Malthus' Population Theory
An Irony in the Annals of Science

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I

MALTHUS is really fortunate!

He gave a wrong theory on the growth of population, which was quite soon replaced by a correct one by Verlhurst. But he is remembered till today, his name is known to all. Whereas nobody knows the name of Verlhurst, he is totally forgotten even among the academics. Earlier he was at least referred to in the textbooks on Degree Statistics. Now there also his theory is taught without a mention of his name.

Hearing me say so, you may feel perplexed, or rather, may be shocked. "Is it really true? How can this happen? Surely there is some mystery behind this." Yes, there is. In science sometimes even a wrong theory opens up a new lead in solving some long-unsolved enigma. Later this wrong theory is rejected, but the man who had propounded it and showed thereby a new vista is remembered as a contributor in the development of the theory. Let us take Berzelius, for instance, from the history of chemistry. He had suggested a wrong theory about the correlation of number of molecules of a gas in a given volume, which was corrected by Avogadro in the form of the famous "Avogadro's hypothesis". Or, in classical political economy, Adam Smith and David Ricardo brought forth the labour theory of value — the limitations of which were later overcome by Karl Marx in his own economic analysis. Examples can be multiplied. But in no case the man showing the right path was forgotten or ignored while glorifying the propounder of the wrong theory. Malthus is, however, an exception. So you can justifiably envy his fame!

II

Let us explain.

Thomas Robert Malthus (1766-1834) was a late eighteenth and early nineteenth century political economist. He had joined the ranks of the economists when mercantile capitalism was speedily flourishing in Europe with free competition as its motto and modus operandi. Free competition among the entrepreneurs meant that those who could produce better goods and sell cheaper could oust the others from the market. In course of dealing with this economic feature, Malthus reflected: The population in each country is growing fast in comparison to the growth of available food-grains, and, there is, therefore, a fierce competition among them over the limited resources. Then why should the surplus among the poor be allowed to swallow the food on which the propertied class could live better and more happily? In fact, he said: "A man who is born into the world already possessed, if he cannot get his subsistence from his parents on whom he has a just demand, and if the society do not want his labour, has no claim of right to the smallest portion of food and in fact has no business to be where he is." [Essay on the Principle of

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Population, 2nd Edition, 1803, pp. 531-32]

Malthus carried forward his arguments still further. He even asked his fellow countrymen to regard war, famine, starvation, pestilence, etc., as some divinely justified measures of positive check against the unrestricted growth of population and punishment of the poor for their lack of restraint in reproductive biology. For these reasons he had opposed all social reform measures like the "Poor Law" of England. According to him: "Since population is constantly tending to overtake the means of subsistence, charity is a folly, a public encouragement of poverty. The state can therefore do nothing but leave the poor to their fate, at most making death easy for them." [Quoted by Eugene Burret — On the Poverty of the Labour in England and France; vol. I, p. 152]

Then in order to give his empirical theory a scientific look he took recourse to mathematics, collected figures on population size and food production for some countries, and claimed to have found that human population grows in geometrical progression (G. P.) whereas food production grows in arithmetic progression (A. P.).

What does this signify mathematically?

It means that population size tends to grow in such a way that its relative rate of growth is also an increasing function over time. It further means that population size tends to become infinitely large over time. [See Fig.1 and the adjacent math-box]

But this appeared implausible. For various reasons, which will be spelt out later on, the population size of an area cannot so rapidly increase as to assume an infinite size as implicit in the above conception. The real demographic data of different countries of Europe also refused to comply with this Malthusian algebra.

Hence the mathematical representation had to be changed.

Pierre-Francois Verlhurst (1804-49), an unknown French scholar on population biology, tried to improve upon the mathematical representation of the population growth curve. He found from empirical studies that for any stable biological population the relative rate of growth tends to fall over time. Because under purely natural conditions the absolute growth in population size leads to a relative shortage in the per capita means of subsistence and hence to a fall in the number of survivors added. Verlhurst therefore assumed the relative rate of growth of population to be a decreasing function of the initial population size.

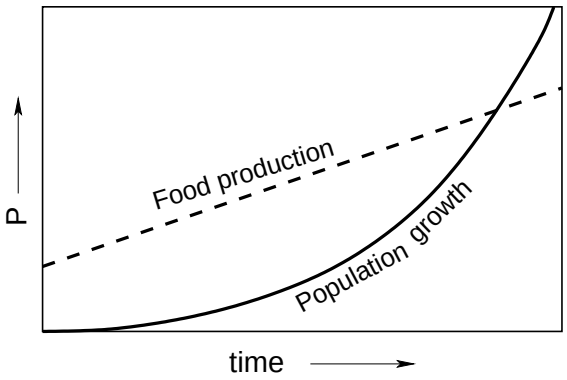

Figure 1: The Malthusian curves of food production and population growth. He showed that food supply, however surplus it may be for the time being, soon falters behind the fast-growing population.

