
Orissa	9.8	13.9	6.9	3.7	9.2	4.2
Punjab	9.3	10.2	5.4	2.4	4.7	2.8
Rajasthan	12.0	11.4	11.3	5.8	8.2	4.0
Tamil Nadu	1.9	1.7	1.0	0.3	1.7	3.0
Uttar Pradesh	5.2	7.0	2.4	2.5	3.4	2.7
West Bengal	7.3	10.2	3.6	1.5	3.2	1.9
Jharkhand	10.6	9.3	5.3	3.5	6.4	5.2
Chhattisgarh	N/A	N/A	7.0	4.1	1.4	3.4
Uttarakhand	8.3	4.56	4.3	1.5	4.3	3.2

Sources: As in table 4.1

Table 4.20: State wise and Sector wise measures of severity of Calorie deprivation, computed using the recommended calorie norm [FGT when $\alpha = 2$]

States	1993-94		2004-05		2009-10	
	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh	6.88	5.03	5.81	5.02	4.70	2.82
Assam	6.25	2.66	4.15	1.94	4.70	2.79
Bihar	5.68	2.67	4.66	2.44	5.35	2.70
Gujarat	5.24	2.67	6.21	2.88	6.51	3.79
Haryana	8.31	5.48	6.92	4.17	4.99	3.32
Himachal Pradesh	4.02	4.14	3.85	3.17	3.94	2.74
Karnataka	3.66	1.30	2.15	1.97	1.74	1.70
Kerala	6.87	2.45	5.60	2.16	6.08	2.75
Madhya Pradesh	6.64	4.81	7.34	5.27	5.70	2.55
Maharashtra	8.14	5.50	6.73	6.15	6.11	4.57
Orissa	5.96	4.23	6.23	3.71	6.28	3.97
Punjab	9.29	4.93	6.92	4.43	3.94	3.10
Rajasthan	4.58	2.35	6.04	3.49	3.99	1.87
Tamil Nadu	3.94	3.65	3.22	2.66	3.33	2.64
Uttar Pradesh	2.94	3.07	3.63	2.72	3.23	1.96
West Bengal	9.32	6.88	7.54	5.41	5.78	3.11
Jharkhand	4.33	6.88	4.08	3.06	4.39	3.27
Chhattisgarh	3.11	1.92	3.20	1.61	2.96	2.14
Uttarakhand	4.48	2.85	4.99	3.97	5.77	3.65

Source: As in table 4.1

Table 4.21: State wise and Sector wise measures of severity of poverty deprivation, computed using official poverty line [FGT when $\alpha = 2$]

States	1993-94		2004-05		2009-10	
	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh	0.9	3.2	1.5	1.9	1.3	0.9
Assam	2.2	0.2	0.8	0.1	1.7	1.6
Bihar	4.9	3.4	1.9	1.5	3.5	2.7
Gujarat	N/A	N/A	2.6	2.0	3.1	2.2
Haryana	1.2	2.0	1.0	0.4	1.0	0.8
Himachal Pradesh	1.7	0.9	0.5	0.7	0.9	1.0
Karnataka	1.6	0.3	0.3	0.1	0.2	0.3
Kerala	N/A	N/A	2.4	0.9	2.2	2.2
Madhya Pradesh	2.0	4.4	0.6	1.1	0.9	1.0
Maharashtra	1.8	1.9	1.0	1.0	0.4	0.4
Orissa	3.6	5.3	2.1	1.9	3.2	1.4
Punjab	3.3	4.2	1.8	1.3	1.2	0.9
Rajasthan	4.1	4.3	4.0	3.0	2.8	1.2
Tamil Nadu	0.5	0.4	0.2	0.1	0.3	0.9
Uttar Pradesh	1.6	2.2	0.6	1.3	0.8	0.8
West Bengal	2.5	3.9	1.1	0.7	0.9	0.5
Jharkhand	3.6	3.4	1.5	1.4	1.8	1.6
Chhattisgarh	N/A	N/A	2.0	1.5	0.4	0.9
Uttarakhand	2.5	1.4	1.2	0.5	1.1	1.0

Source: As in table 4.1

Chapter 5

Empirical Estimation and Results

5.1 Introduction

The reason behind this unusual fall in calorie intake and dietary change has been explained by many researchers from various perspectives. Many have argued that this shift is a result of an interaction effect of both supply side and demand side factors. We have already discussed those views in the preceding chapters. We have seen this change in consumption pattern could either be an indication of dietary diversification or an increase in the state of impoverishment. The later would be the case if there is a fall in purchasing power. The present study, however, intends to focus on the response of the demand side factors.

Therefore, in short, our main objective is to empirically experiment that whether India is passing through a dietary diversification or not. In the preceding chapters we have seen, consumption of inferior food items such as cereal, cereal substitutes and pulses are declining while consumption of high value or superior food items such as milk, egg, sugar and oil are rising. The findings until now do not clarify the reason behind this decline. One way to test this is by estimating the food expenditure elasticity and price elasticity. It has already been said that we will estimate this by using a specific demand model, called the Quadratic Almost Ideal Demand System (QUAIDS) which emanates from the popular AIDS model (Deaton –Mulleabuer 1980).

To test the above objectives we set out the following hypothesis:

Hypothesis 1: Expenditure elasticity for the staple food items will decrease if there is a diversification over the years. Across expenditure class, the expenditure elasticity for staple food items will be higher for the bottom expenditure class and lower for the top expenditure class.

Hypothesis 2: Own price elasticity of a particular food item/group will be negatively related with its price. The goods are substitute[57] if the cross price elasticity is positive and the goods are complementary if the cross price elasticity is negative.

5.2 Empirical Model

Now to test the above two hypotheses the QUAIDS model specified as the following (using equation 19 from Chapter Three):

$$W_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log(X/P^*) + \lambda_i \{\log(X/P^*)\}^2 + \theta_i H + \varepsilon_i$$

Where $W_i = \frac{p_i q_i}{X_i}$ - budget share of good i; p_i, q_i are the price and quantity of i^{th} item

$X = \sum p_i q_i -$ total expenditure of the groups/items considered.

H is the size of the household[58].

γ_{ij} – effects of the changes in j^{th} prices on share of i^{th} item.

$log\ P^* = \sum W_i \log p_i$ is the Stone geometric price index and i = 1(1)7

ε_i is the error term or disturbance term. Consumer's demand can be affected by many other variables other than those explicitly specified in the above QUAIDS equation. To capture that unexplained part ε_i has been introduced additively.

'i' is the major food groups which includes cereal, pulses, milk, edible oil, egg-fish-meat, fruits- vegetable and miscellaneous goods. Miscellaneous group includes spices, sugar and beverages. Hence, the QUAIDS model is regarded as the system of demand equations derived from the household preference ordering for the major food items.

Restrictions are -

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[57] Substitutes and complementary goods are defined as follows:
Two goods are substitutes when for an increase in price of good 1, consumption of good 2 increases and vice versa. For two goods to be complementary the relation is just the opposite, if price of good 1 increases consumption of good 2 will decrease.
Mathematically, $\frac{\Delta x_2}{\Delta p_1} > 0$ for substitutes goods and $\frac{\Delta x_2}{\Delta p_1} < 0$ for complementary.

[58] Household size has been added as a demographic variable following the suggestion of Ray 1999.

Additivity: $\sum W_i = 1$, which is often called the additive condition, requires that

$$\sum_{i=1}^{n} \alpha_i = 0;\ \sum_{i=1}^{n} \beta_i = 0;\ \sum_{i=1}^{n} \lambda_i = 0,\ \sum_{i=1}^{n} \theta_i = 0,\ \sum_{i=1}^{n} \gamma_{ij} = 0\ \forall\ j$$

Homogeneity: $\sum_{i=1}^{n} \gamma_{ij} = 0;$

Symmetry: $\gamma_{ij} = \gamma_{ji}$

5.3 Estimation Results

Table 5.1 Summary statistics - Mean values of QUAIDS variables

	1993-1994		2004-2005		2009-2010	
	Rural	Urban	Rural	Urban	Rural	Urban
Share in total food expenditure (W_i)						
Cereal & Cereal substitution	0.428	0.316	0.362	0.299	0.329	0.287
Pulses	0.067	0.067	0.062	0.060	0.079	0.078
Milk	0.131	0.180	0.140	0.167	0.153	0.181
Edible oil, Honey	0.075	0.180	0.089	0.090	0.076	0.074
Egg-fish-meat	0.066	0.079	0.080	0.082	0.088	0.090
Fruits & Vegetables	0.066	0.079	0.156	0.189	0.151	0.164
Miscellaneous	0.166	0.103	0.111	0.112	0.124	0.127
Logarithms of Food Prices ($logP_i$)						
Cereal and Cereal substitution	1.658	1.844	2.187	2.388	2.613	2.845
Pulses	2.662	2.783	3.288	3.361	4.036	4.119
Milk	2.304	2.499	2.961	3.076	3.350	5.686
Edible oil, Honey	3.523	2.499	3.556	3.427	4.143	4.167
Egg-fish-meat	3.161	2.967	2.142	2.386	4.609	4.650
Fruits & Vegetables	1.444	1.790	4.021	4.033	2.704	2.915
Miscellaneous	1.611	1.755	3.276	3.393	3.784	3.878
Expenditure (X)						
Household Food expenditure[59]	929.6	1026.4	1606.9	1703.3	2433	2637.4
Demographic variable (H)						
Household Size	6.5	4.5	5.1	4.6	4.9	4.4

Source: As in Table 4.1.

[59] Here in this study, calculated household food expenditure does not contain all the food items enlisted in the NSS consumer expenditure schedule 1.0. Since Stone geometric price index (which we have calculated to get expenditures in real terms) seriously suffers from the units of measurement and therefore we have to exclude some items which are not available in similar units such as lemon, measurement unit is 'no.'

Recall, the aggregated food groups are - cereal and cereal substitutes, pulses, milk, edible oil and honey, egg-fish-meat, fruits and vegetables and miscellaneous. Miscellaneous group contains sugar, spices and beverages. Therefore, the demand system consists of seven equations since the number of food groups are seven. QUAIDS model relaxes the linearity assumption and assumes non-linear relationship between household total expenditure and the expenditure shares of the food groups. Quadratic function is used as a specific case to non-linear function. The model is estimated separately for three years 1993-94, 2004-05 and 2009-10 (pertaining to the NSS rounds 50^{th}, 61^{st} and 66^{th}) across rural and urban regions. Three expenditure classes are formed by disaggregating the total per capita expenditures into three categories – bottom 30 per cent (represents the *Poor* class of households whose monthly expenditure lie at the lowest 30 per cent of the expenditure spectrum), middle 40 per cent (represents the *Mediocre* class whose monthly expenditure lie at the middle 40 per cent of the expenditure spectrum) and top 30 per cent (represents the *Rich* class whose monthly expenditure is at the top 30 per cent of the expenditure spectrum). Estimated parameters for the years 1993-94, 2004-05 and 2009-10 are presented in Table 5.2, 5.5 and 5.8. Now before going into the estimated results, let's look at Table 5.1 which exhibits summary statistics of the QUAIDS variables. In both rural and urban, household's average food expenditure has increased continuously over time. Share of cereals have declined in both the sectors over the period. However, the interesting fact is that over time although the share (cereal and cereal substitute) is declining but still for a given cross-section year this group has the highest share among all others. Share of milk has increased in rural but it is almost stagnant in the urban. General trend shows average food prices has risen for all the food groups in both sectors.

