Abstract

Despite several decades of sustained economic growth in India, rampant malnutrition is the condition of a large share of the population. Malnourished people, however, choose to spend a substantial fraction of their budget on conspicuous goods. We argue that relative deprivation could explain this paradox. Relative deprivation is introduced in a linear expenditure system as a social subsistence quantity. In this framework, it biases consumption towards conspicuous goods and decreases the demand for caloric ones. Assuming that nutrition determines future work efficiency, we show that social subsistence also widens the poverty trap in the long run. We identify relative deprivation by the spatial variation of inequality across Indian districts. We use the Indian National Sample Surveys to estimate the parameters of our model, and find that the daily per capita loss due to relative deprivation is between 100 to 300 calories for a Gini coefficient varying from 0.2 to 0.5. In the absence of relative deprivation, the fraction of the population under malnutrition would be four to eight percentage points lower.

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

JEL Classification: D01, D10, I30, Z10
1 Introduction

The concept of deprivation has recurrently been linked to social needs in addition to physiological ones. From Smith (1776)’s concept of appearing in public without shame to Veblen (1899)’s wasteful aspect of consumption and Sen’s capability approach, the social component of commodities is considered crucial to understand consumption choices. There is also ample empirical evidence that the poorest and undernourished people do not only strive for proper nutrition and shelter, but spend a significant amount of their budget on items such as tobacco, alcohol and festivals (Banerjee and Duflo, 2007). We explore how this behavior, and the extent of it, could be explained by relative deprivation.

This article aims at understanding how relative deprivation drives consumption choices, and in particular how it could tilt consumption towards conspicuous items at the expense of adequate nutrition. We consider that subsistence is not only physiological, but also social. If physiological subsistence is determined by the minimum necessary to survive, any individual, even the most deprived, aspires to attain a social standard of decency as well. Social subsistence, however, is relative to each society. We think of social subsistence as being 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. They enter, in return, in an imitation race on positional goods to keep up with the social standard of decency (Veblen, 1899; Baudrillard, 1970; Frank et al., 2005).

The literature on conspicuous consumption has usually used a signaling approach to rationalize the social use of consumption: the individual derives utility in the social status determined by her rank in society. This rank is observable through visible consumption, which is afforded in proportion of the income. In this framework, 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 argue that relative deprivation may further our understanding of the social use of consumption by focusing on the behavior of the lower sections of society.

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) have shown the link between this individual measure and the Gini coefficient, which is an aggregate measure of the relative deprivation level of all individuals. We use the Gini coefficient as our measure of relative deprivation, and explore how it modifies the subsistence level of various consumption categories.

To translate these minimum subsistence levels of consumption into the commodity space, we choose a Stone-Geary representation of utility where positive utility over consumed quantities is experienced once a minimum consumption level has been reached for each commodity. We decompose this minimum quantity, or subsistence level, into a physiological and a social component, the latter being a function of relative deprivation. This utility function leads to the linear expenditure system, which has several advantages: first, by estimating a demand system, we take into account the price and income effects which are potentially correlated with inequality (aggregate level of deprivation). We also take into account the simultaneity of the demand for various categories. This demand system incorporates the idea of subsistence quantities in an intuitive and straightforward way. Additionally, the Stone-Geary utility framework is easily comparable to the theoretical literature, as it has been used in various works to represent interdependent preferences or Veblen effects.

Incorporating relative deprivation into the subsistence level, we can derive conditions for determining empirically if a good is socially valued or not: when relative deprivation makes the subsistence level higher, the good is socially valued. Goods whose subsistence level does not react or decrease with relative deprivation are the ones to which conspicuous goods are substituted when relative deprivation increases. If relative deprivation biases consumption towards conspicuous goods such as clothing, and decreases demand for caloric goods, then individuals incur a caloric cost to leave up to the social standard. This feature, introduced in an overlapping generation model in which nutrition of a child fully determines her future work efficiency, shows how relative deprivation may have long term consequences by widening the poverty trap.

We structurally estimate the linear expenditure system and decompose the subsistence consumption level into physiological and social components. We use five thick rounds of the Indian National Sample Surveys (NSS) for the estimation, as they contain quantities and allow us to estimate unit values at a precise geographical level for twenty groups of commodities, which together account for more than 85% of the budget of below poverty line households. We specifically restrict our analysis to below poverty line households for two reasons: first, 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 (more than
90% of them are under malnutrition. Second, our analysis needs to be based on individuals with similar purchasing power in order to be able to consistently compare their choices with regard to variations in inequality within and across rounds.

We first present the results of the estimation without decomposing the subsistence level parameters. We estimate the system using the iterative generalized nonlinear least square estimator. Reassuringly, the subsistence levels are almost all positive for all NSS rounds, as predicted by the theory. We find that the group of cheap calories ranks highest as the level of subsistence expenditure, followed by clothing and more expensive calories. Computing the share of expenditure by category that subsistence expenditure takes, we also find that the shares of clothing and intoxicant subsistence expenditure increase significantly over the period: individuals experience a lower level of utility from consuming clothing and intoxicants in 2005 than in 1983, as they have to consume a higher subsistence level before experiencing a positive utility from consumption.

We then decompose the subsistence level into five factors: the Gini coefficient in the district which captures spatial differences in relative deprivation, the mean level of expenditure in the district as a control for wealth, the log of the size of the household and a dummy for living in an urban area, capturing demographic and physiological factors. The residual item-specific effect includes metabolic subsistence, but may also account for other unobservable effects. The estimated coefficients are consistent with the theoretical predictions: inequality increases subsistence expenditure in clothing and intoxicants, but decreases them for calorie-intensive categories. Once demographic and social components are accounted for, the residual component remains positive and significant for all groups of expenditures but intoxicants and expensive calories, for which the net residual effect becomes negative.

Finally, we estimate the average caloric loss due to relative deprivation, and find that it amounts to between 100 and 300 daily calories per capita. This amount is in no way trivial, given the state of malnutrition of the population on which the estimation is performed. In the absence of relative deprivation, we estimate that the fraction of the below poverty line population under malnutrition would be four to eight percentage points lower.

The specification of the linear expenditure system has three main advantages. First, it directly relates to the theoretical literature on relative deprivation, in which the reference level enters in the utility in a similar fashion as the subsistence level in the Stone-Geary utility function. Second, the subsistence parameter is micro-founded and structurally esti-

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1 The threshold to malnutrition which is commonly used in India is 2100 daily per capita calories in urban areas, and 2400 in rural areas.
mated within a complete demand system which encompasses relative deprivation. The linear expenditure system allows us to decompose the subsistence level into different explanatory factors in a very tractable way, introducing relative deprivation along with other determinants of the subsistence level such as demographics. The assumptions behind the linear expenditure system could however impact the empirical results. The first one is the assumption of independent wants across commodities, which rules out substitution. Gathering items in twenty wide categories following the National Sample Surveys classification ensures that the model performs better (Pollak and Wales, 1969; Deaton, 1975), as substitution is more likely to happen within each category. Also, the linear expenditure system exhibits linear Engel curves. We present non-parametric Engel curves for sub-categories of expenditure to illustrate the fact that our data is not inconsistent with this assumption.

