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WELFARE IMPLICATIONS OF FISCAL REFORM: THE CASE OF FOOD SUBSIDIES IN INDIA

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1 QUESTIONS ADDRESSED

The main purpose of the proposed research is to investigate the effects of the food subsidy offered through the public distribution system (PDS) on childhood malnutrition in India. This has not been done before. It is of immediate policy interest both with respect to the unusually high incidence of malnutrition in India and with respect to the current re-shaping of the PDS. For this, we use a recent household survey that contains information on grain bought on the PDS and on the open market, anthropometric indicators for child health and a rich set of socioeconomic and demographic variables pertaining to rural households in India in the mid-1990s.

In the course of addressing the main question, our research will illuminate the following questions. *First*, there is the interesting and difficult question of estimating the counterfactual: Do users of the PDS buy more food than they would if they did not face

a subsidy? How much more? *Second* is the often neglected question of inequalities in the within-household distribution of food. This chapter investigates whether there are gender inequalities in the gains accruing to a household on account of a food subsidy. *Third*, there is the question of how health is produced and, in particular, what the contribution of food expenditure is.

2 MOTIVATION

There is a very high incidence of child malnutrition in India, estimated at 66 per cent in 1998 for children under five (World Bank 1998a) and, although this has been declining, the decline has not been as rapid as recent economic growth in India may lead us to expect. Malnutrition is an intrinsic component of well-being and an important index of human welfare, known to predispose a child towards morbidity and mortality (e.g. Gómez *et al.* 2000; Rice *et al.* 2000) and low levels of educational attainment (Glewwe and Jacoby 1995) and productivity (see Dasgupta 1993). In recognition of the importance of this indicator, the human poverty index introduced in the *Human Development Report* (UNDP 1997) includes the percentage of malnourished children under five. As a result, the regular ranking of countries in terms of human development now partly reflects the extent of child malnutrition. Malnutrition tends to be concentrated amongst the poor and the fact that it can impair productive activity and educational achievement creates a poverty trap that can perpetuate itself across generations An intriguing fact about malnutrition in India, though, is that it is not *limited* to the poor. Indeed, about 70 per cent of individuals are estimated to be malnourished in India as compared with the 30 per cent that have incomes below the

poverty line (e.g. Suryanarayana 2001; Swaminathan 2000).[1] We return to this issue below.

To the extent that malnutrition reflects inadequate access to food, a government-led food distribution programme like the PDS would appear to be an appropriate intervention. Until recently, it offered a universal entitlement to a food subsidy. The last decade has seen path-breaking changes in the system, which is now targeted at the poor. Some argue that it should be phased out as it is not only unaffordable but also inefficient, whilst others argue that it is crucial for food security in India. This chapter offers new insights relevant to this ongoing debate on the public distribution system. It also contributes to the literature on child health in India.

3 THE PUBLIC DISTRIBUTION SYSTEM IN INDIA

The rural Indian population spends about 64 per cent of its budget on food. Foodshare is an (inverse) indicator of welfare (e.g. Deaton 1997): it follows that food security should be a major focus of policies concerned with wellbeing in this society. In terms of both coverage and public expenditure, the most important instrument of the Indian state in the area of health and nutrition policy is the public distribution system (PDS). Of the 200 million tonnes of foodgrain produced in 1999-2000, about 29 million tonnes were procured by the government under the PDS, which now supports the largest network of 'fair-price shops' in the world (4.5 lakh outlets in 1999). These provide rice, wheat, sugar, edible oil, soft cake and kerosene oil at subsidized prices. The PDS is managed by state governments which, to varying degrees, also supply other commodities such as pulses, salt and coarse clothing. The central government determines the total

procurement of foodgrains and their allocation across states. The state government then determines the off-take, public distribution, the list of commodities provided, and retail prices (Bapna 1990). Food security falls under the Directive Principles of State Policy in India's federal structure. Locations of the fair-price shops through which the subsidized items are sold are determined by officials at the district level, taking account of village size and 'suitability' (Suryanarayana 1996). There is enormous variation in the density of fair-price shops as also in the regularity of supplies both across and within states.

The PDS has a long history. Quantity rationing of essential commodities was introduced in India in the inter-war period and the PDS took shape soon after the Bengal Famine in 1943. It evolved in the 1950s and 1960s as a mechanism for providing price support to producers at the same time as providing a food subsidy to consumers. This was a time when the country was threatened by national-level food shortages and there was rapid food price inflation, especially in urban areas. By the 1980s, India had generated a surplus of foodgrains and the incidence of poverty had declined progressively from about 50 per cent in the 1960s to about 30 per cent in the 1990s. As a result, the welfare component of the PDS gained strength in the 1980s, when it was considerably extended to rural areas and tribal blocks, with an explicit view to reaching areas of high poverty incidence.

The cost of the food subsidy in the central government budget is argued to have increased substantially since the mid-1980s. In 1993-94, it was 0.7 per cent of GDP. For comparison, it is interesting to note that public expenditures on health and education as a percentage of GDP and GNP, respectively were 0.7 per cent and 3.8 per cent in 1990-96 (World Bank 1998b). The increasing fiscal cost of the PDS has been reflected in higher procurement and issue prices of rice and wheat in the 1990s. With the

consequent shrinking of the difference between PDS and open market prices, consumers have begun to shift from the PDS to the open market. At the same time, farmers have been keen to supply grain to the Food Corporation of India (FCI),[2] given the generous minimum support price offered to producers. As a result, the FCI has bought more foodgrain than it can manage, resulting in a huge increase in the cost of holding buffer stocks (which is counted as part of the cost of the food subsidy).

In view of these developments and against a backdrop of currency devaluation and economic reform in the 1990s, the government sought to both contain fiscal pressure and mitigate adverse welfare consequences by better targeting of PDS supplies at the poor. Until 1992, there was universal entitlement to the PDS but it has since been restructured. In 1992, the subsidy on foodgrains was increased for people in tribal, drought-prone and desert areas (spread over 1775 blocks). This was called the Revamped PDS or RPDS. In 1997, it was replaced by the targeted PDS or the TPDS in which targeting was shifted from poor regions to poor households and the subsidy differential between the poor and the non-poor was widened. More specifically, 10 kilograms of foodgrain were available at a highly subsidized price per family per month for families below the poverty line. This tendency was pushed further in the year 2000, since when families below the poverty line are offered 20 kg per month at half the economic cost, while all other families are required to pay the economic cost (see GoI 2000). The subsidy to the poor is thus indexed to costs and those classified as non-poor now get no subsidy (unless they live in drought-prone areas, in which case they get the 50 per cent subsidy that the poor get) though they are served by fair-price shops, which can play a useful distributional function in areas where private shops have not emerged.

4 A PRELIMINARY ASSESSMENT OF THE DEBATE

It is not the main purpose of this chapter to assess the overall viability or relative effectiveness of the PDS. However, in order to motivate this chapter, we present in this section an overview of the debate that recent reforms (indicated in the preceding section) have generated. This will set the question we ask in a policy context.