Expenditure and price elasticities have estimated for each round across three expenditure groups, separately. The change of estimated expenditure elasticity reveals two types of effects:

(i) Changes in the elasticities of a particular food groups/items for a particular expenditure group over time, which can be termed as "structural shift" due to 'consumption diversification effect'.

(ii) Changes in expenditure elasticity over the expenditure groups in a particular year, which can be termed as 'pure income effect'[60].

5.3.1 Results for 1993-94

Table 5.2 Estimated coefficients of the QUAIDS - Rural[61]

Food Groups	Cereal & cereal subst. (γ_{i1})	Pulses (γ_{i2})	Milk (γ_{i3})	Edible oil, honey (γ_{i4})	Egg-Fish-Meat (γ_{i5})	Fruits & vegetable (γ_{i6})	Misc+ (γ_{i7})
Intercept (α_i)	0.11 (0.00)**	-0.423 (0.00)**	1.491 (0.00)**	-0.258 (0.00)**	-0.450 (0.00)**	0.291 (0.00)**	0.239 (0.00)*
Coefficients for Food Prices (γ_{ij})							
Cereal & cereal substitutes (γ_{1j})	0.365 (0.00)**	-0.020 (0.00)**	-0.118 (0.00)**	-0.067 (0.00)**	0.025 (0.00)**	-0.004 (0.46)	-0.181 (0.00)**
Pulses (γ_{2j})		0.082 (0.00)**	-0.096 (0.00)**	0.023 (0.00)**	0.044 (0.00)**	-0.044 (0.00)**	0.010 (0.00)**
Milk (γ_{3j})			0.235 (0.00)**	-0.049 (0.00)**	-0.039 (0.00)**	0.026 (0.00)**	0.041 (0.00)**
Edible oil, Honey (γ_{4j})				0.080 (0.00)**	0.001 (0.25)	-0.027 (0.00)**	0.039 (0.00)**
Egg-Fish-Meat (γ_{5j})					0.009 (0.00)**	-0.013 (0.00)**	-0.027 (0.00)**
Fruits & Vegetables (γ_{6j})						0.001 (0.57)	0.059 (0.00)**
Miscellaneous (γ_{7j})							0.059 (0.00)**
Log Food expenditure (β_i)	-0.212 (0.00)**	-0.061 (0.00)**	0.234 (0.00)**	0.023 (0.46)	-0.033 (0.00)**	0.025 (0.00)**	0.061 (0.00)**
Log Food expenditure square (λ_i)	-0.021 (0.00)**	0.002 (0.00)**	0.014 (0.00)**	0.003 (0.00)**	0.001 (0.00)**	0.001 (0.00)**	0.012 (0.00)**
Household size (θ_i)	0.002 (0.00)**	-0.001 (0.00)**	-0.001 (0.00)**	0.000 (0.00)**	-0.001 (0.00)**	0.001 (0.00)**	0.000 (0.01)**

p values are in parenthesis. ** is the significant at 1% and 5% levels.

^Coefficients of food prices. +Miscellaneous goods include Sugar, Spices and Beverages

i = 1(1)7 represents share equations in the demand system, j = 1(1)7 represents the number of food price variables in each equation.

[60] Both the terms have been used by Kumar et al. (2011): "Estimation of Demand Elasticity for Food Commodities in India", p: 5

[61] For all three years 1993-94, 2004-05 and 2009-10, summary tables of estimated coefficients for Urban are presented in Appendix.

The estimated parameters of the QUAIDS share equations are shown in the Table 5.2. This section will try to explain the causal relationship between the demographic, income and price factors (independent variables) and the consumption share (dependent variable) for 1993-94. The magnitude and sign of these factors draw valuable implication. There are two types of price coefficients - own price and cross price. Most of the estimated cross-price coefficients are highly significant at 1% level of significance[62] except coefficient of fruits and vegetables (γ_{16} and by symmetry restriction γ_{61}, coefficient of the price of cereal and cereal substitute in demand equation 6 (W_6), is also insignificant) in share equation of cereal and cereal substitutes (W_1) and coefficient of the egg-fish-meat (γ_{45} and by symmetry γ_{54}) in share equation 4 (W_4, equation for edible oil and honey).

All estimated parameters of the own-price variables (i.e. γ_{11}, γ_{22},...., γ_{66}) are positive and highly significant excluding fruits and vegetables (γ_{66}). These significant, positive own price coefficients suggest that even if there is an increase in price of food items, consumer's (precisely households) will maintain the composition (or shares) of food items within their food basket possibly by reducing the total expenditure. Interestingly, among all other coefficients, cereal and cereal substitutes (0.37) have the highest estimated value. Even if other coefficients (except milk) are statistically significant but the values are not very high. Therefore, it can be explained that despite an increase in prices, people will continue to maintain their cereals' share in the food basket may be by sacrificing total food expenditure or expenditures on other food items. So, it actually empirically re-establishes the conventional belief that cereals belong to that group of goods which is considered as a necessary food items in the daily diets of Indian households.

Here, in the estimated results in Table 5.2 we found negative price coefficients (-0.02) between cereals and pulses; which indicate that for an one per cent increase in price of pulses would result in 0.02 per cent fall in share of cereals and vice versa. This seems these goods are complementary in relationship. A similar relationship holds for milk, edible oil, fruits-vegetables and miscellaneous group. In case of egg-fish-meat, the sign

[62] We have used p values to measure the level of significance. p value shows the probability of type-1error. Type-1error occurs when a true null hypothesis is rejected. When p value is greater than 0.1, there is no reason to reject null hypothesis at 1%, 5% and 10% level of significance. On the other hand, if p value is less than 0.01, the alternative hypothesis is accepted at all level of significance.

alters and it explains that cereals share (in demand equation 1) and egg-fish-meat has a positive relationship with respect to changes in prices. An increase in the price of egg-fish-meat will increase the consumption share of cereals.

In case of households food expenditure (in real terms), β_4 (coefficient of the food expenditure in equation 4 (W_4) – share of edible oil and honey) is insignificant. All other coefficients of the total food expenditure are highly significant at all levels of significance. β_3, β_6 and β_7, expenditure coefficients of milk, fruits-vegetables and miscellaneous group respectively, are showing positive significant effect on the dependent variables W_3, W_6 and W_7 (which are the shares of the respective food groups in total food expenditure). This essentially implies, controlling other variables, an increase in total expenditure will have a positive impact on the consumption share of those respective food groups. Although the sign confirms that consumption share will increase but the magnitude of the coefficient reveals that the increase rate will not be very high. Now look at the signs of the staples (β_1 and β_2) which are very promising in context food diversification argument. Coefficients of the cereal and pulses group are showing a negative relation between expenditure and the consumption share. This signifies that an increase in total expenditure will result in a decline in the share of cereals and pulses which is expected if the consumers are diversifying their food baskets.

5.3.1.1 Estimated Demand elasticity

I) Expenditure elasticity

Recall the definition of expenditure elasticity. Expenditure elasticity shows the response of the change in quantity demanded with respect to the changes in total expenditure (or income). Therefore, expenditure elasticity is expected to be positive for a normal good whereas it is negative for inferior goods. The results of the computed 7 item disaggregated food expenditure elasticity from the QUAIDS model are presented in the table below.

Table 5.3: Sector wise and expenditure class wise Expenditure elasticities

1993-1994

	Bottom Expenditure class		*Middle Expenditure class*		*Top Expenditure class*	
	Rural	Urban	Rural	Urban	Rural	Urban
Cereal & Cereal substitutes	1.05	1.02	0.93	0.85	0.70	0.65
Pulses	0.68	0.24	0.60	0.46	0.57	0.16
Milk	0.74	1.16	1.92	1.13	0.85	1.11
Edible oil, Honey	0.33	0.87	0.35	0.99	0.30	1.03
Egg-fish-meat	0.53	0.98	0.29	0.79	0.96	0.69
Fruits & Vegetables	1.49	1.66	1.00	1.97	1.98	1.78
Miscellaneous	0.65	1.05	1.43	1.87	1.29	1.41

Source: Computed from estimated model.

Expenditure elasticities for different levels of income (expenditure) are calculated for both rural and urban sector separately at the second stage of estimation. Both in rural and urban the food expenditure elasticities for all the commodity groups are positive, indicates the commodities are normal goods. If the value of expenditure elasticity is less than unity for a commodity that implies the commodity is a necessary good. On the other hand if it is greater than unity that means the commodity is treated as luxurious by the households. Here, for the bottom income class we found expenditure elasticity for cereals are greater than unity for both rural and urban sectors. This implies for the bottom class even 'necessary' food items are sometimes luxury. This can also happen because of the fact that some food items within cereal and cereal substitutes group are luxury (and hence high elasticity) for this 'Poor' class.

In rural (urban) the food expenditure elasticity for cereal and cereal substitutes declined from 1.05 to 0.93 (from 1.02 to 0.85) as we move from the bottom expenditure to middle expenditure class. The results are consistent if we go further to the top expenditure class (0.70 in rural and 0.65 in urban). It is lower for the 'Rich' compare to the 'Middle' and 'Bottom' class of people. This means that the food preference of the bottom expenditure class is more inclined towards cereals, i.e. compare to other expenditure classes 'Poor' people are more responsive to changes in expenditure. Therefore it can be seen that across expenditure class (or with increase in expenditure) people have a tendency to switch away

from cereals to other food items. In case of pulses the picture is more or less similar for rural India. As we move from the bottom expenditure class to middle expenditure class, elasticity for pulses decreased for rural (0.68 to 0.60) but it increased for urban (0.24 to 0.46). However, when we further move from the middle class to top expenditure class, in both rural and urban, it decreased from 0.60 to 0.57 and 0.46 to 0.16, respectively. So, if we compare bottom and top expenditure class, elasticity has declined. This indicates bottom class is more dependent on pulses compare to rich class. The continuous decline in rural sector implies, for an increase in food expenditure people will shift their preference from pulses to other food items. Notice, expenditure elasticity for pulses is substantially lower in both rural and urban areas. This essentially means pulses belong to the necessary food group for all expenditure classes. On the other hand, elasticities are greater than unity for milk (except bottom rural and top rural), fruits-vegetables and miscellaneous (except bottom class in rural) groups across all expenditure classes. This suggests that for one per cent increase in income or expenditure people will tend to spend proportionately more on these high value food groups/items compare to the other staple foods. We find another supportive result to accomplish the food diversification argument. Elasticity of oils and fats are higher in both the sectors and the values have experienced an increasing trend (slightly decreased in case of rural – top expenditure class) across the three expenditure classes. Therefore with higher level of income households will consume more of these fat and oil food items rather than staples.