This article is related to the literature on status preferences and the conspicuous use of consumption. 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. Ireland (1994) presents a theoretical work on status as signal, developed and applied by Heffetz (2011) who defines status goods as goods whose income elasticity is higher than one. The signaling aspect of consumption has been extended in an inter-temporal setting with poverty trap by Moav and Neeman (2012), and applied to within-group inequality and conspicuous consumption (Charles et al., 2009; Khamis et al., 2012). The signaling theory predicts how the incentive to spend on conspicuous goods increases with income, as it is a device to distinguish oneself from the people ranked below. We take a different approach in this article by modeling and estimating the incentive that the poor have to spend on conspicuous items. We choose a relative deprivation approach, as relative deprivation is the incapability to reach a minimum social level, while signaling is the extent to which one can signal one’s wealth through consumption. Hence, relative deprivation biases the choice of the poorest, while signaling provides an incentive to spend for wealthy people. The reason of this choice is that we consider another aspect of consumption as aspirational in nature, and set by social standards. In this framework, aspiration in consumption has negative consequences, to the difference of aspiration in terms of investment capacity such as in Genicot and Ray (2014). This article is also, to our knowledge, the first attempt to decompose and analyze subsistence levels within a complete demand system with relative deprivation, and derive conditions to identify the goods which are socially valued.

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) and happiness (Frank, 2005). Heffetz and Frank (2008) provide a vast review of literature on the effect of status preferences on choices, and Frank et al. (2005) develop the concept of expenditure cascades, very close to the idea of Veblen (1899) and the work of Baudrillard (1970). The capability approach (Sen, 1983, 1984) is also very close to the concepts used in this article: Sen considers that the capability approach could provide a non-utilitarian way of understanding welfare. Absolute capabilities, such as adequate nutrition or social decency, translate into a relative amount of commodities and income. We consider, in this article, that social decency is a capability that individuals aspire to at any given level of income, and not after they reach an adequate level of nutrition. Relative deprivation increases the cost of reaching social decency, and may crowd out nutrition too. The caloric cost is one way to capture the fact that if relative deprivation increases, an individual with a certain income level is worse-off in terms of reaching several absolute capabilities.

This article also contributes to the literature on malnutrition and the determinants of demand. Dasgupta and Ray (1986) and Baland and Ray (1991) develop two different models which link the uneven distribution of assets to malnutrition and involuntary unemployment. We draw from their work to determine how relative deprivation could lead to a poverty trap. On the determinants of food demand, Deaton and Subramanian (1996) show an interesting pattern of households going from cheap to more expensive calories (substitution among cereals, from coarse ones to rice and wheat), though they would benefit from better nutrition by reallocating their budget. Deaton and Drèze (2009) document the paradox that despite a dramatic economic growth, the last decades witnessed a decrease in calorie intake along with non-increasing real food expenditures: this feature is often referred to as the Indian caloric consumption puzzle. Banerjee and Duflo (2007) also document that the poor seem to face a significant amount of choice in the allocation of their budget, and decide not to spend it on food even though they report lacking an adequate amount of it. Atkin (2013, 2016) add empirical evidence to the fact that food choices depend on preferences such as habit formation or cultural identity. Our article contributes to this literature by bringing evidence that through consumption, people aspire to other goals than nutrition, and that relative deprivation could weight heavily on their budget.

The article is organized as follows: in section 2, we present a model of relative deprivation and extend it to an overlapping generation model showing how relative deprivation could lead to a poverty trap. In section 3, we present the database and the construction of our variables for poverty, inequality and price indexes, and give simple stylized facts to have an intuition on how inequality interacts with consumer choice over food and conspicuous
expenditures. 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 concludes.

2 A Model of Relative Deprivation

We first provide a formal definition of relative deprivation. To estimate its influence on subsistence consumption levels in a complete demand system, we derive the Stone-Geary linear expenditure system (LES). The LES is a model which has long been used to estimate habit formation and interdependent preferences in an intuitive (and easily estimated) way (Pollak, 1970, 1976). 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 signalling component of consumption, another social aspect of consumption distinct from relative deprivation.\(^2\)

2.1 Income inequality and relative deprivation

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 \(B_z(x)\) divided by the population \(n\) in his area:

\[
\rho_z(m) = \sum_{y \in B_z(m)} \frac{(m_y - m_z)}{n} \quad \text{where } m_y > x_z
\]

Assuming we have information about the distribution of income in a given location, we can construct individual deprivation indexes using equation (1). Besides, Yitzhaki (1979)\(^2\)

\(^2\)Heffetz (2004) restricts the analysis to a two goods example and does not attempt to structurally estimate the subsistence parameters.
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. Clark and D’Ambrosio (2014) notes 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 deprivation can simply be captured by the Gini coefficient.

2.2 The Consumer’s Problem

Following Pollak (1976), we postulate that individuals maximize the convex combination of their fundamental utility $U(X)$ from consuming a vector $X$ of quantities, in which they value a minimum compulsory quantity of each good $i$, denoted $b_i$. The corresponding Stone-Geary linear expenditure system is given by:

$$U(X) = \sum_i \alpha_i \ln(x_i - b_i)$$

s.t. $\sum_i p_i x_i = m, \quad \sum_i \alpha_i = 1, \quad \alpha_i > 0, \quad (x_i - b_i) > 0$ (2)

The term $b_i$ can be interpreted as a subsistence level (or reference consumption level) above which the individual allocates her income $m$ according to her taste parameters $\alpha_i$’s if all $b_i$’s are positive and $\sum_i p_i b_i \leq m$. These conditions mean that we cannot interpret the $b_i$’s as subsistence quantities if they are negative, and cannot infer preferences from individuals whose income is below the sum of subsistence expenditures (assuming such individuals cannot live).

Following Pollak (1970, 1976), we decompose the parameter of subsistence $b_i$ into different components which, for the sake of our analysis, we denote “physiological” and “social” (Pollak’s decomposition corresponds to habit formation and interdependent preferences). We can rewrite the necessary quantity of each good as a function of a physiological quantity and a social one (which depends on the environment of the individual). This decomposition is also linked to the idea that each individual wishes to fulfill several capabilities, some of them being to have enough to eat/cover oneself and others being linked to social needs such as not being ashamed to appear in public. The interpretation of the different components of the subsistence quantities depends on the parameters we introduce. In this paper, we consider the following model:

$$b_i = \beta_i + \nu_i \rho$$ (3)
With $\beta_i$ being the physiological level and $\nu_i \rho$ the social level. $\nu_i$ is the Veblen coefficient which captures the extent to which the individual is influenced by the level of reference $\rho$. We assume that this strength $\nu_i$ varies across goods: 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 (corresponding to $b_i = \beta_i + \nu \rho$). Here, on the contrary, we introduce the intuition of the literature on relative consumption and social needs to mark the difference between goods having a social value (conspicuous, or aspirational in nature) and goods consumed privately\(^3\). 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 meat or underwear. The literature on signaling also shows that visible goods such as clothing are the goods relevant to signal one’s status (Heffetz, 2011).

