Growth Induced Threat to Poor Man's Consumption Basket

Debabrata Datta[1]
Professor,
Institute of Management Technology, Ghaziabad

Introduction

Economic sustainability is not synonymous with ecological sustainability. It is true that development in the present period must take care of ecological aspects so that future development is not imperiled. Similarly present resource use must address the problem of future resource availability, failing which global economy will move in to stagnation at some point of time.

However this paper does not address sustainability in the context of aforementioned issues but focuses attention on one developmental fall out, which is not that much highlighted. Nevertheless, this neglected aspect has serious connotations for millions of low income people over the globe. The issue is changes in pattern of resource use with momentum of growth picking up. As an economy starts treading along a higher growth path, the income level of some sections of the society experiences significant increase over a short period. This change in income triggers perceptible changes in the demand pattern. By the mechanism of market economy production of goods used by the high income persons goes up. If now these items of consumption of the high income people consume more resources than what common man's consumption items use, can it so happen that poor man's goods and services disappear from the market, making their livelihood unsustainable? Sustainability of development should imply that all income groups, all clans and all communities get opportunity to survive with adequate availability of consumption items. Negative externality, which is thrust on some sections of the society by the growing income of other sections should also be suitably countered. The conventional definition of sustainable development is "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". This writing looks at that aspect of development where one's growth affects

[1] Address for communication: 167, G.T.Road, Jora Mandir, P.O. Burdwan - 713101. or 603, Khullar Apartments, Byramjee Town, Nagpur – 440012. Email:d.debabrata@gmail.com, Tel. 098300 58991.

other's consumption adversely and in that context defines sustainable development as "*development that meets the needs of the presently prospering people without compromising the ability of persons with stagnant income to meet their own needs"*. We take the help of simple theoretical model to show how an essential item like rice may register decline in production because of growth in the global economy and threaten the economic sustainability of vulnerable sections of the society. Our model thus highlights the need for sustainable development for the present, keeping of course the need for sustainable development for the future in the perspective.

The abovementioned issue assumes significance since world witnessed unprecedented growth for the last four years (2003 – 2007) before the latest slow down in the current year. Two giant less developed economies - India and China were registering more than 8% growth rate. Growth however was not confined only in these two countries. All the less developed economies of the world, including countries in Sub Saharan Africa achieved 5% plus growth rate. The developed countries also recorded growth around 3%. It is yet to be ascertained whether world has achieved a mean shift in the growth rate. But if it does happen, the changes in demand pattern will have profound impact on global production structure.

It is also a fact that when these economies progressed rapidly, every section of the society did not enjoy same increase in income level. Rising inequality in the short and medium run is a definite offshoot of fast economic growth, as pointed out by the Kuznet's inequality curve. The growing inequality has also its impact on the consumption and production structure. (Sen, 2008)

Why are we motivated to highlight this change in production and consumption during the process of economic growth? This is because income distribution as well as the well being of the cross section of the society is fully dependent on the production structure. In this analysis we show in terms of a simple model how change in income and income distribution can affect the production distribution of a good, which has a low quality variety and a high quality variety. The primary focus of our model is rice, where we consider two varieties, ordinary

variety and the aromatic variety.[2] Rice is the staple food of many less developed countries. Food availability for large number of poor people in these countries depends on the production of coarse rice.[3]

There is visible trend in many less developed countries that with rise in income, demand for high quality rice rises at rate higher than the growth rate of income. Several studies show that with the improvement in economic conditions, there is a shift in the demand from low quality to high quality rice. Moreover if prices of rice decline, consumers do not purchase more quantity of rice but shift to better quality rice. In Japan there is a shift from standard quality rice to high quality rice. A similar trend is visible in various other fast growing countries including China, South Korea, Thailand and Malaysia. (Laurian (1986), Chien (2003), Justin (1999)) It has been estimated that as the income of urban households in Thailand increases by 1 per cent, expenditure on high quality rice increases by 2 per cent (IRRI Report, 2004). This shift in demand pattern is also noticed in international trade of rice. The share of aromatic rice in the international market was 9 per cent of total rice traded during 1992-94. It increased to 12 per cent during 2001-2003 (FAO Report, 2004).

There is however perceptible difference in the land productivity of ordinary indica rice and the aromatic basmati rice. The UNCTAD data show that while the per hectare rice production of indica rice is 5 -6 tonnes, for basmati rice it is 2 - 3 tonnes (Commodity Atlas, UNCTAD). Thus there can be substantial drop in total production level if market induces a sizeable shift of land from indica rice production to basmati rice production. Our model is based on this possibility.

