

Preliminary Draft, Comments welcome

Accumulation with Malnutrition - The Role of “Status Seeking” Behavior

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Abstract

We consider a situation where ‘poor’ are concerned about their relative income status with respect to a relevant reference group. Such a concern is explicitly introduced in a utility function to study the consumption and saving behavior of the poor in a dynamic model. The dynamic model exhibits the possibility of a higher rate of accumulation coupled with inadequate nutritional intake, relative to a situation where there is no such concern for status. The accumulation effect confronts a substitution effect away from food or nutritious good, towards the status good. Hence, higher accumulation and malnutrition coexist in a steady state.

JEL Classification: C13, C14, C51, D01, D12, O40

Keywords: Status; Consumption pattern; Inequality; Growth

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1. Introduction

A fundamental query involving the preference pattern of any individual in a society, has to deal with the influence of the society on the consumption behavior of the individual. The idea of conspicuous consumption and the so-called Veblen effect are quite well known in economics. Very recently, Sivanathan and Petit (2010) have confirmed the fact that individuals are quite sensitive about their relative status in the society and would like to ‘mend’ their ‘self’, under constant attack from various social pressures, by taking recourse to status-signaling consumption behavior. A series of experiments confirms such a pattern of human behavior. This is one of the building blocks of the utility function that we use in the subsequent analysis. Early literature includes Frank (1985) who talk about context dependent preferences and the concern for status as we discuss in this paper, is an issue related to a particular social context. More recently, Mujcic and Frijters (2013) have explicitly and convincingly demonstrated a method for measuring the willingness to pay to move up the status ladder. The purpose of this paper is to relate the status seeking behavior to some fundamental issues concerning developing nations: while conspicuous consumption is related are

vague in the literature, we draw the attention to the consequences of status seeking behavior in relation to growth, poverty and nutrition.

Indian Economy has experienced a robust growth phase for a considerable length of time growing at an average rate of 7 - 8 % and often hailed as the 2nd fastest growing nation in the world, next to China. The distribution of benefits from such a remarkable expansionary trend has not been shared equally across income classes with the lower income classes sharing smaller proportion of such expansion. This was pointed out in the economic survey by the Government of India (2011-12). In simple terms, this means that the lower income earning classes will have their income levels falling behind relative to the average income, a sign that inequality is on the rise. However, such a process does not undermine the fact that in absolute terms even the lower income classes are better off but a sense of falling behind in the race cannot be ignored. This plays a critical role in any analysis that relates status driven consumption with the perception of social inequality. The growth literature related to status often highlighted the aspiration effect i.e., the drive towards a higher social status and in the process undertaking growth augmenting investments such as in education. But even in the presence of such a positive effect, inequality driven consumption of status good by driving consumption away from nutritional good may affect the nutritional sustainability of such a growth process.

One must mention that the message of the literature on status and growth initiated by Cole, Mailath, and Postlewaite (1992) and later by Corneo and Jeanne (2001) is that the aspiration effect i.e., the effort to attain higher status induces agents to over-accumulate relative to the standard case i.e., without such concern for status. We reproduce similar result in a much simpler and fundamentally different model and also focus on the dynamic substitution effect between the status good and the non-status good, which affects nutrition and may lead to malnutrition. Status led

consumption can hurt the level of intergenerational bequests and increase the probability of a poverty trap with imperfect credit markets as demonstrated in Moav and Neeman (2012). Marjit , Santra and Hati (2015) discusses the possibility of a conflict between income based and nutrition based measures of poverty in the present of status seeking behavior.

A voluminous literature discusses the impact of social status, relative income and relative rewards on productivity such as Hopkins and Kornienko (2010), Ku and Salmon (2009), on optimal taxation such as Beath and Fitzroy (2010), Kanbur and Tuomala (2010), and on networks such as Ghiglino and Goyal (2008). There is also a huge literature that has empirically examined the relationship between relative societal position and well-being. The papers by Easterlin [(1974), (1995), and (2001),] note that income and self-reported happiness are positively correlated across individuals within a country. The author interprets these findings as evidence that relative income rather than absolute income matters for well-being. Using European micro data, Van de Stadt, Kapteyn, and Van de Geer (1985), Clark and Oswald (1996), Senik (2004), and Ferrer-i-Carbonell (2005), find that well-being is partly driven by relative position, where reference groups are defined by demographic characteristics. Using U. S. data, McBride (2001), finds evidence that relative income affects subjective well-being, but they caution about the statistical reliability of their findings. Also, the paper by Luttmer (2005), using NSFH data finds that, controlling for an individual's own income, higher earnings of neighbors are associated with lower levels of self-reported happiness and that increased neighbors' earnings have the strongest negative effect on happiness for those who socialize more in their neighborhood. However, these papers do not deal with the issues we are discussing in this paper.