By making the Veblen coefficient $\nu_i$ flexible across goods, we introduce a testable prediction: we define a conspicuous good as being a good for which $\nu_i > 0$ and a non-conspicuous good as a good for which $\nu_i \leq 0$ and $-\nu_i \rho \leq \beta_i$. This prediction gives us a strong empirical test 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. It also predicts that relative deprivation can affect subsistence quantities in both directions: it increases subsistence quantities for conspicuous goods, but is neutral or decrease subsistence quantities for inferior goods. It is to be noted that the classification between conspicuous and inferior goods is a matter of social deprivation, not physiological. It is indifferent to the short or long term benefits of consuming certain items rather than others, such as food for example. This result is precisely why inequality could make individuals worst off, as much in terms of achieving several capabilities as in long-term economic outcomes if the allocation is biased towards low-return goods.

We assume $\rho$ to be the same level of reference across goods, as we do not wish to attach any particular good to this reference level of expenditure necessary not to feel socially deprived. This assumption can be understood as $\rho$ representing a basket of visible goods affecting the subsistence level of consumption for each good $i$. Alternatively, in the line of thought of Baudrillard (1970) and others who conceptualized consumption practices, $\rho$ represents a structural constraint of differentiation relative to the others in a society. Consumption is thought as a language, a system of signs corresponding to the imperative of upholding

\(^3\)The fundamental utility function generally used in the theoretical literature assumes that $\beta_i = 0$ and $\nu_i = 1$, without considering the heterogeneity of the comparison effect across goods. This simplification reduces the interest of confronting the theory with the data, not determining a different effect across goods.
social distance and differentiation. In this view, the field of consumption is a structured social field where goods and needs trickle down from a reference group (the elite) to the other strata of society: goods and needs may only appear in the standard package (the necessary commodities) if they went through the elite package and have been replaced by other distinctive needs. This line of thought is very similar to Veblen (1899)’s theory of wasteful expenditure, or the concept of expenditure cascades Frank et al. (2005). It is also an intuition of Duesenberry (1949), who noticed that in a society which puts the level of living standard as its primary goal, any individual living in a place where the living standard is high would tend to spend more on consumption at any relatively low income.

The disclosure of certain goods would then be a function of selective innovation in other goods at the top of the society, so that social distance is restored or maintained. In a stagnating society, the process of aspiration to new goods and needs is limited by resources and the production process, restraining their use: many historical examples of sumptuary laws⁴ witness the attempt of social elites to maintain differentiation by appropriating the use of specific commodities and capping their consumption by other competing groups (merchants of the late Middle Ages and Renaissance), or groups meant to be socially disfavored (Dalits in India (Ambedkar, 1944)). In a growing society, however, the process of aspiration to new goods and needs is limitless and follows the process of differentiation by innovation at the top. Aspiration in consumption may also compensate the dysfunctions in social mobility: the over-consumerist aspiration (mostly of the lower sections of the society) may be the expression of the failure of the status requirement, not being able to ascend the social ladder.

These interpretations can lead to various measures of the social level of reference ρ, from incorporating different measures of inequality or relative deprivation, to analyzing the effect of different reference groups such as the people in the highest income deciles or the ones in one’s own social group (religious, ethnic, etc.). These measures and their meaning will be explored further in the empirical analysis (section 4).

### 2.3 Demand System with Multiple Goods

Replacing $b_j$ by its expression in Equation (3), and solving for the first order conditions of the consumer’s problem (2), we obtain the Marshallian demand function for each good $j$:

$$x_j = \frac{\alpha_j m_j}{p_j} + \beta_j + \nu_j \rho - \frac{\alpha_j}{p_j} \sum_i (\beta_i + \nu_i \rho)p_i$$  

⁴See, for example, Montaigne, *Essais* (1595), I, 43 on sumptuary laws in France
Or, by multiplying Equation (4) by \( p_j \) and dividing by \( m \) in order to have a demand system with shares on the left hand side:

\[
\frac{s_j}{m} = \frac{x_j p_j}{m} = \alpha_j + (\beta_j + \nu_j \rho) \frac{p_j}{m} - \sum_i \alpha_i (\beta_i + \nu_i \rho) \frac{p_i}{m}
\]

(5)

These demand functions exhibit locally linear Engel curves which shift according to the values of the \( \beta_i + \nu_i \rho \)'s.

Differentiating Equation (4) with respect to \( \nu_j \) and to \( \nu_i \), it is straightforward to see that the quantity \( q_j \) of the good \( j \) is a positive function of its Veblen coefficient \( \nu_j \) and a negative function of the Veblen coefficients of other goods \( \nu_i \). In other words, the strength of the Veblen coefficient in certain goods affects the consumption of other goods through the substitution in subsistence quantities. The more conspicuous \( j \) is, the higher is the quantity \( q_j \) consumed. The more conspicuous other goods \( i \) are, the lower is the quantity \( q_j \) consumed.

We derive the income elasticity \( \xi_j \) for each good \( j \) using the standard formula:

\[
\xi_j = \frac{1}{1 + (\beta_j + \nu_j \rho) \frac{1}{\alpha_j} - \sum_i (\beta_i + \nu_i \rho) \frac{1}{\alpha_i}}
\]

(6)

Compared to the homothetic Cobb-Douglas case \( (\beta_j + \nu_j \rho = 0) \) where the two commodities are normal goods \( (\xi_j = 1, \forall j) \), in the relative deprivation model, whether a commodity is a luxury or a necessity depends on the relative size of its physiological and social subsistence quantities compared to other goods.

2.4 Illustration: A Two-Goods Case

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:

\[
U(f, c) = \alpha \ln(f - (\beta f + \nu_f \rho)) + (1 - \alpha) \ln(c - (\beta c + \nu_c \rho))
\]

\[
s.t. \quad p_f f + p_c c = m
\]

(7)

From the expression (4), we write the following demand system:
\[
\begin{align*}
    f &= \alpha m_f + (1 - \alpha)(\beta_f + \nu_f \rho) - \alpha(\beta_c + \nu_c \rho) \frac{p_c}{p_f} \\
    c &= (1 - \alpha) m_c + \alpha(\beta_c + \nu_c \rho) - (1 - \alpha)(\beta_f + \nu_f \rho) \frac{p_f}{p_c}
\end{align*}
\]  

(8)

And derive the income elasticities:

\[
\begin{align*}
    \xi_f &= \left[ 1 + \frac{1 - \alpha}{\alpha} \frac{(\beta_f + \nu_f \rho) p_f}{m} - \frac{(\beta_c + \nu_c \rho) p_c}{m} \right]^{-1} \\
    \xi_c &= \left[ 1 + \frac{\alpha}{1 - \alpha} \frac{(\beta_c + \nu_c \rho) p_c}{m} - \frac{(\beta_f + \nu_f \rho) p_f}{m} \right]^{-1}
\end{align*}
\]  

(9)

From the expression of income elasticities, we can see that the determination of a good being a luxury or a necessity depends on the Veblen coefficients \(\nu_i\) and inequality level \(\rho\). The more \(\nu_c\) is positive and \(\nu_f\) is negative, the more the conspicuous good becomes necessary (\(\xi_c < 1\) and \(\xi_f > 1\)).