II) Uncompensated and Compensated price elasticity

Especially, for the poor class of people cereals and cereal substitutes act as a 'Giffen good'; with an increase in cereal prices, consumption of cereal increases since the poor class has a strict binding income constraint. The results will possibly be the same for the middle income class but may have a slight difference for rich class of people. Rich people will possibly tend to consume more high value food items by substituting cereals but still some minimum level of cereal consumption will always be there. In line with our hypothesis, we found own price elasticities for cereals are positive (and not significantly high) in rural but in case of urban it is highly negative. Uncompensated and compensated price elasticities are calculated from the estimated QUAIDS function. These price elasticities are shown in the table 5.4. Uncompensated price elasticity represents the

changes in quantity demanded for one percent change in the price, capturing both income effect and price effect. On the other hand compensated price effect captures the changes in the quantity demanded with respect to the changes in the prices by capturing only the price effect. Own-price and cross-price elasticities are calculated at the sample mean. All own-prices are not negative. For cereal and edible oil own prices are positive, although they are lower in magnitude. This signifies with an increase in total food expenditure cereal consumption may increase at a very small proportion which once again establishes cereal and cereal substitutes as a 'necessary' food item in the dietary basket in Indian households. Compensated price elasticities almost take the similar values as uncompensated elasticities but in most of the cases it is lower than the uncompensated values. As per the demand theory cross-price elasticity of complementary goods is negative and for substitutes it is positive.

Table 5.4: Uncompensated and Compensated Price elasticities

1993-1994	Uncompensated Elasticity													
	Cereal & Cereal substitutes		Pulses		Milk		Edible oil, Honey		Egg-Fish-Meat		Fruits and Vegetables		Miscellaneous+	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Cereal & Cereal substitutes	0.18	-1.075	-0.48	0.023	0.53	-0.055	-0.33	0.239	-0.42	0.230	0.32	-0.573	-0.14	-0.659
Pulses	0.66	1.059	-0.14	-1.937	0.77	2.040	0.23	-3.827	-0.44	-1.630	0.25	1.182	1.20	2.509
Milk	-3.49	-0.056	0.67	0.063	-3.54	-1.780	0.29	0.191	2.28	0.612	-1.30	-0.533	-0.98	-0.191
Edible oil, Honey	-0.55	2.570	0.48	-3.728	-0.30	2.937	0.17	-1.510	-0.27	-2.601	-0.29	2.602	0.73	3.796
Egg-fish-meat	1.90	1.841	0.34	-0.496	1.27	1.397	-0.34	-1.421	-1.71	-1.987	0.42	1.407	-0.05	0.224
Fruits and Vegetables	-1.49	-1.910	0.16	2.879	-0.89	-2.779	0.04	1.538	0.76	2.187	-1.79	-1.753	0.08	-2.052
Miscellaneous	-4.23	-1.781	1.21	0.366	-1.46	-0.289	1.01	0.990	1.06	-0.092	-0.28	-0.026	-0.72	-1.123
Compensated Elasticity														
Cereal& Cereal substitutes	0.18	-1.075	-0.48	0.023	0.55	-0.055	-0.33	0.239	-0.43	0.230	0.31	-0.573	0.08	-0.122
Pulses	0.50	1.188	-0.04	-1.579	0.76	2.212	0.27	-5.688	-0.34	-1.392	-1.13	3.905	1.05	2.271
Milk	-3.89	-0.984	0.54	-0.333	-3.76	-2.244	0.08	-0.393	1.27	0.574	-0.84	-0.422	-0.54	0.086
Edible oil, Honey	-0.12	1.669	0.74	-3.573	0.40	3.156	0.81	-1.524	-0.20	-3.051	-0.28	2.312	0.71	3.280
Egg-fish-meat	1.93	0.813	0.36	-1.410	0.26	0.274	-0.42	-1.484	-1.83	-2.150	0.26	1.326	-0.10	0.216
Fruits and Vegetables	-1.73	-0.213	1.61	2.261	-0.68	-2.304	0.25	3.868	0.98	2.815	-1.66	-1.154	0.38	-1.254
Miscellaneous	-1.92	-0.267	1.43	0.493	-1.27	0.046	1.24	1.159	0.91	0.069	0.10	0.219	-0.44	-0.900

+Miscellaneous goods include Sugar, Spices and Beverages

Source: As in Table 5.3

5.3.2: Results for 2004-05:

The estimated demand parameters of the seven food groups namely cereal, pulses, milk, edible oil, egg-meat-fish, fruits-vegetables and miscellaneous for the year 2004-05 are presented in the Table 5.5.

Table 5.5: Estimated coefficients of the QUAIDS – Rural

Food Groups	Cereal & cereal substitutes (γ_{i1})	Pulses (γ_{i2})	Milk (γ_{i3})	Edible oil, honey (γ_{i4})	Egg-fish-meat (γ_{i5})	Fruits & vegetable (γ_{i6})	Misc+ (γ_{i7})
Intercept (α_i)	2.475 (0.00)**	0.134 (0.00)**	0.775 (0.00)**	-0.343 (0.00)**	-1.579 (0.00) **	-0.173 (0.00) **	-0.288 (0.00) **
Coefficients for Food Prices (γ_{ij})^							
Cereal & Cereal substitutes (γ_{1j})	0.526 (0.00)**	-0.026 (0.64)	0.163 (0.00)**	-0.075 (0.00) **	-0.335 (0.00) **	-0.098 (0.00) **	-0.156 (0.00) **
Pulses (γ_{2j})		0.002 (0.62)	-0.002 (0.00)**	0.001 (0.00) **	-0.007 (0.00) **	0.026 (0.00) **	0.005 (0.00) **
Milk (γ_{3j})			-0.040 (0.00)**	-0.040 (0.00) **	-0.038 (0.00) **	-0.004 (0.00) **	-0.040 (0.00) **
Edible oil, Honey (γ_{4j})				0.029 (0.00) **	0.060 (0.00) **	0.005 (0.87)	0.019 (0.00) **
Egg-fish-meat (γ_{5j})					0.227 (0.00) **	-0.021 (0.00) **	0.113 (0.00) **
Fruits & vegetables (γ_{6j})						0.078 (0.00) **	0.014 (0.01) **
Miscellaneous (γ_{7j})							0.045 (0.00) **
Log food expenditure (β_i)	0.267 (0.00)**	0.020 (0.00)**	0.030 (0.00)**	-0.058 (0.00) **	-0.216 (0.00) **	0.008 (0.02) **	-0.051 (0.00) **
Log food expenditure square (λ_i)	0.007 (0.00) **	0.001 (0.00) **	-0.001 (0.00)**	-0.002 (0.00) **	-0.005 (0.00) **	0.002 (0.00) **	-0.002 (0.00) **
Household size (θ_i)	-0.001 (0.00) **	0.000 (0.00) **	0.003 (0.00)**	0.000 (0.00) **	-0.001 (0.00) **	-0.002 (0.00) **	0.001 (0.00) **

p values are in parenthesis. ** is the significant at 1% and 5% levels.

^Coefficients of food prices.

i = 1(1)7 represents share equations in the demand system, j = 1(1)7 represents the number of food price variables in each equation.

+Miscellaneous goods include Sugar, Spices and Beverages

All own-price coefficients, except pulses (which is statistically insignificant) and milk (coefficient is negative in sign), are positive and highly significant but very low. Interpretation is similar as 1993-94: if there is a small increase in price for a particular food item, consumer will sacrifice their real food budget but the shares of food items/groups in the commodity basket will remain unchanged. The squared terms of per capita expenditure on food are significant; however the coefficients are very small (close to zero). This essentially demonstrates that the relation between per capita food expenditure and budget share of food items may not be quadratic

5.3.2.1 Estimated Demand elasticity

I) Expenditure elasticity

Table 5.6: Sector wise and expenditure class wise expenditure elasticities

2004-2005

	Bottom Expenditure class		*Middle Expenditure class*		*Top Expenditure class*	
	Rural	Urban	Rural	Urban	Rural	Urban
Cereal & Cereal substitutes	0.93	0.64	0.88	0.77	0.68	0.29
Pulses	0.57	0.33	0.69	0.46	0.80	0.40
Milk	0.85	1.56	0.93	1.58	1.10	1.51
Edible oil, Honey	0.49	0.86	0.48	0.80	0.69	1.07
Egg-fish-meat	-0.16	-0.10	0.54	1.03	1.20	1.26
Fruits & Vegetables	0.52	0.65	1.45	2.06	1.09	1.62
Miscellaneous	0.92	0.84	0.86	0.90	1.45	0.75

Source: As in Table 5.3

Based on the signs of the expenditure elasticities (excluding egg-fish-meat for bottom class of people) as shown above, all the seven food commodities across all expenditure classes are normal or luxury. The rural and urban elasticities are different in magnitude. Notice, elasticities are lower in urban (relative to rural) for cereals and pulses in all three expenditure classes. However, mostly it is significantly high in urban for (high value food items) milk, oil-fats, egg-fish-meat (except bottom class) and fruits-vegetables. Again across expenditure class, both in rural and urban, cereal elasticity have declined; indicates

with higher level of income both rural and urban population has a tendency to switch away their consumption from staples to other food items. However, pulses elasticity has increased with increase in food expenditure in rural India. In urban it decreased slightly from 'Middle' to 'Rich' expenditure class while it increased from 'Bottom' to 'Middle' expenditure group. The general trend shows with an increase in expenditure level consumption of high value food items relative to staples are more elastic. That means people are more responsive in case of superior food items for a certain change in food expenditure level. This fact is well established by the higher income elasticity (general trend) of milk, oil, fruits-vegetables and miscellaneous groups. Surprising result is that, both in rural and urban bottom expenditure class is witnessing negative expenditure elasticity for egg-fish-meat group. On the other hand for the 'Rich' class, consumption egg-fish-meat is highly elastic (greater than unity) for both rural (1.20) and urban (1.26) sectors. In case of edible oils and fats elasticity shows a significant increase for 'Poor' to 'Rich' while it decreased for the 'Middle' income group.

Notice, elasticity of milk is very high in both rural and urban sector (greater than unity or very close to unity for all three classes). This is similar with the earlier findings of an increasing trend of milk consumption over years. Fruits-vegetables, categorised as high value food items, is more elastic with respect to changes in food expenditure in urban compare to rural which is as per our expectation. However, in urban elasticities are falling as we move from middle to high income class which is not as per our expectation. Middle urban class has witnessed the highest expenditure elasticity in case of fruits and vegetables. Across expenditure class values are higher for the bottom class compare to the higher income class of people in urban.

II) Uncompensated and compensated price elasticity

Price elasticity table illustrates both uncompensated and compensated own-price elasticities in rural and urban are negative except one aggregated group - fruits and vegetables. Uncompensated cross-price elasticities were mostly negative indicating complementary relationship of food groups whereas Hicksian elasticities were mostly positive, suggesting substitution relationship of aggregated food groups. The estimates indicate that the cross-price elasticities of pulses, fruits and vegetable, fats and oil with respect to cereal and cereal substitutes exhibit complementary relationship. This implies

that a unit change in the prices of these food items has a strong effect on cereals but a unit change in the prices of the latter has no effect on the demand for the former. A fall in prices of pulses, fruits and vegetable, fats and oil by 10 percent will lead the households to increase their demand for cereals by 11 percent. The cereals, milk, fruits and vegetable, with respect to pulses also have complementary relationship. Cereals, pulses, edible oil and miscellaneous groups also show complementary relationship with milk. A 10 percent fall in price of milk would result in 6.8, 3.5, 3.6 and 3.3 percent increase in the demand for cereals, pulses, fats and oil and miscellaneous respectively. Similarly, a 10 percent increase in the price of fats and oil will decrease the consumption of milk, egg-fish meat and fruits and vegetables by 0.4, 3.3 and 4.3 per cent respectively.