Earlier works, experiments, anecdotal observations, case studies (see Luttmer (2005), Fafchamps and Shilpi (2008), Banerjee and Duflo (2011), etc.) do point toward such behavior.

Given this backdrop we propose to argue that the wage to consume the status good in greater quantity in relation to non-status good such as food which provides nutritional intake is of critical significance for the poor. For anyone who has adequate income such behavior may not deprive her of the initial minimum amount of the nutrition intensive good. But for the poor sustainability of health from adequate nutritional intake can be a problem. In a dynamic content, the poor will try to have more to accumulate and move up the ladder. This in turn allows her to consume more of both goods. But we show that the degree of inequality in a society surpasses a critical value, the typical poor will accumulate more ignoring the nutritional good. This in turn may lead to a conflict between income measure and nutritional measure of poverty.

Our paper is fundamentally based on the literature on repeated socio-psychological experiments as elaborated in Sivanathan and Petit (2010) where status seeking behavior is interpreted as people “mending “ their selves under constant attack in the society and status is like a feel good factor. Once that is decided, the next step is how to signal one’s status. Our main task is to abstract from the signaling issue and assume that income differences are observed. Since our main job is to reflect on the consequence of status seeking behavior on consumption and saving, the method of status signaling is not our prime concern. However, one could show that when instead of income, which is unobserved, only consumption of the status good is observable and we just replace income by the status good as the status denoting variable, we reinforce our basic result with status seeking behavior having no accumulation effect, only consumption effect away from the non-status good. The proof is available on request.

Also in some parts of the literature status is signified through relative position vis-à-vis people below in terms of consumption of the status good and income. That is moving up the ladder when people are left below is the achievement. But we generalize the concept by assuming that

the individuals also look above and see what they do not have. We stress the point that it is not enough to outcompete your own group, but also aspire to reach above. To put them together we take a measure of average income of the whole distribution and then place the individual relative to that average. In this paper we are only concerned with people that are below such average and abstract from the behavior of those above. It is as if those above are not affected by status seeking behavior. This is done deliberately to focus on the poor.

To motivate our theoretical study, we first present a start-up casual empirical exercise, though first of its kind involving a nation-wide aggregate data set and not just case studies and experiments, it is yet to be fully blown into an empirical work. But the exercise will provide prima facie reason to engage in the theoretical work. We take the dataset provided by the National Sample Survey Organization of India viz. the NSS 66th and 68th round all India unit level survey on consumption expenditure (Schedule 1.0, Type 1 and 2). The dataset includes household level observations on item specific expenditure and various household specific characteristics. Apart from this, data is also provided on the households' localization, such as the sector (Rural or Urban), district and state. The total number of household level observations in our analysis is 201649 for the 66th round and 203313 observations for the 68th round. The data spans thirty five states and union territories. The total number of districts in our analysis is 612 for the 66th round and 625 for the 68th round.

For a particular round of data, we consider only those households of rural India who's monthly per – capita consumption expenditures lie within a range¹ of 250 rupees above or below the rural India's lowest quintile (i.e., 25th percentile) level of monthly per – capita consumption

¹ Taking into consideration the number of data points available for the analysis and the difference between the upper limit of the range (which is 250 rupees above the quintile) with the median.

expenditure. This is done to concentrate on that segment of the poor people who may have some choice over what to consume and not on those who do not have sufficient income even to make such a choice. For these households, we consider their per capita monthly expenditure on food and non – food commodities and compute the district wise average food to non-food expenditure ratios. We plot these figures against the respective districts’ rural median monthly per – capita total consumption expenditure. Median expenditure is measured over the entire reference group. We redo this exercise separately for urban India considering the per capita monthly expenditure on food and non – food commodities of those households who’s monthly per – capita consumption expenditures lie within the specified range above or below the urban India’s lowest quintile level of monthly per – capita consumption expenditure. From this data, we likewise calculate the district wise average food to non-food expenditure ratios and plot it in a diagram against the respective districts’ urban median monthly per – capita total consumption expenditure for both rounds of the data. The plots from this exercise for both rounds of data are depicted in figure – 1. We find that each of the scatterplots depicts a negative relationship between the district and sector wise average expenditure ratios and the corresponding district and sector wise median total consumption figures. To illustrate this clearly, we have also fitted a linear trend line to each of the scatterplots. Typically due to Engles’ law food/non-food consumption should be lower with higher levels of expenditure. But the same ratio should not have any relation with the median expenditure of the entire group and such median expenditure is unlikely to be affected by the expenditure of the poor. But as our plots show, higher median expenditure is associated with lower ratios of food/non-food expenditure of the poorer sections. The X axis in the pictures refers to the median expenditure levels.