In what follows we present the model in section I, derive the results in section II and section III. We focus on policy conclusion in section IV.

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[2] As Akerlof (1970) has stated in his paper 'Market for lemons' while considering automobile market, we should also state that rice is used as a finger exercise to illustrate and develop our thoughts. It should not mean that problem discussed in the model is imminent in case of rice.

[3] Many indicators show that the world is entering an era of declining food security. Available land for agriculture has peaked and is currently declining as a result of industrial and urban expansion and losses to degradation. Between 1950 and 1984, world cereal-crop yield increased by an average of 3% per year. Since 1984 yield increases have slowed to around 1% per year — less than the amount needed to keep pace with population growth (Brown and Kane 1994; FAO 1997).

Section I

Model

We consider here a very simple framework, where the society consists of two groups of consumers, one rich and the other poor. The rich group enjoys a certain proportion a of the national income. Obviously an increase in a implies an increased inequality in the economy.

Let the average income level of the rich is

$M_R = aM$

Where M is average income of the economy and $a > 1$.

The average income of the poor is

$M_P = bM$ where $b < 1$.

Then we get

$$M = \frac{naM + NbM}{n + N}$$

Where n = number of rich and N = number of poor.

$$\frac{N}{n} = \frac{a-1}{1-b}$$

We assume $N > n$. Then given N and n, $da > -db$.

On the supply side, there are two types of rice, one high quality (x) and the other low quality (y), produced with given resources. The production function of both types of rice is subject to increasing opportunity cost. This gives rise to a production possibility frontier, concave from below. It is however assumed that high quality rice (x) requires more resources and therefore total production of rice is more if only low quality rice (y) is produced. In order to get the equilibrium point on PPF, where production occurs we have to consider the determination of equilibrium first.

Production Possibility Frontier

We have a PPF of high quality of rice (x) and low quality rice (y) given by the implicit function

$g(x, y, L_0) = 0$

Where L_0 is given size of land. Given our assumption of increasing opportunity cost, we consider the following equation, representing a production possibility frontier, concave from below.

$\lambda x^2 + \mu y^2 = c$ where $\lambda > \mu$.....(3)
We assume without any loss of generality $\lambda > \mu = 1$.

Then we get $y = (c - \lambda x^2)^{1/2}$ …….(4)

The marginal rate of transformation is given by

$$\frac{dy}{dx} = -\frac{\lambda x}{\left(c - \lambda x^2\right)^{1/2}} < 0.$$

$$\frac{d^2 y}{dx^2} = -\frac{\lambda\left(c - \lambda x^2\right)^{1/2} - \lambda^2 x^2\left(c - \lambda x^2\right)^{-1/2}}{\left(c - \lambda x^2\right)} < 0$$

The total production of rice is given by
$T = x + y$ …….(5)

Determination of equilibrium production and prices

Since we have introduced money in the model we have money price of each good as well. Under the competitive pricing mechanism we get production on the PPF by the equality of MRT and price ratio. This gives production of one good as a function of other good

The equilibrium conditions are
$x_D(p_x, p_y, aM) = x_S(p_x, p_y)$.....(1)
$y_D(p_x, p_y, M) = y_S(p_x, p_y) = f(x((p_x, p_y))$
$y_D(p_x, p_y, M) = f(x((p_x, p_y))$.....(2)

From these two equations we can determine p_x, p_y. From the equilibrium values of p_x and p_y, we get *x* and *y* from the PPF.[4]

[4] Model is of course oversimplified. It is assumed that there is a vast exogenous sector which determines M and change in p_x and p_y do not affect M i.e. rice is a small sector in the economy.