All the own-price elasticities are negative except fruits and vegetables in urban. Thus, this indicates that most food items are 'normal' goods. The own price elasticity of fruits and vegetables is the smallest in absolute terms in rural, implies that this food item is the least sensitive to changes in its own price.

Table 5.7: Uncompensated and Compensated Price elasticities

2004-2005	Uncompensated Elasticity													
	Cereal & Cereal substitutes		Pulses		Milk		Edible oil, Honey		Egg-Fish-Meat		Fruits and Vegetables		Miscellaneous+	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Cereal & Cereal substitutes	-1.107	-0.818	-0.263	0.274	-0.069	1.013	-0.005	0.274	0.041	-0.164	-0.119	-2.123	-0.381	0.002
Pulses	-1.222	1.039	-0.708	-0.855	-0.252	0.437	0.205	0.112	0.201	0.296	0.015	-1.473	0.741	0.107
Milk	-0.689	-0.996	-0.355	-0.353	-2.128	-2.088	-0.361	-0.253	1.018	0.434	0.047	0.694	-0.337	-0.503
Edible oil, Honey	0.679	-0.131	0.157	-0.088	-0.048	-0.213	-0.822	-0.988	-0.333	-0.075	-0.432	0.136	0.140	-0.157
Egg-fish-meat	2.091	1.570	0.408	0.593	1.715	1.902	-0.175	0.276	-1.696	-1.023	-1.913	-3.030	1.138	0.978
Fruits and Vegetables	0.901	-3.558	1.053	-0.606	0.460	-2.394	-0.010	-0.557	-2.856	-0.285	0.144	1.723	-0.718	-0.221
Miscellaneous	-0.721	-0.557	0.445	-0.004	0.006	-0.095	0.122	-0.042	0.502	0.443	-0.672	0.167	-0.369	-0.876
Compensated Elasticity														
Cereal & Cereal substitutes	-1.107	-0.818	-0.263	0.274	-0.069	1.013	-0.005	0.274	0.041	-0.164	-0.119	-2.123	-0.327	0.075
Pulses	-1.087	1.047	-0.527	-0.856	-0.059	0.449	0.323	0.134	0.516	0.319	0.651	-1.299	0.813	0.146
Milk	-0.537	-0.904	-0.250	-0.303	-2.071	-2.045	-0.205	-0.169	2.199	1.429	0.237	0.877	-0.069	-0.109
Edible oil, Honey	0.929	0.135	0.336	0.233	0.395	0.271	-0.263	-0.228	-0.285	0.017	-0.376	0.395	0.215	-0.023
Egg-fish-meat	2.173	1.775	0.523	0.827	1.099	1.748	-0.271	0.204	-1.792	-1.225	-2.053	-3.127	1.100	0.957
Fruits and Vegetables	0.381	-3.736	-1.287	-0.001	0.178	-2.252	-3.466	-0.119	-3.046	-0.072	0.832	1.112	-0.765	0.126
Miscellaneous	-2.097	0.019	0.494	0.059	0.068	0.079	0.194	0.053	0.545	0.533	-0.554	0.328	-0.280	-0.763

+Miscellaneous goods include Sugar, Spices and Beverages

Source: As in Table 5.3

5.3.3 Results for 2009-10

Table 5.8: Estimated coefficients of the QUAIDS – Rural

Food Groups	Cereal & cereal subst. (γ_{i1})	Pulses (γ_{i2})	Milk (γ_{i3})	Edible oil, honey (γ_{i4})	Egg-fish-meat (γ_{i5})	Fruits & vegetable (γ_{i6})	Misc+ (γ_{i7})
Intercept	1.744 (0.00)**	0.058 (0.07)*	0.781 (0.00)**	-2.265 (0.00)**	2.136 (0.00)**	-0.182 (0.00)**	-1.272 (0.00)**
Coefficients for Food Prices (γ_{ij})^							
Cereal & cereal subst. (γ_{1j})	0.399 (0.00)**	-0.069 (0.00)**	0.093 (0.00)**	-0.391 (0.00)**	0.387 (0.00)**	-0.056 (0.00)**	-0.362 (0.00)**
Pulses (γ_{2j})		0.003 (0.00)**	-0.005 (0.00)**	0.081 (0.00)**	-0.038 (0.00)**	0.006 (0.00)**	0.020 (0.00)**
Milk (γ_{3j})			0.021 (0.00)**	-0.063 (0.00)**	0.017 (0.05)**	-0.043 (0.00)**	-0.019 (0.00)**
Edible oil, honey (γ_{4j})				0.545 (0.00)**	-0.663 (0.00)**	0.059 (0.00)**	0.432 (0.00)**
Egg-fish-meat (γ_{5j})					0.874 (0.00)**	-0.044 (0.00)**	-0.533 (0.00)**
Fruits & vegetable(γ_{6j})						0.077 (0.00)**	0.001 (0.92)
Miscellaneous (γ_{7j})							0.461 (0.00)**
Log food expenditure (β_i)	0.154 (0.00)**	-0.016 (0.01)**	-0.022 (0.00)**	-0.235 (0.00)**	0.340 (0.00)**	-0.013 (0.00)**	-0.208 (0.00)**
Log food expenditure square (λ_i)	0.004 (0.00)**	-0.001 (0.00)**	-0.006 (0.00)**	-0.003 (0.00)**	0.014 (0.00)**	0.000 (0.11)	-0.008 (0.00)**
Household size (θ_i)	-0.001 (0.00) **	0.000 (0.00) **	0.003 (0.00)**	0.000 (0.00) **	-0.001 (0.00) **	-0.002 (0.00) **	0.001 (0.00) **

p values are in parenthesis. **, * is the significant at 1% and 10% levels, respectively.

^Coefficients of food prices.

i = 1(1)7 represents share equations in the demand system, j = 1(1)7 represents the number of food price variables in each equation.

+Miscellaneous goods include Sugar, Spices and Beverages

All parameters of the price variables are significant at 1% level of significance. Own price coefficients are positive and highly significant for all the price variables. Intercepts are mostly positive significant at 10 percent except oil, fruits-vegetables and miscellaneous group. Coefficients of price variables are not very high indicating the food items share in total food expenditure will be unchanged (and if change, the magnitude will be very small) even if there is an one per cent increase in food prices. Similar as the findings for 1993-94 and 2004-05, here in case of 2009-10 also, we found coefficients of the squared food expenditure are not significantly different from zero. This again signifies that the relation between food expenditure and the share of a particular food item may not be quadratic. Negative sign of cross-price coefficients of pulses, oil, fruits and vegetables and miscellaneous (equation 1) suggests inverse relationship between cereals share and share of food groups, respectively. On the other hand positive signs (milk and egg-fish-meat with respect to cereal; edible oil, fruits-vegetable and miscellaneous with respect to pulses; egg-fish-meat with respect to milk; fruits-vegetable and miscellaneous with respect to edible oil and miscellaneous with respect to fruits and vegetables) in cross-price coefficients signifies direct relationship between the aggregated food groups.

5.3.3.1 Estimated demand elasticity

I) Expenditure elasticity

Table 5.9: Sector wise and expenditure class wise expenditure elasticities

2009-2010

	Bottom Expenditure class		*Middle Expenditure class*		*Top Expenditure class*	
	Rural	Urban	Rural	Urban	Rural	Urban
Cereal & Cereal substitutes	0.82	0.60	0.62	0.66	0.41	0.22
Pulses	0.56	0.21	0.55	0.18	0.36	0.11
Milk	1.28	1.66	0.65	0.72	1.41	1.52
Edible oil, Honey	0.95	1.17	1.01	1.13	1.29	1.67
Egg-fish-meat	1.68	1.31	2.18	1.97	1.78	1.78
Fruits & Vegetables	1.08	1.22	1.16	0.79	1.09	1.88
Miscellaneous	1.83	0.81	0.45	1.13	1.65	1.63

Source: As in Table 5.3

All expenditure elasticities are positive (interpretation is similar as before). Similar as 1993-94 and 2004-05, in rural consumption of cereal and cereal substitutes are clearly falling across expenditure class. The decline rate is higher in rural compare to the urban areas. Opposite trend found in case of edible oils and fats. Elasticity figures suggest intakes of fat will increase with a rise in level of income. The result is consistent for all three years. Therefore, we can say that at least for cereals people have a tendency to shift away their consumption pattern with higher income level. On the other hand in case of consumption of oils and fats households are more inclined to consume this superior group of foods with higher level of income. This essentially implies people are shifting their consumption preference from cereal to non cereal food items. But the argument does not hold in general. In case of pulses, expenditure elasticity is substantially low for the urban in comparison to rural. Unlike other years, pulses elasticity shows a consistent steady declining trend with high level of income. Therefore this also indicates a possible food diversification from staples to high value food groups. Now look at the elasticities of the high value food groups. Considering all three classes together, on an average, elasticity of the egg-fish-meat is higher in both the sectors. This again says that as share of expenditure on food increases the proportion of expenditure on these food groups is much higher than on other food groups. The demand for high-value foods are more income elastic compared to the staples. Therefore it is observed that, despite of having positive expenditure elasticity, the annual per capita consumption of cereal has shown a decline across income (or precisely expenditure) class.

II) Uncompensated and Compensated price elasticity

Similar to the previous findings, also in 2009-10, all own-price elasticities (uncompensated and compensated) do not display expected negative signs. However, the non-negative own-price elasticities are mostly very small in magnitude except the urban egg-fish-meat. In most of the cases, we do not find any substantial difference between compensated and uncompensated own-price elasticities which indicates weak income effect. The magnitudes of elasticities vary across different food groups. The uncompensated own-price elasticities of staples are negative and very low indicate that price increase results in a very small decline in their demand. As we have mentioned earlier this behaviour is probably a reflection of the fact that these food groups are considered as a 'necessary' food items. In case rural, the uncompensated elasticity

estimates for cereals and cereals substitutes are the lowest, indicating that the proportionate decrease in their demand is much lower than other food groups. In general, cross-price elasticity of demand for food groups/items refers to the changes in the quantity demanded of one food group/item as a result of changes in prices of others. Similar as 2004-05, also in 2009-10 one can see the estimates indicate that the cross-price elasticities of pulses, fruits and vegetable, fats and oil with respect to cereal and cereal substitutes exhibit complementary relationship. Again this implies that a unit change in the prices of these food items has a strong effect on cereals but a unit change in the prices of the latter has no effect on the demand for the former. The positive cross-price elasticities between cereal and milk indicate substitutability relation.