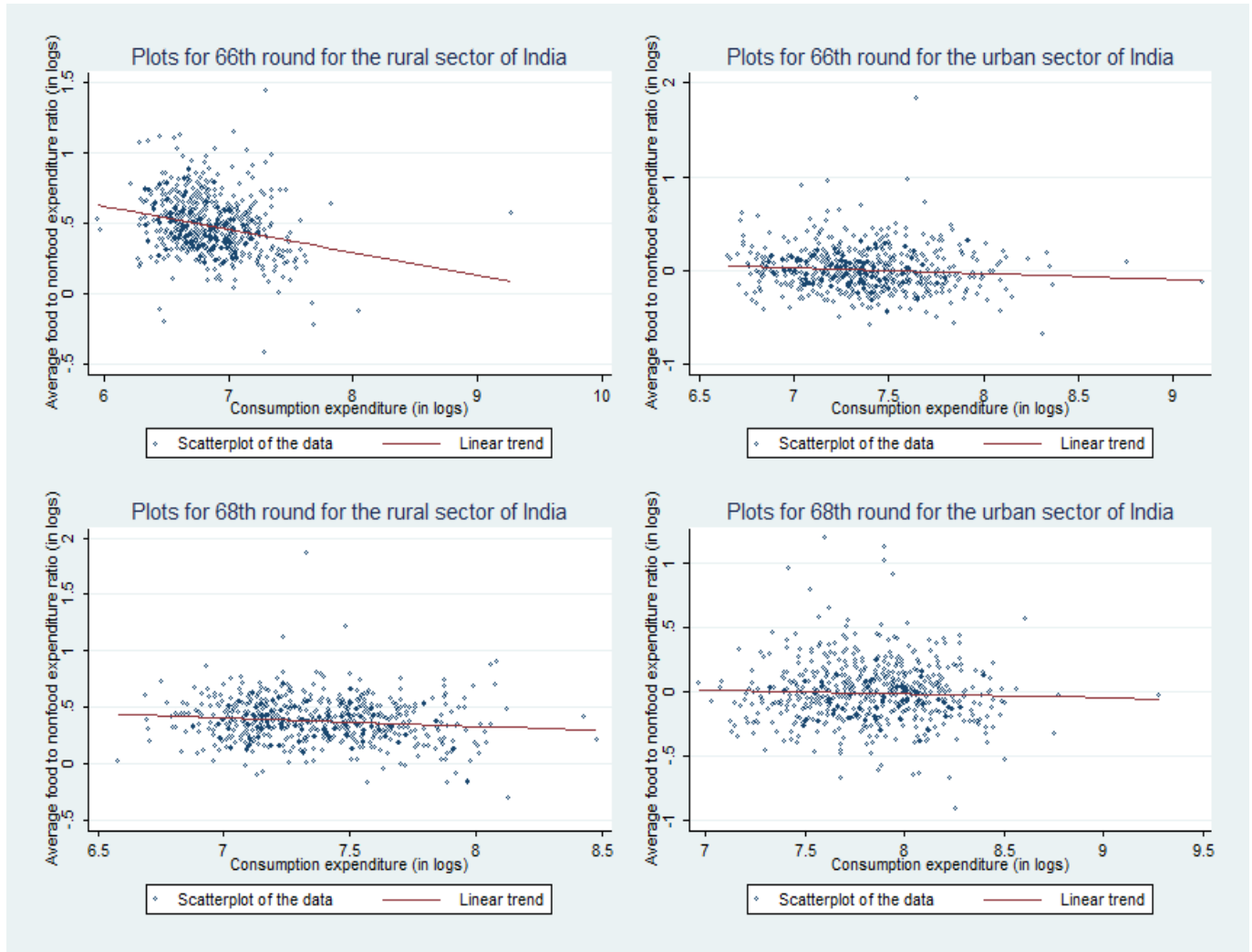


Figure 1

The paper is divided into three sections. The second discusses the basic model and results and the third concludes after commenting on a version when income is unobserved and status variable is related to the observed consumption level of the status good.