Figure 1 illustrates the Engel curves obtained under no relative deprivation. We set the parameters at reasonable levels, assuming an \(\alpha\) of 0.7 which is close to the share spent on food by BPL households. Also, the physiological subsistence levels \(\beta_i\)'s are set to be positive (an assumption of the LES that will be confirmed empirically), with typically a higher physiological subsistence level for food than clothing. In this society, individuals cannot survive with less than \(\beta_f p_f + \beta_c p_c = \text{Rs25 per day}^5\).

\footnote{In all graphs, prices are normalized to 1. We do not exploit price effects in this illustrative section.}
We also observe that food is more necessary than clothing by drawing the elasticities with the same parameters in Figure 2: the income elasticity is below 1 for food, and above 1 for clothing. This result, coming from the assumption of $\alpha_f > \alpha_c$ and $\beta_f > \beta_c$, is consistent with the intuitive idea that food is an absolute necessity when there is no relative deprivation effect. As income increases, the income elasticities tend to the homothetic case where all elasticities are equal to 1.

Once we introduce relative deprivation on the conspicuous good, the Engel curves for both goods shift in the opposite direction so that an individual increases her consumption of clothing and decreases her consumption of food at any level of income. This situation is illustrated in Figure 3 where the dashed lines are the Engel curves without relative deprivation, and the full lines are the Engel curves in the situation where relative deprivation affects positively the subsistence level of clothing. The other effect of relative deprivation is that the minimum expenditure required for an individual to survive in this society is higher.

In cases where the food subsistence level can decrease, however, relative deprivation may affect food as well by depreciating its social value. This is the case represented by Figure 5. As we can see, the corresponding society is very different from the baseline one (Figure 1 or dashed lines) in the composition of the basket of goods, even when these two societies could have the same required minimum expenditure. Introducing relative deprivation makes poor individuals spend more on clothing at any level of income, and therefore need a higher income to reach the same nutrition level (food expenditure) than in the baseline society. The income elasticities, which present an inverse trend compared to the baseline case, reflect the
fact that food can become less necessary than conspicuous items when the social valuation weights differently their respective subsistence level.

\[ \alpha = 0.7, \beta_f = 20, \beta_c = 5 \]
\[ \rho = 500 \]
\[ \nu_c = 0.02 \]
\[ \nu_f = -0.02 \]

Figure 5: Engel Curves with negative response on non-conspicuous good

Figure 6: Income Elasticity with negative response on non-conspicuous good

2.5 Nutrition and Poverty Trap

The choice of consumption between conspicuous items and food also represents 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, and 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)).

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 follow an alternative formulation of the Galor-Zeira growth model (Galor and Zeira, 1993) by Moav (2002), who introduces convexity in the bequest function with respect to income (fixed cost to education). We use the two-goods specification of section 2.4, with a Veblen externality on conspicuous consumption relative to food.
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 (7). 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)\(^6\)). The main difference with previous models is that the link between food consumption and work efficiency is intertemporal:

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

\[\quad \text{(10)} \]

\(^6\)Adapting the definition in Baland and Ray (1991), we assume that $\lambda(f) = 1$ for $f \in [0, \bar{f}]$, $\bar{f} > 0$, $\lambda(f)$ strictly increasing and differentiable for $f > \bar{f}$, $\lambda$ is continuous at $\bar{f}$ and $\bar{f}$, and $\lambda$ is concave on the restriction $[\bar{f}, \infty]$.
The form of the conversion function $\lambda_{t+1}(f_t)$ is illustrated in Figure 7. As the parent is a child who survived, she acquires one efficiency unit of labor skill – this is the minimum level before death, with $f$ 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 labour 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 (10). Replacing the expression for food demand $f_t$ (Equation (8)) in Equation (10), the dynamics of income within a dynasty is given by:
\[ m_{t+1}(m_t) = \begin{cases} 
1 & \text{if } f_t < \bar{f} \\
1 + r_1 \left( \alpha \frac{m_t}{p_{ft}} + (1 - \alpha) b_{ft} - \alpha b_{ct+1} \frac{pc_{ft}}{p_{ft}} - \bar{f} \right) & \text{if } \bar{f} \leq f_t < \bar{f} \\
1 + r_1 (\bar{f} - f) + r_2 \left( \alpha \frac{m_t}{p_{ft}} + (1 - \alpha) b_{ft} - \alpha b_{ct+1} \frac{pc_{ft}}{p_{ft}} - \bar{f} \right) & \text{if } f_t \geq \bar{f}
\end{cases} \]  
(11)

with \( b_{it} = \beta_{it} + \nu_{it} \rho_t \), and \( m_0^i \geq 1 \) given.

Given the conversion function \( \lambda_{t+1} \), there is a set of incomes \( m_t \in [1, \bar{f}] \) for which \( m_{t+1}(m_t) = 1 \). It constitutes a minimum income \( \underline{m} = 1 \), 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:

\[
\frac{1}{p_{ft+1}} (1 + r_1 (\bar{f} - f)) + (1 - \alpha)b_{ft+1} - \alpha b_{ct+1} \frac{pc_{ft+1}}{p_{ft+1}} > \bar{f}
\]  
(12)

Equation (12) ensures the existence of a range of incomes in which \( m_{t+1}(m_t) > m_t \). Given \( \underline{m} \) and Equation (12), 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 (11), we get:

\[
\hat{m} = \frac{r_1 (\alpha b_c \frac{p_c}{p_f} - (1 - \alpha) b_f + \bar{f}) - 1}{r_1 \alpha \frac{1}{p_f} - 1}
\]  
(13)

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 (11)), the high income steady state is characterized by:

\[
\bar{m} = \frac{r_2 (\alpha b_c \frac{p_c}{p_f} - (1 - \alpha) b_f + \bar{f}) - r_1 (\bar{f} - f) - 1}{r_2 \alpha \frac{1}{p_f} - 1}
\]  
(14)
Figure 8: Income Dynamics - low income and high income steady states

Figure 8 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 $\bar{m} = 1$ 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 (13) with respect to $b_c = \beta_c + \nu_c\rho$, we obtain that $\hat{m}$ is a positive function of $b_c$ if $r_1\alpha > 1$, which is always true under the condition (12). Indeed, $r_1\alpha$ is the slope of $m_{t+1}(m_t)$ between $\bar{f}$ and $\bar{f}$, which is higher than 1 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 $b_f$. 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 (14) with respect to $b_c = \beta_c + \nu_c\rho$. $\bar{m}$ is a negative function of $b_c$ if $r_2\alpha < 1$, which is always true in the case where there is a high income steady state (and not infinite growth). Indeed, $r_2\alpha$ 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 $\alpha < 1$. Inversely, $\bar{m}$ as a positive function of $b_f$. 