Table 5.10: Uncompensated and Compensated Price elasticities

2009-2010	Uncompensated Elasticity													
	Cereal & Cereal Substitutes		Pulses		Milk		Edible oil, Honey		Egg-Fish-Meat		Fruits and Vegetables		Miscellaneous+	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Cereal and Cereal substitutes	-0.476	0.077	-0.257	-0.004	0.008	0.047	-0.054	-0.050	-0.084	-0.689	-0.124	0.093	-0.471	-0.405
Pulses	-0.896	-0.729	-0.944	-0.849	0.016	-0.039	0.952	0.686	-0.108	-0.031	0.086	-0.640	0.040	-0.158
Milk	0.832	0.416	-0.072	0.158	-0.937	-0.163	-0.416	-0.448	0.016	-0.666	0.465	0.171	-0.114	-0.061
Edible oil, Honey	0.439	3.215	1.132	1.207	1.225	0.408	-2.116	0.658	0.239	-3.772	0.297	1.110	0.629	0.008
Egg-fish-meat	-1.153	-3.650	-0.335	-0.651	-1.345	-1.188	0.995	-1.249	-0.902	3.373	0.010	-0.672	-0.363	0.288
Fruits and Vegetables	-0.444	0.740	0.853	-0.408	-0.528	0.315	0.270	0.669	0.012	-0.624	0.226	-1.068	-0.400	-0.047
Miscellaneous	-0.329	-0.842	0.207	-0.101	0.878	-0.011	-0.495	0.199	-0.018	0.088	-0.265	0.007	0.511	-0.248
Compensated Elasticity														
Cereal and Cereal substitutes	-0.476	0.077	-0.257	-0.004	0.008	0.047	-0.054	-0.050	-0.084	-0.689	-0.124	0.093	-0.017	-0.105
Pulses	-0.779	-0.643	-0.704	-0.645	0.140	0.060	1.167	0.847	0.004	0.048	0.557	-0.018	0.113	-0.035
Milk	0.989	0.763	-0.004	0.322	-0.813	0.088	-0.350	-0.324	0.506	-0.279	-0.368	0.227	0.088	0.109
Edible oil, Honey	0.614	3.356	1.010	1.319	1.405	0.471	-2.707	0.112	0.084	-3.966	-0.015	0.672	0.545	-0.099
Egg-fish-meat	-1.400	-4.071	-0.465	-0.843	-0.496	-0.452	1.225	-1.011	-0.388	3.971	0.266	-0.380	0.027	0.705
Fruits and Vegetables	-0.218	0.663	0.725	0.153	-0.468	0.372	0.387	0.569	0.074	-0.563	0.337	-0.963	-0.339	0.009
Miscellaneous	-0.406	-0.523	0.180	-0.033	0.823	0.151	-0.547	0.276	-0.078	0.215	-0.291	0.071	0.484	-0.141

+Miscellaneous goods include Sugar, Spices and Beverages

Source: As in Table 5.3

5.4 Time trend

Table 5.11: Expenditure elasticities over time and across food groups – Rural

	Bottom Expenditure class			*Middle Expenditure class*			*Top Expenditure class*		
	1993-1994	2004-2005	2009-2010	1993-1994	2004-2005	2009-2010	1993-1994	2004-2005	2009-2010
Cereal and Cereal subst.	1.05	0.93	0.82	0.93	0.88	0.62	0.70	0.68	0.41
Pulses	0.68	0.57	0.56	0.60	0.69	0.55	0.57	0.80	0.36
Milk	0.74	0.85	1.28	1.92	0.93	0.65	0.85	1.10	1.41
Edible oil, Honey	0.33	0.49	0.95	0.35	0.48	1.01	0.30	0.69	1.29
Egg-fish-meat	0.53	-0.16	1.68	0.29	0.54	2.18	0.96	1.20	1.78
Fruits & Vegetables	1.49	0.52	1.08	1.00	1.45	1.16	1.98	1.09	1.09
Miscellaneous	0.65	0.92	1.83	1.43	0.86	0.45	1.29	1.45	1.65

Source: Table 5.3, 5.6 and 5.9

Table 5.12: Expenditure elasticities over time and across food groups- Urban

	Bottom Expenditure class			*Middle Expenditure class*			*Top Expenditure class*		
	1993-1994	2004-2005	2009-2010	1993-1994	2004-2005	2009-2010	1993-1994	2004-2005	2009-2010
Cereal and Cereal subst.	1.02	0.64	0.60	0.85	0.77	0.66	0.65	0.29	0.22
Pulses	0.24	0.33	0.21	0.46	0.46	0.18	0.16	0.40	0.11
Milk	1.16	1.56	1.66	1.13	1.58	0.72	1.11	1.51	1.52
Edible oil, Honey	0.87	0.86	1.17	0.99	0.80	1.13	1.03	1.07	1.67
Egg-fish-meat	0.98	-0.10	1.31	0.79	1.03	1.97	0.69	1.26	1.78
Fruits & Vegetables	1.66	0.65	1.22	1.97	2.06	0.79	1.78	1.62	1.88
Miscellaneous	1.05	0.84	0.81	1.87	0.90	1.13	1.41	0.75	1.63

Source: Table 5.3, 5.6 and 5.9

We have already seen in the previous chapters that the consumption of oils and fats has increased over the years. This fact, once again, could be judged by looking at the results

shown in the Table 5.11 and 5.12. In other words, the figures of the above tables explain the reason behind the increase (for oils and fats) and the decrease (for cereal and cereal substitutes). This study has found consistent, expected trends of expenditure elasticities for two food times. One, expenditure elasticities of cereal and cereal substitutes have decreased continuously across expenditure classes and over time. Two, in reverse, expenditure elasticities of oils and fats have shown a continuous increase across expenditure classes and over time. From the cross section analysis, computed expenditure elasticity figures suggest (for each individual year) that across expenditure groups, with higher level of income, people have a tendency to move away from cereals to non-cereal food items. On the other hand, for oils and fats, with increase in income people have a tendency to consume more of this food items. This 'shift' in a particular cross section year can be explained as a 'pure income effect'. Time trend also shows similar results. Over the years, elasticities of the high value food items are increasing while it is decreasing for the low value foods. Even if the magnitudes are different for rural and urban areas, however, the direction of change is fairly similar for both staples as well as for the oils and fats. Therefore the change over time can be termed as structural shift due to 'consumption diversification effect'. In case of other food groups direction of change is neither consistent across expenditure groups nor over years. Thus, we can not claim there is complete food 'diversification' from cereals and pulses towards any high value items with higher level of income. We can possibly claim that we found the 'diversification' argument is partially true for some specific food items but not for all.

5.5 Summary

This chapter has tried to examine how far the food 'diversification' argument is empirically true in Indian context. We have estimated the responsiveness of expenditure and price changes on food consumption across three expenditure classes. It has found that the values of expenditure elasticities suggest with higher level of income, households will tend to diversify their consumption from staples to other food items. In all three years consumption of edible oils has shown the opposite result across expenditure class. Time trend shows a major decline in expenditure elasticity for staples while it shows a rise for fats and oils.

Chapter 6

Summary and Conclusion

6.1 Summary

Change in dietary pattern in India has drawn serious insights for policy makers on the one hand; on the other, it has generated much 'heated debate' among the social scientists and nutritionists. The change in consumption pattern in India in the recent past has called for an in-depth analysis to examine whether this change can be viewed as a food diversification or not. In the preceding chapters we have tried to capture those changes across sectors and across several food groups. Broadly, this thesis re-examined those food consumption changes covering the period 1993-94 to 2009-10 for India.

Chapter Two has brought out some recent debates on the issue of declining food consumption and nutritional intake in India and has set out the specific objectives of this study. It found that not only India, but other developing countries also have experienced change in the food consumption pattern. Studies on India showed much debate is still going on this issue. However, it is not confirmed that the decline in consumption of staples is occurring only because of 'diversification'. In contrast, there was a strong argument in favour of the 'voluntary impoverishment'. Keeping this in mind we tried to investigate how valid the 'diversification' argument is, by using a specific demand system.

Chapter Three discussed about the data base and the methodology used in this study. Most of the studies, dealing with demand parameter estimation, assumed that the curvature of the famous Engel curve is linear; indicate that there is an obvious one to one relationship between expenditure and consumption. In reality this is not true. This study allowed for a non-linear (quadratic as a special case) relationship between expenditure and consumption and used a complete demand system framework to estimate the price and expenditure responsiveness of the food consumption.

Chapter Four exhibits the trends and patterns of food consumption starting from 1993-94 to 2009-10. The entire analysis was restricted in three NSS quinquennial survey rounds – 50th, 61st and 66th. Consumption of staples was found declining since the beginning of 1970's and the declining rate was accelerated in the post liberalisation period. In reverse, consumption of superior food items such as Milk, Oils and fat have increased over the years. The other surprising fact was that the consumption of calorie and protein was declining at a very fast rate. The recommended norm was never met in any of the quinquennial rounds since 1972. Chapter Four gave a detail discussion on the calorie – income relationship. We also looked at the inter-linkages between poverty and calorie intake. It was found that the official poverty measure (indirect measure of poverty) exhibits a decline in poverty (during 1993-94 to 2009-10) while direct poverty measure shows an increasing trend. There was a large gap between indirect and direct poverty measure. In rural India around 34% people were deprived according to direct poverty measure while from indirect measure it was 81% in 2009-10.

6.2 Conclusion

All food groups (except for rural bottom class in 2004-05) had positive expenditure elasticities but the magnitude of those elasticities differs for various food categories. In line with the demand theory, our estimated own price elasticities were found negative. Expenditure elasticities suggest that staple food and oils (in most of the cases) are necessities while vegetables, meat and fish, milk and milk products are luxuries. The households with higher income were expenditure elastic on milk and milk products group. The finding of substantial consumption differences between rural and urban households, as well as among households in different income-groups has important welfare implications. These results indicate that the design of anti-poverty and nutrient enhancement policies needs to be sector-specific and should be based on accurate and comprehensive food poverty studies. No systematic differences in the absolute magnitudes of the expenditure elasticities and own-price elasticities were found (for instance, it could not be said that households were more responsive to expenditure changes than price changes); this suggests that a simultaneous use of income and price policies may be more effective in influencing consumption patterns.

The results of the QUAIDS model show that own price of all food items were inelastic implying that a percentage change in the quantity of every food consumed is less than the percentage changes in their price. This has serious implication on a household's food security. One of the striking results was that household size has little effect on consumption of food items.

It had also been exposed in this study that share of consumption expenditure varies across food groups, and more importantly, along and across income groups. This study showed how demand for each food group is income responsive and it also found out that in general high value food such as milk and milk products, egg-fish-meat, fruits and vegetable groups were more income elastic. The thesis further revealed that all food groups were 'normal good' and price inelastic. Moreover, some food groups were found to be substitutes and others were complements as per our expectation. The study also found out a clear declining trend in the expenditure elasticity of staples. However, for oils and fats the relationship is the opposite. Although the finding does not produce any conclusive result in favour of complete 'diversification' but empirically, it once again corroborates with the conventional characteristics of Engel's law (i.e. after a certain level of income people will always tend to shift their consumption preference from inferior to superior commodities).

6.3 Scope of further Research

NSS does not provide person level consumption figures. A person level analysis may provide different results since per capita (or per head) figures do not reflect actual variation in consumption within the household. Thus analysis using household level consumption can be misleading at times. This calls for an individual level analysis which is almost impossible at hand because of unavailability of required data. Only way to do that is to conduct a survey by the researcher herself.

