The Cost of Relative Deprivation: Social Subsistence and Malnutrition in India*

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Abstract

To be acceptable in society, individuals consume a minimum level of socially valued goods. We call this minimum level social subsistence. In this article, we ask: are malnourished people ready to forgo calories in order to keep up with social subsistence? We consider social subsistence as being driven by the wealthier sections of society. In this case, it increases with relative deprivation, i.e. the aggregate income gap. We use a linear expenditure system to measure good-specific subsistence levels as functions of relative deprivation. Within this demand system, our theory provides guidance to empirically determine which goods are socially valued. The demand system is estimated over nineteen food and non-food categories of expenditure using five Indian National Sample Surveys covering 160,000 Below Poverty Line households. We find that (1) socially valued goods are non-food or less nutritive goods, and (2) the caloric loss due to relative deprivation amounts to 10 to 15 percent of the mean daily per capita calorie consumption. As a counterfactual, we estimate that the number of Below Poverty Line households under malnutrition would be ten percentage points lower in the absence of relative deprivation.

Keywords: consumer behavior, inequality, relative deprivation, malnutrition, poverty

JEL Classification: D01, D10, I30, Z10

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1 Introduction

Despite struggling to fulfill their basic needs, the poorest sections of society choose to spend a significant amount of their budget on socially rewarded goods (Banerjee and Duflo, 2007). The poor seek social inclusion at an elevated cost. Poverty measures have increasingly accommodated social needs by combining both absolute and relative components of poverty (Sen, 1983; Atkinson and Bourguignon, 2001; Ravallion and Chen, 2011). This article explores how social needs are determined, and how they weigh on nutrition spending.

We understand subsistence as not only physiological, but also social. If physiological subsistence is determined by the minimum necessary to survive, any individual, even the most deprived, also aspires to attain a social standard of decency. Social subsistence, however, is relative to each society. It is set by the positional consumption of the wealthier sections of society: the higher the gap between them and the poorest section, the more the latter feel relatively deprived. In response, the poor enter in an imitation race to keep up with the social standard of decency (Veblen, 1899; Baudrillard, 1970; Frank et al., 2005).

We take the Gini coefficient as our measure of relative deprivation, and explore how its spatial variation modifies the social subsistence level of deprived households for various consumption categories. Relative deprivation has been modeled as the sum of the income gaps between an individual and all people richer than her. Income giving command over commodities, this measure of relative deprivation gives a sense of the consumption units not reachable by the individual compared to the people ranked above. Yitzhaki (1979) and Hey and Lambert (1980) show a direct link between this individual measure and inequality: the Gini coefficient is equal to the aggregate relative deprivation level in a society.

We adopt a Stone-Geary representation of utility to account for the existence of minimum subsistence levels of consumption into the commodity space. In this family of demand systems, positive utility over consumed quantities is experienced once a minimum consumption level has been reached for each commodity. These demand systems thus allow the estimation of the subsistence quantity of each good in an intuitive and straightforward way, while taking into account price and income effects. We disaggregate the subsistence level of each commodity into a basic and a social component, the latter being a function of relative deprivation. This type of utility function leads to the linear expenditure system (LES) and generalizations of the LES relaxing the assumption of independent want across commodities.

We empirically determine which goods are more consumed by the poor when relative deprivation increases. First, we define socially superior goods as the goods whose social subsistence level increases with relative deprivation. The demand of each good does not depend only on its own subsistence level, but on the subsistence level of other goods as well. We thus define an aspirational good as a socially superior good whose demand increases with relative deprivation. If aspirational goods are non-caloric (e.g. clothing), and socially inferior goods are major sources of calories (e.g. cereals), then the poor incur a caloric cost to live up to the social standard.

We use five thick rounds of the Indian National Sample Surveys (NSS) for the estimation. The NSS contain information on household expenditure and consumed quantity for about two hundred items. The estimation is performed on these items gathered in nineteen categories, together accounting for more than 85% of the budget of below (absolute) poverty line households. We specifically restrict our analysis to below poverty line households for several reasons: first, they are highly budget constrained and, at the same time, the most relatively deprived as they are at the bottom of the income pyramid. Second, they constitute a wide share of the population (from 45% in the 1983 round to 27% in the 2005 round) for whom reaching adequate nutrition is not feasible.[1] Third, our analysis gains at being based on individuals with similar purchasing power, in order to consistently compare their choices with regard to variations in inequality within and across rounds.

We structurally estimate the parameters of the linear expenditure system over food and non-food categories of expenditure using the NSS rounds. First, we present the results of the estimation without disaggregating the subsistence level parameters. We use the iterative generalized nonlinear least square estimator for the estimation over the demand system. The subsistence levels are almost all positive, consistently with theoretical assumptions, and the group of cheap calories ranks highest as the level of subsistence expenditure. The total subsistence quantity for all food categories is 500 to 900 daily per capita calories, a range considered as the lower bound for metabolic survival in various works. These findings suggest that our estimated subsistence levels are consistent with expectations.

We then disaggregate the subsistence level and include the regional Gini coefficient in the estimation as a measure of relative deprivation. We find that relative deprivation increases subsistence expenditure in non-caloric or less caloric-intensive items (dairy products, spices, drinks, fuel and light, clothing), but decreases subsistence expenditure for caloric-intensive categories such as cereals and, interestingly, meat. The fact that meat is empirically found

[1]The official poverty line in India is absolute and is defined as the expenditure per capita above which the household can reach an adequate level of nutrition. It is very close to the $1 a day threshold at 2005 prices (Ravallion, 2010).

as a socially inferior good, and dairy product as a socially superior good, is consistent with Indian religious norms: meat is considered impure and confined to lower castes in India as a source of cheap calories, while dairy products are used in Hindu rituals and are the major source of animal product consumption. This difference is specific to the Indian context and provides empirical evidence that our framework accurately captures which goods are socially valued in each society. We also find that aspirational goods tend to be luxury goods (income elasticity higher than one), consistently with the findings of Heffetz (2011) on status goods. Our empirical findings suggest that status goods become more necessary (their income elasticity decreases) as inequality increases.

Our main result is the average caloric loss incurred by BPL households due to relative deprivation: we find that it amounts to between 200 and 250 daily calories per capita for a median Gini coefficient of 0.30, compared to calorie consumption in the absence of relative deprivation. This amount is substantial given the state of malnutrition of Below Poverty Line (BPL) households, and represents 10% to 15% of their mean daily per capita consumption.[2] The caloric loss is an aggregate result of the substitution across categories, and therefore takes into account all negative and positive social valuations across food categories. In the absence of relative deprivation, we estimate that the fraction of the BPL population under malnutrition would be ten percentage points lower.

We perform several robustness checks to test the consistency of our results: first, we estimate a non-linear preference demand system which is a generalization of the linear expenditure system integrating cross-price terms. We also estimate the system on Gini coefficients by village, on Muslims and Scheduled Caste Hindus separately, and on the full sample. These specifications do not qualitatively change our results. We interestingly find that meat is not socially superior for Muslims, who are not confronted to the taboo surrounding meat consumption. Second, we present non-parametric Engel curves to illustrate the fact that our data is consistent with the assumption of linear Engel curves in the Linear Expenditure System. Third, we use another common flexible functional form, the Almost Ideal Demand System (Deaton and Muellbauer, 1980), to introduce fixed effects and controls along with the Gini coefficient. This functional form confirms that households substitute non-caloric items to food when relative deprivation increases. Finally, we check if the poor in high inequality regions are relatively richer, and find no evidence of this correlation.

[2] The threshold for malnutrition which is officially used in India is 2100 daily per capita calories in urban areas, and 2400 in rural areas. More than 90% of BPL households are below these thresholds in our data. Their mean daily per capita consumption is about 1700 calories.

This article is related to the literature on relative comparisons and upward-looking preferences. After the seminal work of Veblen (1899) on these concepts, Duesenberry (1949) is the first to introduce the concept of relative income into a theoretical framework and estimate its impact on saving decisions. Several works provide empirical evidence of the effect of inequality on other variables such as saving decisions (Duesenberry, 1949; Bertrand and Morse, 2013), work hours (Bowles and Park, 2005), mortality (Deaton, 2001), happiness (Frank, 2005), expenditure cascade (Frank et al., 2005), and conspicuous behavior of underprivileged social groups (Bellet and Sihra, 2016). Relative comparison effects need not be detrimental to the individual. In Genicot and Ray (2014) the investment choice of the reference group defines one's own investment aspirations and decisions. Aspirations negatively affect the individual only if they are set on less productive goods, or decrease investment in necessary capacities such as adequate nutrition. In this article, we bring empirical evidence that relative deprivation affects consumption decisions by modifying the minimum standard for socially valued goods. We also identify that socially valued goods are less caloric-intensive, leading to a decrease in calorie consumption when inequality increases.

Another strand of the literature uses a signaling approach to rationalize the social use of consumption. Conspicuous behavior is modeled as a signal over one's status (Ireland, 1994), and a status good is defined as a good whose income elasticity is higher than one (Heffetz, 2011, 2012). The signaling aspect of consumption has been extended in an intertemporal setting with poverty trap by Moav and Neeman (2012), and applied to within-group inequality (Charles et al., 2009; Khamis et al., 2012). In this approach, the individual derives utility from her social status determined by her rank in society. This rank is observable through visible consumption, which is afforded in proportion of one's income. Thus, the incentive to consume conspicuously rises with income: a richer individual marginally spends a higher share on visible items in order to distinguish herself from the people ranked below. This mechanism well explains the positional behavior of wealthier individuals, but cannot account for the conspicuous behavior of the poor. We take a different and complementary approach by focusing on the behavior of the lowest sections of society.

Several works in consumer behavior introduced interdependent preferences, or peer effects, in demand systems (Pollak, 1976; Alessie and Kapteyn, 1991). Lewbel et al. (2016) take the approach of peer-determined social needs on Indian data and interestingly find that peer effects are less strong on the consumption of lower castes or less educated people. This interesting result brings additional evidence that individuals with a low social or economic status do not look up to their peers. We argue that they look up to higher sections of society, and complement this literature by focusing on vertical (upward-looking) comparison effects rather than horizontal ones.

A branch of the literature analyzes the determinants of demand for food, especially for people under malnutrition. Deaton and Subramanian (1996) show that households substitute expensive calories to cheap ones in India (substitution among cereals, from coarse cereals to rice and wheat), though they would benefit from better nutrition by reallocating their budget. Deaton and Drèze (2009) document that despite a spectacular economic growth, the last decades witnessed a decrease in calorie intake along with non-increasing real food expenditures for all income categories in India. Banerjee and Duflo (2007) give empirical evidence that the poor face a relatively significant amount of choice in the allocation of their budget, and decide not to spend it on food, though they report lacking an adequate amount of it. Atkin (2016) shows that people are ready to incur a loss of calories in order to preserve their cultural preferences, even under malnutrition. Our article brings empirical evidence that through consumption, people aspire to other goals than nutrition. We document relative deprivation as a major determinant of these aspirations.

The article is organized as follows: in section 2, we present a model of relative deprivation using the linear expenditure system. In section 3, we present the database and the construction of our variables for poverty, inequality and price indexes. In section 4 we fit the model on multiple goods and show the effect of relative deprivation on consumption choices. We compute an estimate of the caloric cost of inequality using the parameters of the model. Section 5 provides robustness checks to our results. Section 6 discusses the implications of these results for short and long-term poverty. Section 7 concludes.

2 A Model of Relative Deprivation

We first provide a formal definition of relative deprivation within a complete demand system, and derive conditions under which a good becomes aspirational. To estimate the influence of relative deprivation on subsistence consumption levels, we use the Stone-Geary linear expenditure system (LES). Generalized models of the LES family have been used to estimate habit formation and interdependent preferences in an intuitive and directly estimated way (Pollak, 1970, 1976; Lewbel et al., 2016). It can also be related to a family of relative deprivation models with comparison-concave utility, in which relative deprivation is understood as an imitative force (Clark and Oswald, 1998; Bowles and Park, 2005). Finally, it is the demand system used in Heffetz (2004) to underline the signaling component of consumption, another social aspect of consumption distinct from relative deprivation.[3]

2.1 Relative Deprivation and Income Inequality

Income captures the individual ability to consume commodities. Hence, assuming income of others is directly or indirectly observable through consumption choices, income inequality captures the extent to which households feel relatively deprived. The impact of deprivation resulting from not having X when others have it should be an increasing function of the number of persons in the reference group who have X. Yitzhaki (1979) and Hey and Lambert (1980) quantify this definition of relative deprivation constructing individual and aggregated indexes. The advantage of their approach is that the index accounts for the overall distribution of income in an area. The deprivation function $\rho_z(m)$ of a individual z with income m_z is defined as the sum of all the gaps in the set of better-off individuals $B_z(m)$ divided by the population n in her area:

$$\rho_z(m) = \sum_{y \in B_z(m)} \frac{(m_y - m_z)}{n} \quad \text{where } m_y > m_z \tag{1}$$

Assuming we have information about the distribution of income in a given location, we can construct individual deprivation indexes using Equation (1). This measure, however, would be highly correlated with individual income. Yitzhaki (1979) proves that aggregate deprivation, defined as the average value of all individual deprivation functions in an area, corresponds exactly to the absolute Gini coefficient, i.e. the Gini coefficient multiplied by the mean income in the area. Chakravarty (1997) and Clark and D'Ambrosio (2014) note that expressing $\rho_z(m)$ as a fraction of mean income is an appropriate normalization for the comparison of the same area at different points in time, or different areas. In that case, aggregate relative deprivation is simply captured by the Gini coefficient. We use the spatial variation in the Gini coefficient as a measure of aggregate relative deprivation in the empirical analysis.

2.2 The Consumer Problem

Following Stone (1954) and Geary (1950), we postulate that individuals maximize the convex combination of their fundamental utility $U(Q)$ from consuming a vector Q of quantities,

[3] Heffetz (2004) does not use the subsistence parameters in the empirical analysis, focusing on signaling which affects the curvature of the Engel curve.

in which they value a minimum compulsory quantity of each good i, denoted γ_i. The corresponding Linear Expenditure System (LES) is given by:

$$\begin{aligned} U(Q) = & \sum_i \beta_i \ln(q_i - \gamma_i) \\ s.t. & \sum_i p_i q_i = m, \quad \sum_i \beta_i = 1, \quad \beta_i > 0, \quad (q_i - \gamma_i) > 0 \end{aligned} \tag{2}$$

The term γ_i can be interpreted as a subsistence level above which the individual allocates her income m according to her taste parameters β_i's subject to the budget constraint $\sum_i p_i q_i = m$. The interpretation of the γ_i as subsistence quantities implies that they shall be strictly positive. We cannot infer preferences from individuals whose income is below the sum of subsistence expenditures (such individuals cannot live). The supernumerary income of each household is defined as $m - \sum_i \gamma_i p_i$.

To introduce subsistence as a function of relative deprivation, we linearly decompose the parameter of subsistence γ_i into different components which, for the sake of our analysis, we denote "basic" and "social" subsistence levels.[4] The basic subsistence level contains physiological subsistence and other factors influencing the level of each good deemed necessary by the household, and the social subsistence level is the level of each good necessary for social inclusion in her society. We can rewrite the necessary quantity of each good as a function of the basic and the social subsistence quantities. We consider the following model:

$$\gamma_i = \tau_i + \nu_i \rho \tag{3}$$

With τ_i the basic subsistence quantity and $\nu_i \rho$ the social subsistence quantity. ν_i is the good-specific Veblen coefficient which captures the extent to which the individual is influenced by the level of deprivation ρ in her consumption of good i. We assume ρ to be the same level of reference across goods. This can be understood as ρ representing aggregate relative deprivation in terms of income, but being expressed in the commodity space by positional consumption, thereby affecting differently the subsistence level of each good i. This assumption is a major difference from the models of external habit, which assume that the individual consumption of any good is a function of the consumption of others with usually the same strength of comparison across goods.[5] This alternative form does not consider the heterogeneity of the comparison effect across goods. Here, on the contrary, we mark the difference between goods having a social value (conspicuous, or aspirational in

[4] Pollak (1970, 1976) proceeds to a similar linear decomposition to introduce habit formation or demographic components in the LES.

[5] In our framework, this case would correspond to $\gamma_i = \tau_i + \nu \rho_i$.

nature) and socially inferior goods for the same level of deprivation. It is quite telling that Adam Smith chose a linen shirt or leather shoes as examples of necessary items for appearing in public without shame in his time (Smith, 1776), and not cereal or underwear.

By making the Veblen coefficient ν_i flexible across goods, we introduce a first empirically testable prediction to differentiate between the goods which are considered important for self-esteem in each society, and the inferior goods which are substituted away when the level of relative deprivation increases.

IMPLICATION 1: *A socially superior good is a good for which* $\nu_i > 0$*, and a socially inferior good is a good for which* $\nu_i \leq 0$*.*

PROOF: $\frac{\partial \gamma_i}{\partial \rho} = \nu_i$, so the sign of $\frac{\partial \gamma_i}{\partial \rho}$ is the sign of ν_i. If $\nu_i > 0$, the total subsistence level γ_i of good i increases with relative deprivation ρ, and inversely for $\nu_i \leq 0$.

Relative deprivation can therefore affect subsistence quantities in both directions: it increases subsistence quantities for conspicuous goods, but is neutral or decreases subsistence quantities for inferior goods. Here, the classification between conspicuous and inferior goods is a matter of social deprivation, not physiological.

Upward-looking preferences would translate into defining socially valued goods as goods relatively more consumed at the top of the income distribution. The empirical implication of such preferences is that socially valued goods are luxury goods (income elasticity higher than one), which signal status for richer individuals. This implication links our work to Heffetz (2011), who finds that conspicuous goods are luxury goods. An increase in relative deprivation would set a higher level of luxury goods as socially required, leading the poor to spend a higher income share on socially valued goods (e.g. clothing) and a lower income share on socially inferior goods (e.g. cereals).

Blundell and Ray (1982, 1984) show that the LES framework can be nested in a family of demand systems. These generalizations are all members of the Gorman Polar Form, and are generated by the following cost function $C(p,u)^\alpha$ with utility level u and price vector p:

$$C(p,u)^\alpha = a(p,\alpha) + b(p,\alpha)u, \quad (0 < \alpha \leq 1) \tag{4}$$

with $a(p,\alpha)$ and $b(p,\alpha)$ two price aggregators corresponding, respectively, to the cost of living and the relative price of high-income elastic goods. These two price aggregators are homogeneous of degree α in prices. In this article, we will restrict our attention on $\alpha = 1$.