2. Basic Model when Income is observed

In this section we consider a simple infinite horizon model where a poor status affected individual makes a rational judgment on consumption and saving or investment over time. This is an individual choice problem where the social average income of the reference group is taken as a parameter and the agent chooses consumption and investment as a response to her concern for social status as dictated by the given social parameter i.e., the average income. The choice is between the quantities of consumption of the nutritious good ' N ' and the luxury good ' L ' on one hand and how much to save and consume on the other. Since we are not interested in relative price effects, we continue to choose units in such a way that relative price is constant at unity. We argue that a status concerned individual will tend to accumulate more, relative to the benchmark case (i.e., without any status effects) but in the process will consume less of the nutritious good and if the nutritional intake falters for people with low absolute income we shall have a case for growth with malnutrition.

We start from two axioms on how perceived social inequality affects the individual welfare.

Axiom 1: Inequality hurts

This implies that having below average income in a society reduces individual utility. Our assumption is that being above average does not matter, but being below definitely hurts. This asymmetry is deliberate to highlight the implications of belonging to the downside of inequality.

Axiom 2: Inequality increases MU for status good

Having lower than average income increases the marginal utility of conspicuous consumption or consumption of the status good. This is directly drawn from experimental psychology literature where intensity of desire to consume the status good seems to be greater among those who are affected by social inequality.

We now invoke a simple utility function with N, the consumption of nutrition good and L, the consumption of luxury or status good or non-nutritious good.

$$U = f\left(\frac{\bar{y}}{y}\right) \left[N^\alpha + \phi\left(\frac{\bar{y}}{y}\right) L^\alpha \right] \quad 0 < \alpha < 1 \quad (1)$$

where $\bar{y}$ is average income of the reference social group and ‘y’ is the individual’s level of income.

$$f\left(\frac{\bar{y}}{y}\right) \begin{cases} = 1 & \text{for } y \geq \bar{y} \\ < 1 & \text{for } y < \bar{y} \end{cases} \quad (2)$$

From Axiom 1, we have $f' < 0$.

$$\phi\left(\frac{\bar{y}}{y}\right) \begin{cases} = 1 & \text{for } y \geq \bar{y} \\ > 1 & \text{for } y < \bar{y} \end{cases} \quad (3)$$

From Axiom 2, we have $\phi' > 0$. We will not discuss price effect and assume prices to be equal to one.