As per our knowledge we do not find any substantial study comparing India's experience with other developed and developing countries on this issue. So it would be necessary to document their experiences as well.

Many a times it is argued that expenditure is not a suitable for proxy for income. Till now only one study (Oldiges 2012) has looked at the direct impact of income on consumption using a cross section data from National Council of Applied Economic Research (NCAER). Therefore, econometrically, a panel data study comparing recent income and consumption data would be more appropriate to estimate the price and expenditure response on consumption.

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APPENDIX

Table A.1: Percentage change in Rice and Wheat Consumption across several Socio-Economic and Demographic variables – Rural

		Rice and Rice products			Wheat and Wheat products		
		1993-94 to 2004-05	2004-05 to 2009-10	1993-94 to 2009-10	1993-94 to 2004-05	2004-05 to 2009-10	1993-94 to 2009-10
Household Size	1-5	5.5	4.8	10.1	6.3	-4.1	2.5
	6-10	7.7	11.5	18.3	-0.8	-2.6	-3.4
	11-15	14.7	8.6	22.0	-1.6	8.0	6.6
	16-20	10.1	29.6	36.7	5.4	-7.3	-1.5
	21-26	40.3	15.7	49.7	1.9	-18.1	-15.8
Education	Not literate	8.4	6.8	14.7	2.5	-3.0	-0.4
	Below primary	4.9	8.7	13.2	2.8	-1.4	1.5
	Below graduate	2.6	6.1	8.6	8.9	-0.5	8.5
	Graduate & above	9.3	5.7	14.4	5.7	3.6	9.0
Social Group	SC	8.2	8.6	16.1	-8.5	-27.0	-37.8
	ST	7.3	8.5	15.2	-2.4	-1.3	-3.7
	OBC	N/A	4.2	N/A	N/A	2.9	N/A
	OTHERS	1.0	6.4	7.3	13.0	-2.4	10.9
Religion	Hindu	8.0	6.5	14.0	1.0	-2.3	-1.3
	Muslim	1.2	8.1	9.2	14.3	3.8	17.5
	Christian	4.4	4.3	8.4	-0.2	-9.1	-9.2
Age Group	0-6	9.7	6.9	15.9	4.0	0.0	4.0
	7-15	7.6	7.9	14.9	0.4	-1.2	-0.8
	16-30	6.0	7.8	13.3	2.7	-2.8	0.0
	31-60	1.4	5.6	6.9	6.2	-1.1	5.2
	61 and above	1.4	5.3	6.6	5.8	0.8	6.5

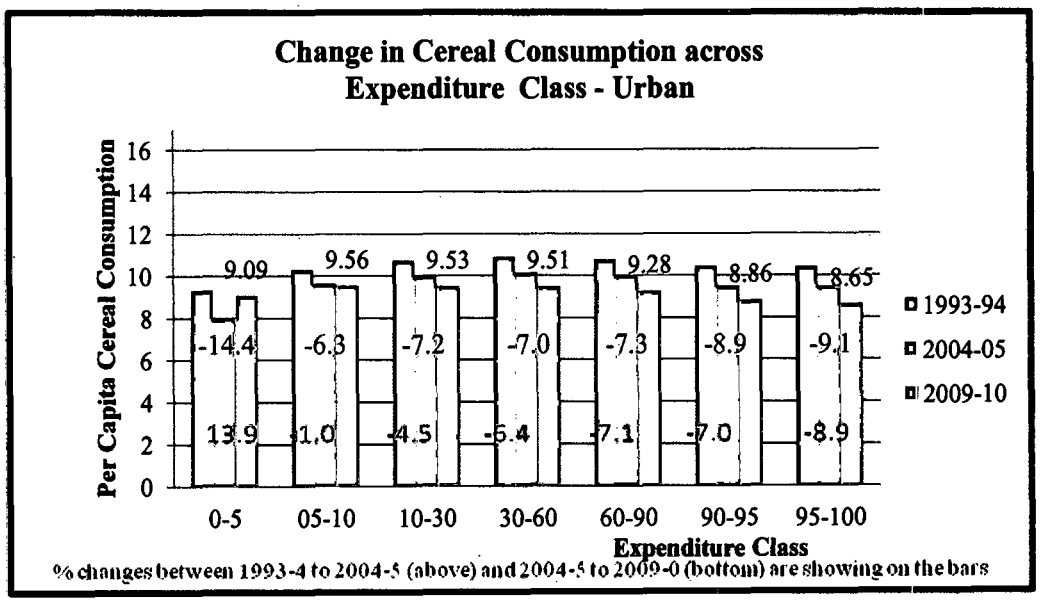
Source: own calculation from respective NSS rounds

Table A.2: Percentage change in Rice and Wheat Consumption across several Socio-Economic and Demographic variables –Urban

		Rice and Rice products			Wheat and Wheat products		
		1993-94 to 2004-05	2004-05 to 2009-10	1993-94 to 2009-10	1993-94 to 2004-05	2004-05 to 2009-10	1993-94 to 2009-10
Household Size	1-5	6.5	3.9	10.1	4.6	4.8	9.2
	6-10	12.6	5.8	17.7	-3.3	6.4	3.4
	11-15	6.0	19.6	24.4	4.1	-0.1	4.0
	16-20	-12.2	14.6	4.2	-4.6	10.3	6.1
	21-26	-67.6	50.0	16.1	16.6	-19.2	0.6
Education	Not literate	4.1	4.5	8.4	4.5	5.0	9.3
	Below primary	6.8	3.4	9.9	0.4	7.0	7.4
	Below graduate	6.5	3.5	9.8	3.3	6.2	9.3
	Graduate & above	4.0	4.7	8.4	8.4	6.9	14.7
Social Group	SC	5.6	4.2	9.6	4.9	5.6	10.2
	ST	1.2	6.1	7.2	5.9	1.9	7.7
	OBC	N/A	4.2	N/A	N/A	9.3	N/A
	OTHERS	16.0	5.3	20.5	-0.9	4.2	3.3
Religion	Hindu	5.8	4.8	10.4	6.1	4.9	10.7
	Muslim	4.0	1.1	5.0	-4.5	10.9	6.8
	Christian	2.7	4.3	6.9	11.9	1.4	13.1
Age Group	0-6	8.2	3.7	11.6	4.5	6.7	10.9
	7-15	8.8	3.2	11.8	-0.4	6.9	6.6
	16-30	6.7	7.8	14.0	4.8	5.1	9.6
	31-60	2.8	3.1	5.8	5.7	5.9	11.3
	61 and above	6.9	-2.5	4.6	3.2	8.8	11.7

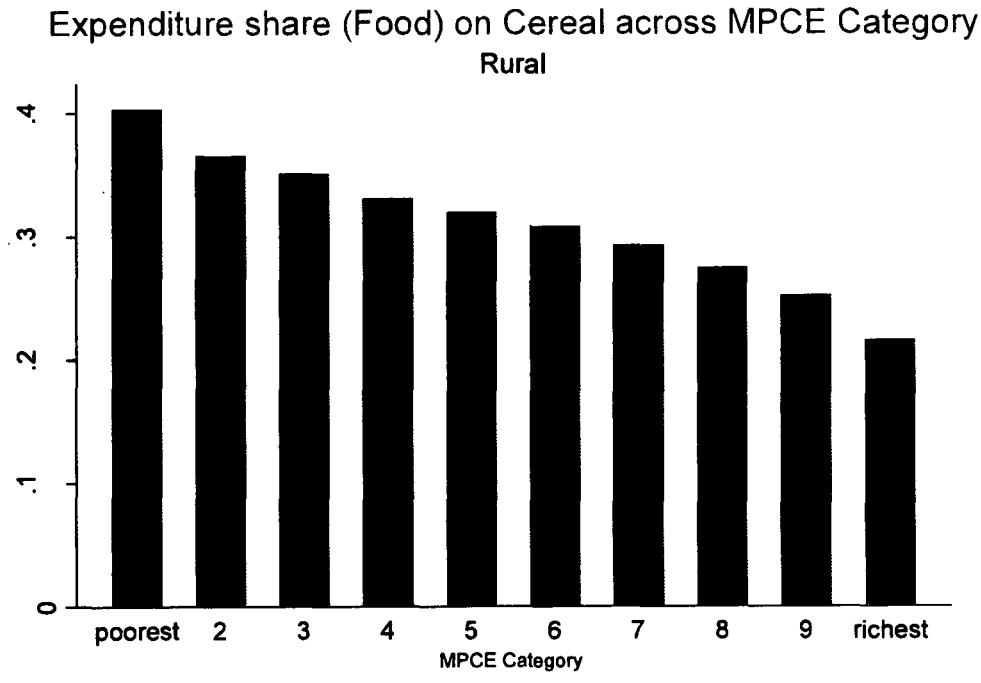
Source: As in Table A.1

Figure A.1: Average per capita Cereal consumption across MPCE category (Urban)



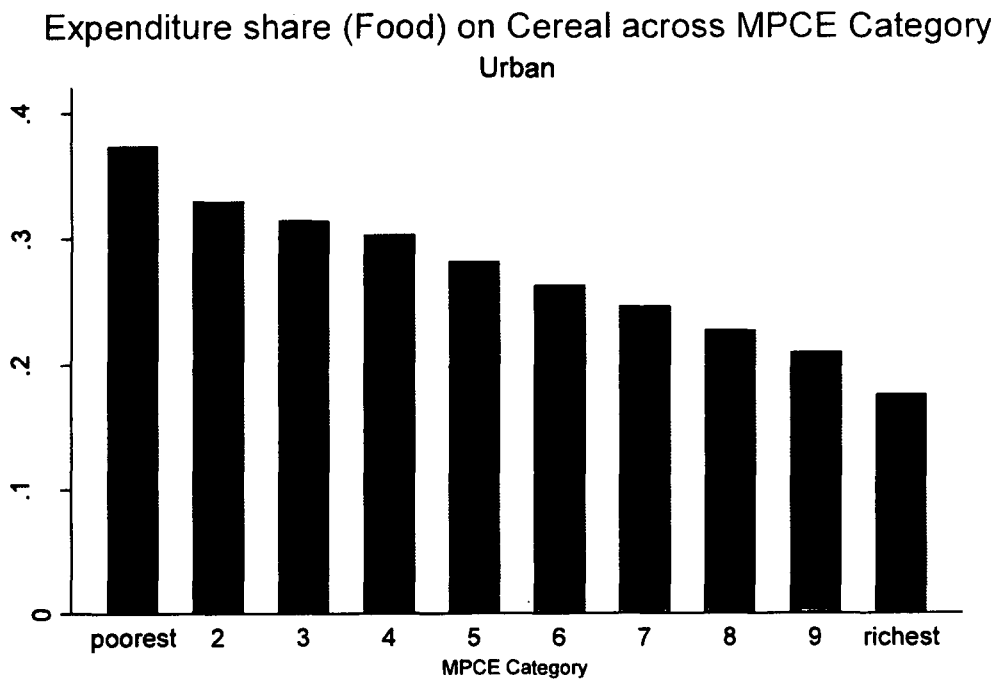
Source: As in Table A.1

Figure A.2: shows the expenditure share on Cereals across the various MPCE categories in Rural (2009-10)