Arguments against the PDS

Arguments in favour of a severe trimming down of the PDS are of *two sorts*, and it is important to distinguish between them. One is that it is too great a fiscal strain (e.g. Umali-Deininger and Deininger 2001; World Bank 1998b; Radhakrishna and Subbarao 1997). This argument often rests on indications of how the PDS is inefficiently run, which means that it imposes an *unjustifiable* fiscal strain (see Dev and Suryanarayana 1991; Swaminathan 2000). For example, there is evidence of leakages, with subsidized grain being diverted to the open market for profit. It has also been argued that meeting the cereal needs of the poor in India requires a budgetary commitment that is simply too large (Geetha and Suryanarayana 1993). These estimates deserve closer consideration, especially as other research has estimated that the cost of achieving calorie adequacy is a trivial fraction of the household budget (see Deaton and Subramaniam 1996). Also, such a claim needs to be investigated in relation to the entire programme of public spending. The discussion should clearly indicate whether the argument is about cutting the share of social spending or about allocating a given or greater share amongst alternative programmes. This is beyond the scope of the current chapter. Some discussion of alternative programmes is in Radhakrishna and Subbarao (1997) and

Chatterjee and Measham (1997), both World Bank publications.[3] There remains considerable scope for tightening the analysis.

The second argument adduced to support a narrowing of the scope of the PDS is that it is not progressive: it is argued to have failed in many states to provide nutritional support to the poor (see Umali-Deininger and Deininger 2001; World Bank 1998b; Radhakrishna and Subbarao 1997). Parikh (1994), for example, uses aggregative data to show that the participation rate in the PDS is similar across income groups. It has been argued that other schemes such as food-for-work programmes are more progressive because the non-poor will tend to select themselves out of participation in a programme that offers a low wage and requires work (e.g. World Bank 1998b). However, this argument seems flawed unless it can be shown that the PDS is non-progressive *after controlling for access*. Within regions, for a given level of access, we may expect that the non-poor will select themselves out of the scheme on account of the poor quality of grain that is supplied through it or else on account of having to queue for supplies. Suppose, however, that the location of fair-price shops or the delivery of regular supplies favours relatively rich regions, say, on account of political lobbying or because transport costs are lower (poorer regions tend to be more remote). Then, taking aggregate data and failing to control for programme access, the programme may appear to be non-progressive when in fact it is not. So access is key and analysis of micro-data, controlling for access, is warranted. The regional distribution of the PDS has, in fact, been very uneven, there being a greater density of fair-price shops in urban than in rural areas (e.g. Howes and Jha 1992) and, this aside, a much better developed distribution network in some states than in others (see Table 13.1).[4] As the states with a weak PDS are relatively poor states and as the poor are disproportionately located in rural areas,

access has disfavoured the poor.[5] In summary, if the programme is pro-poor conditional on access, then the role for policy is to expand access. This is distinct from searching for alternative pro-poor programmes on the grounds that the PDS is inherently unprogressive.

Arguments in favour of the PDS

Authors arguing in defence of the PDS see these changes of content and tone as indicators of the general weakening of welfare systems in the context of economic liberalization (e.g. Mooij 1994, Swaminathan 2000). They argue that the PDS is an important safety net for the poor, likely to be especially useful in the current context of deregulation and inflation. On this side of the debate it is useful to distinguish the following five arguments. First, even if entitlement were universal as was the case until 1992, some degree of progressivity is likely to have been introduced by (i) self-selection, as discussed above, and (ii) by virtue of the fact that the poor spend a larger fraction of their budget on food than the rich. Second, the (centralized) PDS plays a critical distributional function that ongoing reforms in India need to be careful to protect. The grain distributed under the PDS is regularly procured by the government from farmers at a supported price and a certain (large) fraction is held as a buffer stock. This is available to smooth supply and stabilize prices in response to fluctuations in production. For example, in 1979 and 1987, years of low production, PDS supplies were considerably higher than usual. In both these years, the government increased supply through employment programmes located in distressed areas (see Radhakrishna and Subbarao 1997). In the extreme, PDS reserves are available for the central government to react to regional crises created by drought or flood, for example (see Besley and Burgess 2001) for evidence that it does react in this way). A third problem with cutting

back the PDS or narrowing its reach to the income-poor is that of physical access to food. By virtue of building fair-price shops, the PDS has, at least in some states, significantly improved access in some of the more remote and economically underdeveloped regions where the market has yet to penetrate. Indeed, in the 1980s, the rural network of PDS supplies expanded considerably (be there much scope for improvement). As Sen (1981, for example) has emphasized, aggregate availability is not enough to avoid food deprivation when distribution is uneven. And distribution does not just involve purchasing power but also an effective delivery system (see Venugopal 1992).[6] These arguments militate against narrowing the scope of the PDS down to those classified as income poor. Fourth, universal access programs are often more viable on account of broader political support, and administratively easier to run. Fifth, the proportion of people below the poverty line is considerably smaller in India than the proportion malnourished. In 1999/2000, poverty incidence is estimated to have been 26 per cent (e.g. Sundaram 2001), while malnutrition is estimated to have been about 70 per cent around 1998 (World Bank 1998a). This is not implausible since the non-poor may, for example, be calorie-adequate but not able to afford a regular supply of essential micro-nutrients that is necessary to build disease resistance. In this context, it is relevant that the income distribution in India is highly skewed, with a large slice of society above the poverty line not very well off. In any case, it implies that a programme that offers food subsidies to a larger proportion of the population than that classified as income poor may be justified as addressing the problem of malnutrition. This particular link has not been established, and investigation of it is the objective of this chapter.

TABLE 13.1
PARTICIPATION IN PDS: BY STATE AND INCOME GROUP

	No. of households	% PDS users	% Subsidy	Poverty rank	% Poor
Andhra	2,100	64.0	13.0	15	21.9
Assam	1,233 (NE)*	21.6 (NE)*	4.3	5	41.1
Bihar	2,155	5.6	4.5	1	55.2
Gujarat	1,606	47.5	3.6	14	24.2
Haryana	1,722	9.4	2.7	12	25.2
Himachal	1,225	75.2		10	28.6
Karnataka	2,523	69.9	5.7	9	32.9
Kerala	1,474	76.1	9.5	13	25.1
Madhya	4,162	33.9	3.9	3	42.5
Maharashtra	2,765	2.3	7.6	6	36.8
Orissa	1,971	5.2	3.1	2	48.6
Punjab	1,303	6.4	2.0	16	11.5
Rajasthan	1,984	24.3	4.8	11	27.5
Tamil	1,456	81.0	6.2	8	35.4
Uttar	4,036	4.3	7.7	4	41.2
West Bengal	1,515	9.4	7.1	7	36.9
a	33,230	34.6	100	-	36.1

Sources: Columns 1 and 2: Human Development Report, India and author's own calculations based on NCAER (1994). Column 3: Performance Budgets of FCI (reported in Radhakrishna and Subbarao 1997: Table 3.4). Column 5 has the headcount index for rural and urban areas combined, from World Bank (1997: Annex 1, Table 1) and column 4 is based on column 5.