The cost function of the LES corresponds to:

$$C(p,u) = \sum_i \gamma_i p_i + u\Pi_i p_i^{\beta_i} \tag{5}$$

With the following price aggregators:

$$\begin{aligned} a(p) &= \textstyle\sum_i \gamma_i p_i \\ b(p) &= \Pi_i p_i^{\beta_i} \qquad (\textstyle\sum_i \beta_i = 1) \end{aligned} \tag{6}$$

Blundell and Ray (1982, 1984) suggest a generalization of the LES that preserves linearity of the Engel curves (quasi-homothetic preferences) but allows to relax the assumption of linearly separated preferences. They refer to this system as the Non-Linear Preferences (NLP) system. The NLP system describes a flexible functional form for the expenditure function in the price space.

$$C(p,u)_{\text{NLP}} = \sum_i \sum_j \gamma_{ij}^* p_i^{1/2} p_j^{1/2} + u\Pi_i p_i^{\beta_i} \tag{7}$$

This demand system reduces to the LES with the additional assumption of $\gamma_{ij} = 0$ for all $i \neq j$. The utility level u has a lower bound at 0, at which the cost function is $C(p,u) = a(p)$. The price aggregator $a(p)$ is therefore equivalent to the minimum expenditure for the household to be alive, supernumerary expenditure giving her a strictly positive level of utility. This family of demand systems keeps the ease of interpretation of the cost of living as the sum of subsistence expenditure, which is the subsistence quantity multiplied by the price: $\sum_i \gamma_i p_i$ in the LES and $\sum_i \left[\sum_j \gamma_{ij}^* (\frac{p_j}{p_i})^{1/2}\right] p_i$ in the NLP.[6]

The empirical predictions regarding the effect of social subsistence on demand are similar in both frameworks. Though we derive most of our results from the LES, which is easily tractable, the assumption of linearly separated preferences will be tested in the empirical estimation using the NLP system.

[6] It is not the case of the Almost Ideal Demand System (Deaton and Muellbauer, 1980) (AIDS), a specific class of Price Independent Generalised Linear (PIGL) models widely used in empirical estimations of demand systems. The LES generalization allows us to have a direct estimation and intuitive interpretation of subsistence levels. The AIDS functional form will be nonetheless tested as a robustness check.

2.3 Demand System

Replacing γ_j by its expression in Equation (3), and using Shephard's Lemma, the price derivatives of the cost function in Equation (5) generate the following Hicksian demand functions for each good i:

$$\frac{\partial C(p,u)}{\partial p_i} = q_i(p,u) = \tau_i + \nu_i\rho + \frac{\beta_i}{p_i} u \Pi_i p_i^{\beta_i} \tag{8}$$

Assuming that the household spends her entire income by minimizing her expenditure, so that $C(p,u) = m$, we can rewrite Equation (4) to have an expression of the indirect utility level u:

$$u = \frac{C(p,u) - a(p)}{b(p)} = \frac{m - a(p)}{b(p)} \tag{9}$$

This expression shows in a more intuitive way why $a(p)$ is interpreted as subsistence expenditure, with $m - a(p)$ the supernumerary income indexed by the second price aggregator $b(p)$. Replacing u in the Hicksian demand functions (8), we obtain the Marshallian demand functions:

$$q_i(p,m) = \tau_i + \nu_i\rho + \frac{\beta_i}{p_i}(m - \sum_j (\tau_j + \nu_j\rho)p_j) \tag{10}$$

Or, re-expressed as expenditure functions which are more linear in the parameters:

$$x_i = q_i p_i = (\tau_i + \nu_i\rho)p_i + \beta_i(m - \sum_j (\tau_j + \nu_j\rho)p_j) \tag{11}$$

These demand functions produce locally linear Engel curves which shift according to the values of $\tau_i + \nu_i\rho$ for all goods. The strength of the Veblen coefficient in good i affects the consumption of all other goods through the substitution in subsistence quantities. The more socially valued good i is, the higher is the quantity q_i consumed. The more socially valued other goods are, the lower is the quantity q_i consumed. This result brings us to a second empirical predictions:

IMPLICATION 2: *The demand for good i increases with relative deprivation if and only if* $\nu_i p_i > \frac{\beta_i}{1-\beta_i}\sum_{j\neq i}\nu_j p_j$. *An aspirational good is a good satisfying this condition.*

PROOF: Differentiating Equation (10) with respect to the level of relative deprivation ρ, we obtain: $\frac{\partial q_i}{\partial \rho} = (1-\beta_i)\nu_i p_i - \beta_i \sum_{j\neq i} \nu_j p_j$. This expression is positive if and only if $\nu_i p_i > \frac{\beta_i}{1-\beta_i} \sum_{j\neq i} \nu_j p_j$.

Implication 2 helps us identify aspirational goods in the data: they are not only socially superior (Implication 1), but relatively more than the others. These are the goods which truly define the signs of social inclusion, and without which the poor would feel socially deprived. This implication is flexible and relative to the society or social group to which the test is applied, and brings different predictions that will be shown in the empirical section.

We derive the income elasticity ξ_i for each good i using the standard formula:

$$\xi_i = \frac{1}{1 + (\tau_i + \nu_i \rho)\frac{1}{\beta_i}\frac{p_i}{m} - \sum_j (\tau_j + \nu_j \rho)\frac{p_j}{m}} \tag{12}$$

IMPLICATION 3: *If a good is aspirational, its elasticity decreases with relative deprivation, i.e. it becomes relatively more necessary.*

PROOF: Differentiating Equation (12) with respect to the level of relative deprivation ρ, we obtain: $\frac{\partial \xi_i}{\partial \rho} = \frac{-\frac{1-\beta_i}{\beta_i}\nu_i \rho \frac{p_i}{m} + \sum_{j\neq i} \nu_j \rho \frac{p_j}{m}}{\left[1+(\tau_i+\nu_i\rho)\frac{1}{\beta_i}\frac{p_i}{m} - \sum_j (\tau_j+\nu_j\rho)\frac{p_j}{m}\right]^2}$. This expression is negative if and only if $\nu_i p_i > \frac{\beta_i}{1-\beta_i} \sum_{j\neq i} \nu_j p_j$, i.e. if good i is aspirational.

Implication 3 is a corollary to Implication 2, and clarifies why aspirational goods could become more necessary to the poor when relative deprivation increases. Also, compared to the homothetic Cobb-Douglas case ($\tau_i + \nu_i \rho = 0$) where the two commodities are normal goods ($\xi_i = 1, \ \forall i$), whether a commodity is a luxury ($\xi_i > 1$) or a necessity ($\xi_i < 1$) in the relative deprivation model depends on the size of its basic and social subsistence levels compared to other goods.

If preferences are upward-looking, we in fact expect that the same goods defined as conspicuous in Heffetz (2011), i.e. which signal status of wealthier individuals, would be aspirational for the poor. This expectation would translate into aspirational goods being goods whose income elasticity is higher than one (Heffetz, 2011) in the absence of relative deprivation. This intuition will also be underlined in the empirical section.

The demand system in the NLP case is developed in appendix A.1, and a two-goods case of the LES illustrates the main intuitions of the model in appendix A.2. This 2-

goods illustration in appendix shows the effect of the three related testable implications of our demand system with relative deprivation: (1) socially superior goods are goods whose subsistence level increases with relative deprivation, (2) relative deprivation biases demand towards aspirational goods, (3) the income elasticity of aspirational goods decreases with relative deprivation (they become more necessary).

3 Data and Stylized Facts

3.1 Databases

We use five thick rounds of the Indian National Sample Surveys (NSS) on Consumption and Expenditure (38th, 43rd, 50th, 55th and 61st), which correspond to two decades where India experimented drastic changes in its economy (1983 to 2005). These surveys are cross-sections containing very detailed consumer expenditure. They also provide detailed economic, demographic and social characteristics for households and individuals. They are representative at the regional level, which is formed of several districts and smaller than a State (88 regions for 29 States and 7 union territories). Regions have been constructed so as to gather territories sharing similar agro-climatic and population characteristics within each State. The NSS surveys also provide caloric equivalents for all food items, and survey weights which we use in all computations and estimations.

3.2 Poverty Measure

We focus on below poverty line (BPL) households for several reasons: first, our aim is to capture the effect of relative deprivation on vulnerable populations which are highly budget constrained. Second, we do not wish the results to be affected by the signaling purpose of consumption, and BPL households have few to no incentive to signal their income by this type of consumption compared to households in higher income categories. Additionally, more than 90% of them suffer from malnutrition while they need physical work capacity in their daily activities, so we could except them to value adequate nutrition. Finally, we wish to estimate the demand system on households with similar standards of living, both within and across rounds, so that we do not capture relative economic differences across regions rather than consumption choices.

To define our sample of below poverty line households, we use poverty line thresholds for all NSS thick rounds detailed in a recent report of the Government of India (Planning

Table 1: Descriptive statistics across NSS rounds, below poverty line households

	38th round	43rd round	50th round	55th round	61st round	Total
Population share (%)	45	39	36	26	27	35
Monthly Per Capita Expenditures (Rs 2005)	284	299	305	318	318	304.1
Household size (no)	8.1	8.0	7.6	8.3	7.9	8.1
Scheduled Caste (%)	20	21	25	25	26	23
Scheduled Tribe (%)	11	12	12	13	13	12
Hindu Other Caste (%)	52	50	47	43	43	47
Muslim (%)	14	15	16	18	18	16
Rural Sector (%)	78	77	77	77	76	77
Agricultural Labor Share (%)	60	58	57	57	53	57,3

Commission, 2014). This line corresponds to the money value needed to consume a sufficient amount of calories, proteins and fats based on Indian Council of Medical Research norms differentiated by age, gender and activity for all-India rural and urban areas within each Indian State. This absolute definition of poverty allows us to compare relatively similar households across States, sectors and waves in terms of standard of living. The poverty rate estimated went from 45% of the population in 1983 to 27% of the population in 2005, as shown in Table 1. The total number on which the estimation is performed is 160,093 BPL households. Poor households lying below the threshold are on average similar across waves in their main social and economic characteristics. Their mean total expenditure shows a very limited increase over time within the group of absolute poor households.

3.3 Measures of prices and quantities

The NSS rounds contain detailed expenditure on food, fuel and light, services, clothing and footwear, and durable goods. We have information on the quantities consumed for most food items, fuel and light, clothing and footwear. As it is crucial to consider prices in the consumption choices of the households, we restrict our analysis to those (nondurable) items for which we can compute unit values (expenditure divided by quantity). This restriction still gathers the large majority of expenditure for below poverty line households, comprising between 85% and 90% of their budget as shown in Table 2:

Table 2: Expenditure shares across NSS rounds (in %), BPL households

	38th round	43rd round	50th round	55th round	61st round	All rounds
Food expenditures	*72.4*	*71*	*69.2*	*67.2*	*62.2*	*68.4*
Cereals	42.2	36.6	33.8	33.4	26.9	34.6
Fruit and vegetables	6.2	7.1	8.2	8.4	9.2	7.8
Fat	4.6	5.5	5.1	4.5	5.7	5.1
Pulse	3.7	4.5	4.4	4.5	3.9	4.2
Dairy	3.9	5.0	5.8	4.7	5.2	4.9
Salt and spices	2.8	3.2	3.1	3.3	2.6	3.0
Sugar	2.4	2.6	3.0	2.3	2.5	2.6
Processed and drinks	2.5	3.0	3.3	3.0	3.1	3.0
Meat	2.5	2.9	2.9	3.1	2.9	2.9
Other expenditures	*27.6*	*29*	*30.8*	*32.8*	*37.8*	*31.6*
Clothing and footwear	7.7	7.8	8.7	7.5	8.4	8.0
Durables	3.1	3.5	4.3	4.6	4.8	4.0
Fuel	6.6	7.1	6.7	6.8	9.5	7.3
Intox	2.6	3.0	3.1	2.7	2.5	2.8
Other goods and services	7.6	8.0	7.6	11.2	12.6	9.4

The reason why durable goods are usually excluded in demand analysis is that the demand system is built on the allocation of total expenditure among goods in a single period, while it is necessary to model an explicit intertemporal dimension in order to accommodate the spending decision on savings or durable goods (Pollak and Wales, 1969, 1978). In this paper, we assume separability with nondurables and exclude the nondurables whose consumption may be influenced by the stock of durables (transporation and oil, for example, related to the number of vehicles).

To compute price indexes for different subgroups of expenditures, we obtain unit values by item following the methodology of Deaton and Tarozzi (2000). We systematically draw the quantity and unit value densities for each item in each round, and delete the few items which are not registered in all rounds or which have multimodal distributions (23 items). The dropped items should not affect the empirical analysis, as they represent a very small fraction of expenditure within each category (less than 1% of total expenditure). For several items, some quantities are recorded using a different measure across rounds: we harmonize these measure across all rounds whenever possible. We also harmonize the classification so as to have the same number of items in all rounds. Table 8 in appendix B summarizes the changes performed on the expenditure data.

Once we obtain unit values for each item by household, we compute the weighted median price by smallest geographical level: village-level if the item is consumed at that geographical unit.[7] The weight used to compute median prices is the household weight given in the NSS data. We use village median unit values rather than individual ones in order to avoid endogeneity issues arising from the simultaneous choice of the price and quantity for each household (Atkin, 2013).

We finally gather the 170 remaining items in twenty categories of expenditure. Figures 14 and 15 in appendix B summarize the kernel distributions of quantities and unit values across the four rounds for these twenty categories, showing that quantities are consistently similar across rounds and unit values increase over time.

Price indexes are constructed for the twenty categories of expenditure used in our empirical analysis and computed from the median village prices we obtain for each item. The price index P_v^i of a given category of expenditure i containing n_i commodities aggregated at regional level r is calculated using the following formula:

$$P_v^i = \sum_{j=1}^{n_i} w_{j,r}^i p_{j,v} \quad \text{s.t.} \quad \sum_{j=1}^{n_i} w_{j,r}^i = 1$$

where $p_{j,v}$ corresponds to the median unit value of commodity j in village v and $w_{j,r}^i$ corresponds to the mean budget share in category i of commodity j in region r. The weight on budget shares is at regional level in order to have a representative share of the preferences of consumers in a region given the prevalence of zero expenditure at household or village level.

4 Empirical Analysis

4.1 Estimation Procedure

The estimation method we use is the iterative generalized nonlinear least square estimation, a standard method for demand estimations (for instance, see Deaton (1986); Herrendorf et al. (2013)). The seemingly unrelated regression framework takes into account that error terms

[7] In case the item is not consumed in the smallest level of aggregation, we step one level higher by geography*sector until we obtain a unit value for the item

are correlated in a demand system, even when the endogenous variable of each equation is not an explanatory variable of the other ones. Under the assumption that the error terms are not correlated with the exogenous variables, the iterative feasible generalized nonlinear least square estimator is equivalent to maximum likelihood estimation (Greene, 2012). The expenditure shares summing to one, the error covariance matrix is singular unless we drop one of the demand equations. We choose to drop fuel in all estimations, but the estimation procedure is not sensitive to the equation we drop.

The linear expenditure system in its simplest form is parsimonious in the parameters to estimate $(2n-1)$. Several attempts have been made in the past to include other parameters in the subsistence quantities, such as habit formation or interdependent preferences (Pollak, 1970, 1976). Preferences are also determined by household-level factors such as household demographics, and could make the demand for each good vary in important ways. As in Pollak and Wales (1978), we assume that the total subsistence quantities γ_i depend linearly on such factors, and introduce them as such in the theoretical specification, adding n parameters to estimate for each additional factor.

The linear expenditure system makes the assumption of separability across commodities through its additive form, which implies independent wants across commodities. This feature is more reasonable when goods are aggregated in broad categories, as substitutes are very imperfect, so we would expect the model to perform better on aggregate groups of commodities (Pollak and Wales, 1969; Pollak, 1971; Deaton, 1975). We gather all items in nineteen categories as indicated by the National Sample Surveys: cereals, footwear, spices, etc. It is also unlikely that this assumption affects our estimates of social subsistence once we control for local own price variations. Nonetheless, we perform the NLP estimation to make sure that cross-price effects do not invalidate our results.

Second, the linear expenditure system exhibits linear Engel curves (constant marginal budget shares): the individual purchases necessary quantities of the goods and then divides his supernumerary income among the goods in fixed proportions. Linearity is in fact a good approximation of the Engel curves for below-poverty line households as shown by the non-parametric Engel curves drawn in section 5.6.

4.2 Empirical Results

4.2.1 Simple Demand System: γ_i

Using the linear expenditure system described in section 2.3, we structurally estimate monthly subsistence levels of consumption γ_i for nineteen categories of expenditure. For all food items, we convert quantities into thousands of calories to have the same quantity unit and ease the conversion into a caloric cost. The sample is restricted to below poverty line (BPL) households in the analytical results that follow.

The estimation method used is the iterative generalized nonlinear least square estimator, which takes into account the fact that the demand functions form a complete system (detailed in section 4.1). For each expenditure category i, we compute price indexes as described in section 3.3, following the method of Deaton and Tarozzi (2000).

We estimate the expenditure functions as in Equation (11). This specification gives us the following demand system to estimate on $n-1$ goods for household h in village v and cross-section y:

$$\begin{cases} x_{1h,v} = \beta_1 m_h + \gamma_1 p_{1,v} - \beta_1 \sum_i \gamma_i p_{i,v} \\ ... \\ x_{n-1h,v} = \beta_{n-1} m_h + \gamma_{n-1} p_{n-1,v} - \beta_{n-1} \sum_i \gamma_i p_{i,v} \end{cases} \tag{13}$$

With $\gamma_i = \gamma_{i,83} + b_{i,88} I_{88} + b_{i,93} I_{93} + b_{i,99} I_{99} + b_{i,04} I_{04}$ a vector constituted of an intercept and four round fixed effects (1983 is omitted). We add these good-specific NSS round fixed effects in the subsistence level to capture any round-specific variation.