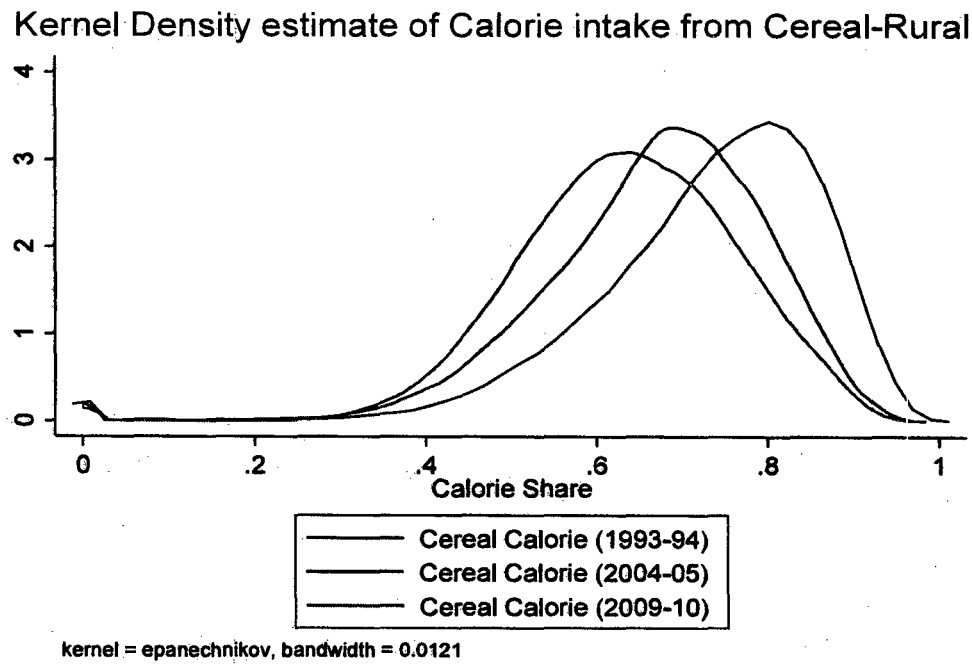
Source: As in Table A.1

Figure A.3: shows the expenditure share on Cereals across MPCE categories in Urban (2009-10)



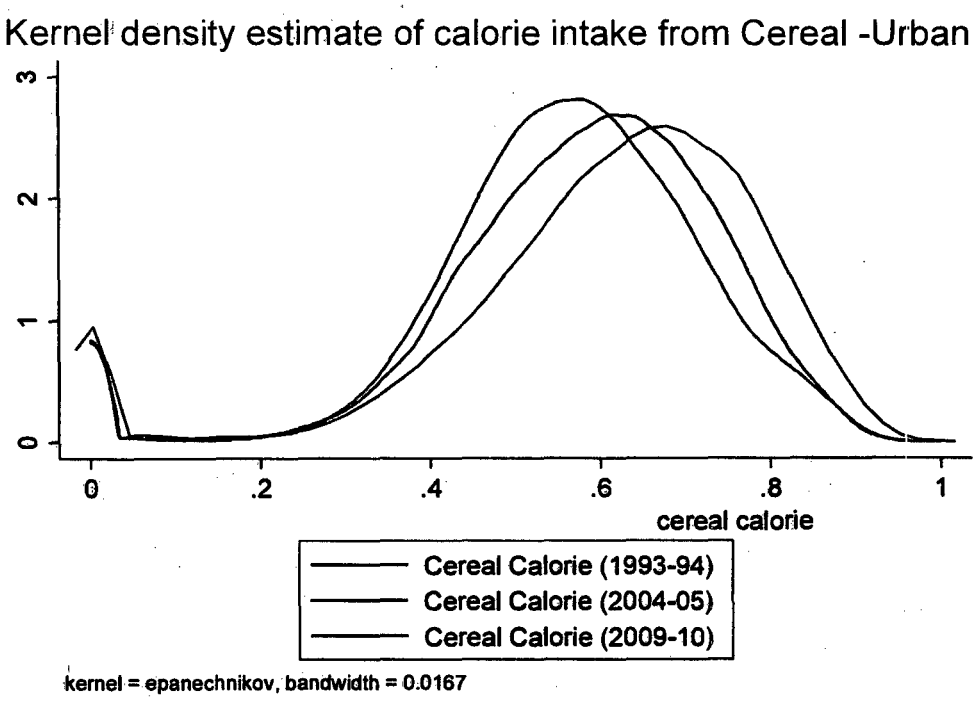
Source: As in Table A.1

Figure A.4: Kernel Density Estimation for Rural



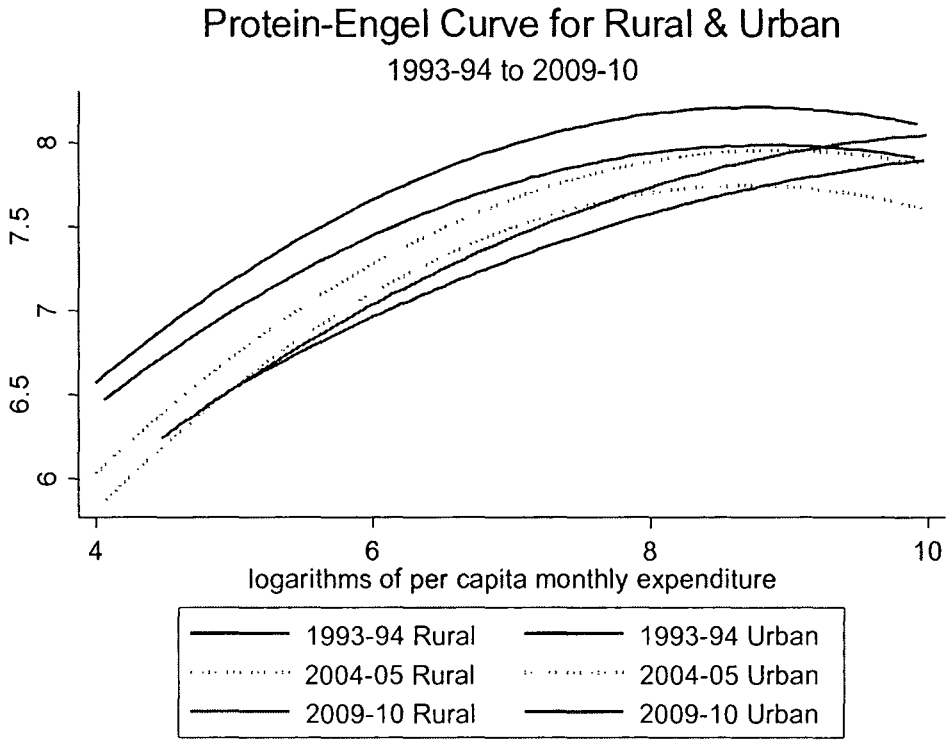
Source: As in Table A.1

Figure A.5: Kernel Density Estimation for Urban



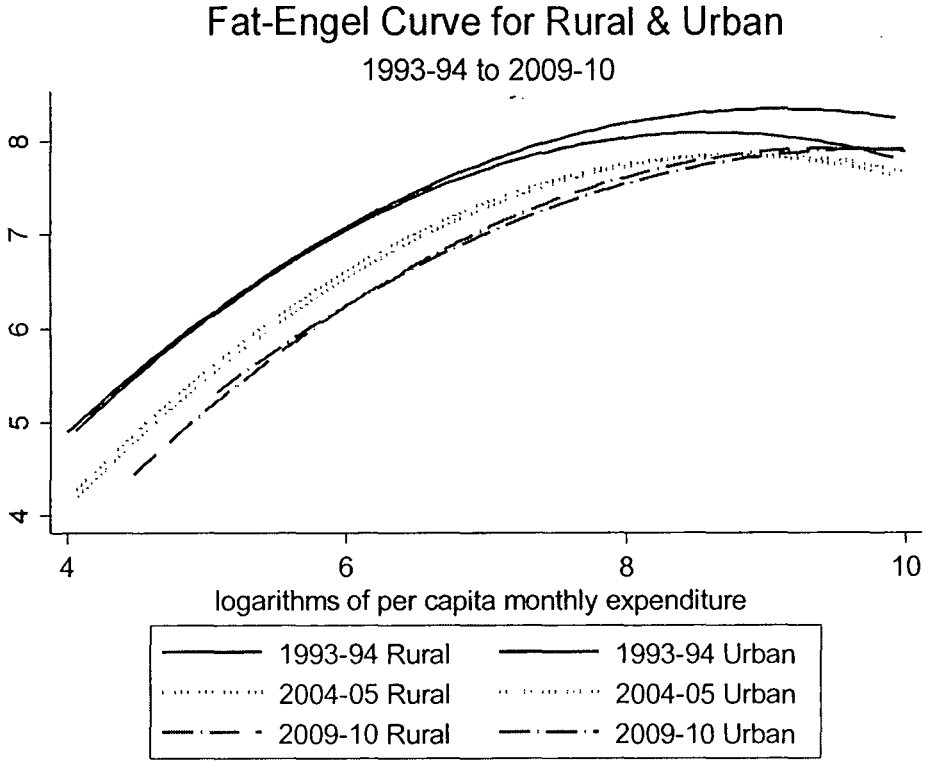
Source: As in Table A.1

Figure A.6: Protein-Engel curve



Source: As in Table A.1

Figure A.7: Fat-Engel Curve



Source: As in Table A.1

Table A.3: Calorie consumption from Cereals

	Calorie					
	1993-94		2004-05		2009 - 10	
	Rural	Urban	Rural	Urban	Rural	Urban
Rice	770.2	584.2	754.5	559.2	707.0	536.6
Wheat	524.9	549.9	487.3	524.6	492.9	492.8
Coarse Cereals	221.11	75.82	140.40	49.20	95.90	41.11
All Cereals	1516.3	1209.9	1382.2	1133.0	1295.8	1070.5

Source: As in Table A.1

Table A.4: Protein consumption from Cereals

	Protein					
	1993-94		2004-05		2009 - 10	
	Rural	Urban	Rural	Urban	Rural	Urban
Rice	16.7	12.7	16.3	12.1	15.3	11.6
Wheat	18.6	19.4	17.2	18.5	17.4	17.3
Coarse Cereals	6.7	2.2	4.3	1.4	2.9	1.2
All Cereals	41.9	34.3	37.9	32.0	35.6	30.1

Source: As in Table A.1

Table A.5: Fat consumption from Cereals

	Fat					
	1993-94		2004-05		2009 - 10	
	Rural	Urban	Rural	Urban	Rural	Urban
Rice	1.1	0.8	1.1	0.8	1.0	0.8
Wheat	2.6	2.7	2.4	2.5	2.4	2.4
Coarse Cereals	1.8	0.5	1.3	0.4	0.8	0.3
All Cereals	5.5	4.0	4.8	3.7	4.3	3.5

Source: As in Table A.1

Table A.6: Total Expenditure, Protein and Fat intake among Social groups in Rural India