Overall, it is clear that, in the context of this debate over the whittling down of one of the oldest, most far-reaching food subsidy programmes in the world, it is important to see if the new methods and new data used in this study can throw any light on the actual effects of the PDS on child malnutrition and, thereby, contribute to reconsideration of its benefits.

5 PREVIOUS RESEARCH AND CONTRIBUTIONS OF THIS STUDY

5.1 On the Indian PDS

There is no existing research that attempts to analyse the impact of the Indian public distribution system on childhood malnutrition. Previous research on the PDS in India has been concerned with its inflationary consequences, its administration, and its correlation with poverty. Particular questions investigated include regional variation in the supply of foodgrains through the PDS (Tyagi 1990), urban bias (Howes and Jha 1992), targeting (Jha 1991; Dev and Suryanarayana 1992), and the growing cost of the food subsidy (e.g. World Bank 1998b).

The only studies that appear to investigate welfare effects of the PDS are Parikh (1994: described in section 5) and Radhakrishna and Subbarao (1997). Both studies use the 1986-87 national sample survey data which provide information on open market and PDS prices and expenditures for a range of commodities. These are microdata but both studies use these data aggregated up to deciles of monthly per capita expenditure. Parikh tabulates PDS use-rates by expenditure group and finds no evidence of progressivity. Radhakrishna and Subbarao (1997) compute the income gain for users of the PDS as the product of the quantity purchased from the PDS and the price differential between the open market and the PDS. They use income elasticities of calories estimated by decile in Radhakrishna and Ravi (1990) to translate the income gains into increases in calorie intake associated with the PDS. They report only small increases in calorie intake although, given that the poor have higher calorie-income elasticities, the gains are, on average, larger for the poor than the non-poor.

5.2 On childhood malnutrition

Research on malnutrition has advanced in the last decade, with the appearance of microdata for developing countries that contain information on relevant indicators, namely child height and weight (see Strauss and Thomas 1995 and 1998). Much of this research attempts to explain individual variation in heights and weights of children in terms of household and community-specific variables. There is no consensus on whether income or food expenditure improves health or not, contrary to the common presumption that they do (e.g., see Behrman and Deolalikar 1987). It is unclear to what extent this puzzling result refelects problems of model specification.

5.3 Contributions of this study

Although the question of whether the PDS is any good for the poor is at the very heart of fairly radical changes in progress in India today, the analyses done so far do not offer conclusive evidence on this question. Since questions of distribution are key to this debate, the use of regional aggregates in existing research is a limitation. This analysis attempts to contribute in the following ways. First, it uses a household survey, allowing for differences in household behaviour within regions (e.g., differences between rich and poor households). Second, it attempts to control for the possible endogeneity of programme placement. Third, it produces answers to new questions, specified so as to be useful in identifying where exactly policy action is needed (see section 1).

6 THE DATA AND DESCRIPTION

This study uses data collected in 1994 by the National Council of Applied Economic Research (NCAER) for 34,000 rural households. This survey formed the basis of the India Human Development Report (Shariff 1999). It asked respondents whether the household had bought any cereal on the PDS in the month before the survey. It then asked what quantities of a few basic foods were bought on the PDS and what problems, if any, households faced in using the PDS. It also offers detailed data on heights and weights of children under twelve, which permit construction of anthropometric measures of malnutrition. Other relevant variables in the data include household income, household demographics, parental characteristics and indicators of community infrastructure.

6.1 Participation in the PDS and childhood malnutrition incidence

Table 13.1 presents information on the percentage of (rural) households in the NCAER survey that report having bought some grain on the PDS. The average is only 35 per cent and there is considerable inter-state variation. It also reports the cost of the subsidy cost to the government by state, and shows that the state dispersion of participation rates is not closely related to poverty incidence. State-wise data on three anthropometric indicators of malnutrition are presented in Table 13.2 (definitions are in section 6.2). Using the commonly-used reference population of healthy children in the US, our data suggest that 63 per cent are stunted, 29 per cent have low weight for age and 10 per cent are wasted. As with PDS-usage, there is enormous inter-state variation. An interesting feature of these data for rural India is that they do not exhibit an income gradient.

TABLE 13.2
INCIDENCE OF MALNUTRITION BY STATE

State	Number of children	Wasting	Stunting	Low weight for age
Andhra	3,151	13.0	55.6	24.6
Bihar	4,780	8.1	68.7	30.8
Gujarat	2,766	13.0	69.2	39.3
Haryana	3,835	8.4	64.8	28.1
Himachal	2,056	4.4	66.3	20.6
Karnataka	4,553	12.2	73.4	29.3
Kerala	2,062	11.8	44.5	18.4
Maharashtra	4,858	10.9	56.7	31.6
Madhya	8,462	9.0	68.2	29.6
Orissa	3,534	8.5	48.1	21.6
Punjab	2,449	6.4	53.9	18.6
Rajasthan.	4,706	8.7	61.0	29.8
Tamil	1,999	7.1	58.6	26.3
Uttar	9,016	13.9	63.5	32.9
W. Bengal	3,050	11.1	62.7	33.9
N-East	2,575	6.8	71.9	25.5
All India	63,852	10.0	63.1	28.9

6.2 Anthropometric measures of malnutrition

This sub-section defines anthropometric measures and considers the advantages and disadvantages of using them relative to alternatives. Normalized body size has been shown to be a fairly robust indicator of nutritional status. The commonly used measures are height for age (stunting), weight for age (underweight) and weight for height (wasting). These are translated into z-scores by subtracting the median and dividing by the standard deviation derived from a reference population of a given age and sex. The convention is to use a reference population of healthy American children, which is the NCHS/WHO standard (this choice is discussed further below). Binary indicators of stunting, wasting and underweight are defined by setting to unity observations for which z-scores fall two standard deviations below the reference median. The choice amongst the three measures depends upon the time horizon of interest, the age of the target group

(height increases most rapidly for children under two), and the form of nutritional deficiency (calorie/micronutrient) that one is investigating. This choice can be crucial to the results of the analysis since the correlation amongst the measures is often low (see Micklewright and Ismail 2001). In this analysis, we therefore report results for both height-for-age which is a good measure of chronic malnutrition and weight-for-age which picks up shorter-term undernourishment. We briefly indicate results for weight-for-height but do not highlight these since previous research suggests that this measure is more suitable for adults than for children (Micklewright and Ismail 2001).

An advantage of anthropometrics over alternative measures of welfare (such as household income or expenditure) is that they refer to the individual rather than the household. This is especially relevant in the current context, where we would like to allow for gender differentials in child malnutrition. A second benefit is that they capture *net* nutritional status, whereas measures like income make no allowance for the fact that the efficiency with which the body converts food into nutrition varies across individuals. Third, as compared with the commonly used calorie measure of nutrition, anthropometrics allow for the nutritional contribution of protein and micronutrients and also for dietary differences across regions. A fourth advantage is that, in rural economies, accurate measurement of income is very problematic whereas weighing and taking the height of a child would appear to be relatively straightforward.