The identification of the parameters come from the household-level income variation m_h and the village-good-level price variation $p_{i,v}$. As the sum of expenditure is equal to total expenditure m_h, we estimate $n-1$ equations which give us n parameters γ_i and $n-1$ parameters β_i (we drop fuel and light expenditure in all estimated systems – the estimation method is not sensitive to the dropped category). We then compute the parameter β_n using the constraint $\sum_i \beta_i = 1$, and the parameters $\gamma_{i,y} = \gamma_{i,83} + b_{i,y}$ for all rounds beside 1983.

We take into account the endogeneity of prices by using median village price indexes for all categories i instead of household unit values, following Atkin (2013).[8] Villages or urban units are small units in which all households are likely to buy goods at a single market, or consume home-produced goods priced at market level in the NSS data. The measure of

[8] Atkin (2013) notes that "median village prices are robust to outliers and are not contaminated by quality effects that typically overstate the price response."

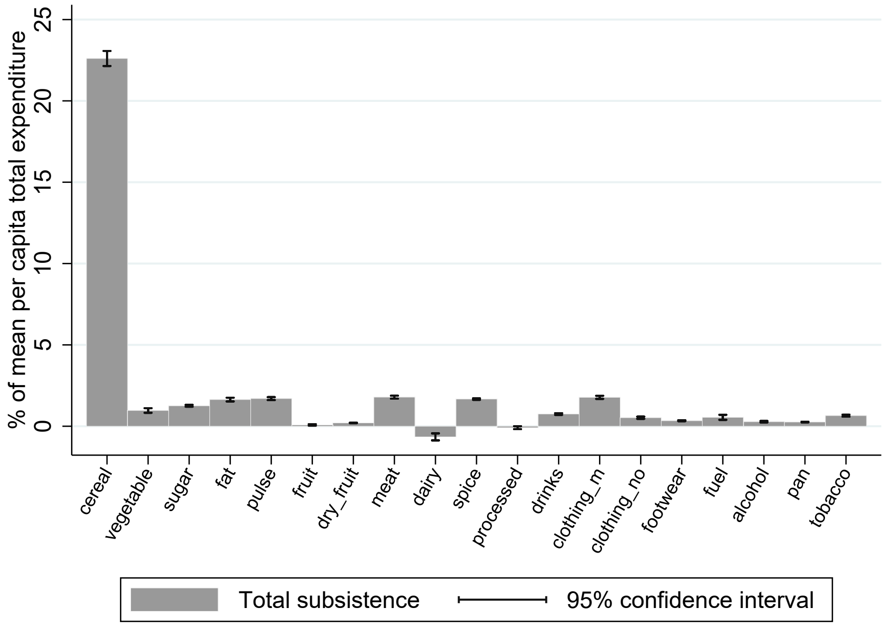


Figure 1: Total subsistence expenditure by broad categories (% of mean total per capita expenditures)

total expenditure used to estimate the demand functions is the per capita expenditure on the twenty categories.

The estimation results produce all β_i bounded between 0 and 1, and almost all γ_i positive, as can be seen in Table 9 of appendix C. The negative γ_is correspond to categories with low or zero expenditures and allow the system to be defined at zero. Each estimated subsistence quantity γ_i is then multiplied by average price and divided by the mean total per capita expenditure. These estimates give an intuitive interpretation of subsistence as a share of total expenditure. Results are presented in Figure 1 for Below Poverty Line (BPL) households.

In Figure 1, we can see that cereal is the first group of expenditure in terms of subsistence, representing more than 20% of the mean monthly total expenditure of BPL households. Then come other caloric items such as fat and pulse, meat, and non-caloric items such as clothing. Fuel and intoxicants have very low subsistence expenditure levels.

Figure 16 in appendix C shows the same results excluding cereal, where we see that other subsistence levels do not exceed 2% of mean monthly per capita expenditure. Figure 17 in appendix C disaggregates the results across rounds by broad categories. Subsistence levels are consistent across rounds, though they show an interesting pattern for cheap calories (cereals, pulses, fat and sugar) whose subsistence level decreased over time. This result

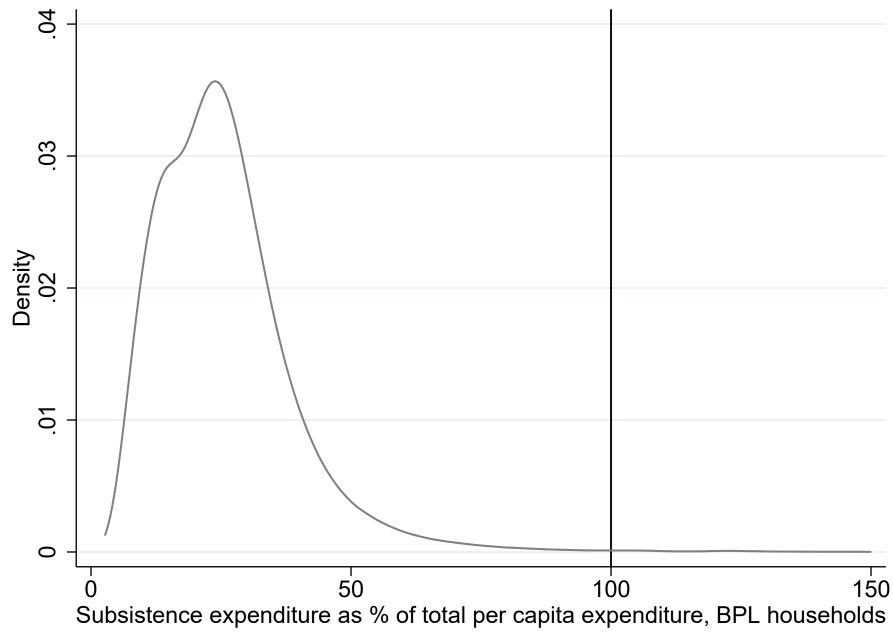


Figure 2: Subsistence Expenditure as Share of Total Expenditure subsistence

shows an interesting trend coherent with the hypothesis of Deaton and Drèze (2009) on the Indian calorie consumption puzzle: a better epidemiological environment and a decreased physical requirement in occupations may explain part of this trend.

To explore how subsistence expenditure weight in the per capita total expenditure of the poor, we draw subsistence expenditure as a percentage of total budget for our sample of all NSS rounds (Figure 2). The majority of our sample of BPL households is well above the subsistence expenditure level, with a peak at around 30% of the per capita budget. Though comprising a significant share of the budget of the poor, total subsistence expenditure can be afforded by most households in our sample.

As a further test on our measure of subsistence expenditure, we sum subsistence quantities for all food categories (γ_i by rounds in Table 9 of appendix C), multiply this sum by 1000 to obtain number of calories (recall that the quantity is expressed in thousands of calories) and divide by 30 to obtain the daily per capita subsistence level of calories. We obtain a subsistence level of between 500 (NSS 61st round) and 900 (NSS 38th round) per capita calories, which is usually considered as a lower bound for metabolic survival.[9] All these

[9]The National Institutes of Health's Medline Plus considers that a diet of 500 to 800 calories a day is close to starvation. Several clinical experiments involved diets at 500 to 800 calories a day (Bortz, 1969; Ball et al., 1970; Sandhofer et al., 1973; Willms et al., 1978).

findings are reassuring on the interpretation of these measures as "subsistence" expenditure.

4.2.2 Demand System with Relative Deprivation: $\gamma_i = \tau_i + \nu_i \rho$

We disaggregate the subsistence level into an intercept (basic subsistence) and the measure of aggregate relative deprivation ρ which is the Gini index, as derived in section 2.1. The Gini index of per capita expenditure in each NSS region provides a local variation in the level of social subsistence. We also add a dummy for urban households and the log of household size, allowing to take into account demographic effects commonly found in demand estimation. The expression of the subsistence parameter γ_i of Equation (13) in this specification is:

$$\gamma_i = \tau_{i,0} + \nu_i \text{Gini}_r + \tau_{i,1} U_h + \tau_{i,2} \ln(\text{size})_h + \gamma_{i,83} + \sum_{y \neq 83} b_{i,y} I_y \tag{14}$$

Social subsistence is good-specific, and is composed of the Veblen coefficient ν_i and the aggregate measure of relative deprivation Gini_r. This decomposition allows to test Implications 1, 2 and 3 presented in section 2. U is a dummy capturing whether the household lives in an urban area, and $ln(\text{size})$ is the log of the household size. The effect of each of these demographic variables is assumed to depend on each good i, and is captured respectively by parameters $\tau_{i,1}$ and $\tau_{i,2}$. The remaining parameter $\tau_{i,0}$ capture the residual component of subsistence quantities. The specification also contains good-specific year dummies to capture any trend specific to each survey.

Figure 3 presents the social subsistence levels obtained by Specification (14) for all goods as a percentage of total monthly per capita expenditure. To obtain subsistence expenditure, we multiply their Veblen coefficient nu_i by the mean regional Gini coefficient Gini_r and price index. We then divide by the mean monthly total per capita expenditure to have an intuitive estimate of its magnitude. Figure 18 in appendix C shows the same results for a specification without the demographic variables.

The sign of ν_i gives us information on socially inferior or socially superior goods (Implication 1). Here, consistently with our hypothesis, cereal is clearly an inferior good, i.e. whose subsistence level decreases with relative deprivation. More interestingly, meat is considered socially inferior as well. This result is a good test of our theoretical definition of inferior and superior goods: in India, meat is a cheap source of proteins as it is considered to make one impure – specifically beef and pork meat. It is therefore reserved to lower sections of the society such as Scheduled Castes, or other religions such as Muslims and Christians. The fact of not consuming meat is a sign of wealth and status, and one of the first practices to

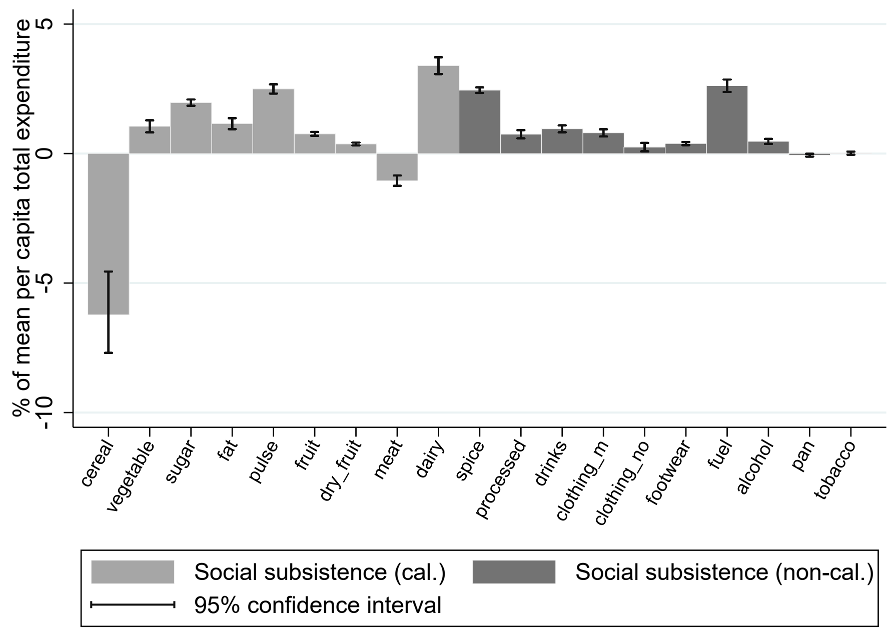


Figure 3: Social subsistence expenditure (% of total expenditure), BPL households

be given up in the process of mimicking higher status groups (sanskritization, as defined by Srinivas (1956)). If, in other societies, we would expect meat to be a superior good, it is revealing that the data show the contrary in the case of India. We expect the social standard of meat consumption to decrease with inequality.

The socially superior goods are food items associated with wealth and abundance (sugar, fat, drinks, processed food), vegetarianism norm (pulse, dairy products) and non-caloric visible items (clothing, footwear, fuel and light). Apart from alcohol, intoxicants do not respond much to relative deprivation. This result is another interesting outcome of our detection of superior goods, as the consumption of intoxicants has often been underlined as a sign of lack of self-control (temptation goods), and a threat to long-term investments such as nutrition or education. Intoxicants, aside from their addiction and temptation components, are also social goods. Here, additionally, the force of substitution between inferior and superior goods does not rely on them. These results show that, aside from temptation, the social constraint of the poor may also be a plausible explanation for their spending choices.

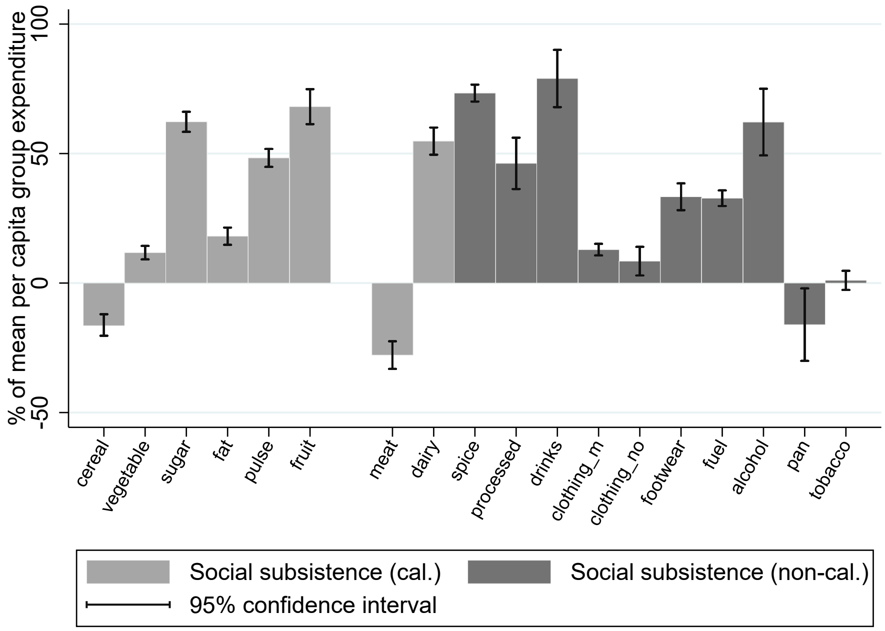


Figure 4: Social subsistence expenditure (% of good expenditure), BPL households

Figure 3 gives an intuition of these social subsistence levels as a percentage of monthly total budget. These goods, however, have different budget shares – cereals are much more largely consumed than meat, for example. To give an idea of how important social subsistence is within the good budget, we draw Figure 4 which shows social subsistence level of good i as a percentage of monthly per capita expenditure on good i. The category of dry fruits is excluded as it is an outlier (around 150% the mean category expenditure), likely due to the very small budget share spent on dry fruits by BPL households in our data.

The social subsistence level for cereal now appears to be a small fraction of cereal expenditure (15%). Cereals are the major source of calories for BPL households, so it is not surprising that these households cannot substantially decrease their consumption of cereals. We also see in Figure 4 that non-caloric superior goods (darker bars) have on average a social subsistence level comprising a higher share of the category budget than caloric superior goods. This is especially true for spices, drinks and alcohol. Social subsistence for meat, as expected by the social norm of vegetarianism, comprises a bigger share of the budget allocated to this category (around 28%) than cereals.

Implications 2 and 3 provide a definition of aspirational goods, i.e. socially superior goods whose demand increases (and income elasticity decreases) with relative deprivation. This definition does not depend solely on the social valuation of the good ν_i, but also on the social valuation of other goods and the relative budget share (section 2.3). We identify the goods qualified as aspirational in our sample by computing income elasticities in regions with different Gini coefficients (Gini of 0.2 in low inequality regions, and 0.4 in high inequality regions – the median Gini is 0.3), but using the same parameters, income and price levels.

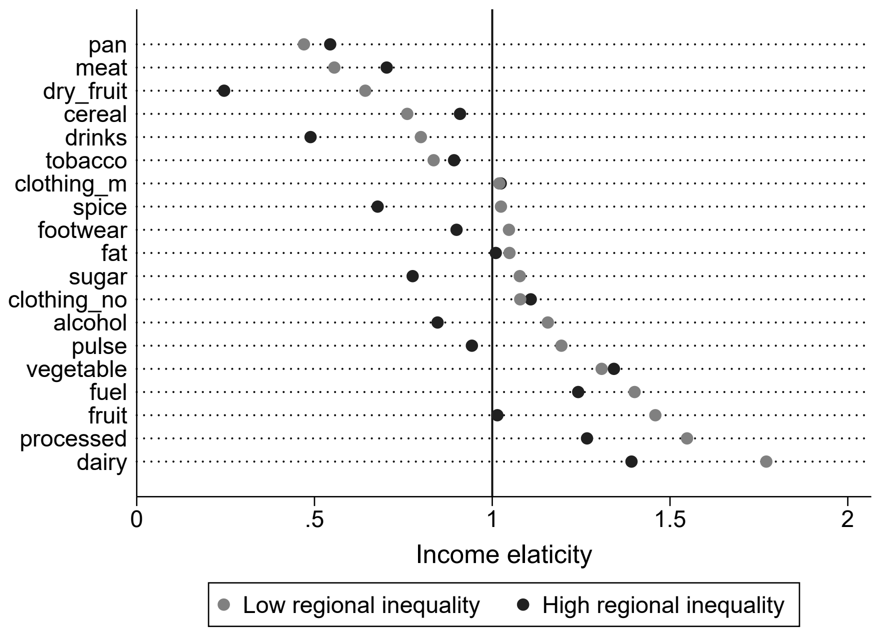


Figure 5: Estimated income elasticities in low vs. high Gini regions, all rounds

Figure 5 shows the income elasticities for each good in low (light) and high (dark) inequality regions. We find results close to the ones given by the Gini coefficients nu_i: cereal and meat are non aspirational goods, as well as most intoxicants (pan, tobacco) and slightly vegetable. On the contrary, goods identified as highly socially superior (sugar, spice, drinks, processed food, dairy, footwear, fuel and light) are clearly aspirational as well. Alcohol seems to be aspirational too. When relative deprivation increases, socially superior goods tend to become more necessary to the poor.

An additional hypothesis, linked to the work of Heffetz (2011) on income elasticities, is that goods which signal status for the wealthier sections of society are goods which are aspirational for the poor. Heffetz (2011) defines signaling goods as luxury goods, i.e. whose income elasticity is higher than one. Indeed, richer individuals allocate a higher share of their budget on such goods to signal their position in society. In a high inequality region, the top income households are wealthier and thus spend more on such goods. In the case where the social standard of consumption is determined by relative deprivation, we would expect that goods classified as luxuries are aspirational, and thus tend to become more necessary in high inequality regions.