18
These results produce the main intuition behind the 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 9 illustrates these dynamics, with the dashed line being the same case as in Figure 8 and the full line representing a population for which relative deprivation has increased (either through the Veblen coefficient $\nu$, or through a higher reference income $\rho$). 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 run income level than in the absence of relative deprivation.

## 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.

### 3.2 Poverty Measure

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 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 state. Besides restricting the analysis to poor households, this absolute definition of poverty allows us to compare relatively similar households across 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 poor households lying below the threshold are on average similar across waves in their main social and economic characteristics, as Table 1 shows.\(^7\) In particular, their mean individual income expressed in 2000 level went from 256 rupees per month in 1983 to 287 rupees in 2000, which shows a very limited increase in income within the group of absolute poor households.

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

<table>
<thead>
<tr>
<th></th>
<th>38th round</th>
<th>43rd round</th>
<th>50th round</th>
<th>55th round</th>
<th>61st round</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population share (%)</td>
<td>45</td>
<td>39</td>
<td>36</td>
<td>26</td>
<td>27</td>
<td>35</td>
</tr>
<tr>
<td>Monthly Per Capita Expenditures (Rs 2005)</td>
<td>284</td>
<td>299</td>
<td>305</td>
<td>318</td>
<td>318</td>
<td>304.1</td>
</tr>
<tr>
<td>Household size (no)</td>
<td>8.1</td>
<td>8.0</td>
<td>7.6</td>
<td>8.3</td>
<td>7.9</td>
<td>8.1</td>
</tr>
<tr>
<td>Scheduled Caste (%)</td>
<td>20</td>
<td>21</td>
<td>25</td>
<td>25</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>Scheduled Tribe (%)</td>
<td>11</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Hindu Other Caste (%)</td>
<td>52</td>
<td>50</td>
<td>47</td>
<td>43</td>
<td>43</td>
<td>47</td>
</tr>
<tr>
<td>Muslim (%)</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>18</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Rural Sector (%)</td>
<td>78</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>76</td>
<td>77</td>
</tr>
<tr>
<td>Agricultural Labor Share (%)</td>
<td>60</td>
<td>58</td>
<td>57</td>
<td>57</td>
<td>53</td>
<td>57.3</td>
</tr>
</tbody>
</table>

\(^7\)The only noticeable change across NSS rounds within the group of poor people corresponds to a lower share of Hindus belonging to higher castes.
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 number and unit of the quantities consumed for most food items, fuel and light, clothing and footwear, along with some durable goods (furniture, transportation, personal goods, etc.). 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 expenditures 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

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

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 shall assume separability with nondurables and exclude the nondurables whose consumption may be influenced by the stock of durables (transportation and oil, for example,
related to the number of vehicles)\textsuperscript{8}.

To compute price indexes for different subgroups of expenditures, we obtain unit values by item following the methodology of Deaton and Tarozzi (2000). Doing so requires a detailed data examination of each commodity for the four rounds of the NSS that we use. For several categories of expenditure some quantities are recorded using a different measure. It is often the case for food items which are sometimes measured in grams rather than kilograms. In such cases, we harmonize the measure across all rounds. We delete the few items which are not registered in all rounds or where the unit values appeared not to be reliable so that we have comparable subgroups of expenditures across rounds\textsuperscript{9}. For the remaining items, we delete major outliers capping the distribution within each commodity at the 99th percentile. Figures 17 and 18 in appendix B summarize the kernel distributions of unit values across the four rounds within the 20 categories of expenditures used in the empirical analysis.

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\textsuperscript{10}. The weight used to compute median prices is the household weight given in the NSS data, multiplied by the size of the household in order to have an individual-weighted level of price.

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 $P^i_v$ of a given category of expenditure $i$ containing $n_i$ commodities aggregated at regional level $r$ is calculated using the following formula:

$$P^i_v = \sum_{j=1}^{n_i} w^j_{i,r} p^j_{v} \text{ s.t. } \sum_{j=1}^{n_i} w^j_{i,r} = 1$$

where $p^j_{v}$ corresponds to the median unit value of commodity $j$ in village $v$ and $w^j_{i,r}$ corresponds to the mean budget share in category $i$ of commodity $j$ in region $r$. The weight

\textsuperscript{8}Note that for small durable goods such as crockery or appliances this should be less of an issue since the expenditures are recorded on an annual basis and the empirical analysis assumes households allocate their annual income rather than their monthly income, which is what we do here.

\textsuperscript{9}This is the case for some clothing expenditure, where the same items are measured in meters for some rounds and in numbers for some other rounds. We therefore drop these items. Fortunately, this should not affect the empirical analysis as the commodities deleted generally represent a very small fraction of expenditure within each category.

\textsuperscript{10}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.
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.

### 3.4 Inequality and subsistence expenditures

To test the relevance of relative deprivation for the study of social subsistence, we can look at the cross-correlations between regional Gini coefficients of per capita expenditure and regional subsistence expenditures. To do so, we focus on four broad categories of commodities: clothing items measured in meters, which account for a majority of clothing expenditure and are more easily comparable across districts and rounds (dhoti, sari, clothing for shirt, pyjama, salwar, coat, trousers, and overcoat), intoxicants (alcohol, tobacco and pan) and two subgroups of food expenditure (cheap calories and expensive calories commodities). We derive reduced form estimates of region-specific subsistence expenditures for each of these categories. To do so, we specify for each round the following OLS regression on our sample of poor households:

\[
S_{c,h} = \beta_0 + \gamma_c E_h + \sum_r \alpha_{c,r} \text{region}_{h,r} + \sum_r \beta_{c,r} \text{region}_{h,r} E_h + \gamma_c \sum_j \gamma_j \ln(prices_{j,h}) + \delta X_h + \epsilon_{c,h} \tag{15}
\]

where \( S_{c,h} \) is the expenditure share on category \( c \) spent by household \( h \) living in region \( r \); \( E_h \) is the household’s per capita expenditure, \( \text{region}_{h,r} \) are regional dummy variables (the default being the Coastal region of Andhra Pradesh); \( \ln(prices_{j,h}) \) is the log price index of the jth item computed at the village level; and \( X_h \) is a vector of geographical and demographic controls which includes the mean per capita expenditure in the district where the household lives and whether he lives in an urban area. The \( \alpha_r \) parameters correspond to the intercepts of regional Engel curves for category \( c \). In other words, it captures how much more (or less) percentage of his budget every poor households living in a different region consume compared to similar households from the Coastal region of Andhra Pradesh. This constant can be interpreted in first approximation as region-specific subsistence expenditures (or minimal standards of living) for each of these expenditure categories.