Against these advantages, a difficulty with anthropometrics is that they are subject to genetic and environmental influences. While averages for a population are relatively robust, analysis of individual heights and weights as attempted in this chapter should attempt to control for these influences.The survey data used here has information on community characteristics such as availability of safe water and presence of sanitation

schemes, on the structure and cleanliness of the house and on literacy and other skills of parents. These are expected to control for environmental influences. Unfortunately, they do not contain information on the heights and weights of parents, which may be used to control for genetic endowments (see Thomas *et al.* 1990, for example). In principle, we could control for these as household-level unobservables by using sibling fixed effects. This strategy would, however, be inappropriate in the current context because food expenditure, a household-level variable, would be wiped out in sibling-fixed-effects estimation. Instead, we control for ethnicity which, we expect, is likely to account for some part of the genetic variation in stature. A second potential problem with these data is that they display a non-monotonic relation with welfare. However, in our sample of rural Indian households, this concern is not substantially relevant, the problems of obesity tending to come into play at rather higher income levels than are observed here.

7 RESEARCH STRATEGY

The effect of the PDS food subsidy on childhood malnutrition is investigated by attempting to address the following three linked questions. To what extent does a reduction in the price of food (the subsidy) encourage households to spend more on food? For any given increase in food expenditure, do boys and girls in the households benefit equally? And, third, how large an impact does food have on child health? The analysis is first conducted on the entire sample of households and then on only the poorest 40 per cent.

7.1 Step 1—Does the food subsidy result in higher purchases of food?

The aim of the exercise is to estimate the increase in the quantity (and quality) of food consumed by households in rural India that is associated with the price subsidy. This question is not straightforward to answer because the data do not contain market and PDS prices and quantities. We therefore proceed as follows.

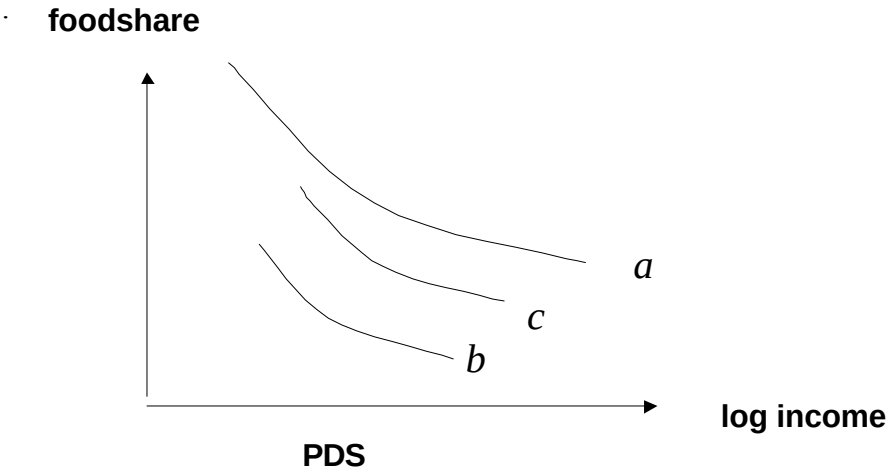
i) A food demand equation is estimated on the sample of households that do not use the PDS. If we control for selection into the programme (or programme placement), these estimates can be used to predict the food expenditure that PDS users would make if they did not have a subsidy. Let this be $\omega_{\text{no-subsidy}}$.

ii) Given that users do enjoy a subsidy (call this β), they can buy a food basket with the same quantities and composition of foods with an expenditure of $(1-\beta)\omega_{\text{no-subsidy}}$.

iii) We observe that they spend ω_{actual}.

iv) The difference between ω_{actual} and $(1-\beta)\omega_{\text{no-subsidy}}$ denotes the increase in quantity (or quality/mix) of food that they choose upon receiving the subsidy. (see Figure 13.1).

FIGURE 13.1
ENGEL CURVES: DO PDS USERS CONSUME MORE?



Curve ***a*** denotes estimates for the non-PDS sample Curves ***b*** and ***c*** refer to the PDS sample alone. Curve ***b*** lies below a by the (%) amount of the subsidy. Curve ***c*** plots the actual data for users.

The intention of the subsidy is to get people who cannot afford to meet food needs to be able to do so. If we find that lowering the price of food does not result in higher food purchases, then we may infer that the households being subsidized are not very poor, that is, they are not 'hungry' households.[7] In this case, food purchases under the PDS may simply be substituting for food purchases on the open market. Alternatively, the quality of food offered on the PDS may be so low as to discourage purchase, or access of the poor to the PDS may be very limited. Overall, the estimates obtained in step 1 indicate the impact of the PDS on food security.

Estimation issues

The equation modelling food demand is specified as a Working-Leser Engel curve:

$$\omega = F(y) + \alpha n + \Sigma_k \gamma_k(N_k/N) + \varphi^T z + \delta\lambda + \nu \qquad (1)$$

where ω is household foodshare (share of food expenditures in total expenditures), y is log household income, F is a quadratic function, n is log household size, N_{ki}/N_i are a vector of k variables reflecting the age-gender composition of the household, and z are other relevant controls. λ is the inverse Mills ratio, a correction factor for (village-level) PDS access. This is obtained from probit estimates of an auxiliary model that describes village-level access as a function of a set of instruments and all exogenous variables in equation (1). Equation (1) is estimated by OLS.

Controlling for access is important if the distribution of fair price shops and supplies under the PDS was systematically associated with endogenous characteristics (such as poverty and health). In this case, the foodshare equation is different in slope and intercept for users and non-users. Including a sample selection correction term in the equation for non-users allows consistent prediction of the demand behaviour of users (see Heckman 1974).[8]

The data do not provide information on which villages had regular PDS supplies. We therefore define access by creating a dummy variable which is zero if less than 5 per cent of the households in the village reported using the PDS and unity otherwise.[9] The identifying variables in the auxiliary equation are state dummies, district-level poverty and inequality rates and village size.[10] These are likely to have influenced access for the following reasons. The state dummies allow comprehensively for all relevant between-state differences. Within states, to the extent that poor districts are more remote, supplies to them may be thinner. On the other hand, poorer districts may have qualified for greater support and certainly did after 1992, so this effect could go either way. Inequality may influence the political economy of programme placement. Village size

appears to be an explicit criterion for allocation of PDS resources (Suryanarayana 1996).

State-specific estimates are also obtained for the four states at the two ends of the distribution of poverty and of PDS usage. These allow for the fact that access to the PDS subsidy differs widely across the Indian states, the state being a natural unit of disaggregation because state governments are responsible for conduct of the PDS. However, given the considerable within-state variation in PDS access, we prefer to concentrate here on the estimates that pool state data but control for village-level access.