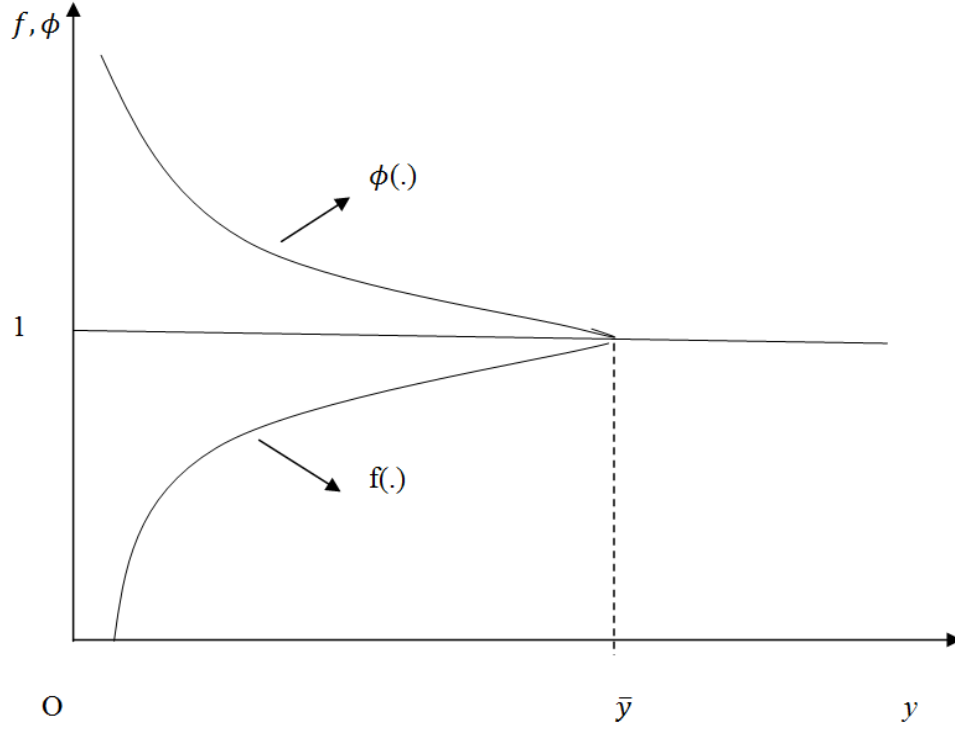


Figure 2

If inequality truly hurts,

$$f\left(\frac{\bar{y}}{y}\right)\left[\tilde{N}^\alpha + \phi\left(\frac{\bar{y}}{y}\right)\tilde{L}^\alpha\right] < \left[N_0^\alpha + \phi\left(\frac{\bar{y}}{y}\right)L_0^\alpha\right] \quad (4)$$

Where $(\tilde{N}, \tilde{L})$ are optimal consumption levels for $y < \bar{y}$ and the same are denoted by (N_0, L_0) for the benchmark case with $y = \bar{y}$.

Invoking the Envelope property it is straightforward to interpret (U) as

$$\frac{dU}{dy} = f' \cdot \left(-\frac{\bar{y}}{y^2}\right) \left(\tilde{N}^\alpha + \phi\left(\frac{\bar{y}}{y}\right)\tilde{L}^\alpha\right) + f \cdot \phi' \cdot \left(-\frac{\bar{y}}{y^2}\right) \tilde{L}^\alpha > 0$$

$$\text{Or, } -\left(\frac{\bar{y}}{y^2}\right) f' \tilde{N}^\alpha - \left(\frac{\bar{y}}{y^2}\right) L^\alpha [f' \phi + f \phi'] > 0$$

Since $f' < 0$ and $\phi' > 0$, a sufficient condition is given by:

$$[f' \phi + f \phi'] < 0 \quad (5)$$

Note that if ‘ y ’ moves up the ladder ‘ $f(\cdot)$ ’ increases but ‘ ϕ ’ drops. Or put differently if ‘ y ’ drops from ‘ $\bar{y}$ ’, ‘ $f(\cdot)$ ’ goes down to a value less than unity, but ‘ ϕ ’ increases, the net effect has to be negative if inequality has to hurt in equilibrium.

Given ‘ $\bar{y}_t$ ’, the average income at period ‘ t ’, an individual decides on consumption and saving which can be in terms of a non-depreciating capital and she has to allocate her income between ‘ N_t ’ and ‘ L_t ’. While taking such decisions, ‘ $\bar{y}_t$ ’ and its distribution over time is treated as endogenous and ‘ N_t ’, ‘ L_t ’ and saving will be conditional on ‘ $\bar{y}_t$ ’. To simplify further we assume: $f(\cdot) = \frac{y}{\bar{y}}$ and $\phi(\cdot) = \frac{\bar{y}}{y}$. This allows us to specify the dynamic relations quite cleanly.

Note that such simplification is consistent with our earlier specifications. The maximization problem faced by the representative agent is given by:

$$\text{Max}_{\{N_t, L_t\}} \sum_{t=0}^{\infty} \beta^t \left[\frac{y_t}{\bar{y}_t} N_t^\alpha + L_t^\alpha \right], \quad 0 < \beta = \frac{1}{1+\rho} < 1 \quad (6)$$

$$x(k_t) - N_t - L_t - k_{t+1} + k_t = 0 \quad (7)$$

Where $x(k_t)$ is the standard production function with $x' > 0$, $x'' < 0$, $x(0) = 0$

The dynamic programming problem is characterized by:

$$\text{Max} \left(\frac{y_t}{\bar{y}_t} N_t^\alpha + L_t^\alpha \right) + \beta V(\bar{y}_{t+1}, k_{t+1}),$$

where $V(\cdot)$ is the optimal value function.

$$\text{s.t. } x(k_t) - N_t - L_t - k_{t+1} + k_t = 0 \quad (8)$$

$$\text{Define } Z_t = \frac{y_t}{\bar{y}_t} N_t^\alpha + L_t^\alpha + \beta V(k_{t+1}, \bar{y}_{t+1}) + \lambda_t [x(k_t) - N_t - L_t - k_{t+1} + k_t]$$