We see that this is the case in our data: in high inequality regions, luxuries are more necessary to the poor than in low inequality regions (Figure 5). Some aspirational goods even reverse, from an income elasticity higher than one in low inequality regions to an income elasticity lower in high inequality regions (spice, footwear, sugar, pulse). Non-aspirational goods, on the contrary, have an income elasticity which is almost always below 1. These results provide an interesting interpretation on social valuation of goods, and hopefully would lead to additional work on the social determinant of consumption over the entire income scale.

4.3 Caloric Cost of Relative Deprivation

The Indian poverty line is computed such that the households living below cannot afford a basket of goods which provides adequate nutrition.As shown by Table 3, more than 90% of the population living below poverty line is under malnutrition. This fraction does not seem to reduce with time, consistently with the caloric consumption puzzle underlined by Deaton and Drèze (2009) using the same data. BPL households in India would all benefit from a higher calorie consumption. The constraint of social inclusion weights even more heavily on these households when it does not require the same types of goods than the ones which could better their nutrition state.

	1983	1988-89	1993-94	1999-00	2004-05	Total
Fraction under malnutrition	0.90	0.90	0.93	0.95	0.97	0.93
Mean daily per capita calories	1727.31	1742.97	1700.72	1661.93	1623.22	1685.47

Malnutrition is measured as total daily calories per capita below 2100 (urban) or 2400 (rural). Total calories are computed by multiplying each reported quantity by a nutrient equivalent given by the NSS databases.

Table 3: Malnutrition among below poverty line households (NSS Data)

To have an order of magnitude of the cost of relative deprivation, we quantify the average loss in consumed calories driven by inequality. From Equation (10), we compute the difference in quantity driven by relative deprivation for each good. We think ot this difference as the gap between an individual who does not suffer from relative deprivation or, alternatively, lives in a society where the capability to appear in public without shame is not translated in the commodity space. Intuitively, it is proportional to the gap between two Engel curves with and without relative deprivation, as depicted in Figure **??**. We can write this gap as the difference between the demand functions with and without relative deprivation. For each good j, it is given by the expression:

$$\begin{aligned} \Delta_i &= (\beta_i \tfrac{m}{p_i} + \tau_i + \nu_i \rho - \tfrac{\beta_i}{p_i} \textstyle\sum_i (\tau_i + \nu_i \rho) p_i) - (\beta_i \tfrac{m}{p_i} + \tau_i - \tfrac{\beta_i}{p_i} \textstyle\sum_i \tau_i p_i) \\ &= \nu_i \rho - \tfrac{\beta_i}{p_i} \textstyle\sum_i \nu_i \rho p_i \end{aligned} \tag{15}$$

Section 4.2 provides the parameters β_i and ν_j for all goods in the relative deprivation specification. We use the parameters estimated in the model with demographic controls, but results are extremely similar without them. We use the variables computed at regional level: ρ is the per capita expenditure gini by region used in the estimation, and the price index p_i is taken at region level. We compute Δ_i for each good i using these parameters and variables.

In all estimations, quantities have been converted in thousands of calories using the nutrient equivalent for each food item available within the National Sample Surveys. This nutrient equivalent provides the caloric content of all specific items, including drinks, spices, pan or alcohol. The total caloric cost κ_{calorie} is the sum of these calorie differences Δ_i for all good i:

$$\kappa_{\text{calorie}} = \sum_i \Delta_i \tag{16}$$

The measure of calorie consumption affected by relative deprivation is not a cost by construction, as it takes into account the social valuation of all caloric items. If caloric items were mostly socially valued, our measure would provide a caloric benefit to relative deprivation. Even though this result would be counter-intuitive, it underlines the flexibility of our framework to account for all aspects of social valuation, letting the empirical analysis determine how each good is affected by relative deprivation.

As our estimation is based on monthly per capita consumption, we divide κ_{calorie} by 30 in order to obtain the average daily per capita caloric loss estimated by our model of relative deprivation. Figure 6 shows the calories forgone by below poverty line households in each round when introducing inequality in consumer demand. The caloric loss goes from about 100 to 200 daily calories per capita for a regional Gini of 0.2 to 200 to 350 for a regional Gini of 0.4, which is a substantial amount for malnourished people. Additionally, the caloric cost has increased over time, consistent with the Indian caloric consumption puzzle underlined by Deaton and Drèze (2009).

We can also obtain an estimate of the fraction of households whose per capita daily

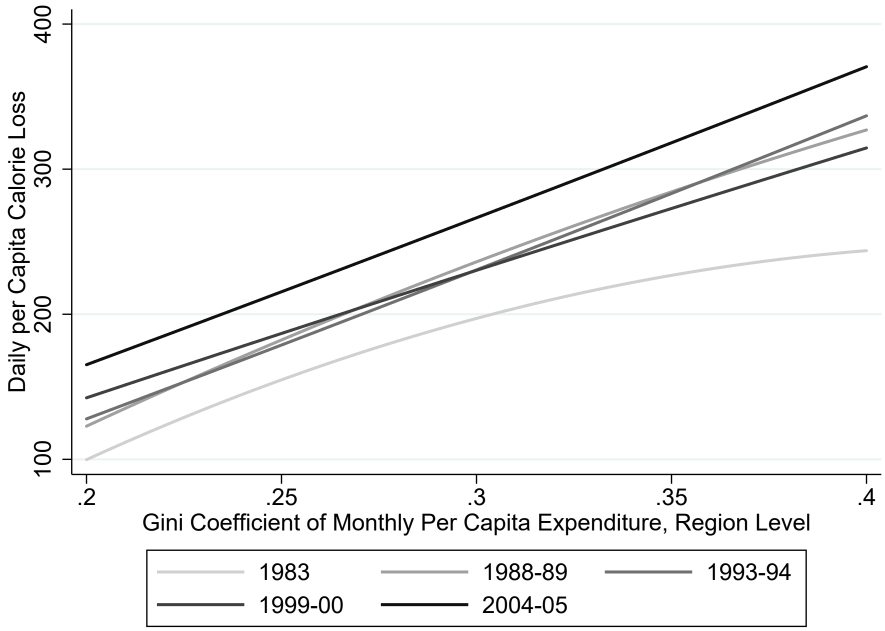


Figure 6: Calories Forgone in Function of Regional Inequality, BPL households

	1983	1988-89	1993-94	1999-00	2004-05	Total
Fraction under malnutrition	0.90	0.90	0.93	0.95	0.97	0.93
Fraction under malnutrition w/o rel. depriv.	0.82	0.79	0.84	0.89	0.88	0.84
Mean daily per capita calories	1726.92	1742.58	1700.73	1661.94	1623.29	1685.28
Mean daily per capita calories w/o rel. depriv.	1905.32	1968.28	1915.43	1859.83	1897.62	1907.93

Table 4: Estimated malnutrition among below poverty line households without relative deprivation (NSS Data)

caloric consumption would be above the malnutrition thresholds in the absence of relative deprivation. We add the estimated caloric loss to total calorie consumption for each region within each round, and find that malnutrition would be reduced by around 10 percentage points in the absence of relative deprivation (Table 4). The mean daily per capita calories consumed would also be much closer to the malnutrition threshold.

The estimated caloric loss is an important indicator that relative deprivation is not neutral to the way consumers allocate their budget. We interpret these results as a strong clue that it is more expensive for households to reach adequate nutrition in places where relative deprivation is higher.

5 Robustness Checks

5.1 Non-Linear Preferences

The non-linear preferences demand system is a generalization of the LES relaxing the assumption of independent wants across commodities. It therefore contains all cross-price terms for each demand equation (see section 2.2). We estimate the NLP demand system with expenditure on each good i being defined as Equation (21) (appendix A.1). We use the same database and methodology as for the LES estimation.

Figure 19 in appendix C presents the social subsistence levels of the NLP estimation compared to the LES estimation. It is remarkable that for most goods, the estimates are not significantly different. Also, the sign of the Veblen coefficient, giving us information on the social valuation of the goods, is the same except for fat.

If the addition of cross-price terms, allowing for substitution between goods, may affect the basic subsistence level for own good τ_{ii}, it is unlikely to affect directly the social component of consumption. Indeed, the valuation of each good is not linked to the economic environment. Theoretical works have underlined that inequality could affect relative prices if necessary and luxury goods share the same input of production (Dasgupta and Ray, 1986; Baland and Ray, 1991). In our demand system, the local price variation fully accounts for this effect. We find that social subsistence is mostly not affected by these patterns.

5.2 Village versus Regional Gini

When considering relative deprivation, we may wonder what the adequate geographical level of analysis is. Does relative deprivation decrease or increase with the geographical unit we take? Bowles and Park (2005) suggest two characteristics of Veblen externalities: first, they are typically asymmetrical, i.e. they cascade downwards: the poor look up to the rich. This is consistent with the assumption of a relative deprivation model, in which inequality affects consumption aspirations and the social standard of decency. Second, the influence of the reference group may be substantially independent of its size. Even though our measure of relative deprivation captures an aggregate level of inequality, there could be more weight at the top of the distribution. The level at which individuals compare their income and feel relatively deprived may be much larger than their own street or city, due to the trickle down effects (a small group at the top influences by cascade all sections of income). These characteristics suggest that a wider area, such as the NSS regions, could measure more accurately the real sense of social deprivation and its impact on consumption.

Another consideration could argue in favor of a stronger effect at the regional rather than town level: upward-looking preferences may have stronger effects on the consumption of aspirational goods when these are the only status symbols that people observe from the rich. Typically, wealthy elites of one's region are publicly seen only through local medias or days of festival, and their consumption practices trickle down the entire income range to reach the poorest sections. On the contrary, positive aspirations, as theoretically modeled by Genicot and Ray (2014), are long-term monetary investments or investments in human capital visible which may be visible only to one's neighbors. The choice of the wealthier households in terms of education would then not be observed by poor households. The social standard for aspirational goods may therefore be set at a much higher income rank than the one for education.

We therefore could expect that a smaller level of aggregation, such as the smallest sample unit containing ten households in our data (a village, or an urban block), may have a lesser effect on social subsistence. We perform the same estimation of the disaggregated subsistence level (Specification (14)), but using the Gini coefficient at village level. Figure 20 of appendix 4 shows the difference between social subsistence levels as captured by a regional and village variation of the Gini coefficient. We find that the village Gini indeed lowers the effect of relative deprivation on consumption choices, though the results are maintained in terms of the sign and relative magnitude of the effect. This finding suggests that the area that matters for setting the social standard of consumption is larger than one's village or town.

5.3 Scheduled Caste versus Muslim Social Subsistence

Our specification can also be used to test if it predicts with accuracy what is conspicuous for individuals. India is marked by strong social and religious divisions, and each social group may have its own definition of socially valued goods when relative deprivation increases. For instance, the empirical results of Section 4 show that meat is not socially valued in India, which is consistent with the fact that vegetarianism is the norm of the upper castes, which have a higher social status. In fact, several works point out that food practices are at the root of untouchability (Ambedkar, 1948; Rege et al., 2009), and the process of sanskritization involves adopting higher caste practices, especially regarding diet and cooking (Srinivas, 1956). Inversely, this phenomenon is not true for Muslims outside the caste hierarchy, for whom meat is a usual component of their diet as in Western societies.

An interesting test of our specification would be to estimate the demand system with relative deprivation on sub-samples of BPL Scheduled Caste Hindus (former Untouchable) and Muslims. We expect that meat is not a socially inferior good for Muslims, and that food items associated with High Caste consumption (dairy products, vegetables, pulses) is more socially superior for Scheduled Castes.

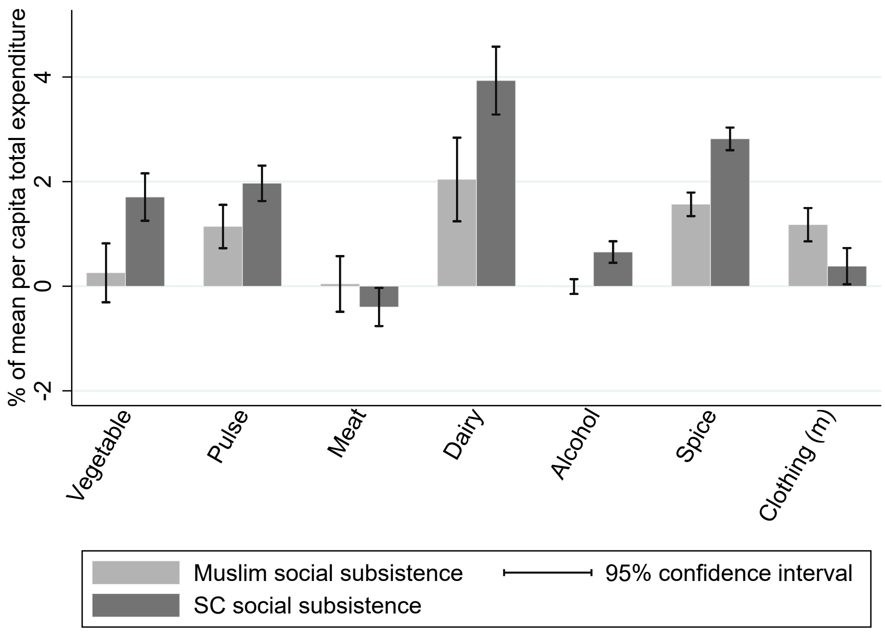


Figure 7: Social subsistence for Muslims and Scheduled Caste Hindus, selected categories

Figure 7 shows the social subsistence levels for Scheduled Castes and Muslims for selected items, confirming this prediction: meat is socially inferior for Scheduled Castes, who in return value vegetables, pulses and dairy products much more when relative deprivation increases. Inversely, alcohol consumption of Muslims, which is a taboo in Islam, does not react to relative deprivation, on the contrary to Scheduled Castes. Muslims seem more sensitive to other goods such as clothing. The social valuation of these two groups is however not significantly different for most categories, especially for the negative social valuation of cereals (see Figure 21 in Appendix C for all categories). In a newspaper article, Aparna Pallavi (food researcher) writes: "Contemporary urban Dalit food is mostly spicy, heavy on oil-both of which were hallmarks of rich people's food. The high use of salt, oil and chilli, therefore, is a reaction to the Dalit sense of deprivation" (Livemint, 2016). Our data suggests a similar pattern.

5.4 Full Sample Estimation

In all specifications, we consider the aggregate level of relative deprivation (Gini coefficient) as an adequate measure of the feeling of relative deprivation for each BPL household. It allows to have a measure not correlated with household income and exogenous to her consumption choices. Underlying to the relative deprivation concept is the idea that people are upward-looking: their social standards of consumption are determined by wealthier households. We therefore expect that aggregate relative deprivation would have a lesser impact on the full sample including wealthier households than on the sample restricted to Below Poverty Line households.

Figure 22 in appendix C shows that it is indeed the case in our data: the social subsistence level of most categories is significantly lower for the entire sample than for BPL households. Meat, however, is even more socially inferior – reflecting the norm of vegetarianism among the wealthier sections of society. Fat also switches to socially inferior. Soft drinks are, on the contrary, more socially valued. Overall, these results suggest that relative deprivation weights more heavily on the poorer sections of society which have to strive to reach both adequate nutrition and social inclusion.

5.5 Caloric Cost of Relative Deprivation: All Robustness Checks

Our baseline specification evaluated the daily per capita calorie loss due to relative deprivation to around 200 calories. Table 5 summarizes the same amount for all robustness specifications. Adding demographic variables (baseline LES) lowers down the calorie loss, it therefore seems necessary to control for the household composition and sector. The estimation using a village Gini and the one performed on the full sample lower the caloric cost of relative deprivation, as underlined in the above sections. All specifications suggest a negative effect of relative deprivation on the nutrition state of the household.

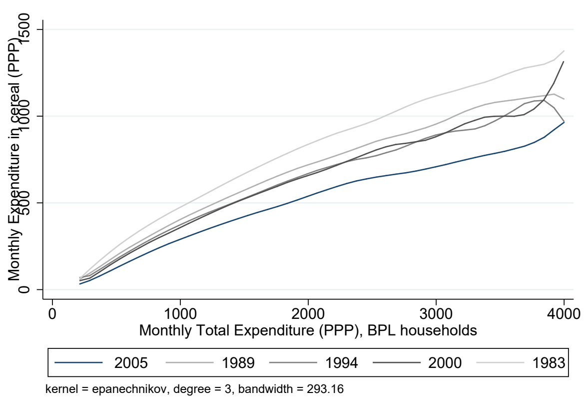
	Daily Per Capita Calorie Loss
Baseline LES	-212.37
w/o demographics	-422.35
NLP	-497.39
Village Gini	-73.16
Muslims	-213.09
Scheduled Caste Hindus	-265.08
Full Sample	-127.57

Table 5: Mean Calorie Loss due to Relative Deprivation, All Robustness Checks (NSS Data)

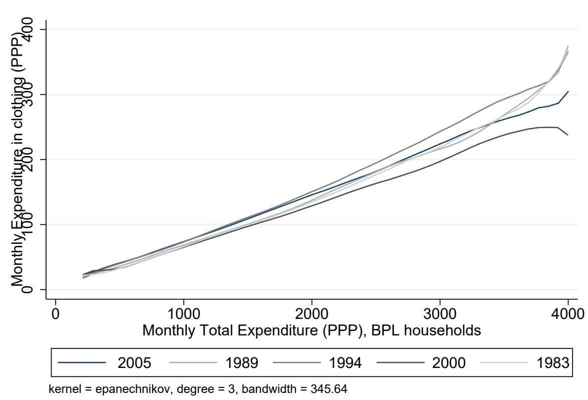
5.6 Non-parametric Engel Curves

The utility function which yields the linear expenditure system is quasi-homothetic, thus producing linear Engel curves. It is a convenient theoretical assumption allowing aggregation across consumers (Gorman, 1953), though not systematically verified in the data (see Lewbel (2008) for a summary of the literature). In this section, we proceed to draw non-parametric Engel curves in order to check if linearity is a good approximation of the Engel curves for below poverty line households.