Equation (1) and (2) can be plotted in the diagram. X_E and Y_E curve represent equilibrium in x and y market. We assume and our model also suggests that x and y are gross substitutes. A rise in p_x causes excess supply, which can be corrected only by rise in p_y. Hence X_E curve is upward rising. Moreover rise in p_y has to be more on the assumption that direct price effect is greater than indirect price effect i.e. the X_E curve will have slope exceeding unity in the p_x p_y plane. Similarly Y_E curve is upward rising with the slope being less than one. The assumption of gross substitutability and pattern of slope ensures stability in the market.[5]

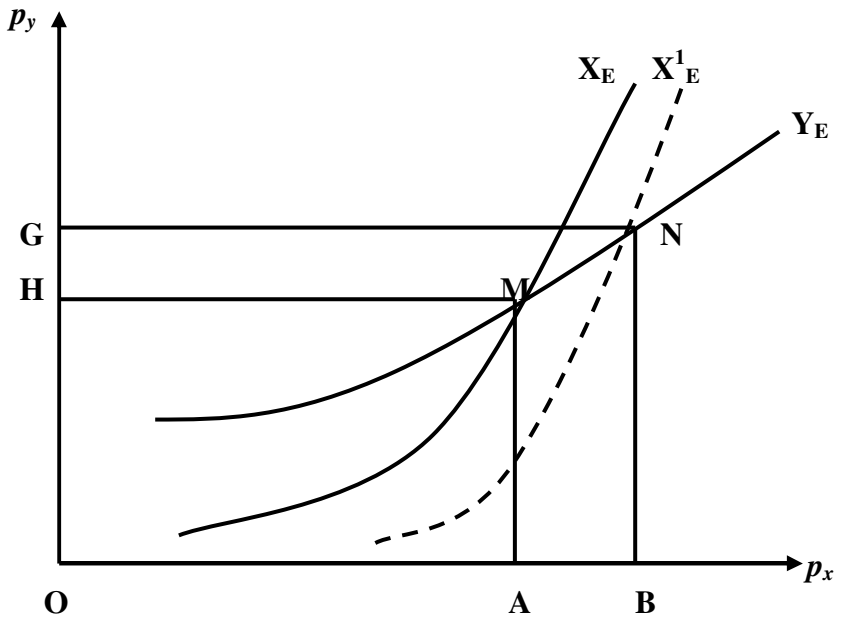

Diagram 1

In this diagram 1 initial equilibrium is characterized by OA of p_x and OH of p_y.

Section II
Results

We want to capture the reality that as income rises demand for high quality rice rises faster than low quality rice. This requires a utility function that can represent the Engel expenditure pattern. This does not happen in case of Cobb - Douglas utility function where the income elasticities are unity and the Engel curve is straight line through the origin. For Stone Geary

[5] Take any point away from equilibrium. If p_x adjusts for x market and p_y adjusts for y market, system moves to the equilibrium. So this equilibrium is statically stable.

utility function also the Engel curve is straight line although not through the origin. Here the income elasticities are not unitary but the marginal budget share is constant.

Therefore we use the indirect addilog model of Houthakker (1960), where the indirect utility function is considered and the demand is derived from this function by using Roy's identity. Usually the indirect utility function of the addilog expenditure system is given by

$$V = \sum \alpha_i \left(M / p_i \right)^{\beta_i} \quad \text{.....(6)}$$

Where M is the minimum expenditure for a given utility U.

$M = \sum p_i Q_i$ and $\alpha_i > 0, \beta_i > 0, \sum \alpha_i = 1$.

The expenditure on x and y is

$$E_R^x = p_x x$$
$$E_R^y = p_y y$$

Given the addilog utility model the demand for x of rich is given by

$$D_x^R = \frac{n\alpha_x \beta_x (aM)^{\beta_x} (p_x)^{-\beta_x - 1}}{\alpha_x \beta_x (aM)^{\beta_x - 1} (p_x)^{-\beta_x} + \alpha_y \beta_y (aM)^{\beta_y - 1} (p_y)^{-\beta_y}} \quad \text{.....(7)}$$

Demand for y of rich can be similarly represented.

We assume that poor consumes only y whose demand is therefore given by

$$D_y^P = \frac{NbM}{p_y} \quad \text{.....(8)}$$

Comparative static effect of rise in income and income inequality

Proposition I: *If income elasticity of x is high and income elasticity of y is low an increase in national income leads to higher production of x and lower production of y. An increased income inequality also leads to similar result.*

Proof: Suppose there is a change in income level and induced change in price by change in demand. On the assumption of perfect competitive market, the change in price is reflected by change in marginal cost.

In equilibrium, $\frac{p_x}{p_y}=\frac{c_x}{c_y}$……(9)

where c_x and c_y represents marginal cost of x and y.

Since $\frac{c_x}{c_y}$ is inversely related to $\frac{x}{y}, \pi$ is inversely related to $\frac{x}{y}$.