This empirically derived population growth function (once again see the math-box, and Fig.2) was published by Verlhurst in 1838 in some innocuous journal and then virtually lost under dust and soot for almost a century. Nobody cared to attach any importance to this more correct mathematical representation of the population growth. Malthusian theory reigned unchallenged in the textbooks, academic deliberations, journalistic analyses and state policy decisions. It was only in the 1920s that Pearl and Reed, who were

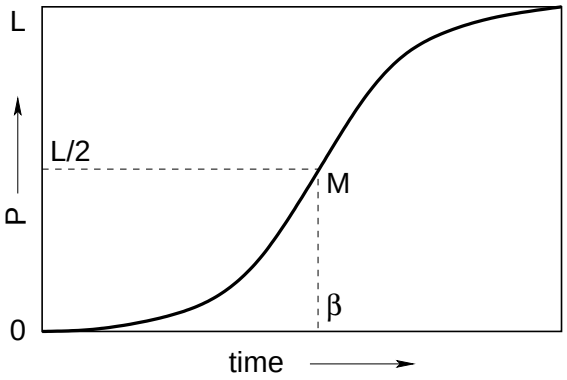

Figure 2: The logistic curve lying between the two asymptotes. The point $M(\beta, L/2)$ represent the critical value in the transition from an increasing to a decreasing growth rate.

in search of a realistic growth function, found out from worn-out files the theory of Verlhurst. [1. Raymond Pearl and Lowell J. Reed — "On the Rate of Growth of the Population of the United States since 1790 and its Mathematical Representation"; Proceedings of the National Academy of Science 6(6): pp. 275-288; 15 June 1920. 2. Raymond Pearl — The Biology of Population Growth (1925); Arno Press, New York; 1976] They were astonished to see that this functional form agreed much better with the actual US population data for three decades. Later it was found suitable for population growth rate of many other countries and also for future projection of data.

III

If this is so, then why is the man, who evolved this more accurate formula for population growth study, forgotten or ignored?

Why is Malthus, in spite of his wrong formulation of the problem, kept alive in academic as well as public memory?

Wait a bit for the answer.

IV

Many people do not know — another implication of Malthusian population theory was proved wrong within a century. But that by Darwin. Without his being aware of it.

Malthus not only gave a gloomy picture of population growth, but also contended that the availability or production of foods required by man grows more slowly (as first degree equation of time) than demanded by the exponentially increasing bulk of population. As a result, even if a nation at a particular time has a surplus of food, it would soon reach a size at another point whence food production would begin to gradually lag behind the demand of the population. This idea is held till today by many politicians, social planners, administrators, and even some academicians.

Darwin did not so much bother about the Malthusian population theory or its implication for the future of mankind. He simply borrowed the idea of excess birth rate compared to the population size of any species sustainable by the existing availability of its nutrients, and applied it to the realm of animal and plant worlds — to indicate an obvious conflict between the two. With this, he found, he could easily explain the phenomenon of more or less constancy of the number of individuals in each species around the world, as an outcome of the fierce competition or struggle for existence of the individuals over exploiting the limited resources.

Darwin did not notice — nor did any other thinker of his time and later, except one man — that by borrowing Malthusian ideas and applying them to the organic world as a whole, he actually refuted two basic tenets of Malthusianism. The one man I have just referred to was Karl Marx, who had an excellent habit of noting every discovery of science with a serious and integral outlook.

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The Mathematical Aspects at a Glance

Let us see how the Malthusian contention appear in terms of higher mathematics. Suppose P is the size of human population at a point of observation t and ΔP is the increase in population in a time interval Δt.

Then the rate of population growth would be given as,

$$\lim_{\Delta t \to 0} \frac{\Delta P}{\Delta t} = \frac{dP}{dt},$$

and the relative rate of growth would be given as $\frac{1}{P}.\frac{dP}{dt}$.

According to Malthusian proposition,

$$\frac{1}{P}.\frac{dP}{dt} = r,$$

where r is a positive constant. Or,

$$\frac{dP}{P} = r.dt$$

Integrating both sides, we have,

$$\log P = rt + c,$$

where c is the constant of integration. So,

$$P = e^{c+rt} = A.e^{rt},$$

where $A = e^c$ is a constant.