To compare the Engel curves for various items across waves, we need a factor of conversion in order to have Purchasing Power Parity (PPP) expenditure. The poverty line used by the Indian government gives a monthly per capita expenditure under which a household is considered poor for each sector within a state; we have different poverty lines for rural Punjab and urban Punjab, for example. As the measure is based on prices for a given basket of goods on which the poor spend a majority of their budget, it is a measure of the cost of living for poor people in a sector within a state. We use these poverty lines to derive a PPP conversion factor which is anchored on the 55th round (1999-2000) in the respective sector within each state. We then divide total household expenditure and expenditure by item using this factor of conversion, and obtain equivalent expenditure by sector, state and round. The factor of conversion takes into account different evolutions across sector and state in time, but reassuringly, the variance within round is small.



(a) Cereal expenditure



(b) Clothing expenditure

Figure 8: Non-parametric Engel curves across rounds, BPL households

Figures 8a and 8b are kernel-weighted local polynomial regressions of expenditure on monthly total expenditure.[10] The Engel curves are drawn using the sample of below poverty line households in the four NSS rounds, while adjusting for the difference in living standard across sector, state and round. They appear fairly linear for below poverty line households, and confirm that the assumption of the linear expenditure system is a good approximation of our data. We could note the slight curvature which appears concave for cereal and convex for clothing, consistent with these categories being necessities and luxuries respectively. The Engel curves for the other categories used in the demand system present a similar pattern (Figures 23 to 32 in appendix D).

5.7 AIDS Functional Form

The model estimation does not accommodate fixed effects which could control for important determinants of consumption. In this section, we present an Ordinary Least Squares (OLS) estimation of the Linear Approximate Almost Ideal Demand System (Deaton and Muellbauer, 1980) introducing additional controls to test if the relative deprivation effect is robust to other specifications.

The main source of concern is a systematic difference in supply side parameters correlated with inequality. For instance, the availability and exposure to different goods could vary across states and sectors. To control for these variations, we introduce fixed effects by state, year and sector. Regions may also be characterized by specific tastes due to spatial sorting or agro-climatic conditions, which could be correlated with inequality. We introduce region fixed effects to control for fixed regional components through time (we follow the same regions over all rounds in the NSS). Finally, as the OLS estimation allows to easily accommodate other variables, we introduce other demographic and occupational controls such as household population by age and gender, if the head of household is self-employed, and if he/she works in the agricultural sector. These controls are specified by Deaton and Subramanian (1996) as affecting demand for nutrition.

We estimate the following specification:

$$\mathrm{s}_{ihy} = \tau_{0i} + \nu_i \mathrm{Gini}_{ry} + \beta \ln m_{hy} + \sum_j \gamma_j \ln P_{j,vy} + \tau_{1i} X_{hy} + \mathrm{FE}_{\mathrm{s,u,y}} + \mathrm{FE}_r + \epsilon_{ihy} \tag{17}$$

[10]The lowest and highest percentiles of monthly total expenditure have been truncated from the Engel curves.

With Gini_{ry} the Gini of region r in the NSS round y, $\ln m_{hy}$ log of real income of household h in NSS round y (monthly per capita expenditure divided by Stone price index), $\ln P_{i,vy}$ stone price index for category j, X_{hy} a vector of demographic and occupation characteristics (log household size, fraction by age and gender, self-employed, agricultural sector), $\text{FE}_{\text{s,u,y}}$ a fixed effect at the State*sector*year level, FE_r a fixed effect at region level (same region across years), and ϵ_{ihy} an error term. We perform the estimation on all rounds at a time, hence the introduction of round-specific and region-specific fixed effects.

Table 6: Working-Leser Engel Specification with Gini, BPL households, all rounds

	food	no calories	clothing	intox	fuel
	(1)	(2)	(3)	(4)	(5)
Regional Gini	-0.0732***	-0.0099	0.0714***	0.0034	0.0085
	(0.0234)	(0.00934)	(0.0165)	(0.0121)	(0.0143)
log per cap expend.	0.0382***	-0.0048***	-0.0254***	0.0078***	-0.0159***
	(0.00253)	(0.00110)	(0.00236)	(0.000843)	(0.00143)
Observations	157693	157693	157693	157693	157693
Adjusted R^2	0.466	0.433	0.323	0.087	0.366
log prices	Yes	Yes	Yes	Yes	Yes
demographic controls	Yes	Yes	Yes	Yes	Yes
FE state*sector*year	Yes	Yes	Yes	Yes	Yes
FE region	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 shows the results on food, clothing and other non caloric categories. It is striking to see that the regional Gini decreases food expenditure in the same proportion as it increases clothing expenditure, so that the substitution seems to be between these two categories. In fact, a back-of-the-envelop calculation with this estimate of the Gini effect on food shows that, for the median BPL household in a region with a Gini of 0.30 (the median Gini in our data), this estimate corresponds to a caloric cost of about 100 daily per capita calories. This number is smaller, but reassuringly close to the estimates produced by the structural estimation of the linear expenditure system (200 to 250 calories for the same Gini).

5.8 Inequality and Wealth Level of the Poor

Another potential issue with our estimate of the caloric cost of relative deprivation stems from the fact that BPL households could be wealthier in regions where inequality is higher. For instance, if inequality is higher - i.e. there are more high incomes - in more developed regions, then the poor may be expected to be comparatively richer too. This correlation could lead to an estimated subsistence level for the poor which has a higher proportion of non-caloric items, if they are wealthier and less malnourished.

Table 7: Descriptive Regression: MPCE on regional Gini, BPL households, all rounds

	(1) log per cap expenditure
1983 × Regional Gini	-0.542***
	(0.0997)
1989 × Regional Gini	-1.041***
	(0.0513)
1994 × Regional Gini	-0.853***
	(0.0570)
2000 × Regional Gini	-0.746***
	(0.0608)
2005 × Regional Gini	-0.533***
	(0.0538)
Observations	160086
Adjusted R^2	0.860
log prices	Yes
household size	Yes
FE year*sector	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In order to check if this conjecture is indeed realized in our data, we regress the log of the monthly per capita total expenditure of BPL households on the regional Gini index and the other variables of our estimation (prices, household size and sector). Table 7 shows the resulting coefficients of this descriptive region: the correlation between the Gini index and the total expenditure of the poor is negative for all rounds. As we could expect, regions where inequality is higher capture a lower wealth level for the poor, and not some other determinants such as a higher level of development. This correlation rules out the development explanation of the bias towards non-caloric goods that the poor have in high inequality regions.

6 Short and Long-term Consequences

6.1 Measurement of Deprivation

These findings bring empirical evidence to our understanding of poverty as the state of deprivation in multiple dimensions. The methodology used could be extended to identify deprivation of different capabilities, following Sen (1983, 1984)'s approach to poverty. Sen (1983) asserts that "absolute deprivation in terms of a person's capabilities relates to relative deprivation in terms of commodities, incomes and resources". This definition leads to an understanding of income not as reflecting command over commodities, but over capabilities. Consumption provides a mean to reach several ends ranging from adequate nutrition to social esteem and decency. In fact, in Sen (1983)'s work, as well as in a long tradition dating from Adam Smith (1776) and his example of the linen shirt, the capability to not appear ashamed in public has been considered of central importance for understanding deprivation.[11]

The capability approach leads us to consider that an individual is poorer than another if, with the same real income, she cannot attain physical basic needs and social decency. By identifying that households below poverty line consume less calories where the social standard is higher, we may say that these households are deprived of more capabilities than equivalent households in less unequal places. Though we cannot have a utilitarian welfare interpretation of this substitution between food and social commodities – as an individual spending more on social commodities may be as satisfied as another spending more on food –, the capability approach allows us to infer that one is worse-off than the other in terms of reaching several capabilities (meeting nutritional requirements, not being ashamed in public). The second and corollary result is that even under necessity, an individual does not fulfil one capability (for example, adequate nutrition) before others (social decency, self-respect), but weights all of them within her budget constraint.

In the literature on poverty line, several works have tried to conceal absolute and relative dimensions of poverty. Atkinson and Bourguignon (2001) derive a poverty line in terms of economic resources combining physical basic needs and socially defined minimum consumption standards. They define these dimensions in the capability space as well, these two needs corresponding to functioning satisfactorily in purely physical terms and in social terms. Ravallion and Chen (2011) propose a weakly relative poverty line, recognizing that

[11] Smith (1776) notes that "the Greeks and Romans lived very comfortably though they had no linen, [but] in the present time, through the greater part of Europe, a creditable day-laborer would be ashamed to appear in public without a linen shirt".

the poor in terms of physical deprivation also strives for social inclusion: they underline that "the cost of a socially-acceptable linen shirt will not be zero, and will presumably be no different for a poor person."

Our work suggests a measure of social need derived from the literature on relative deprivation as the sum of income gaps (rather than the mean). It provides an empirical method to determine how social need affects consumption choices of people who are highly budget-constrained, and an estimate of the cost incurred to fulfill both physical and social needs when the level of the latter is rising. The methodology can be applied to other dimensions of deprivation and other databases, both to confirm these results and better inform on the multiple costs of deprivation.

6.2 Poverty Trap

The choice between social aspiration and adequate nutrition may also represent an intra-temporal choice between low versus high return investments. Several instances in the literature (and in particular Dasgupta and Ray (1986)) show that there is a difference between hunger and malnutrition: if the former leads to a certain death, the latter can be prevalent in the population without facing immediate death. Malnutrition, however, has long-term effects such as diminishing muscular strength, growth retardation, increased illness and vulnerability to disease, decreased brain growth and development, which all affect future work capacity and income prospects. The nutrition one receives in childhood is a determinant of future outcomes, especially among a population suffering from malnutrition (for a review of the literature in nutrition science and economics, see Dasgupta (1997)).

Section A.3 in appendix develops an overlapping generation model to give an intuition of the long-term impact of relative deprivation on income distribution. To capture this idea, we use an alternative formulation of the Galor-Zeira growth model (Galor and Zeira, 1993), using the convexity introduced by the Stone-Geary specification in the utility function. We consider that food consumption in childhood is the input in future work capacity, which determines future income. As poor parent devotes less budget to food in order to fulfill social needs, they lower the income opportunity of the child.

Our model is related to the poverty trap derived by Moav and Neeman (2012) who introduce conspicuous behavior in an inter-temporal setting. The major difference of our setting is that relative deprivation endogenously gives the poorest a higher incentive to spend on socially valued items. The signaling framework of Moav and Neeman (2012) makes assumptions on the goods individuals use to signal their status according to their income level: the poor signal by conspicuous consumption, while the rich signal by human capital as well. Their model also focuses on the substitution between conspicuous consumption and human capital, while we argue in this article that the very poor tend to substitute with caloric items. The similarity, however, is that they substitute with an item which enters in their future work capacity (or the one of their child). In the Indian context, it is likely that physical strength and good health are factors more intensely used in the occupations of the poor.

Our illustrative framework shows how relative deprivation could contribute to reinforce income inequalities in the long-term. For the population affected by it, relative deprivation produces a higher basin of attraction of the poverty trap, and a lower high income steady state. The income under which the poor fall in a poverty trap increases with relative deprivation. Additionally, the poor who are getting richer, if they continue to spend more on the aspirational good, reach a lower long run income level.

7 Conclusion

This article introduces relative deprivation in a complete demand system, and estimates its impact on the consumption of below poverty line households in India. It uses the family of the linear expenditure system to decompose subsistence level quantities into basic and social ones, the latter varying with relative deprivation. The demand model provides three testable implications of the effect of relative deprivation: (1) we empirically determine socially superior goods as goods for which social subsistence increases with relative deprivation, (2) we determine aspirational goods as goods for which demand increases with relative deprivation, (3) the income elasticity of these goods decreases with relative deprivation, making these goods relatively more necessary in regions with a high Gini coefficient (our aggregate measure of relative deprivation).

The structural estimation of the demand system confirms our hypothesis: relative deprivation increases the subsistence level of less calorie-intensive or non-caloric items, thereby causing an estimated loss of 200 to 250 daily per capita calories for a Gini coefficient of 0.30. An analysis of the income elasticities in low and high inequality regions also shows that these goods become more necessary as the Gini increases.

Our findings provide a rational for the conspicuous behavior of the poor. We believe that they could help achieve a better understanding of the multiple dimensions of deprivation.

Notably, a common argument against the policies of poverty relief under the form of direct or indirect transfer is that the poor choose to spend a substantial amount of the additional budget on goods we may think as non-necessary, rather than spending it all on food or education. Understanding how their social environment determines a minimum social standard may help redirect the argument on inequality rather than the presumed lack of rationality of the poor.

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Appendix

A Theoretical Framework

A.1 NLP Demand System

Using Shephard's Lemma as in section 2.3, we derive the demand functions of the NLP framework:

$$\frac{\partial C(p,u)_{\text{NLP}}}{\partial p_i} = q_i(p,u) = \sum_j \gamma_{ij}(\frac{p_j}{p_i})^{\frac{1}{2}} + \frac{\beta_i}{p_i} u \Pi_i p_i^{\beta_i} \tag{18}$$

Where $\gamma_{ij} = (\gamma_{ij}^* + \gamma_{ji}^*)/2$, and the following restrictions hold:

$$\begin{array}{ll} \sum_j \beta_j = 1 & \text{(adding up)} \\ \gamma_{ij} = \gamma_{ji} & \text{(symmetry)} \end{array} \tag{19}$$

Following the same procedure as section 2.3, we obtain the expenditure functions of the NLP demand system:

$$x_i = q_i(p,m)p_i = \sum_j \gamma_{ij}(p_i p_j)^{\frac{1}{2}} + \beta_i(m - \sum_k \sum_j \gamma_{kj}(p_k p_j)^{\frac{1}{2}}) \tag{20}$$

Or, replacing γ_{ii} by its expression in Equation (3):

$$x_i = (\tau_{ii} + \nu_{ii}\rho)p_i + \sum_{j \neq i} \gamma_{ij}(p_i p_j)^{\frac{1}{2}} + \beta_i(m - \sum_k (\tau_{kk} + \nu_{kk}\rho)p_k - \sum_k \sum_{j \neq k} \gamma_{kj}(p_k p_j)^{\frac{1}{2}}) \tag{21}$$

Equation (21) gives the expenditure system estimated which is used to check if non-linear preferences modify our empirical results. It is straightforward to derive Implication 2 and Implication 3 from the NLP system.

A.2 Illustration: A Two-Goods Case of the LES

To illustrate the properties of the linear expenditure system with relative deprivation, we take a simple two-goods case where the individual spends her income on food f and a conspicuous good, say clothing, c. Rewriting the consumer's problem (2), we obtain:

$$
\begin{aligned}
U(f,c) = &\quad \beta \ln(f - (\tau_f + \nu_f \rho)) + (1-\beta)\ln(c - (\tau_c + \nu_c \rho)) \\
s.t. &\quad p_f f + p_c c = m
\end{aligned} \tag{22}
$$

And derive the following demand system:

$$
\begin{cases}
f = \beta \frac{m}{p_f} + (1-\beta)(\tau_f + \nu_f \rho) - \beta(\tau_c + \nu_c \rho)\frac{p_c}{p_f} \\
\\
c = (1-\beta)\frac{m}{p_c} + \beta(\tau_c + \nu_c \rho) - (1-\beta)(\tau_f + \nu_f \rho)\frac{p_f}{p_c}
\end{cases} \tag{23}
$$

We now assume that good c is socially superior, i.e. $\nu_c > 0$ and $\nu_f \leq 0$ (Implication 1). In this simple 2-goods case, the socially superior good is the good whose demand increases with relative deprivation, i.e. it is an aspirational good (Implication 2). We can see it more clearly by differentiating the demand equations with respect to the level of relative deprivation:

$$
\frac{\partial c}{\partial \rho} = \beta \nu_c - (1-\beta)\nu_f \frac{p_f}{p_c} > 0, \qquad \frac{\partial f}{\partial \rho} = (1-\beta)\nu_f - \beta \nu_c \frac{p_c}{p_f} < 0, \tag{24}
$$

As the level of relative deprivation ρ increases, the individual spends a higher fraction of her income on the socially superior good. If this good is non caloric, as in our case with clothing, then she diminishes by the same amount her calorie consumption.

We also derive the income elasticities to obtain Implication 3, which is that an aspirational good becomes more necessary as relative deprivation increases:

$$
\begin{cases}
\xi_f = \left[1 + \frac{1-\beta}{\beta}\frac{(\tau_f + \nu_f \rho) p_f}{m} - \frac{(\tau_c + \nu_c \rho) p_c}{m}\right]^{-1} \\
\\
\xi_c = \left[1 + \frac{\beta}{1-\beta}\frac{(\tau_c + \nu_c \rho) p_c}{m} - \frac{(\tau_f + \nu_f \rho) p_f}{m}\right]^{-1}
\end{cases} \tag{25}
$$

Differentiating the income elasticity of the conspicuous good c with respect to relative deprivation ρ, we obtain:

$$
\frac{\partial \xi_c}{\partial \rho} = \frac{-\frac{\beta}{1-\beta}\frac{p_c}{m}\nu_c + \frac{p_f}{m}\nu_f}{\left[1 + \frac{\beta}{1-\beta}\frac{(\tau_c + \nu_c \rho) p_c}{m} - \frac{(\tau_f + \nu_f \rho) p_f}{m}\right]^2} < 0 \tag{26}
$$

The income elasticity of the conspicuous good is a negative function of the level of relative deprivation, as the numerator is always negative under the assumption that $\nu_c > 0$ and $\nu_f \leq 0$. This result means that as relative deprivation increases, the conspicuous good becomes more necessary, i.e. its income elasticity decreases. Similarly, the income elasticity of the non-conspicuous good is a positive function of the level of relative deprivation (thus becoming less necessary with relative deprivation).