7.2 Step 2—Allocation of food and the food subsidy within households

Food purchased by the household may be distributed unequally amongst its members. In particular, there is considerable evidence that women and girls are disadvantaged in India and that this disadvantage may stem from differential treatment within the household (e.g. Chen *et al.* 1981; Harriss 1990). If this is the case, then interventions aimed at providing food security may have to be re-designed to target individuals rather than households. For example, children could be offered free school meals.[11] In order to investigate any differences in food allocation as between boys and girls of similar ages, an Engel curve is estimated on the full sample, allowing interactions of every regressor with an indicator variable for PDS use (denoted I).

$$\omega_i = F(y_i) + \alpha n_i + \Sigma_k \gamma_k(N_{ki}/N_i) + z_i\varphi + \delta\lambda_i +$$

$$I*F_0(y_i) + \alpha_0 I*n_i + \Sigma_k \gamma_{k0} I*(N_{ki}/N_i) + (I*z_I)\varphi_0 + \delta_0 I*\lambda_i + \nu_I \qquad (2)$$

The notation in Eq. (2) is the same as that in Eq. (1). If the coefficient on the k^{th} variable is γ_k, then the change in foodshare upon replacing a person in the suppressed group (suppressed on account of collinearity) with a person from the kth group, holding constant total household size, is γ_k/N. Estimates of Eq. (2) can be used to compare the coefficients on proportions of girls and boys in the household (of specified age groups) for households that are and are not on the PDS (i.e. compare γ_k and γ_{k0} for boys and girls). Estimation is, as for (1), by OLS.

7.3 Step 3—Is food inadequacy an important determinant of child malnutrition?

In general, malnutrition indicators compound the effects of food quantity and quality, disease, and genetic endowments. An important empirical research question is, therefore, to estimate the size of the effect of food expenditure on nutritional status. This will complete the investigation of the effects of the PDS food subsidy on nutritional status. This is done by estimating the health production function:

$$\text{z-score}(X)_{ijks} = f(\ln \text{food}_{jks},\ C_{ijks}, H_{jks,} V_{ks}, Z_s, \varepsilon_{ijks}) \qquad (3)$$

where X is an anthropometric indicator for individual i in household j in village k in state s, C, H and V are child, household and village characteristics respectively, Z are state dummies and ε is a random term. The key variable of interest is household-level expenditure on food ($\ln \text{food}_{jks}$). We also investigate any additional effects of household income ($\ln \text{p.c.income}_{jks}$) which may arise, for example, by virtue of access to sanitation and medicines increasing in income. The data we use have the advantage of offering an unusually rich set of control variables. In addition to food expenditure and

income, a further variable denoting household resources that is investigated is the number of adults in the household.[12] Relevant child-specific characteristics include age, gender and birth-order, (and interactions thereof). We also include indicators of the child's health endowment (age of mother at childbirth) and of early feeding of the child (age till breastfeeding and age at which solid foods were introduced- although these are choice variables, they are predetermined). Household-level controls include indicators of mother's 'ability' (educational level, whether she reads the newspaper, and whether she has knowledge of diarrhoea treatments), father's ability (his education, whether he reads the newspaper), indicators of environmental factors that might determine vulnerability to disease at the household level (whether mother and father smoke, whether kitchen and toilet in the house are clean, whether house is pucca, i.e. of robust material), and also at the village level (indicators of sanitation and health schemes and of public goods including access to clinics), village-level demographics (age-gender composition of population including 'female status' measured as the ratio of women to men in the village), and a measure of genetic endowments that may influence stature (ethnic group).

Estimation issues

If households in which children are more prone to ill-health spend more on food then food expenditure is potentially endogenous in (3) and, if this problem is not addressed, its coefficient will tend to be biased downwards. It is therefore instrumented with predicted PDS access (obtained from the auxiliary equation described in section 7.1 above). When used as a regressor, income is instrumented by land owned, which is assumed to be exogenous to the model. Overidentifying restrictions associated with parents' education are investigated. Estimates of (3) are obtained by 2SLS.

Although anthropometric data are available for children under 12, we restrict the analysis in step 3 to children under 8, in view of WHO guidelines on the usefulness of anthropometric indicators by age. In order to allow for biological differences in the growth path by age and gender, a full set of dummies interacting age and gender of the index child is included amongst the regressors. I also estimate separate equations by gender as girls and boys may have different health production functions for biological reasons (see Duraisamy and Duraisamy 1995 for India and Hill and Upchurch 1995 for studies of gender differences in health functions in a number of developing countries).

Almost all previous studies of child health use the NCHS/WHO reference population which is of healthy children in the USA. If healthy Indian children are shorter or lighter for genetic/ethnic reasons then z-scores obtained by normalization on the parameters of a US population will tend to overestimate the incidence of malnutrition in India. However, in the current analysis, the question of which reference group is used is not such an issue. To see why, let us write the z-score for indicator X as $(X-\mu)/\sigma$, where μ and σ are the mean and standard deviation of the reference population. These parameters are constants for a given age and sex of the child. The z-score is the dependent variable in step 3. Rewriting the z-score as $(X/\sigma)-(\mu/\sigma)$, it is clear that (μ/σ) is a constant, the size of which is irrelevant once we have included a full set of age-gender dummies on the right hand side of the model. The term (X/σ) involves deflation of X by an age-gender-specific σ and now the population from which σ comes becomes relevant. However, if we are willing to assume that the standard deviation of the reference population actually used (the NCHS/WHO) is a constant multiple of the standard deviation of the true population (of healthy children) at every age and sex, then again the use of the NCHS/WHO standard becomes innocuous. A way of freeing the estimates entirely of any relation to the choice of standard would be to allow every

regressor to be interacted with age and sex dummies. We do not take this route as this level of generality seems unnecessary.

8. RESULTS

This section discusses the results in the three steps outlined in the methods section. Other interesting findings that emerge from the estimated equations are discussed in Bhalotra (2002). A full set of estimates is available from the author on request.

8.1 Does the PDS subsidy result in greater spending on food?

Estimates of the Engel curve for households that do not use the PDS (Equation 1) were obtained, taking into account differential access to the PDS. The instruments in the auxiliary model were jointly highly significant. Using the estimated coefficients and the characteristics of PDS-users, we obtain the mean predicted foodshare of PDS-users, as 50.9 per cent ($\omega_{no\text{-}subsidy}$). It turns out that this is not significantly different from the actual mean foodshare of this group, which is 50.5 per cent (ω_{actual}). Distinguishing the sample of households with incomes in the bottom 40 per cent of the distribution does not alter this result: their actual and their predicted foodshare is 67 per cent. Distinguishing cereals and pulses from other foods also does not alter this result. The actual budget share of cereals and pulses for PDS users is 39 per cent and the predicted share is 41 per cent.

In terms of Figure 13.1, this suggests that curves *a* and *c* happen to coincide. The additional expenditure on food associated with the subsidy is given by the vertical

distance between curves *b* and *c*. In this case, this is the distance between curves *b* and *a*, which is the unit subsidy, β (see section 7.1). So if PDS prices are 23 per cent lower than market prices, then our data indicate that PDS users buy 23 per cent more food. This is why their observed food expenditure (the product of a lower price and a higher quantity) is the same as the expenditure they would incur without a subsidy.[13] Thus, our estimates indicate that, on average, the subsidy translates entirely into more (or better) food. It is important to note that we can make this inference without knowing the true value of β.