The associated first order conditions are:

$$\frac{\delta Z_t}{\delta N_t} = 0 \implies \frac{x(k_t)}{\bar{y}_t} \alpha N_t^{\alpha-1} = \lambda_t \quad (9)$$

$$\frac{\delta Z_t}{\delta L_t} = 0 \implies \alpha L_t^{\alpha-1} = \lambda_t \quad (10)$$

$$\frac{\delta Z_t}{\delta k_{t+1}} = 0 \implies \beta \frac{\delta V}{\delta k_{t+1}} = \lambda_t \quad (11)$$

$$\frac{\delta Z_t}{\delta \lambda_t} = x(k_t) - N_t - L_t - k_{t+1} + k_t \quad (12)$$

$$\text{Now, } V'(k_t) = \lambda_t [x'(k_t) + 1] + \frac{x'(k_t)}{\bar{y}_t} N_t^\alpha$$

Updating, we have

$$\beta V'(k_{t+1}) = \beta [\lambda_{t+1} [x'(k_{t+1}) + 1] + \frac{x'(k_{t+1})}{\bar{y}_{t+1}} N_{t+1}^\alpha] \quad (13)$$

Equating (13) and (15), we get

$$\beta [\lambda_{t+1} (x'(k_{t+1}) + 1) + \frac{x'(k_{t+1})}{\bar{y}_{t+1}} N_{t+1}^\alpha] = \lambda_t \quad (14)$$

Second order conditions are satisfied with standard curvature restrictions. In steady state we have $k_{t+1} = k_t = k^*$, $\lambda_{t+1} = \lambda_t = \lambda^*$, $\bar{y}_{t+1} = \bar{y}^*$, $N_t = N^*$, etc. Note that ' $\bar{y}$ ' is not chosen by the individual. Hence, ' $\bar{y}^*$ ' is exogenously specified.

Therefore we get

$$\beta (x' + 1) + \beta \frac{x'}{\bar{y}^* \lambda^*} N^{*\alpha} = 1,$$

$$\text{Or, } x' + 1 + \frac{x'}{\bar{y}^* \lambda^*} N^{*\alpha} = \frac{1}{\beta} = 1 + \rho$$

$$\text{Or, } x' = \frac{\rho}{1 + \frac{1}{\bar{y}^* \lambda^*} N^{*\alpha}} \quad (15)$$

Note that for $y \geq \bar{y}$, equation (15) reduces to $x' = \rho$, the well-known steady state condition. Since LHS in (15) is less than ' ρ ', the status effect exerts a positive impact on the accumulation process.

Substituting for ' λ^* ' from (9) into (15) we get

$$x' = \frac{\rho}{1 + \frac{1}{\bar{y}^*} \frac{N^{*\alpha}}{x(k^*)^\alpha N^{*\alpha-1}}}$$

$$= \frac{\rho}{1 + \frac{N^*}{x(k^*)^\alpha}} \quad (16)$$

$$\text{Also } x(k^*) = N^* + L^*$$

$$\text{Or, } N^* = \frac{x(k^*)}{1 + \left[\frac{x(k^*)}{\bar{y}^*}\right]^{\frac{1}{\alpha-1}}} \quad (17)$$

$$\text{For } y \geq \bar{y}^*, N^* = \frac{x(k^*)}{2}$$

Since $\frac{x(k^*)}{\bar{y}^*} < 1$ and $0 < \alpha < 1$, we have $\left(\frac{x(k^*)}{\bar{y}^*}\right)^{\frac{1}{\alpha-1}} > 1$, which in turn implies that ‘ N^* ’

will be lower on that count. But note that ‘ k^* ’ assumes a bigger value in the model which includes the concern for status. Therefore ‘ N^* ’ can be higher than ‘ N_0 ’.

From (16) and (17) we can determine ‘ N^* ’ and ‘ k^* ’.

It is easy to check that if (k_0, N_0) is the solution to the problem without concern for status, then

$$k^* > k_0$$

Therefore, we get

$$N^* < N_0 \text{ if and only if } \frac{x(k^*)}{1 + \left(\frac{x(k^*)}{\bar{y}^*}\right)^{\frac{1}{\alpha-1}}} < \frac{x(k_0)}{2} \quad (18)$$

Simplifying (18) we get

$$\frac{2x(k^*) - x(k_0)}{x(k_0)} < \left[\frac{\bar{y}^*}{x(k^*)}\right]^{\frac{1}{1-\alpha}} \quad (19)$$

$$\text{Let } x(k^*) = \mu x(k_0), \mu > 1$$

Hence, we have

$$N^* < N_0 \text{ iff } \frac{\bar{y}^*}{x(k^*)} > (2\mu - 1)^{1-\alpha} \quad (20)$$

However, (20) implies the fact that both ' k^* ' and hence ' μ ' will be affected by ' $\bar{y}^*$ '. Following equation (16) and (17) we can see the direction of the impact. From (16) we can derive Figure 3 representing the LHS and RHS in (16) as a function of ' K^* '.