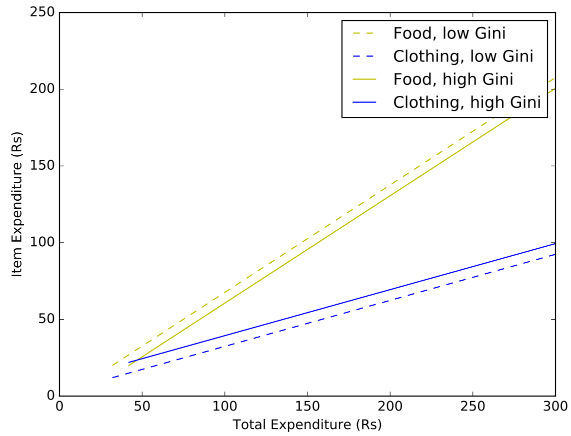

Figure 9: Engel Curves with variation in relative deprivation

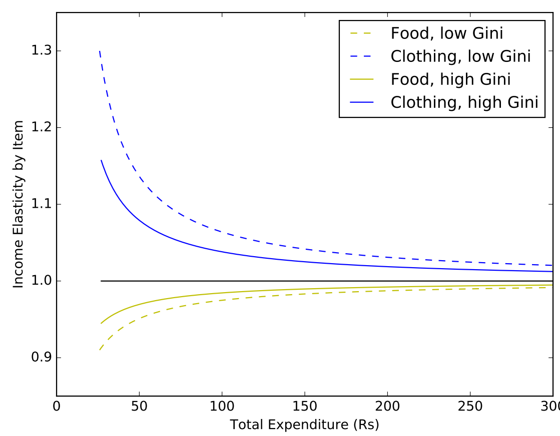

Figure 10: Income Elasticities with variation in relative deprivation

Figure 9 shows the Engel curves obtained with a low level (dotted lines) and high level (full lines) of relative deprivation when the aspirational good is c. We set the parameters at reasonable levels, assuming a β_f of 0.7 which is close to the share spent on food by BPL households. Also, the basic subsistence levels τ_i's are set to be positive, with typically a higher basic subsistence level for food than clothing.[12] The Gini coefficient varies from 0.2 (low Gini) to 0.4 (high Gini).

The Engel curves shift in the opposite direction when relative deprivation increases, illustrating that an individual increases her consumption of clothing and decreases her consumption of food at any level of income. The other effect of relative deprivation is that the minimum expenditure required for an individual to survive increases, except if the non-conspicuous good is socially dis-valued by the same amount than the conspicuous good is valued ($\nu_f p_f = -\nu_c p_c$).

We also observe that even when food is more necessary than clothing, the income elasticities converge as relative deprivation increases. Figure 10 illustrates the difference in income elasticities between low Gini and high Gini regions. We can imagine a case where relative deprivation is so high that income elasticities inverse their trend, making the conspicous good more necessary than the non-conspicuous one. This case shows how income elasticities are social constructs, following the work of Heffetz (2011).

[12]In all graphs, prices are normalized to 1. We do not exploit price effects in this illustrative section.

A.3 Poverty Trap with Relative Deprivation

This section develops an overlapping generation model to give an intuition of the long-term impact of relative deprivation on income distribution. To capture this idea, we use an alternative formulation of the Galor-Zeira growth model (Galor and Zeira, 1993), using the convexity introduced by the Stone-Geary specification in the utility function. We use the two-goods specification of section A.2 in appendix, with a Veblen externality on conspicuous consumption relative to food, leading to the following demand system:

$$\begin{cases} f = \beta \frac{m}{p_f} + (1-\beta)(\tau_f + \nu_f \rho) - \beta(\tau_c + \nu_c \rho)\frac{p_c}{p_f} \\ \\ c = (1-\beta)\frac{m}{p_c} + \beta(\tau_c + \nu_c \rho) - (1-\beta)(\tau_f + \nu_f \rho)\frac{p_f}{p_c} \end{cases} \tag{27}$$

The economy is composed of dynasties, each corresponding to a single representative household with two individuals: a parent and her child. A household from generation t lives for one period and gives birth to one child who will become a parent in generation $t+1$. There is a continuum of generations in each dynasty, starting from generation t_0 born with income m_{t_0}. A parent from generation t allocates her income according to the consumer's problem as specified by Equation (22). The consumption of the conspicuous good c_t lasts for one period, unlike f_t which enters in the production of future physical work capacity of the child, and hence her income in $t+1$. In generation $t+1$, the child becomes a parent whose income m_{t+1} is a function of his parental investment in nutrition f_t. She decides the amounts c_{t+1} and f_{t+1} to be consumed by the household.

Food consumption f_t is the input in the production of efficiency units for the child, hence determining her future physical work capacity. The conversion function $\lambda_{t+1}(f_t)$ takes a form consistent with the literature on nutrition and efficiency (see Dasgupta and Ray (1986); Baland and Ray (1991)[13]). The main difference with previous models is that the link between food consumption and work efficiency is intertemporal:

$$\lambda_{t+1}(f_t) = \begin{cases} 1 & \text{if } f_t < \underline{f} \\ 1 + r_1(f_t - \underline{f}) & \text{if } \underline{f} \leq f_t < \bar{f} \\ 1 + r_1(\bar{f} - \underline{f}) + r_2(f_t - \bar{f}) & \text{if } f_t \geq \bar{f} \end{cases} \tag{28}$$

[13] Adapting the definition in Baland and Ray (1991), we assume that $\lambda(f) = 1$ for $f \in [0, \underline{f}]$, $\underline{f} > 0$, $\lambda(f)$ strictly increasing and differentiable for $f > \underline{f}$, λ is continuous at $\underline{f}$ and $\overline{f}$, and λ is concave on the restriction $[\underline{f}, \infty]$.

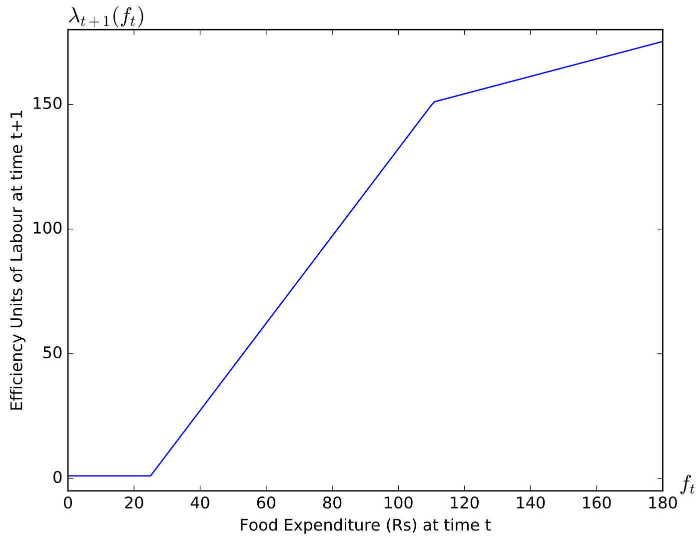

Figure 11: Conversion Function of Food in t into Efficiency Units of Labor in $t+1$

The form of the conversion function $\lambda_{t+1}(f_t)$ is illustrated in Figure 11. As the parent is a child who survived, she acquires one efficiency unit of labor skill – this is the minimum level before death, with $\underline{f}$ defining the Resting Metabolic Rate (RMR). The child receiving a single efficiency unit is reduced to perform activities such as begging, or very minor works. The level of efficiency units is an increasing concave function of the consumption of food the period before, with r_1 corresponding to the return of food when the child reached the RMR but is still under malnutrition, and r_2 the return of food after the child reached a level of adequate nutrition $\bar{f}$. The condition $r_2 < r_1$ ensures the concavity of the function, and corresponds to the intuition that there are decreasing returns to scale to nutrition for work capacity.

Each parent supplies her efficiency units inelastically on the labor market. For simplicity, we assume that one efficiency unit is equivalent to one unit of wage, or income: $\lambda_{t+1}(f_t) = m_{t+1}$. We can determine the income m_{t+1} by knowing food consumption in period t and the relationship with efficiency units and hence income, given by Equation (28). Replacing the expression for food demand f_t (Equation (27)) in Equation (28), the dynamics of income within a dynasty is given by:

$$m_{t+1}(m_t) = \begin{cases} 1 & \text{if } f_t < \underline{f} \\ 1 + r_1(\beta \frac{m_t}{p_{f_t}} + (1-\beta)b_{f_t} - \beta b_{c_t}\frac{p_{c_t}}{p_{f_t}} - \underline{f}) & \text{if } \underline{f} \leq f_t < \bar{f} \\ 1 + r_1(\bar{f} - \underline{f}) + r_2(\beta \frac{m_t}{p_{f_t}} + (1-\beta)b_{f_t} - \beta b_{c_t}\frac{p_{c_t}}{p_{f_t}} - \bar{f}) & \text{if } f_t \geq \bar{f} \end{cases} \tag{29}$$

with $b_{it} = \tau_{it} + \nu_{it}\rho_t$, and $m_0^i \geq 1$ given.

Given the conversion function λ_{t+1}, there is a set of incomes $m_t \in [1, \underline{f}]$ for which $m_{t+1}(m_t) = 1$. It constitutes a minimum income $\underline{\mathrm{m}} = 1$, which is a poverty trap under the dynamical system.

We further assume that the return to food consumption at the point $\bar{f}$, where the child does not suffer from malnutrition, is sufficiently large so that food consumption $f_t = \bar{f}$ translates into a higher level of food consumption to one's offspring, $f_{t+1} > f_t$. This requires the following condition:

$$\beta \frac{1}{p_{f_{t+1}}}(1 + r_1(\bar{f} - \underline{f})) + (1-\beta)b_{f_{t+1}} - \beta b_{c_{t+1}}\frac{p_{c_{t+1}}}{p_{f_{t+1}}} > \bar{f} \tag{30}$$

Equation (30) ensures the existence of a range of incomes in which $m_{t+1}(m_t) > m_t$. Given $\underline{m}$ and Equation (30), there exists an income threshold $\hat{m}$ such that dynasties with income below $\hat{m}$ converge to the poverty trap income level $\underline{m}$, and dynasties with income above $\hat{m}$ have their income increasing period by period. From the dynamical system in Equation (29), we get:

$$\hat{m} = \frac{r_1(\beta\gamma_c\frac{p_c}{p_f} - (1-\beta)\gamma_f + \underline{f}) - 1}{r_1\beta\frac{1}{p_f} - 1} \tag{31}$$

The concavity of the conversion function ($r_2 < r_1$) ensures the existence of a high income steady state rather than a diverging path. Note that this is particular to the fact that food is the only input to future work capacity, which applies well to mainly rural developing countries or individuals finding themselves under malnutrition and below the poverty line. From the dynamical system (Equation (29)), the high income steady state is characterized by:

$$\bar{m} = \frac{r_2(\beta\gamma_c\frac{p_c}{p_f} - (1-\beta)\gamma_f + \bar{f}) - r_1(\bar{f} - \underline{f}) - 1}{r_2\beta\frac{1}{p_f} - 1} \tag{32}$$

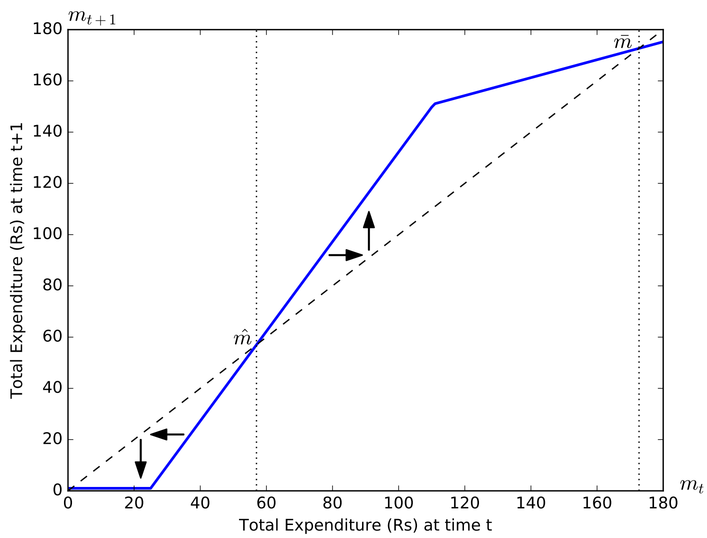

Figure 12: Income Dynamics - low income and high income steady states

Figure 12 illustrates the long-term steady states in income dynamics. With income below the threshold level $\hat{m}$, the dynasty converges to a status trap steady state $\underline{m} = 1$ characterized by minimum efficiency and rampant malnutrition. A dynasty whose income is above $\hat{m}$ converges to the high income steady state $\bar{m}$.

Differentiating Equation (31) with respect to $\gamma_c = \tau_c + \nu_c \rho$, we obtain that $\hat{m}$ is a positive function of γ_c if $r_1 \beta > 1$, which is always true under the condition (30). Indeed, $r_1 \beta$ is the slope of $m_{t+1}(m_t)$ between $\underline{f}$ and $\bar{f}$, which is higher than one in order for the condition $m_{t+1} > m_t$ to be fulfilled for a range of incomes. Similarly, $\hat{m}$ is a negative function of γ_f. These results translate into a higher basin of attraction of the poverty trap if the relative deprivation factor increases, thus increasing the minimum level of consumption of the conspicuous good (and in some cases, decreasing the minimum level of food consumption).

We obtain inverse results when differentiating Equation (32) with respect to $\gamma_c = \tau_c + \nu_c \rho$. $\bar{m}$ is a negative function of γ_c if $r_2 \beta < 1$, which is always true in the case where there is a high income steady state (and not infinite growth). Indeed, $r_2 \beta$ is the slope of $m_{t+1}(m_t)$ when food consumption is higher than $\bar{f}$, and we have both conditions $r_2 < 1$ and $\beta < 1$. Inversely, $\bar{m}$ is a positive function of γ_f.

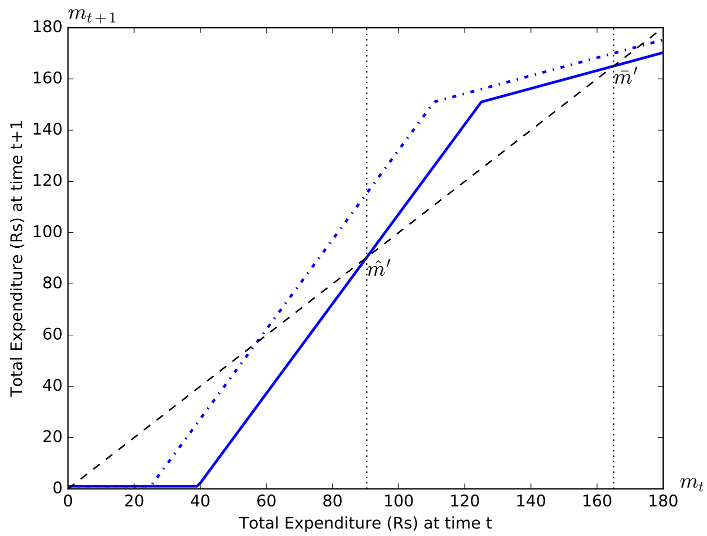

Figure 13: Income Dynamics with an increase in relative deprivation

These results provide the main intuition behind the long-term effect of relative deprivation on income dynamics: for the population affected by it, relative deprivation produces a higher basin of attraction of the poverty trap, and a lower high income steady state. Figure 13 illustrates these dynamics, with the dashed line being the same case as in Figure 12 and the full line representing a population for which relative deprivation has increased (either through the Veblen coefficient ν_c, or through a higher reference income ρ). As predicted, the corresponding income threshold $\hat{m}'$ is higher than $\hat{m}$, and the high income steady state $\bar{m}'$ is lower than the initial $\bar{m}$. Under relative deprivation, not only is the poverty trap wider for the poorest sections of society, but people getting richer reach a lower long-term income level than in the absence of relative deprivation.

B Distribution of Quantities and Unit Values

Table 8: Items dropped for all rounds or modified for some rounds

Normalized Quantity	Item Dropped
chicken	cereal substitutes
other meats	ice-cream
eggs	other milk products
banana	lemon
pineapple	guava
coconut	other nuts
orange,mausami	oilseeds
turmeric	ice
black pepper	other beverages (cocoa, chocolate)
dry chillies	other processed food
garlic	pan: leaf
tamarind	leaf tobacco
ginger	other tobacco products
curry powder	ganja
other spices	other intoxicants
tea: cups	dung cake
tea: leaf	gobar gas
coffee: cups	other fuel
coffee: powder	knitting wool, cotton yarn
cold beverages: bottled/canned	cotton
fruit juice and shake	second-hand clothing
coconut: green	coal gas
cooked meals	other oil used for lighting
pickles	other clothing
sauce	kerosene
jam, jelly	LPG
pan: finished	cheroot
supari	leaf tobacco
lime	hookah tobacco
katha	
other ingredients for pan	
bidi	
cigarettes	
snuff	
zarda, kimam, surti	
electricity	
matches	
candle	
lungi	
headwear	
leather boots, shoes	
leather sandals, chappals etc.	
other leather footwear	
other footwear	