Figure 10 shows the cross-correlation between the \( \alpha_r \) parameters (i.e. the conditional differences in expenditure share relative to Coastal Andhra Pradesh region) and the gini coefficient in region \( r \). The correlation for clothing and intoxicants is positive and significant,
while it is negative and significant for cheap calories. The coefficient for expensive calories is positive but weakly significant. This reveals a relationship between inequality measured by the Gini coefficient and regional standards of living biased in favor of more conspicuous items. We will further explore this relationship in the empirical estimation.

Figure 10: Cross-correlation between Gini and conditional difference in expenditure share relative to Coastal Andhra Pradesh region, BPL households.

4 Empirical Analysis

4.1 Estimation Procedure

The linear expenditure system makes two strong assumptions for empirical application. First, the utility function is strongly separable 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 items in categories as indicated by the National Sample Surveys: cereals, footwear, spices, etc. Also, finding strictly positive subsistence quantities implies that all goods are price inelastic.

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. The linearity assumption could be a bit far-fetched over the entire income range, but as we restrict the analysis on below poverty line households, linearity is in fact a good approximation of the Engel curves.

The estimation method we use is the iterative generalized nonlinear least square estimation, a standard method for demand estimations (Deaton (1986)). For example, Herrendorf et al. (2013) estimate a linear expenditure system using the same procedure. The seemingly unrelated regression framework takes into account that error terms 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 – $b_i$’s not additively separated – is parsimonious in the parameters to estimate $(2n - 1)$. We discussed in section 2 that 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 demographics or employment, and could make the demand for each good vary in important ways. Pollak and Wales (1978) assume that the $b_i$’s depend linearly on such factors (in this example, the number of people in the household), and introduce them as such in the theoretical specification, adding $n$ parameters to estimate for each additional factor. We use the same specification in order to introduce controls that could influence both the strength of the Veblen coefficient $\nu_i$ and the consumption of specific items.

4.2 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.

Figure 11: Non-parametric Engel curves across rounds, BPL households

(a) Cereal expenditure  
(b) Clothing expenditure

Figures 11a and 11b are kernel-weighted local polynomial regressions of expenditure on monthly total expenditure\(^{11}\). 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 the behavior of our data. We could note the slight curvature which appears concave for

\(^{11}\)The lowest and highest percentiles of monthly total expenditure have been truncated from the Engel curves.
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 19 to 28 in appendix C).

### 4.3 Empirical Results

From the linear expenditure system described in section 2.3, we structurally estimate subsistence levels of consumption $b_i$ from Equation (5) for twenty categories of expenditures. The sample is restricted to below poverty line (BPL) households in all the analytical results that follow. We estimate the demand functions expressed as shares in order to restrict outliers. This gives us the following demand system to estimate on $n$ goods:

$$
\begin{align*}
\frac{x_1}{p_1} &= \alpha_1 + b_1 \frac{p_1}{m} - \sum_i \alpha_1 b_i \frac{p_i}{m} \\
\frac{x_2}{p_2} &= \alpha_2 + b_2 \frac{p_2}{m} - \sum_i \alpha_2 b_i \frac{p_i}{m} \\
&\cdots \\
\frac{x_n}{p_n} &= \alpha_n + b_n \frac{p_n}{m} - \sum_i \alpha_n b_i \frac{p_i}{m}
\end{align*}
$$

(16)

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 Stone indexes of the items within a category as explained in section 3.3, following the method of Deaton and Tarozzi (2000) (possibility of two-stage budgeting mentioned in Nevo (2010)).

We take into account the endogeneity of price to the demand functions by replacing price indexes of all groups $i$ as median village price indexes, following Atkin (2013). 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 total expenditure used to estimate the demand functions is the per capita expenditure on the twenty categories.

As all shares sum to 1, we estimate $n - 1$ equations which give us $n$ parameters $b_i$ and $n - 1$ parameters $\alpha_i$ (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 $\alpha_n$ using the constraint $\sum_i \alpha_i = 1$. Reassuringly, the estimation results produce all $\alpha_i$ positive and bounded between 0 and 1, and almost all $b_i$ are positive, two conditions which have to be

---

12 Atkin (2013) notes that “median village prices are robust to outliers and are not contaminated by quality effects that typically overstate the price response.”

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Table 3: List of estimated parameters from LES, BPL households.

<table>
<thead>
<tr>
<th>Item</th>
<th>$\alpha_i$ parameters</th>
<th>$\beta_i$ parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38th round</td>
<td>43rd round</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.00571</td>
<td>0.00726</td>
</tr>
<tr>
<td>Cereals</td>
<td>0.472</td>
<td>0.409</td>
</tr>
<tr>
<td>Clothing (meters)</td>
<td>0.0649</td>
<td>0.0604</td>
</tr>
<tr>
<td>Clothing (number)</td>
<td>0.0168</td>
<td>0.0199</td>
</tr>
<tr>
<td>Dairy</td>
<td>0.0472</td>
<td>0.0588</td>
</tr>
<tr>
<td>Drinks</td>
<td>0.0194</td>
<td>0.0212</td>
</tr>
<tr>
<td>Dry fruits</td>
<td>0.00148</td>
<td>0.00154</td>
</tr>
<tr>
<td>Footwear</td>
<td>0.00774</td>
<td>0.00789</td>
</tr>
<tr>
<td>Fruit</td>
<td>0.00871</td>
<td>0.0107</td>
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<tr>
<td>Fuel</td>
<td>0.0749</td>
<td>0.0810</td>
</tr>
<tr>
<td>Meat</td>
<td>0.0291</td>
<td>0.0316</td>
</tr>
<tr>
<td>Pan</td>
<td>0.00424</td>
<td>0.00386</td>
</tr>
<tr>
<td>Processed</td>
<td>0.0105</td>
<td>0.0140</td>
</tr>
<tr>
<td>Pulse</td>
<td>0.0430</td>
<td>0.0514</td>
</tr>
<tr>
<td>Salt</td>
<td>0.00273</td>
<td>0.00229</td>
</tr>
<tr>
<td>Spice</td>
<td>0.0297</td>
<td>0.0347</td>
</tr>
<tr>
<td>Sugar</td>
<td>0.0282</td>
<td>0.0301</td>
</tr>
<tr>
<td>Tobacco</td>
<td>0.0198</td>
<td>0.0236</td>
</tr>
<tr>
<td>Vegetables</td>
<td>0.0613</td>
<td>0.0601</td>
</tr>
</tbody>
</table>
fulfilled for the model to perform well, as can be seen in Table 3.