It is difficult to determine the value of β because PDS prices vary by state and open market prices vary by centres within each state and the relevant data are not readily available for the country as a whole for every year. PDS and open market prices for the year 1986-87 are reported for rural and urban areas for every Indian state for rice and wheat separately in Radhakrishna and Subbarao (1997), based on NSS data. A simple average for all-India suggests β=0.23 or that the PDS price is 77 per cent of the open market price. The price ratios are reproduced in Table 13.3, where we also present predicted and actual foodshares of PDS users from our data. These predictions are from an equation in which data are pooled across the states. The purpose of Table 13.3 is not only to show the reader the level and variation of the PDS subsidy (β) across the Indian states but also to show that, at any given β, the extent to which the subsidy results in higher food expenditure varies across states.[14] Consider Andhra Pradesh, a southern rice-eating state. The foodshare predicted for users of the PDS in the absence of a subsidy is 60 per cent. Given that the cost of rice on the PDS is 64 per cent that on the open market, their foodshare with this subsidy would fall to 38 per cent (0.64*0.60). Since we observe that the actual foodshare of this group is 54 per cent, we can infer that

a unit subsidy of 26 per cent stimulates a 16 per cent point increase in food purchases.[15] Looking down the rows of Table 13.3, it is evident that in every state, PDS use is associated with a positive increase in food purchased.

TABLE 13.3
ACTUAL AND PREDICTED FOODSHARES BY STATE
AND PRICE SUBSIDY RATES ON RICE AND WHEAT

	Foodshares		Subsidy	
	Actual	Predicted	$(1-\beta)_{rice}$	$(1-\beta)_{wheat}$
Andhra	0.54	0.60	0.64	0.76
Assam	0.53	0.55	0.66	0.25
Bihar	0.35	0.47	0.83	0.78
Gujarat	0.55	0.62	0.60	0.71
Haryana	0.46	0.49	0.75	
Himachal	0.62	0.75		
J&Kashmir			0.77	0.95
Karnataka	0.54	0.65	0.60	0.64
Kerala	0.49	0.55	0.66	0.73
Madhya	0.48	0.52	0.77	0.97
Maharashtra	0.45	0.48	0.88	0.79
Orissa	0.54	0.59	0.89	0.97
Punjab	0.56	0.68		1.04
Rajasthan	0.54	0.68	0.66	0.80
Tamil Nadu	0.50	0.63	0.61	0.76
Uttar Pradesh	0.55	0.69	0.97	1.07
West Bengal	0.68	0.86	0.76	0.83
Simple average			0.74	0.80

Notes: Columns 1 and 2 are the actual and the predicted foodshares estimated by the author from the 1994 NCAER survey of rural households. These are predictions from a single equation that pools data across states. The figures in columns 3 and 4 are the ratios of the PDS price to the open market price for rural areas of each state in the year 1986-87. These are obtained from Radhakrishna and Subbarao (1997).

We also estimated state-specific equations for selected states, thus allowing complete heterogeneity in the parameters of the Engel curve by state. The actual and predicted shares were as follows: 26 per cent and 28 per cent in Kerala, 41 per cent and 42 per

cent in Andhra, 33 per cent and 38 per cent in Bihar and 42 per cent and 50 per cent in Uttar Pradesh. These shares are not very different.

8.2 Is the additional spending on food distributed equally amongst boys and girls?

Estimates of equation (2) are consistent with the view that boys and girls aged 0-12 have equal claims on food, irrespective of whether the household is on the PDS. Both boys and girls get a slightly larger share of food amongst households that use the PDS but the difference is not significant. Amongst 0-6 year olds, boys in PDS-using households claim a higher foodshare than girls but, again, the difference is not significant. These results are unchanged when the sample is restricted to the poorest 40 per cent of households.[16]

8.3 Do higher food expenditures at the household level improve child nutritional status?

This section reports estimates of equation (3). When the dependent variable is the child's height for age, then higher food expenditures are associated with significantly better child nutritional status, though the effect is not large. An increase in food expenditure of 23 per cent predicts an increase in child height of 0.09 standard deviations (at a given age and sex). When included in the model, the level of income is insignificant. This may be because ncome in rural households is volatile and prone to mis-measurement or because income that is not spent for food genuinely has no effect

on child health. There is no direct effect of gender on child height. The set of age and state dummies is highly significant.

When the full set of individual, household and community characteristics indicated in section 7.3 is included, food expenditure remains significant. Some of the control variables are interesting in themselves (see Bhalotra 2002). The same specification was estimated on a sample restricted to households in the bottom 40 per cent of the income distribution. The effect of food expenditures on health was still significant but smaller. This may reflect the fact that the translation of food consumption into child health depends upon complementary factors such as maternal ability, information, or hygienic living conditions, which are less available in poor households.[17] Although the gender dummy is insignificant in these models, gender may nevertheless have slope effects. This was investigated by separating the samples of boys and girls. There are some significant differences in slope. Food spending remains a significant determinant of height and the effect is (just) significantly higher for boys than for girls.

Estimates of the determinants of child weight-for-age reveal bigger gender differences. Food expenditures have a significant positive effect (even at given levels of income) for both boys and girls, the effect being somewhat larger and more robust for boys than for girls. Household income has no relation to girl weight but has a significant non-linear effect on boys' weight. At low-income levels, an increase in income generates a reduction in weight which may reflect a diversification in diet away from cereal alone. However, at higher levels of income, increments in income are associated with weight gains. This is a plausible pattern. It should be emphasized that our measure is of current rather than permanent income and that child weight is a current or short-term measure of nutritional status.

Child weight-for-height was also investigated, although the results are not reported in any detail as this is not such a meaningful measure for children. There are no significant gender differences here. Food expenditure takes a positive sign but the effect is not robust. Income is insignificant.

We also investigated including medical expenditure as a regressor. This has a significant but small positive effect on child height-for-age in the pooled sample. Separating genders reveals that the positive effect of household medical expenditures is significant (with a coefficient of 0.03) only for boys, being completely insignificant for girls. This is consistent with research on gender differentials in child welfare that argues that it is in health care and expenditure that parents exercise some relative neglect of girls (e.g. Basu 1989). In the weight-for-age equation, medical expenditures display a negative association with the weight of boys, which would appear to suggest reverse causality. There is no effect for girls. In the weight-for-height equation, medical expenditures are not significant for boys but are significant for girls once the full range of control variables is included in the model.

Our main conclusion here is that we find a significantly positive effect of food expenditure on height- and weight-for-age for both boys and girls under the age of eight. We have also reported finding generally insignificant effects of income and unstable effects of medical expenditures on child health, holding food expenditure constant.

9 CONCLUSIONS

This chapter illuminates two very different concerns of immediate relevance to policy reform in the context of human development in India by analysing the determinants of child malnutrition and by evaluating, in this context, the benefits of the food subsidy carried by the PDS. A striking result is that the entire food subsidy appears to be spent on increases in food quantity (or quality). We find no evidence of significant gender differences amongst children in the allocation of food or the food subsidy. Food expenditures have a significant impact on child health, whether measured as height- or weight-for-age. Given food expenditure, income has no significant effect. The impact of food expenditure on child health tends to be larger for boys than girls and larger amongst the non-poor than amongst the poor.