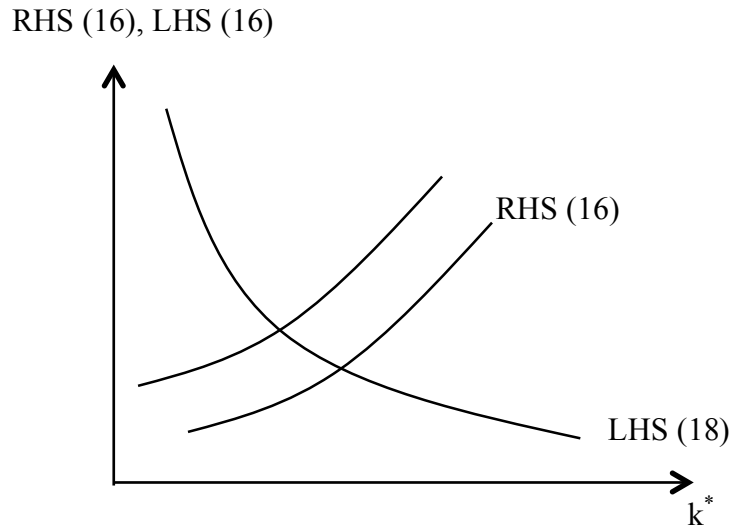


Figure 3

If ' N^* ' increases RHS (16) shifts down and ' K^* ' increases. This defines line kk in figure 4. Similarly, (17) defines line NN in Figure 4 with ' k^* ' adjusting along kk and ' N^* ' adjusting along NN. An increase in ' $\bar{y}^*$ ' shifts NN to the right lowering ' k^* ' and ' N^* '.

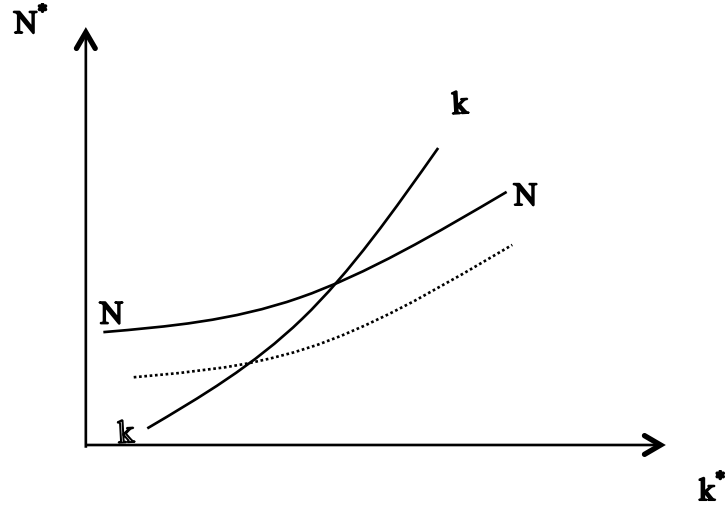


Figure 4

Therefore equation (20) can be rewritten as

$$\frac{\bar{y}^*}{x[k^*(\bar{y}^*)]} > [2\mu(\bar{y}^*) - 1]^{1-\alpha} \quad (21)$$

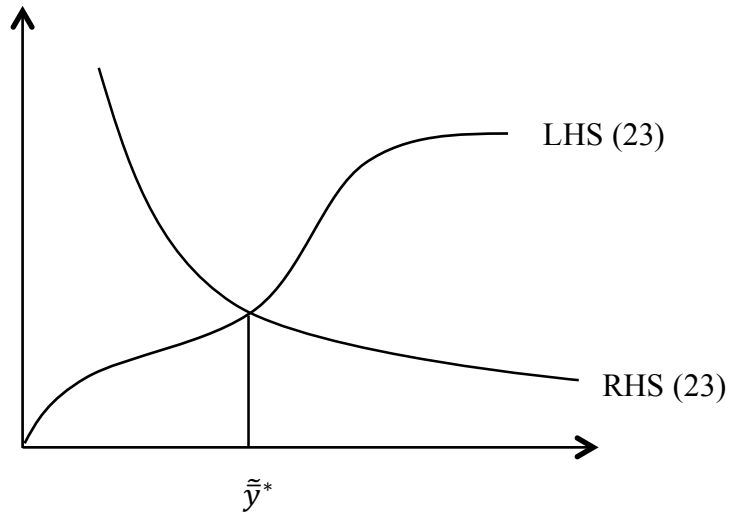


Figure 5

Figure 5 derives the critical level of ' $\bar{y}^*$ ' as ' $\tilde{y}^*$ ' such that $\forall \bar{y}^* > \tilde{y}^*, N^* < N_0$.