Each estimated subsistence quantity $b_i$ is then multiplied by average price and divided by the median total per capita expenditure or category expenditure. To ease the interpretation of the results, we aggregate our twenty categories within six broad groups of expenditure: cheap calories items (cereals, pulse, sugar, fat, salt), medium-priced calories items (drink, dry fruits, fruits, vegetables), expensive calories items (meat, dairy, spice, processed food), clothing items (commodities measured in meters, commodities measured in numbers, footwear), intoxicants (tobacco, pan, alcohol) and fuel. Results are presented in Figures 12a and 12b:

![Figure 12a](image1)

(a) Fraction of median total per capita expenditure

![Figure 12b](image2)

(b) Fraction of median category per capita expenditure

Figure 12: Subsistence expenditure (aggregated by broad categories), BPL households

In Figure 12a, the subsistence expenditures are expressed as a fraction of the total budget of below poverty line households. As expected, food is the first group of expenditures in terms of subsistence, as it represents between 2% and 8% of median poor household’s budget. Then come clothing, intoxicant and fuel expenditure. The desegregation of food items according to their caloric intensity shows cheap calories are ranked first, above medium and expensive calories. Note that the income required to meet subsistence for food decreased in 2000 and 2005, with a more systematic decrease for cheap calories. On the contrary, the income required to meet subsistence for clothing saw a constant rise, going from 0.5% in 1983 to about 2.5% of the median total per capita expenditure of the poor in 2000 and 2005.

In Figure 12b, we express subsistence levels as a fraction of the group’s total expenditure. This metric has an intuitive implication for welfare analysis: subsistence expenditure being defined as the level of expenditure up to which one receives positive utility from con-
umption, if the share of estimated subsistence within a given expenditure category increases while spending on this category remains unchanged, one can say that households experience a lower level of utility for the same level of expenditure. According to this metric, clothing is the category which saw the highest increase in subsistence expenditures between the period 1983-2005. They only accounted for 5% of the total clothing expenditure of poor households in 1983. This number reached 10% in 1989, 20% in 1994 and up to 30% in 2000 and 2005. Not only did the share of clothing expenditure increase over the period, as shown in Table 1, but the fraction of spending providing positive utility to poor households significantly fell. Interestingly, intoxicants show a similar trend, with the share of subsistence spending required to meet subsistence going from 3% to 15% within this group of expenditures. Tobacco, pan and alcohol tend to be associated with conspicuous items due to their high social visibility, as discussed in Heffetz (2011).13

We now explore the determinants of these subsistence levels and the likely explanations for their measured variation, including relative deprivation. We estimate the parameters of the same system (16) but decompose $b_i$ into various components likely to affect subsistence levels, such as Pollak and Wales (1978) suggest to do for demographic effects. As a measure of $\rho$, we take the Gini coefficient of per capita expenditure in the district where the household resides. To account for differences in economic development, we add the mean total expenditure in the district $\bar{Y}$. We also add a dummy $U$ to capture whether the household lives in an urban area, along with the log of the household size $\ln(size)$. The effect of each of these variables is assumed to depend on the category of expenditure $i$, and is captured respectively by parameters $\nu_i$ (Veblen coefficient), $\beta_1i$, $\beta_2i$ and $\beta_3i$. The remaining parameter $\beta_{hi}$ capture the residual component of subsistence quantities. The estimated decomposition of the subsistence quantity $b_{ih,d}$ of category $i$ for household $h$ in district $d$ can be summarized by the following equation:

$$b_{ih,d} = \beta_{0ih,d} + \nu_{ih,d}Gini_d + \beta_{1ih,d}\bar{Y}_d + \beta_{2ih,d}U_h + \beta_{3ih,d}\ln(size)_h$$ (17)

This specification significantly raises the number of parameters to estimate, $n$ additional parameters by factor. To compare the contribution of each factor across categories of expenditure, we compute the sample mean of each of the five variables in the right hand side of Equation (17) and multiply it by the estimated coefficients. We normalize each factor as a

---

13 However, it has also been shown that stress and mental health could also be caused by feelings of relative deprivation. Since both effects would lead to a higher consumption of intoxicants, it is unclear what effect dominates here.
fraction of the subsistence level of expenditure $b_i p_i$, which can be recovered from Equation (17)\textsuperscript{14}.

Figure 13 summarizes the mean decomposition for all rounds. Local differences in inequality appear to be an important factor to explain variations in subsistence expenditure. The sign of the effect is also coherent with our intuitions: inequality increases subsistence expenditure in clothing and intoxicants but decreases the level of subsistence expenditure on most caloric food items, in particular cheaper but more caloric intensive products. The negative result on expensive calories (meat and dairy products) is quite interesting given the Indian context where vegetarianism is a high status social norm. The size of the household is positively correlated with subsistence levels of expenditure except for fuel and clothing, and poor households living in urban areas need a higher income to reach subsistence.

\textsuperscript{14} The gross subsistence level $b_i$ computed is very close to the subsistence level previously estimated from Equation (16) without decomposition.
Looking at the substitution across rounds for social subsistence expenditure, we note that all non caloric categories (clothing, non caloric food items (drinks, spices), intoxicants and fuel) have an overall positive Veblen coefficient (Figure 14). The substitution in high inequality regions is higher on caloric products, but more weighted on expensive calories (dairy, meat and processed products) over time. This pattern is quite interesting as the vegetarianism norm in India makes animal products a low social status consumption. It could affect nutrition in other ways such as the number of proteins consumed. This nutrition effect will be quantified in later versions of the article.

4.4 Estimation of the Cost of Relative Deprivation

4.4.1 Caloric Cost

To have an order of magnitude of the cost of relative deprivation, we quantify the average loss in consumed calories driven by inequality. Measuring the caloric cost has two advantages: first, it is a single unit, unlike quantities of the various groups. Second, and more importantly, it is a necessary measure to the extent of malnutrition. The Indian poverty line is computed
such that the households living below cannot afford a basket of goods for proper nutrition. We find this pattern in the data by round, as shown by Table 4: more than 90% of the population living below poverty line is under malnutrition. This fraction does not seem to reduce with time, as underlined by Deaton and Drèze (2009) using the same data.