	Schedule Tribe			Schedule Caste			Other Backward Caste			Others		
MPCE	bottom 30%	middle 40%	top 30%	bottom 30%	middle 40%	top 30%	bottom 30%	middle 40%	top 30%	bottom 30%	middle 40%	top 30%
1993-94	151.4	254.4	495.8	154.0	254.6	475.3	N/A	N/A	N/A	160.9	260.8	507.2
2004-05	330.3	486.9	823.9	367.4	498.5	882.8	393.1	522.3	937.9	439.2	581.5	1055.6
2009-10	532.9	903.1	1645.3	550.1	913.0	1635.8	569.8	921.8	1777.5	581.7	932.6	2005.1
PCPD Protein (gm)												
1993-94	53.9	69.7	88.1	55.8	71.7	92.0	N/A	N/A	N/A	57.3	74.1	97.0
2004-05	45.7	53.7	62.5	48.9	56.3	65.4	49.5	57.8	68.0	49.2	57.7	68.8
2009-10	44.5	55.6	65.7	46.2	56.5	66.4	46.6	56.2	68.0	44.1	54.9	69.6
PCPD Fat (gm)												
1993-94	16.8	26.4	40.5	17.7	27.9	44.7	N/A	N/A	N/A	19.5	32.5	54.1
2004-05	21.8	31.1	38.4	24.9	32.9	43.4	27.7	36.9	51.9	30.4	39.8	55.3
2009-10	24.5	37.7	52.4	25.2	40.1	55.7	27.0	41.2	58.6	25.4	40.4	63.6

Source: As in Table A.1

Table A.7: Total Expenditure, Protein and Fat intake among Social groups in Urban India

	Schedule Tribe			Schedule Caste			Other Backward Caste			Others		
MPCE	bottom 30%	middle 40%	top 30%	bottom 30%	middle 40%	top 30%	bottom 30%	middle 40%	top 30%	bottom 30%	middle 40%	top 30%
1993-94	205.2	367.4	752.6	201.2	365.0	770.7	N/A	N/A	N/A	211.0	375.7	838.3
2004-05	506.5	836.2	1498.9	519.4	731.1	1333.8	562.4	781.2	1454.5	650.9	900.8	1906.3
2009-10	680.8	1359.0	3669.6	692.4	1281.3	2928.3	704.4	1299.4	3089.4	723.6	1367.5	3597.1
PCPD Protein (gm)												
1993-94	56.6	72.9	93.3	57.5	75.7	91.3	N/A	N/A	N/A	58.3	75.2	94.9
2004-05	46.1	54.5	60.2	48.2	52.0	57.6	48.2	54.4	62.9	52.4	54.5	62.4
2009-10	44.2	52.8	60.7	43.9	52.4	62.8	45.2	51.6	61.8	43.9	51.4	62.4
PCPD Fat (gm)												
1993-94	20.1	34.2	52.8	22.3	36.3	53.3	N/A	N/A	N/A	24.2	41.0	64.6
2004-05	27.4	41.4	52.7	30.7	39.4	51.5	32.5	43.2	58.6	40.7	46.5	66.1
2009-10	28.5	40.6	62.6	29.5	45.1	62.2	30.9	45.2	62.2	29.9	47.7	69.6

Source: As in Table A.1

Table A.8: QUAIDS estimated parameters for Urban -1993-94

Food Groups	Cereal & cereal subst. (γ_{i1})	Pulses (γ_{i2})	Milk (γ_{i3})	Edible oil, honey (γ_{i4})	Egg-fish-meat (γ_{i5})	Fruits & vegetable (γ_{i6})	Misc+ (γ_{i7})
Intercept (α_i)	1.491 (0.00)**	-0.960 (0.00)**	0.574 (0.00)**	-2.024 (0.00)**	-0.522 (0.00)**	1.934 (0.00)**	0.508 (0.00)*
Coefficients for Food Prices (γ_{ij})^							
Cereal & cereal substitutes (γ_{1j})	0.242 (0.00)**	-0.134 (0.00)**	0.089 (0.00)**	-0.235 (0.00)**	-0.029 (0.00)**	0.143 (0.00)**	-0.077 (0.00)**
Pulses (γ_{2j})		0.178 (0.00)**	-0.043 (0.00)**	0.171 (0.00)**	0.054 (0.00)**	-0.203 (0.00)**	-0.023 (0.00)**
Milk (γ_{3j})			-0.058 (0.00)**	-0.086 (0.00)**	0.042 (0.00)**	0.043 (0.00)**	0.013 (0.00)**
Edible oil, Honey (γ_{4j})				0.471 (0.00)**	0.087 (0.00)**	-0.383 (0.00)**	-0.027 (0.00)**
Egg-fish-meat (γ_{5j})					-0.018 (0.00)**	-0.088 (0.00)**	-0.050 (0.00)**
Fruits & Veg. (γ_{6j})						0.355 (0.00)**	0.131 (0.00)**
Miscellaneous (γ_{7j})							0.032 (0.00)**
Log Food expenditure (β_i)	0.157 (0.00)**	-0.185 (0.00)**	0.062 (0.00)**	-0.368 (0.00)**	-0.094 (0.00)**	0.365 (0.00)**	0.063 (0.00)**
Log Food expenditure square (λ_i)	0.003 (0.00)**	-0.007 (0.00)**	0.001 (0.00)**	-0.013 (0.00)**	-0.002 (0.00)**	0.016 (0.00)**	0.001 (0.00)**
Household size (θ_i)	0.002 (0.00)**	0.000 (0.00)**	-0.001 (0.00)**	-0.002 (0.00)**	-0.002 (0.00)**	0.002 (0.00)**	0.001 (0.00)**

p values are in parenthesis. **, * is the significant at 1% and 10% levels, respectively.

^Coefficients of food prices.

i = 1(1)7 represents share equations in the demand system, j = 1(1)7 represents the number of food price variables in each equation.

+Miscellaneous goods include Sugar, Spices and Beverages

Table A.9: QUAIDS estimated parameters for Urban - 2004-05

Food Groups	Cereal & cereal subst. (γ_{i1})	Pulses (γ_{i2})	Milk (γ_{i3})	Edible oil, honey (γ_{i4})	Egg-fish-meat (γ_{i5})	Fruits & vegetable (γ_{i6})	Misc+ (γ_{i7})
Intercept (α_i)	0.370 (0.00)**	0.136 (0.00)**	1.550 (0.00)**	0.336 (0.00)**	-0.564 (0.00)**	-0.978 (0.00)**	0.150 (0.00)*
Coefficients for Food Prices (γ_{ij})^							
Cereal & cereal substitutes (γ_{1j})	0.946 (0.00)**	0.103 (0.00)**	-0.428 (0.00)**	-0.073 (0.00)**	0.385 (0.00)**	-0.885 (0.46)	-0.049 (0.00)**
Pulses (γ_{2j})		0.010 (0.00)**	-0.057 (0.00)**	-0.011 (0.00)**	0.063 (0.00)**	-0.108 (0.00)**	0.000 (0.99)
Milk (γ_{3j})			0.403 (0.00)**	0.082 (0.00)**	-0.268 (0.00)**	0.286 (0.00)**	-0.018 (0.01)**
Edible oil, Honey (γ_{4j})				0.022 (0.00)**	-0.066 (0.25)	0.052 (0.00)**	-0.006 (0.00)**
Egg-fish-meat (γ_{5j})					0.254 (0.00)**	-0.417 (0.00)**	0.050 (0.00)**
Fruits & Veg. (γ_{6j})						1.060 (0.57)	0.012 (0.19)
Miscellaneous (γ_{7j})							0.012 (0.00)**
Log Food expenditure (β_i)	-0.363 (0.00)**	-0.043 (0.00)**	0.229 (0.00)**	0.045 (0.00)**	-0.201 (0.00)**	0.341 (0.00)**	-0.008 (0.06)*
Log Food expenditure square (λ_i)	-0.038 (0.00)**	-0.005 (0.00)**	0.009 (0.00)**	0.002 (0.00)**	-0.014 (0.00)**	0.048 (0.00)**	-0.002 (0.00)**
Household size (θ_i)	0.000 (0.00)**	0.000 (0.00)**	0.001 (0.00)**	0.000 (0.00)**	-0.001 (0.00)**	-0.001 (0.00)**	0.000 (0.00)**

p values are in parenthesis. **, * is the significant at 1% and 10% levels, respectively.

^Coefficients of food prices.

i = 1(1)7 represents share equations in the demand system, j = 1(1)7 represents the number of food price variables in each equation.

+Miscellaneous goods include Sugar, Spices and Beverages

Table A.10: QUAIDS estimated parameters for Urban: 2009 -10

Food Groups	Cereal & cereal subst. (γ_{i1})	Pulses (γ_{i2})	Milk (γ_{i3})	Edible oil, honey (γ_{i4})	Egg-fish-meat (γ_{i5})	Fruits & vegetable (γ_{i6})	Misc+ (γ_{i7})
Intercept (α_i)	1.129 (0.00)**	0.432 (0.00)**	-0.103 (0.00)**	-1.105 (0.00)**	0.744 (0.00)**	0.092 (0.00)**	-0.189 (0.00)*
Coefficients for Food Prices (γ_{ij})^							
Cereal & cereal substitutes (γ_{1j})	0.265 (0.00)**	-0.019 (0.02)*	0.024 (0.00)**	0.092 (0.01)**	-0.296 (0.00)**	0.032 (0.00)**	-0.098 (0.00)**
Pulses (γ_{2j})		0.041 (0.00)**	-0.016 (0.00)**	-0.118 (0.00)**	0.175 (0.00)**	-0.047 (0.00)**	-0.016 (0.00)**
Milk (γ_{3j})			0.111 (0.00)**	0.123 (0.00)**	-0.272 (0.00)**	0.030 (0.00)**	0.000 (0.95)
Edible oil, Honey (γ_{4j})				1.211 (0.00)**	-1.501 (0.25)	0.150 (0.00)**	0.043 (0.14)*
Egg-fish-meat (γ_{5j})					2.074 (0.00)**	-0.168 (0.00)**	-0.012 (0.75)
Fruits & Veg.(γ_{6j})						0.003 (0.59)	0.001 (0.79)
Miscellaneous (γ_{7j})							0.082 (0.00)**
Log Food expenditure (β_i)	-0.075 (0.00)**	0.051 (0.00)**	-0.066 (0.00)**	-0.397 (0.00)**	0.534 (0.00)**	-0.049 (0.00)**	0.003 (0.79)
Log Food expenditure square (λ_i)	-0.014 (0.00)**	0.002 (0.01)**	-0.005 (0.00)**	-0.024 (0.00)**	0.044 (0.00)**	-0.005 (0.00)**	0.003 (0.00)**
Household size (θ_i)	0.000 (0.00)**	0.000 (0.00)**	0.000 (0.00)**	-0.001 (0.00)**	0.000 (0.00)**	0.000 (0.00)**	0.000 (0.18)**

p values are in parenthesis. **, * is the significant at 1% and 10% levels, respectively.

^Coefficients of food prices.

i = 1(1)7 represents share equations in the demand system, j = 1(1)7 represents the number of food price variables in each equation.

+Miscellaneous goods include Sugar, Spices and Beverages