Note that as $\bar{y}^* \rightarrow 0$, $N^* \rightarrow x(k^*)$. As $\bar{y}^* \rightarrow 0$, LHS in (21) $\rightarrow 0$ and RHS in (21) $\rightarrow$ a positive value. Similarly, as $\bar{y}^* \rightarrow \infty$ LHS will entirely dominate RHS. Thus $\tilde{\bar{y}}^*$ is unique. Thus we can state the following core proposition of the paper.

Proposition

If the degree of inequality of income crosses a critical threshold, status concerned individual will consume less of the nutritious good and may be malnourished even if she accumulates more than an individual who is not concerned for the relative status.

Proof:

For $\bar{y}^* \in (\tilde{\bar{y}}^*, \infty)$, $N^* < N_0$, though $k^* > k_0$. If N^* drops substantially, it may fall below the critical minimum required for nutrition. Q.E.D.

One could argue that the result is only an outcome of the specifics of the utility function. But that may not be valid if one looks at the basic intuition, even if it is difficult to analyze the steady state as cleanly as we have done it here.. The status effect in a general model must have a positive effect on the incentive to accumulate because higher relative income gives effectively more utility and therefore that is the add-on relative to any standard model of capital accumulation. At the same time concern for status will make us consume more of the status good. So there will be a trade-off between the accumulation and substitution effect and hence the window will remain open for higher income but lower nutrition.

Our paper shows that if people care about social status, they will accumulate more because they value improvement in their relative status. But they cannot avoid a critical substitution effect. Status concerned individual will try to signal their status by consuming more of the status-good

and less of the nutritious good. Thus, concern for status will lead to greater accumulation and less nutrition. But that critically depends on the extent of the income effect i.e., $x(k^*) - x(k_0)$. An increase in $\bar{y}^*$, the average income of the reference group, will also reduce the rate of accumulation as the marginal utility from status declines with the increase in ' $\bar{y}^*$ '. However, the level effect will be dominating, meaning $k^* > k_0$. If income effect of status is not substantial, nutrition is likely to suffer due to the substitution effect.

One implication of the result derived in the paper is relevant for the debate on the conflicting measures of poverty as reported in Patnaik (2007), Marjit (2012), Marjit, Santra and Hati (2015) etc. Consider a situation where the representative agent's income $x(k_0)$ is below poverty line defined in terms of income. If she is concerned about status, she will choose a $k^* > k_0$. $x(k^*) > x(k_0)$ indicates an improvement in terms of the poverty measure. In particular if ' $\tilde{x}$ ' represents the poverty line, $x(k^*) > \tilde{x} > x(k_0)$ means an end of poverty for the agent. However, by the same argument if $\tilde{N} > N_0$ represents the poverty line in terms of nutrition, $N^* < N_0 < \tilde{N}$ will mean a further increase in the incidence of poverty. Thus in terms of income measure poverty rate will decline, while in terms of nutrition there will be more people under poverty line. Thus growth with malnutrition will also imply conflicting measures of poverty.

4. Summary and Conclusions

In this paper we establish a link between status seeking behavior, growth, poverty and nutrition in developing nations. We consider a situation where 'poor' are concerned about their relative income status with respect to a relevant reference group in a dynamic model. We find that status concerned individual could consume less of the nutritious good and may be malnourished

even if she accumulates more than an individual who is not concerned for the relative status if the degree of inequality of income crosses a critical threshold. We show that there are both income effect and substitution effect when income is observable while there is only substitution effect hence the above conclusion is strengthened when income is unobservable. This implies that consumption of status good may affect the nutritional sustainability of such a growth process by driving consumption away from nutritional good. These findings also help to explain the possible conflict between income based and nutrition-based measure of poverty.

One could easily show that our result does not depend on whether income is observed or not. In fact when the status is signaled by relative observed consumption of the status good and not by relative income, the steady state accumulation relationship will give us the standard golden rule result, implying no extra accumulation effect. But the substitution effect will be there and that will strongly reinforce our result.

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