<table>
<thead>
<tr>
<th>Fraction under malnutrition (BPL)</th>
<th>38 mean</th>
<th>43 mean</th>
<th>50 mean</th>
<th>55 mean</th>
<th>61 mean</th>
<th>Total mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean daily per capita calories w/o rel. depriv.</td>
<td>0.90</td>
<td>0.90</td>
<td>0.93</td>
<td>0.95</td>
<td>0.97</td>
<td>0.93</td>
</tr>
<tr>
<td>1727.31</td>
<td>1742.97</td>
<td>1700.72</td>
<td>1661.93</td>
<td>1623.22</td>
<td>1685.47</td>
<td></td>
</tr>
</tbody>
</table>

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 4: Malnutrition among below poverty line households (NSS Data)

From Equation (4), we compute the difference in quantity driven by relative deprivation for each good. We think of 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 3 – except that the Engel curves are drawn using expenditure rather than quantity. 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:

\[
\Delta_j = (\alpha_j \frac{m}{p_j} + \beta_j + \nu_j \rho - \frac{\alpha_j}{p_j} \sum_i (\beta_i + \nu_i \rho) p_i) - (\alpha_j \frac{m}{p_j} + \beta_j - \alpha_j \sum_i \beta_i p_i) - \frac{\alpha_j}{p_j} \sum_i \nu_i \rho p_i \tag{18}
\]

Section 4.3 provides the parameters \( \alpha_j \) and \( \nu_j \) for all goods in the relative deprivation specification. \( \rho \) is the expenditure gini by district used in the estimation, and the price index \( p_i \) taken at district level. We can compute \( \Delta_j \) for each good \( j \) using these parameters and variables.

Using the nutrient equivalent for each food item, we construct a weighted average of caloric intensity by quantity unit for each food group, denoted \( n_j \).\(^{15}\) We obtain \( n_j \Delta_j \) for each food group \( j \), which is the number of calories forgone in order to sustain one’s reputation in society. The total caloric cost \( \kappa_{\text{calorie}} \) is the sum of these forgone calories:

\(^{15}\)The weight applied is the mean share of each item in the total reported quantity by item group, in order to give more weight to items consumed in bigger quantities (for example, rice versus bajra in the group cereals).
\[ \kappa_{\text{calorie}} = \sum_i n_i \Delta_i \] (19)

As our estimation is based on monthly per capita consumption, we divide \( \kappa_{\text{calorie}} \) by 30 in order to obtain the average daily per capita caloric loss estimated by our model of relative deprivation. Figure 15 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 daily calories per capita for a Gini of 0.2 to between 200 and 300 daily calories per capita for a Gini of 0.5.

![Figure 15: Calories Forgone in Function of Inequality by District, BPL households](image)

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 and self-esteem in places where inequality is higher. Alternatively, inequality makes individuals with the same income revise both aims downwards.

We can also obtain an estimate of the fraction of households whose per capita daily caloric consumption would be above malnutrition in the absence of relative deprivation.
Table 5: Estimated malnutrition among below poverty line households without relative deprivation (NSS Data)

We add the estimated caloric loss to total calorie consumption in each round, and find that malnutrition would be reduced by 4 to 8 percentage points in the absence of feeling of relative deprivation (Table 5). The mean daily per capita calories consumed would also be closer to the malnutrition threshold.

4.5 Price Endogeneity

In section 4.3, we use median village price indexes in order to account for the endogeneity of prices in the choice of the household – especially since we observe unit values at the household level. Prices, however, could be correlated with an idiosyncratic village component which may link demand to prices and therefore affect the estimation of the subsistence expenditure level and price elasticities.

We follow Hausman (1996) and Atkin (2013) by using village price indexes within the same district as instruments for prices. The intuition is that each price is composed of an underlying cost which is not correlated with stochastic disturbances in the demand equation. This underlying cost is similar across villages, the variation between prices coming from a mean zero stochastic disturbance which is independent across cities, and can be interpreted as a temporary supply shock. Atkin (2013) provides empirical evidence that this instrument is valid in the case of cereal prices in India.

The non-linear relationship between the parameters of the model prevents us from using a three stages linear square estimator with the price instruments. We therefore perform the first stage separately, and regress each price index by village on the price index for the same category in the next village of the same district. We compute the fitted values from these linear regressions, and use them as our instrumented price indexes in the iterated estimator of the linear expenditure system. The standard deviations do not take into account the first stage, but the estimated coefficients shall be similar to a three stages linear square method.
Reassuringly, this procedure does not drastically change the estimated caloric cost. Figure 16 shows the caloric cost in function of inequality for the specification including the instrumented prices. An additional work on prices will be included in a latter version of the article.

5 Conclusion

This article introduces relative deprivation in a complete demand system, and estimates its impact on the calorie consumption of below poverty line households in India. It uses the linear expenditure system to decompose subsistence level quantities into physiological and social ones, the latter varying with inequality and across goods. The predictions of the model are that higher inequality biases demand towards non-caloric conspicuous goods, and decreases demand for calories. The structural estimation confirms theoretical predictions: relative deprivation causes an estimated loss of 100 to 300 daily per capita calories when the district Gini coefficient varies from 0.2 to 0.5.

These results illustrate that the social environment is not neutral to consumption choices.
If we take the capability approach to poverty seriously, we shall consider the effect that rising inequality has on the feeling of relative deprivation, and consequently, on the budget allocation of the lower sections of societies. In an unequal society, reaching adequate nutrition and self-esteem becomes increasingly expensive. It has serious implications on the way we measure and design policies on poverty and malnutrition. These results also bring new light on the effect of deprivation on individual choices: in a society where social esteem is attained through a certain standard level of consumption, the aspirations of the poor are set on conspicuous goods rather than nutritive ones, or at certain levels of income, human and social capital.

References


Appendix

A Theoretical Framework
## Distribution of Quantities and Unit Values

<table>
<thead>
<tr>
<th>Category</th>
<th>Density</th>
<th>Annual Quantities</th>
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<tbody>
<tr>
<td>Fat</td>
<td>0.0002</td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>0.0004</td>
<td></td>
</tr>
<tr>
<td>Durables</td>
<td>0.0006</td>
<td></td>
</tr>
<tr>
<td>Clothing (number)</td>
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<td></td>
</tr>
<tr>
<td>Clothing (meters)</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Footwear</td>
<td>0.0002</td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td>0.0004</td>
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</tr>
<tr>
<td>Pulse</td>
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<td></td>
</tr>
<tr>
<td>Cereals</td>
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<tr>
<td>Alcohol</td>
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<td></td>
</tr>
<tr>
<td>Spice</td>
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<td></td>
</tr>
<tr>
<td>Salt</td>
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<td></td>
</tr>
<tr>
<td>Vegetables</td>
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<tr>
<td>Pan</td>
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<tr>
<td>Dairy</td>
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<td>Footwear</td>
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<td>Clothing</td>
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<td>Fuel</td>
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</tbody>
</table>

![Kernel distributions of annual quantities consumed, BPL households.](image-url)
Figure 18: Kernel distributions of unit values, BPL households.
C Non-parametric Engel Curves

Figure 19: Engel curve for vegetable and fruit expenditure across rounds, BPL households

Figure 20: Engel curve for pulse expenditure across rounds, BPL households

Figure 21: Engel curve for sugar expenditure across rounds, BPL households

Figure 22: Engel curve for oil expenditure across rounds, BPL households
Figure 23: Engel curve for meat and dairy expenditure across rounds, BPL households

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

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

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

Figure 27: Engel curve for footwear expenditure across rounds, BPL households

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