The results are linked as follows. If the average subsidy for the average household on the PDS is 23 per cent (which is what the data suggest), then our findings indicate that the PDS-using household buys 23 per cent more food (step 1). The additional expenditure on food translates, on average, into statistically significant increases of 0.09 standard deviations in height and 0.05 standard deviations in weight for boys, and into smaller increases for girls (step 3). Gender differences appear not in the allocation of food expenditure but in the conversion of this into health and also in the effects of other covariates on health (steps 2 and 3). Overall, we conclude that the PDS has a significantly positive effect on childhood nutritional status, although the size of this effect is small.

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NOTES

1 A likely explanation of this is that the poverty line is calorie-based and adequate nutrition requires more than calories. Since the relative prices of foods rich in proteins and in vitamins and minerals are relatively high, it may not be so surprising that a large fraction of households with incomes above the poverty line cannot afford to balance their diets.

2 The FCI is the central body responsible for procuring and distributing grain under the Public Distribution System.

3 Radhakrishna and Subbarao (1997) estimate the cost per unit of income or nutritional gain under the PDS and compare this with other anti-poverty programmes in India, concluding that the PDS is considerably less cost-effective than the JRY, MEDS or ICDS.

4 Diversity in the experience of states is valuable in illustrating the *potential* of the PDS. In Kerala, for example, delivery functions without too much malpractice and utilization is nearly universal.

5 In the sample of rural households analysed in this chapter, about 34 per cent of all households report buying grain on the PDS in the preceding month and this percentage is similar among the non-poor and the poor. Since access is regionally differentiated, it may be the case (for example) that most non-poor households have access and 66 per cent self-select themselves out of the scheme whereas only about 34 per cent of poor households have access and most of them use the PDS. No previous research has attempted to distinguish between self-selection and programme selection.

6 Previous research has established that the distribution of cereal consumption and calorie intake across the Indian states is not correlated with foodgrain production (*except in drought years)* but with the distribution of purchasing power and physical access to food (Suryanarayana 1996). This differs remarkably across states with Kerala having a very dense network of fair price shops in rural and urban regions and less well-governed states like Bihar having no shop in most villages.

7 To the extent that consumers buy a fraction of their grain on the PDS and the rest on the open market, the marginal price is the open market price and this is no different for users and non-users. In this case, any increase in food expenditure associated with PDS-use represents an income effect.

8 It may be useful to draw an analogy with the classical problem of estimating the effect of union-membership on wages. If one believes that there is simply an intercept effect then it is enough to include a union dummy in a pooled sample and to instrument it if it is thought that union membership is endogenous to wages. This would be equivalent in our context to estimating an Engel curve on the sample of all households with a dummy on the right hand side indicating whether the household reported using

the PDS or not. Returning to the union-wage case, if one believes that union membership influences not only the intercept but all slopes in the wage model, then a sample selection model is appropriate. In this case, the sample is split into union and non-union workers and a wage equation estimated for each. To allow for the fact that each sub-sample is non-random (or that union-membership is endogenous), an auxiliary model describing the determination of union status is estimated and an inverse mills ratio based on this is included in the wage model. The parallel with our context is clear: We prefer the more general assumption that the food demand equation for PDS users may have not only a different intercept but also different slopes than that for non-users. So we split the sample. If PDS-access is non-random (or if programme placement is endogenous) then we need an auxiliary model determining PDS access. Using this, we introduce a sample selection correction factor into the Engel equation for food.

9 We define this indicator variable in terms of reported access of less than 5 per cent to allow for measurement error and also to allow for the possibility that the village in question does have access in principle but that actual access is very difficult for most (95 per cent) of households. In principle, the dependent variable we have defined will pick up not only access (selection) but also self-selection. In practice, it is unlikely that to be the case that a village has good PDS facilities (access) but that less than 5 per cent of households choose to use it. It therefore seems reasonable to define access in this way.

10 Distance of the village to the nearest town, an indicator of remoteness of the village and transport costs associated with getting supplies there is a likely to be a good additional instrument but it is unavailable in the NCAER. Future work merging the NCAER and Census data holds the potential of exploiting this instrument as well as other useful information.

11 This raises the potential for parents to reduce food given to the child at home in the knowledge that the child has had a meal at school: a case of crowding-out of private by public expenditure. However, it is likely to be an improvement on a subsidy offered bluntly to the household.

12 The number of children is not included because fertility and child quality (including child health) are co-determined in a Beckerian framework.

13 There is not a lot of variation in quality in the food items available on the PDS. However the PDS user often buys some food on the PDS and some on the open market. The subsidy accruing to the user through purchases on the PDS may result, as we suggest in more food being bought, whether on the PDS or the open market. However, it is recognized that the additional expenditure on food could also involve changes in composition and quality (e.g. a higher ratio of protein to cereal). What is interesting from our perspective is that the extra spending is on food and not on clothes, ceremonies, or something else. We can safely conclude that the food subsidy does improve food security if this is understood to mean a greater realized demand for food quantity or quality, both of which may be expected to generate health improvements.

[14] In other words, curves *a* and *c* coincide for India as a whole but, for many states, the predicted food share deviates considerably from the actual foodshare.

[15] This analysis assumes that if a household reports buying any cereal on the PDS then it buys all its cereal on the PDS. Suppose that this is not true but that the household buys only a fraction p of its cereal on the PDS. Then β will be replaced by $p\beta$ in this discussion. The spirit of the argument is unchanged.

[16] It may be of interest to note that the Engel curve for the poor is downward sloping and concave to the origin while that for the whole sample is downward sloping and convex to the origin.

[17] A smaller marginal effect of food expenditure on child health amongst poor as opposed to non-poor households is unlikely to be explained by the lower nutritional quality of food purchased by the poor because quality should be reflected in prices and therefore in expenditures.

REFERENCES

Bapna, S. L. (1990). 'Food Security through the PDS: The Indian Experience', in D. S. Tyagi and V. S. Vyas (eds), *Increasing Access to Food: The Asian Experience*. New Delhi: Sage Publications.

Basu, A. M. (1989). 'Is Discrimination in Food Really Necessary for Explaining Sex Differentials in Childhood Mortality?' *Population Studies*, 43: 193-210.

Besley, T., and R. Burgess (2001). 'The Political Economy of Government Responsiveness: Theory and Evidence from India'. *Quarterly Journal of Economics* (forthcoming).

Behrman, J., and A. Deolalikar (1987).'Will Developing Country Nutrition Improve with Income? A Case Study for Rural South India. *Journal of Political Economy*, 95 (3): 492-507.

Behrman, J., and A. Deolalikar (1989). 'Is Variety the Spice of Life? Implications for Calorie Intake'. *The Review of Economics and Statistics*, 71 (4): 666-72.