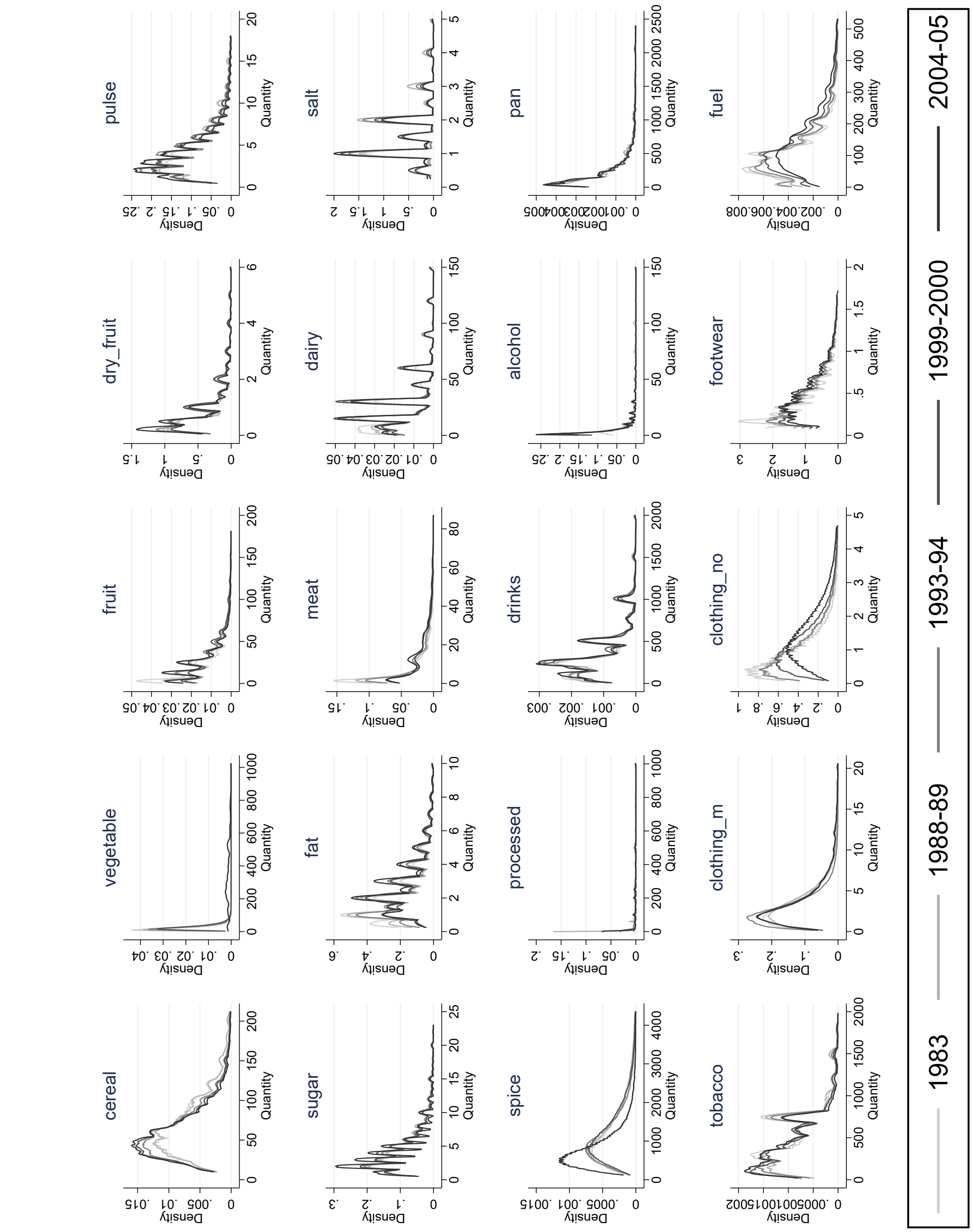

Figure 14: Kernel distributions of quantities, all rounds

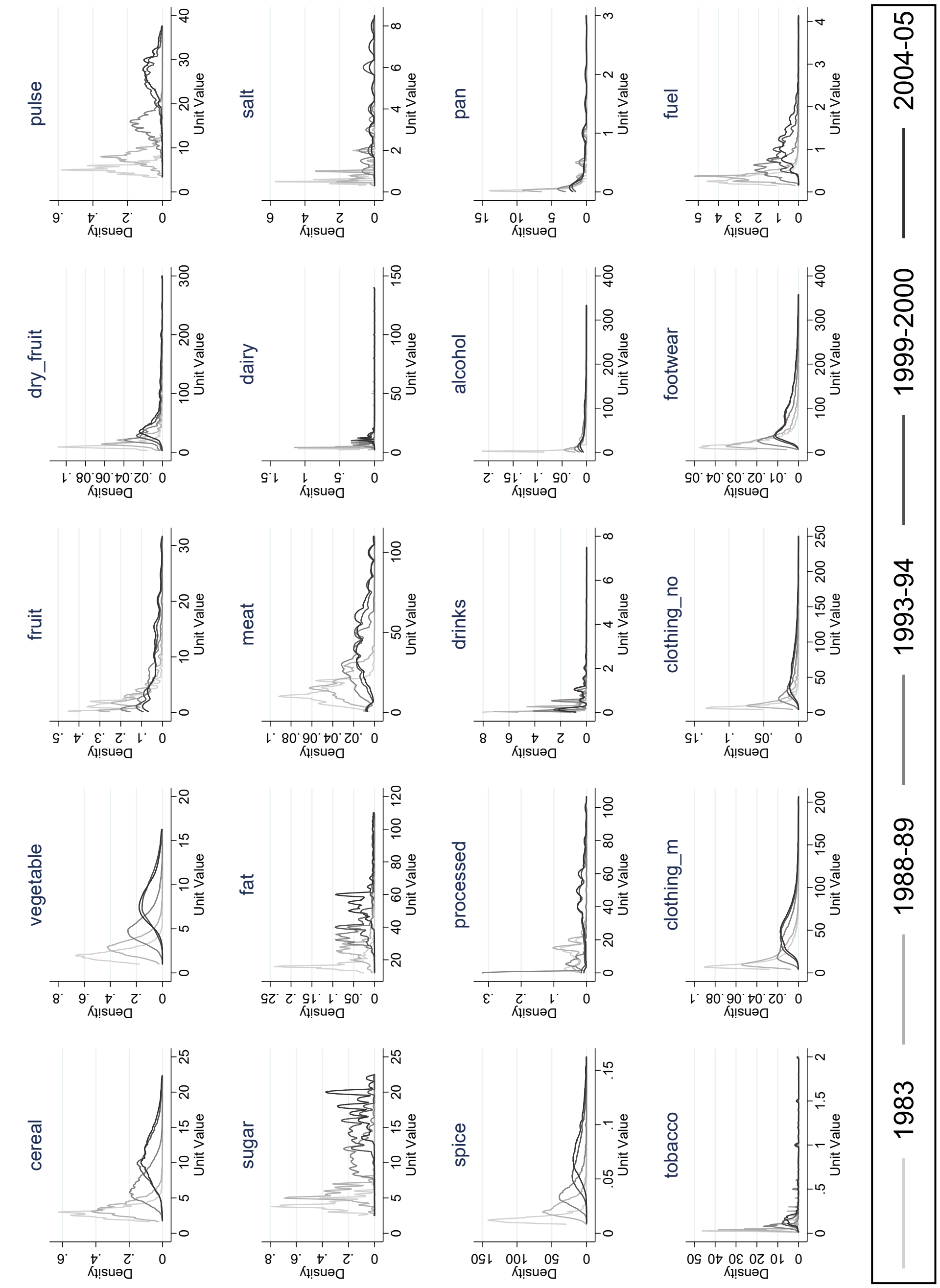

Figure 15: Kernel distributions of unit values, all rounds

C Empirical Analysis

Table 9: List of estimated parameters from LES, BPL households.

	β_i parameters	γ_i parameters				
		38th round	43rd round	50th round	55th round	61st round
Alcohol	0.00853	0.163	0.0790	0.0624	0.0778	0.0488
	0.000306	0.0113	0.00719	0.00707	0.00851	0.00602
Cereals	0.254	26.79	24.30	21.60	19.82	11.88
	0.00257	0.260	0.237	0.244	0.260	0.303
Clothing (meters)	0.0731	0.145	0.127	0.104	0.0431	0.00665
	0.000694	0.00354	0.00282	0.00279	0.00327	0.00164
Clothing (number)	0.0317	-0.00242	0.00375	0.0307	0.0274	0.0516
	0.000501	0.00213	0.00155	0.00164	0.00160	0.00187
Dairy	0.108	-0.332	-0.163	0.169	-0.240	-0.298
	0.00189	0.0322	0.0306	0.0355	0.0358	0.0393
Drinks	0.00849	0.0724	0.0706	0.0679	0.0567	0.0547
	0.000340	0.00252	0.00243	0.00265	0.00293	0.00282
Dry fruits	0.00152	0.107	0.172	0.167	0.131	0.124
	0.000101	0.00720	0.00768	0.00740	0.00767	0.00621
Fat products	0.0713	0.502	0.691	0.765	0.463	0.737
	0.000732	0.0253	0.0238	0.0258	0.0297	0.0291
Footwear	0.0120	0.0105	0.00206	0.0144	0.0122	0.0143
	0.000202	0.000915	0.000542	0.000499	0.000518	0.000590
Fruits	0.0160	-0.00715	0.0260	0.0303	0.000873	0.00829
	0.000280	0.00389	0.00399	0.00402	0.00422	0.00439
Fuel	0.109	1.045	1.046	0.350	0.142	2.413
	.	0.161	0.156	0.177	0.193	0.172
Meat products	0.0334	0.135	0.166	0.171	0.152	0.134
	0.000803	0.00452	0.00449	0.00460	0.00503	0.00515
Pan	0.00246	4.301	3.790	4.270	3.461	2.547
	0.000110	0.171	0.155	0.169	0.176	0.142
Processed food	0.0256	-0.0000190	-0.000953	0.000574	-0.00107	-0.000380
	0.000968	0.000147	0.000349	0.000140	0.000306	0.000202
Pulse	0.0541	0.585	0.745	0.702	0.651	0.244
	0.000712	0.0189	0.0168	0.0177	0.0194	0.0224
Spice	0.0278	0.193	0.168	0.162	0.153	0.0589
	0.000318	0.00253	0.00208	0.00220	0.00248	0.00232
Sugar	0.0312	0.817	0.837	1.076	0.588	0.534
	0.000445	0.0203	0.0186	0.0207	0.0211	0.0232
Tobacco	0.0179	17.75	20.90	23.40	0.602	6.816
	0.000337	0.779	0.765	0.810	0.803	0.813
Vegetables	0.114	0.00246	0.0630	0.166	0.146	0.0860
	0.000830	0.00884	0.00789	0.00880	0.00867	0.00707

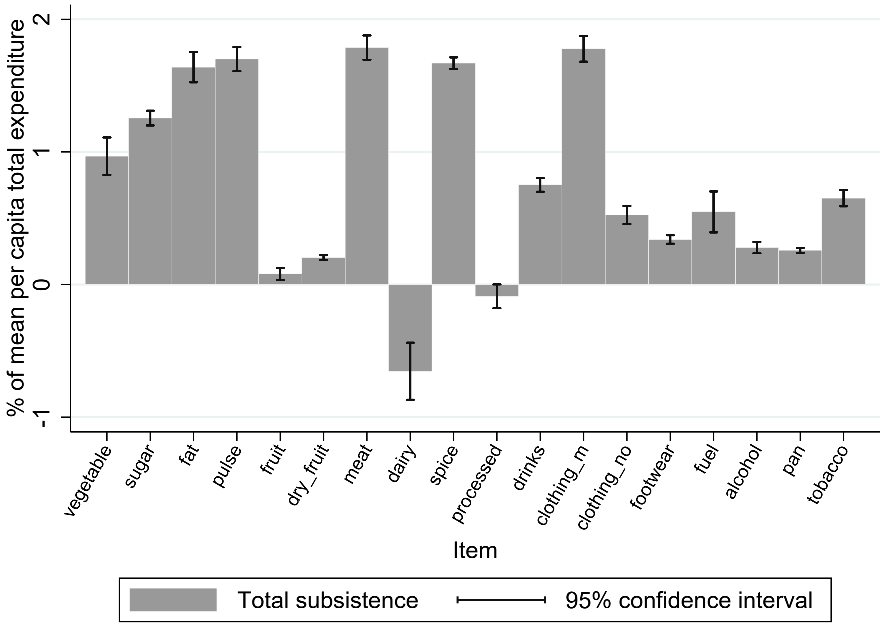

Figure 16: Total subsistence expenditure by categories (% of mean total per capita expenditures), without cereal

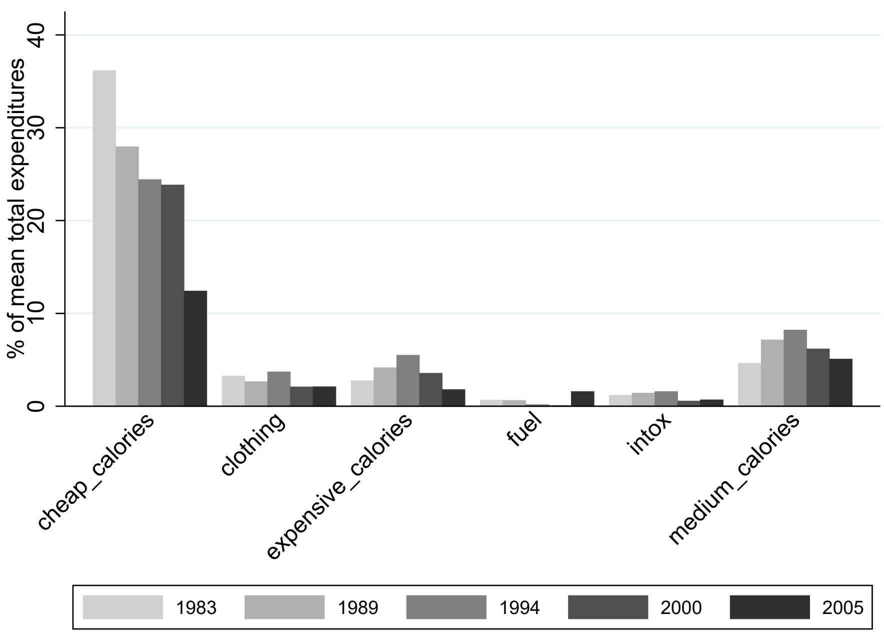

Figure 17: Total subsistence expenditure by broad categories across NSS rounds (% of mean total per capita expenditures)

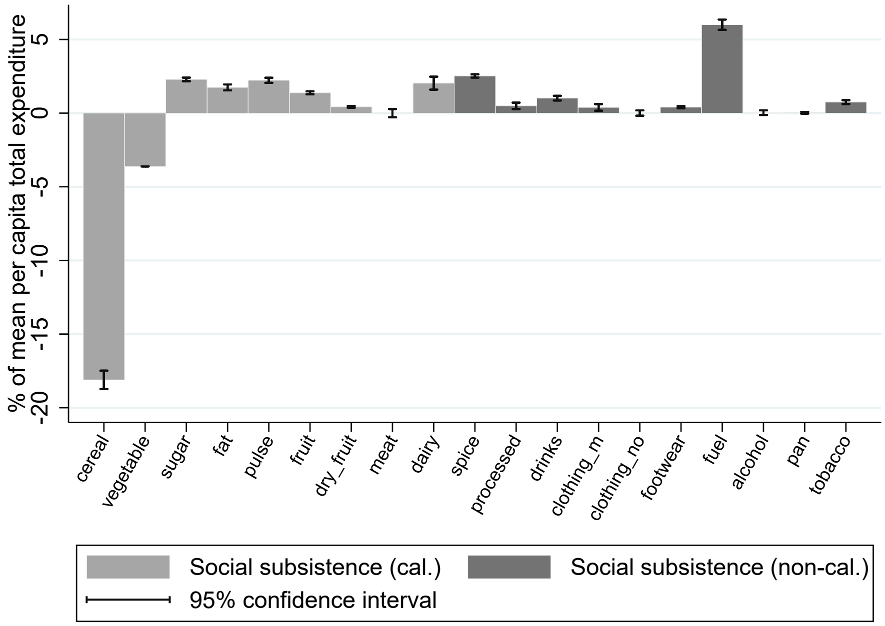

Figure 18: Social subsistence expenditure with basic subsistence intercept, BPL households