Therefore

$$\frac{p_x}{p_y}=-\frac{dy}{dx}=\frac{\lambda x}{\left(c-\lambda x^2\right)^{1/2}}$$

or $\frac{p_y}{p_x}=\frac{\left(c-\lambda x^2\right)^{1/2}}{\lambda x}$

In order to get the comparative static effect of a rise in M, we assume without any loss of generality, that value of p_y and λ is unity. In that case in equilibrium from the PPF we get that

$$p_x=\frac{x}{\left(c-x^2\right)^{1/2}} \text{ ……..(10)}$$

We replace this p_x in (6) in our demand for x.

$$x=\frac{n\beta_x\alpha_x\left(aM\right)^{\beta_x}\left(\frac{x}{\left(c-x\right)^{1/2}}\right)^{\beta_x-1}}{\beta_x\alpha_x\left(aM\right)^{\beta_x-1}\left(\frac{x}{\left(c-x\right)^{1/2}}\right)^{\beta_x}+\beta_y\alpha_y\left(aM\right)^{\beta_y-1}}$$

Differentiating x with respect to M, we get the following.

$$\frac{dx}{dM}=\frac{\left(c-x\right)\left[-\beta_x wM^{\beta_y-1}-vM^{\beta_x-1}\left(z\right)^{-\beta_x}-wM^{\beta_y-1}+w\alpha_y M^{\beta_y-1}\right]}{M^{\beta_x+\beta_y}\left(2c-x\right)\left(z\right)^{-\beta_x-1}v\left[-\beta_x w-2vM^{\beta_x-\beta_y}\left(z\right)^{-\beta_x}-2w-2xvM^{\beta_x-\beta_y-1}\left(z\right)^{1-\beta_x}-4xwz\right]-2xw^2M^{2\beta_y-1}\left(2c-x\right)}$$

$z=\frac{x}{\left(c-x\right)^{1/2}}, v=\beta_x\alpha_x$ and $w=\beta_y\alpha_y$ .....(11)

In (11) the denominator is unambiguously negative. There is only one positive term in numerator, which clearly shows that unless preference for y (α_y) and income elasticity $\left(\beta_y\right)$

is quite large $\frac{dx}{dM}$ is positive. In our case where we assume large values for α_x and β_x and small values for α_y and β_y, $\frac{dx}{dM}$ is definitely positive. ■

This result thus signifies that when *x* is significantly luxury and income elasticity of *x* is very high, compared to that of *y,* as national income rises production of *x* rises.

Remarks 1: It should be noted that this comparative static result showing effect of rise in *M* on *x* considers not the ceteris paribus effect of rise in income. Effect of resultant change in price in response to change in opportunity cost is also incorporated in this comparative static effect. This means preference for *x* so rises with rise in income that demand for *x* overcomes the impact of cost induced - rise in price and hence production of *x* rises. The degree of response however depends on quantum of *x* and *c*. As *x* approaches *c* the increase in *x* in response to change in *M* also approaches zero.

Diagrammatically,

as income of the rich rises, X_E curve shifts to the right and new equilibrium is reached with higher p_x and p_y at a different point on Y_E. Since Y_E curve has slope less than unity at all points this implies a rise in $\frac{p_x}{p_y}$ and shift of production point on the PPF to the right with increased production of *x*. As income rises there is a demand-led increase in p_x and a supply – led (more *x* leading to shortage of *y*) increase in p_y but as a whole $\frac{p_x}{p_y}$ rises and production of *x* rises.

Effect of an increase in inequality

Let us consider the effect of an increase in *a* and fall in *b*, *M* remaining the same. In this case X_E curve shifts to the right and Y_E curve shifts to the left. p_x is higher in new equilibrium but p_y may rise or fall. $\frac{p_x}{p_y}$ rises definitely and production of *x* rises and that of *y* falls. This result again implies that given high income elasticity of *x* in relation to *y* when inequality in national

income rises production of x rises. Preference for x rises with rise in income that raises demand for x.

Section III

Effect on total production

That demand and production of x rises with increased income and inequality is not at all surprising. Higher production of quality goods may not be a matter of concern if total production in the economy rises. If increase in production of x leads to increase in total production low income people can be supplied some x by suitable subsidization since per capita availability is not a problem. But more serious question is whether this increase in x production can reduce the total production of rice. Then according to our interpretation sustainability of development suffers.