Bhalotra, S. (2002), Welfare implications of fiscal reform: The case of food subsidies in India, Discussion Paper No. 2002/32, Helsinki: UNU/WIDER.

Bhalotra, S., and C. Attfield (1998). 'Intrahousehold Resource Allocation in Rural Pakistan: A Semiparametric Analysis. *Journal of Applied Econometrics*, 13 (5): Sept/Oct.

Chatterjee, M., and A. Measham (1997). 'Wasting Away: Malnutrition in India'. Washington, DC: World Bank.

Chen, L. C., E. Huq, and S. D'Souza (1981). 'Sex Bias in the Family Allocation of Food and Health Care in Rural Bangladesh'. *Population and Development Review*, 7 (1): 55-70.

Dasgupta, P. (1993). *An Inquiry into Well-Being and Destitution*. Oxford: Clarendon Press.

Deaton, A. (1997). 'The Analysis of Household Surveys: A Microeconometric Approach to Development Policy'. Washington, DC: World Bank.

Deaton, A., and S. Subramaniam (1996). 'The Demand for Food and Calories'. *The Journal of Political Economy*, 104 (1): 133-62.

Deaton, A., and C. Paxson (1998). 'Economies of Scale, Household Size, and the Demand for Food'. *The Journal of Political Economy*, 106 (5): 897-930.

Dev, M., and M. H. Suryanarayana (1991). 'Is PDS Urban-Biased and Pro-Rich? An Evaluation'. *Economic and Political Weekly*, 26 (41): 2207-13.

Duraisamy, P., and M. Duraisamy (1995). 'Determinants of Investment in Health of Boys and Girls: Evidence from Rural Households of Tamil Nadu, India'. *Indian Economic Review*, 30 (1): 51-68.

Geetha, S., and M. H. Suryanarayana (1993). 'Revamping PDS: Some Issues and Implications'. *Economic and Political Weekly*, 28 (41).

Glewwe, P., and H. Jacoby (1995). 'An Economic Analysis of Delayed Primary School Enrollment in a Low Income Country: The Role of Early Childhood Nutrition'. *The Review of Economics and Statistics*, 77 (1): 156-69.

Gómez, F., R. Ramos Galvan, S. Frenk, J. Cravioto Muñoz, R. Chávez, and J. Vázquez (2000). 'Mortality in Second and Third Degree Malnutrition'. *Bulletin of the World Health Organization***,** *The International Journal of Public Health*, 78 (10): 1275-80.

GoI (Government of India) (2000). 'Report of the Expenditure Reforms Commission'. Presented to the Government of India on 10 July 2000. Available on http:// expenditurereforms.nic.in/vsexpenditurereforms/foodsubsidy.

Harriss, B. (1990). 'The Intra-Family Distribution of Hunger in South Asia', in J. Dreze and A. K. Sen (eds), *The Political Economy of Hunger, Entitlement and Well-Being.* New York: Oxford University Press.

Heckman, J. (1974). 'Shadow Prices, Market Wages and Labour Supply. *Econometrica*, 42: 679-94.

Hill, K., and D. Upchurch (1995). 'Gender Differences in Child Health: Evidence from the Demographic and Health Surveys'. *Population an Development Review*, 21 (1): 127-51.

Howes, S., and S. Jha (1992). 'Urban Bias in the Public Distribution System'. . *Economic and Political Weekly*, 27 (9): May 9.

Jha, S. (1991). 'Consumer Subsidies in India: Is Targeting Effective?'. Bombay: IGIDR.

Micklewright, J., and S. Ismail (2001). 'What Can Child Anthropometry Reveal About Living Standards and Public Policy?: An Illustration from Central Asia'. *Review of Income and Wealth*, 47 (1): March.

Mooij, J. E. (1994). 'Public Distribution System as Safety Net: Who is Saved?'. *Economic and Political Weekly*, 29 (3): 119-26.

Parikh, K. (1994). 'Who Gets How Much from PDS: How Effectively Does It Reach the Poor?' *Sarvekshana*, 17 (3): January-March.

Radhakrishna, R., and C. Ravi (1990). 'Food Demand Projections for India'. Hyderabad: Centre for Economic and Social Studies. Mimeo.

Radhakrishna, R., and K. Subbarao with S. Indrakant and C. Ravi (1997). 'India's Public Distribution System: A National and International Perspective'. World Bank Discussion Paper No. 380. Washington, DC: World Bank.

Rice, A. L., L. Sacco, A. Hyder, and R. E. Black (2000). 'Malnutrition as an Underlying Cause of Childhood Deaths Associated with Infectious Diseases in Developing

Countries'. *Bulletin of the World Health Organization*, *The International Journal of Public Health*, 78 (10): 1207-21.

Sen, A. K. (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Oxford University Press.

Shariff, A. (1999). *India: Human Development Report*. Delhi: Oxford University Press.

Strauss, J., and D. Thomas (1995). 'Human Resources: Empirical Modeling of Household and Family Decisions', in T. N. Srinivasan and J. Behrman (eds), *Handbook of Development Economics*, vol. IIIA. North Holland.

Strauss, J., and D. Thomas (1998). 'Health, Nutrition, and Economic Development'. *Journal of Economic Literature*, 36 (2): 766-817.

Subbarao, K. *et al.* (1997). 'Safety Net Programs and Poverty Reduction'. Washington, DC: World Bank.

Sundaram, K. (2001). 'Employment-Unemployment Situation in the Nineties: Some Results from NSS 55th Round Survey'. *Economic and Political Weekly*, 36 (11): 931-40.

Suryanarayana, M. H. (1996). 'Food Security and Calorie Adequacy Across States: Implications for Reform'. *Journal of Indian School of Political Economy*, 8 (2): 203-65.

Suryanarayana, M. H. (2001). 'Poverty in India: Mis-Estimates and Mis-Sepecified Policies'. Mumbai: IGIDR. Mimeo.

Swaminathan, M. (2000). *Weakening Welfare: The Public Distribution of Food in India*. Delhi: LeftWord Books.

Thomas, D., J. Strauss, and M. H. Henriques (1990). 'Child Survival, Height-for-Age and Household Characteristics in Brazil'. *Journal of Development Economics*, 33 (2): 197-234.

Tyagi, D. S. (1990). *Managing India's Food Economy: Problems and Alternatives*. New Delhi: Sage Publications.

Umali-Deininger, D., and K. Deininger (2001). 'Towards Greater Food Security for India's Poor: Balancing Government Intervention and Private Competition', *Agricultural Economics* (forthcoming).

UNDP (1997). *Human Development Report*. New York: United Nations.

Venugopal, K. R. (1992). *Deliverance from Hunger: The Public Distribution System*. New Delhi: Sage Publications.

World Bank (1997). 'India: Achievements and Challenges in Reducing Poverty'. A World Bank Country Study. Washington, DC: World Bank.

World Bank (1998a). 'World Development Indicators'. Washington, DC: World Bank. CD-ROM.

World Bank (1998b) 'Reducing Poverty in India: Options for More Effective Public Services'. A World Bank Country Study. Washington, DC: World Bank.