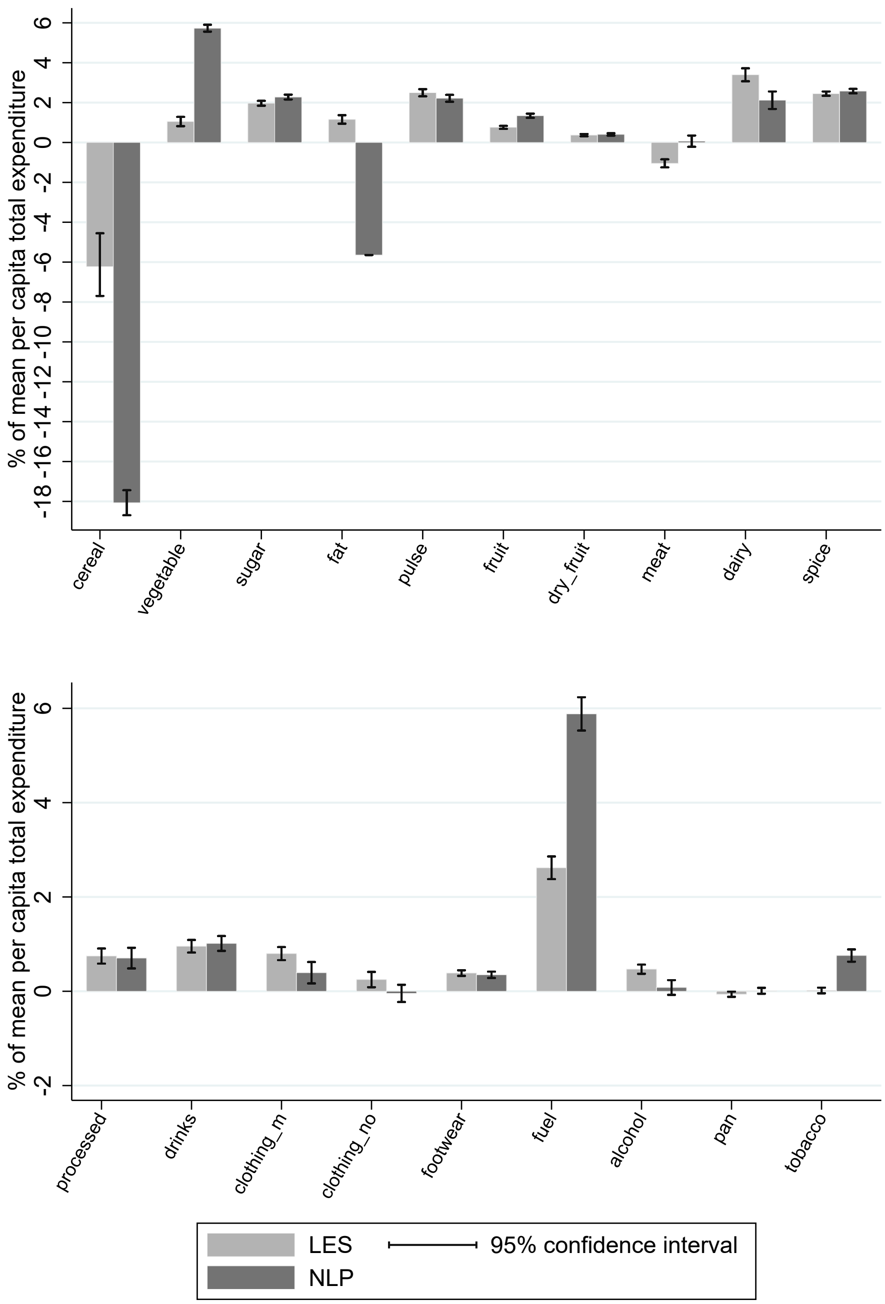

Figure 19: Social Subsistence in LES and NLP estimations, BPL households

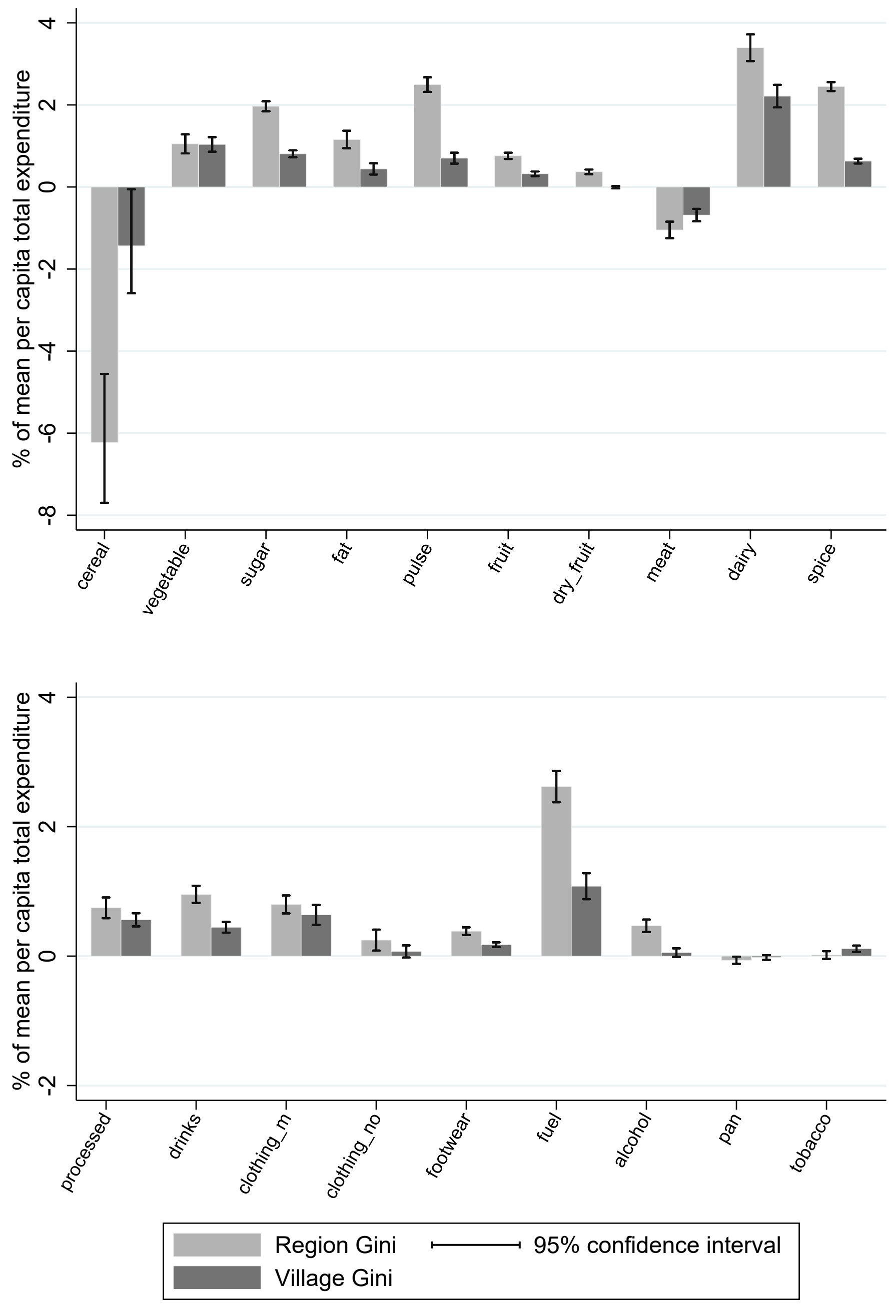

Figure 20: Social Subsistence Estimates using Village Gini Coefficients, BPL households

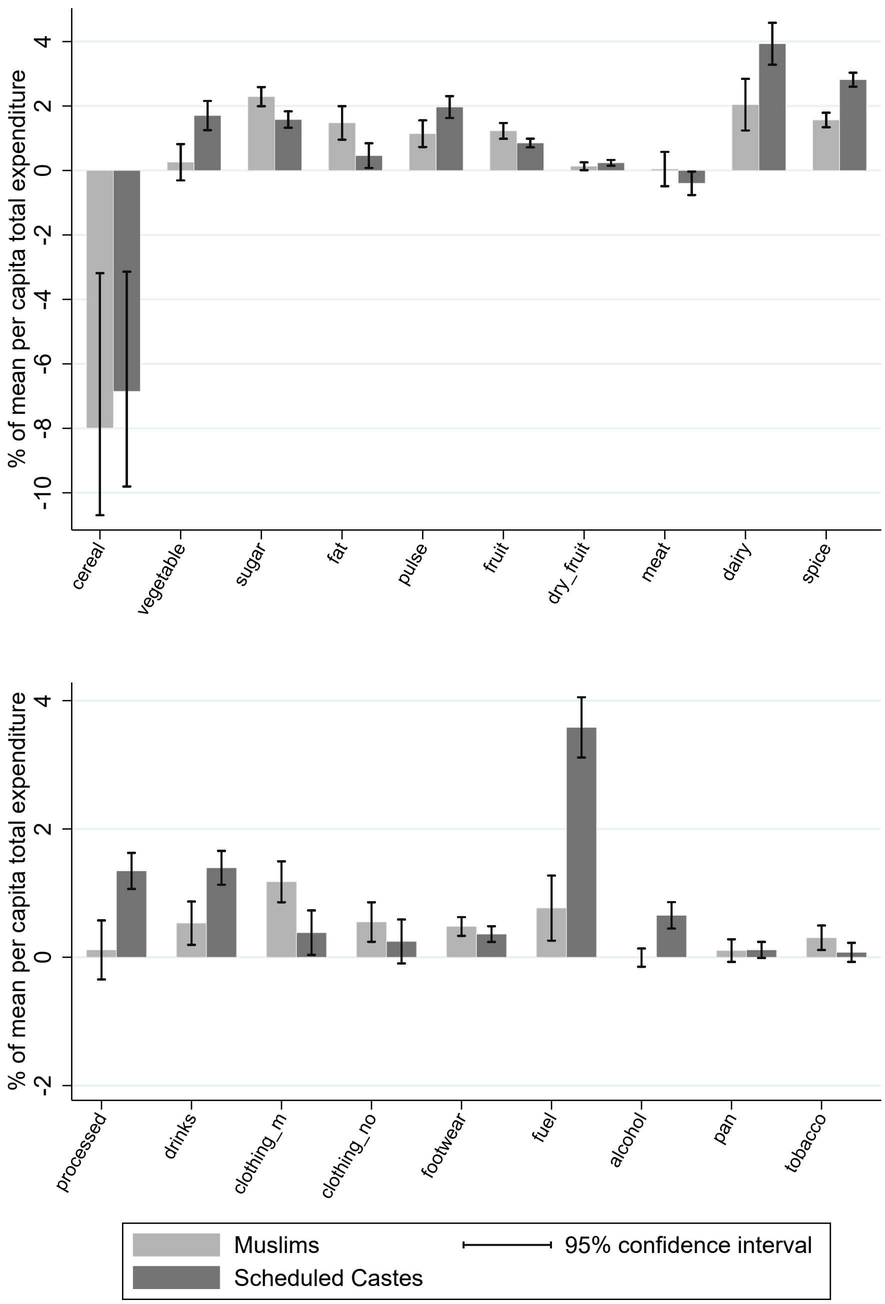

Figure 21: Social Subsistence for Muslims and Scheduled Caste Hindus, BPL households

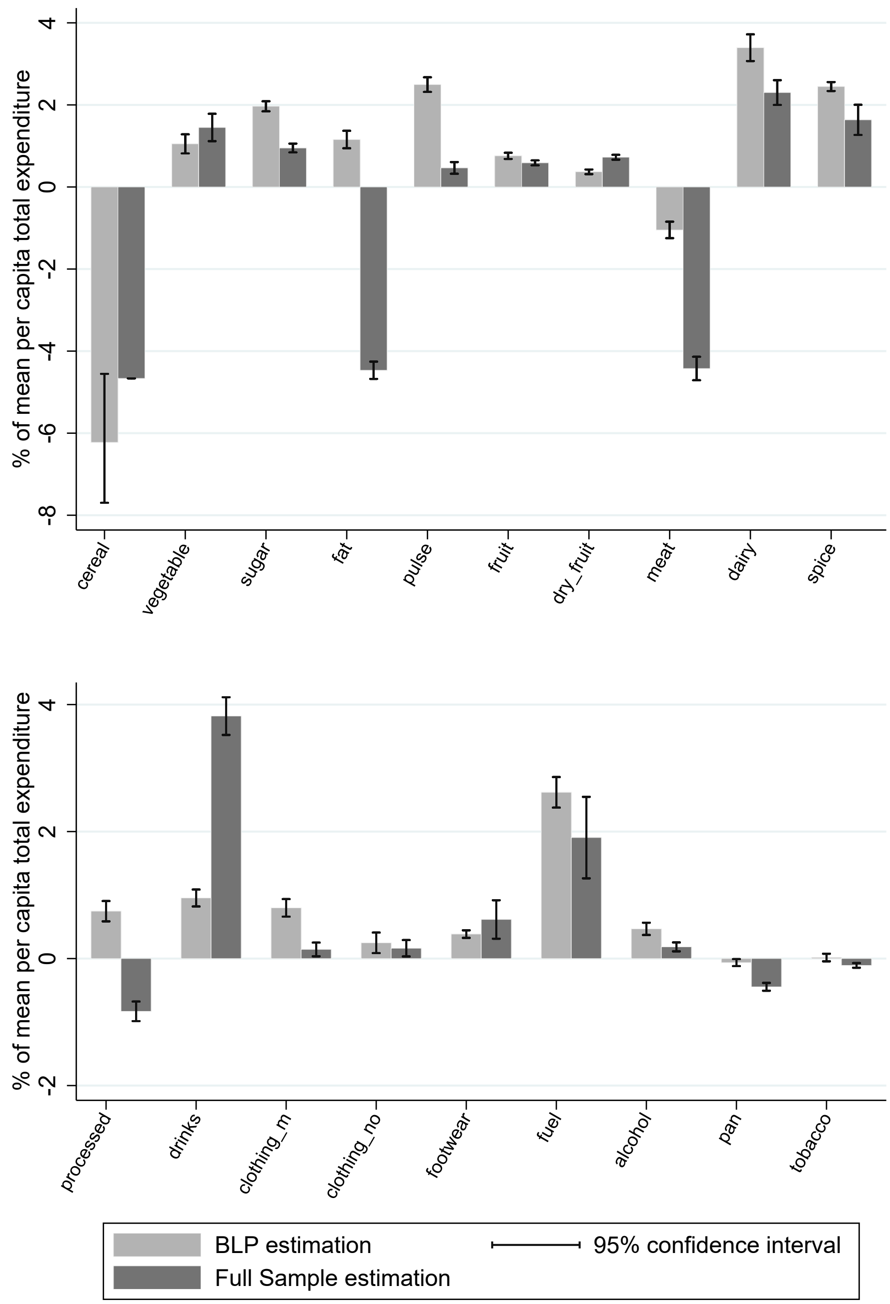

Figure 22: Social Subsistence for BPL and Full Sample households

D Non-parametric Engel Curves

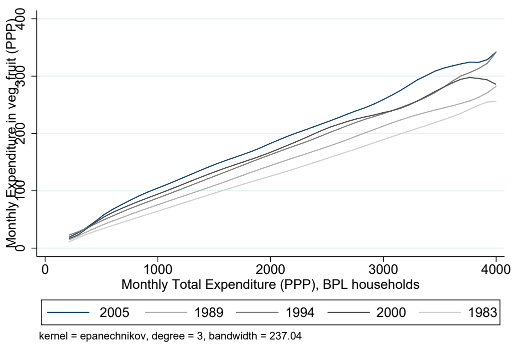

Figure 23: Engel curve for vegetable and fruit expenditure across rounds, BPL households

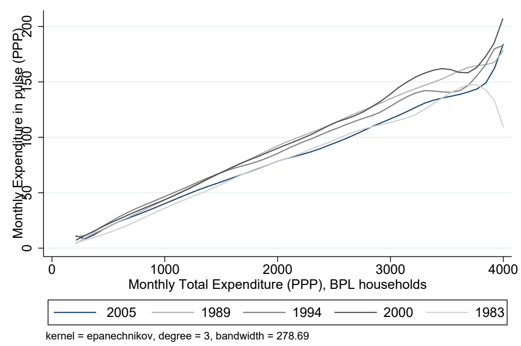

Figure 24: Engel curve for pulse expenditure across rounds, BPL households

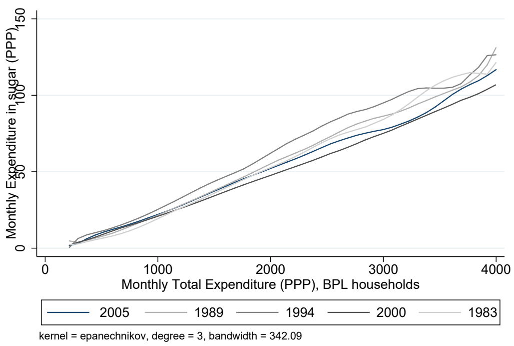

Figure 25: Engel curve for sugar expenditure across rounds, BPL households

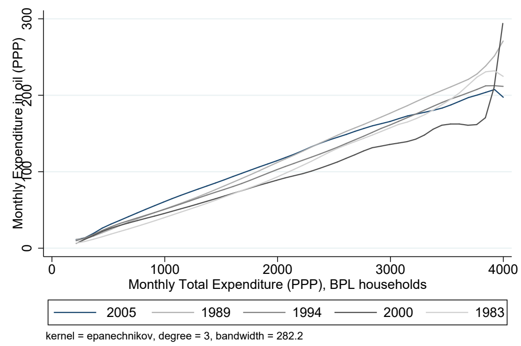

Figure 26: Engel curve for oil expenditure across rounds, BPL households

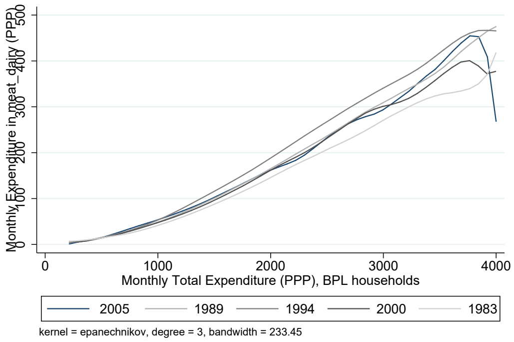

Figure 27: Engel curve for meat and dairy expenditure across rounds, BPL households

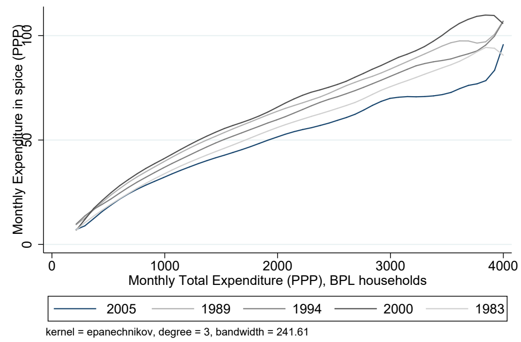

Figure 28: Engel curve for spice expenditure across rounds, BPL households

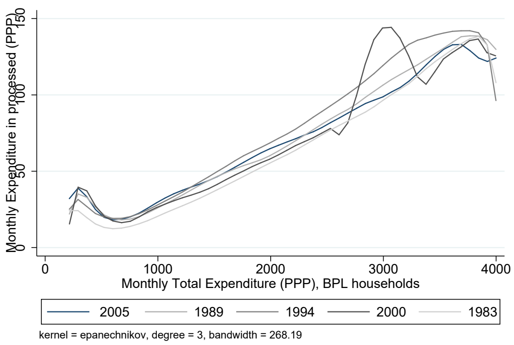

Figure 29: Engel curve for processed food expenditure across rounds, BPL households

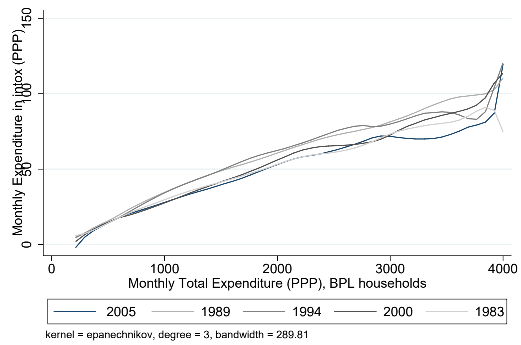

Figure 30: Engel curve for intoxicant expenditure across rounds, BPL households

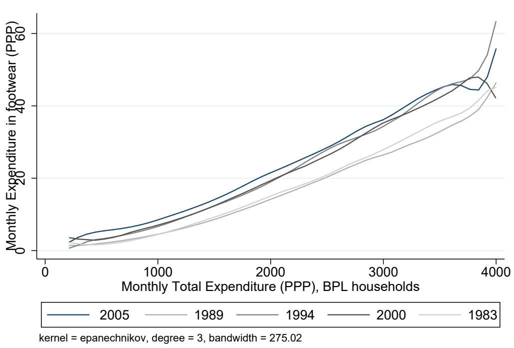

Figure 31: Engel curve for footwear expenditure across rounds, BPL households

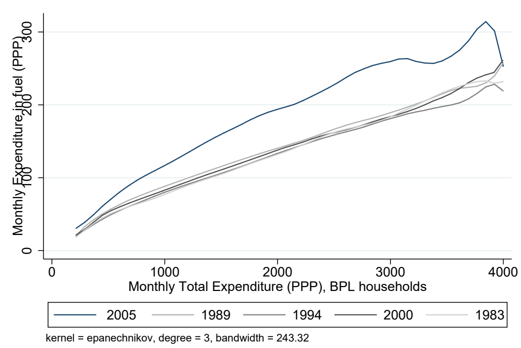

Figure 32: Engel curve for fuel expenditure across rounds, BPL households