Proposition II: *As income and income inequality rises, there is a chance of decline in total production of rice, implying decline in per capita availability.*

Proof: Let us show that fall in total production as production of high quality good rises is a distinct possibility.

Let the total production be given by

$$T = x + y$$

So

$$\frac{dT}{dx} = 1 + \frac{dy}{dx}$$

Hence $\frac{dT}{dx} < 0$ for $-\frac{dy}{dx} > 1.$

Given $C = \lambda x^2 + y^2$ we get

$$\frac{dy}{dx} = -\frac{\lambda x}{\left(C - \lambda x^2\right)^{1/2}}$$

$$-\frac{dy}{dx} > 1 \text{ for}$$

$$\lambda^2 x^2 > C - \lambda x^2 \quad \text{.....(12)}$$

The lhs of the above inequality is positive and rises with x.
The rhs of the above inequality falls with x and becomes zero for $y = 0$.

Hence at some $x > 0$ and some $y > 0$ we get $\frac{dT}{dx} < 0$. •

Remarks 2: The main question is whether this will necessarily occur in a growing economy. The answer depends on the response of x to increase in M. As we see in our result of $\frac{dx}{dM}$ that so long as income elasticity of x remains very high, production of x goes on rising and the chance of fall in total production by market mechanism remains high. If income elasticity starts falling beyond a certain income this possibility recedes.

One critical point in this regard is the critical amount of x from where the decline in total production starts.

From the condition of

$$\frac{dT}{dx} < 0$$

we derive the condition $x > \left(\frac{c}{\lambda + \lambda^2}\right)^{1/2}$

Now the maximum possible production of x is

$$x = \left(\frac{c}{\lambda}\right)^{1/2} > \left(\frac{c}{\lambda + \lambda^2}\right)^{1/2}$$

we derive the condition $\left(\frac{c}{\lambda}\right)^{1/2} > x > \left(\frac{c}{\lambda + \lambda^2}\right)^{1/2} > 0.$

Such value of x exists since x lies between 0 and $\left(\frac{c}{\lambda}\right)^{1/2}$.

The percentage of x production to capacity production (θ) where decline start

is given by $s = \frac{100}{\sqrt{1+\lambda}}$ .....(13)

Higher is λ, lower is percentage of x production to capacity output where decline starts.

λ is the marginal rate of transformation of *x*. If this is high i.e. *x* consume much higher resources compared to *y,* the problem appears early. Effect of a technological change i.e. change in λ is thus important. If technological change can reduce λ, the problem is eased[6].

The other determinant is the total resource availability (c). If c is low, the problem crops up quicker than at high level of *c*.

Diagrammatic analysis

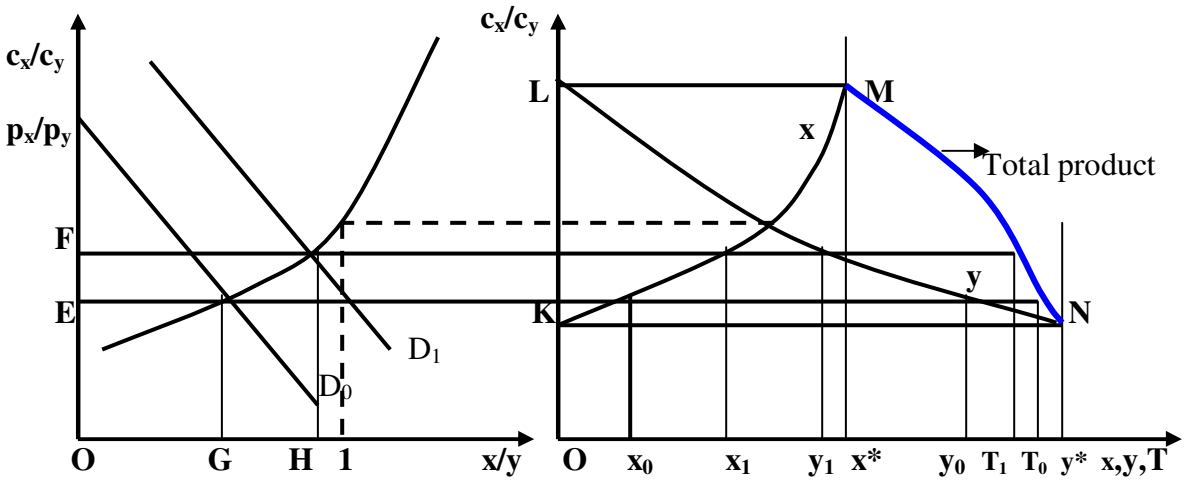

Diagram 2

In this diagram we show how change in demand of higher quality rice can lead to decline in total production. In this diagram in left side panel we show the initial demand for the better quality rice *x* by demand curve D_0. This is shown against the relative price ratio p_x/p_y and for obvious reason this demand curve is downward sloping. On the right hand side panel we show the total supply $(x+y)$ by the total product curve MN which is a vertical sum of production of *x* and production of *y*. The production of *x* is given by the upward rising curve KM and the production of y is given by the downward sloping demand curve LN. The total product curve MN is vertical sum of KM and LN. If only *x* is produced the total production is LM and if only *y* is produced the total production is KN. KN > LM since total area of land produces less quantity of the super quality rice than the ordinary rice.

[6] Of late there is invention of Pusa variety of basmati, which is claimed to have Larger productivity. This sort of development can ease the problem.

Given the initial demand of D_0, the total product is $OT_0 = Ox_0 + Oy_0 = OT_0$. Now as demand for higher quality rice increases the demand curve shifts to D_1 and the equilibrium price rises to OF from OE. This increases the production of x to Ox_1 and production of y falls to Oy_1. The total production of rice however falls to OT_1, as is visible in the diagram. The condition for this to happen is that the income induced demand for *x* will go up so much that despite increase in price of *x* more than the price rise of *y* production of *x* crosses the critical level that total production of rice starts falling. So what happens here is a demand-led rise in price of *x* accompanied by a shortage-led rise in price of *y* fails to check the supply rise of *x*. This happens only when income of rich rises briskly and income of the poor stagnates. But if this happens people in the low income bracket will be in a difficult position to meet their food requirements.

Remarks 3: It is not necessary that demand increase for high quality product, rice in our example, should take place within the country itself. If there is a high export demand for high quality rice again the same phenomenon can take place. As we see in Komiya (1967) and Ethier (1972) in terms of a simple Heckscher – Ohlin model with three goods, there is a possibility that a country will produce more *x*, less *y* and less *z* and import *z* and export *x*. y remains a non traded good. Hence it is quite likely that with increased demand for high quality rice (*x*) in the international market, production of low quality rice (*y*) falls.

Remarks 4: Although we present the arguments in our model in terms of a good like rice as an illustration, similar phenomenon can arise for increase in production of other goods, consumed by rich. An important example in this regard is consumption of more protein in the diet (Yatopolous (1985). Estimates show that if cereal food is to be replaced by consumption of chicken, land requirement will be increased by twice the amount, compared to land required for cereal production. If chickens have access to waste food, this requirement is not increased twice but by 1.5 times. On the other hand if cereal consumption is to be substituted by red meat, land requirement goes up by 4 times (Elferink E.V., Nonhebel S. (2007)). In fact there is already news that with rapid increase in income, more and more lands are gradually being used in fodder production rather than for production of cereals for human consumption in China. Against this backdrop, it is apprehended that food shortage and requirements of

large scale food import is not unlikely in China, unless agricultural productivity rises significantly in cereal production. (Daniel, Scott, Huang and Lee (2001))

Remarks 5: We can also refer to another consumption item of the rich and poor alike – road area. Rich by using car or taxi claim much larger road area on an average, compared to pedestrians and travelers in public transport. We have estimated that compared to a traveler by bus, a passenger using small car claims 4 times road area whereas a large car user occupies 5 times more road area, given that both bus and cars run with maximum number of passengers. So, similar problem can arise in road use pattern as well, where increase in the number of small passenger vehicles can reduce total passenger kilometers.

Section IV

Conclusion

Our model shows a grim possibility of poor finding it more and more difficult to sustain themselves in a growing economy, not because their income is falling but because their neighbours are prospering and demanding high quality goods that requires relatively high resources. Although we illustrate the model in terms of rice and introduce increase in production of basmati rice as a threat to increase in total rice production, this is just an illustrative example. Actually production of basmati rice is trivially low in comparison to the total rice production and so chance of total production of rice falling on account of higher production of basmati is remote at least in the medium run. But this should also not suggest that in some other areas such problem cannot crop up. Here lies the importance of the main message of the paper. The policy maker should be aware of such threat so that some remedial action can be undertaken by the government, where it so warrants. It may be needed to tax the high quality product so that its growth does not impinge on the poor men's consumption.

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