This means that human population growth is represented by an exponential curve, that is, P increases exponentially with time and tends to become infinite rapidly (as shown in Diagram 1). From this mathematical picture it follows that when t tends to $-\infty$, P tends to 0; and when t tends to be very large, P tends to infinity. This functional form could not be fitted with the then available data on population growth.

It was here that Verlhurst came in.

He took a particularly simplified form of the general Riccati differential equation

$$\frac{dy}{dx} = a.x^n + b.y^2$$

for the study of population as follows:

$$\frac{dP}{dt} = rP(1 - kP),$$

where r and k are both positive constants. On simplification,

$$\frac{1}{P(1-kP)}.\frac{dP}{dt} = r,$$

$$\text{or,} \quad \frac{1}{P}.\frac{dP}{dt} + \frac{k}{1-kP}.\frac{dP}{dt} = r,$$

$$\text{or,} \quad \frac{dP}{P} + \frac{K.dP}{1-kP} = r\ dt.$$

(continued to next page)

He, in his rough scriblings later published as "The Theories of Surplus Value", vol.II, pointed them out.

First, if mankind was disposed to high birth rate without any social and human control, then the very laws of the organic world would force it to maintain a more or less constant population size. Secondly, since plants and animals form the stock of foods for man, and since they are also born with a Malthusian (exponential) rate, man would, therefore, have no scarcity of food, provided he protects, preserves and takes care of the flora and fauna he needs for his subsistence and survival.

V

Time has been wearing on silently but with a bit of humour perhaps. Malthus had seen only the first upshots of the Industrial Revolution. Science and technology has, since then, and particularly in the 20th century, advanced beyond any Malthusian conceivability. The actual food production throughout the world has increased manifold and at a much faster rate than population growth. The potentiality of food production created by science but yet to be explored is still much higher.

On the other hand, population growth curve is much different from what Malthus

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$$\log P - \log(1 - kP) = r\,t + C,$$

where C is the constant of integration.

$$\text{So,} \quad \log\left(\frac{P}{1-kP}\right) = r\,t + C,$$

$$\text{or,} \quad \frac{P}{1-kP} = e^{(rt+C)} = A.e^{rt},$$

where $A = e^C$. Hence

$$P = \frac{1}{k + \frac{1}{A}\,e^{-rt}}.$$

In this function, r, k, and A all being positive quantities, as t tends to $-\infty$, P tends to 0; but as t tends to ∞, P tends to $1/k$, i.e., P tends to attain an upper limit over time.
Let this upper limit be $L = 1/k$. Then

$$P = \frac{L}{1 + \frac{L}{A}e^{-rt}}.$$

Now suppose that P reaches half of this upper limit, i.e., $L/2$ at a time $t = \beta$. Then

$$A = L.e^{-r\beta},$$

and therefore

$$P = \frac{L}{1 + e^{r(\beta - t)}}.$$

This is known as the logistic function of population growth.
Some properties of this curve can be studied with interest:

- First of all we see that

  $$\frac{dP}{dt} = rP(1 - \frac{P}{L}) \quad > 0,$$

  since $r > 0, P > 0$, and $P < L$.
  This implies that P increases with t, or, that population grows over time.
- Secondly,

  $$\frac{d^2P}{dt^2} = r(1 - \frac{2P}{L}).\frac{dP}{dt},$$

  which will be greater than, equal to or less than 0, according as P will be less than, equal to or greater than $L/2$.
  This implies that so long as P remains below $L/2$, population grows with an increasing rate of growth. This rate reaches its maximum when $P = L/2$, at $t = \beta$. As soon as P exceeds $L/2$, the population still continues to grow, but the rate of growth gradually falls.
- It is further seen that $dP/dt = 0$ when $P = 0$, or, L.
  Hence the logistic curve has two asymptotes as follows: $P = 0$, when $t = -\infty$, and, $P = L$, when $t = \infty$. The curve and the two asymptotes are shown in the Fig. 2.

It is obvious that the population curve never attains the asymptotic values. It also agrees with the known facts, for, (after the emergence of man as a biological species) population in a country can never be absolutely nil nor become infinite.

had predicted in most of the countries separately and as a world picture as well. In the backward countries of Asia, Africa and Latin America, no doubt the birth rate is very high due to three factors — namely, prevalence of superstition out of ignorance, necessity of extra hands among the poor for supporting the family (particularly in view of the low survival rate of the children) and lack of sufficient scope of cultural diversion and recreation among the common men. But diseases, epidemic, famine, flood, drought and other natural calamities, malnutrition, overwork in farms and factories, child labour, industrial hazards, accidents, uncontrolled environmental pollution, etc., etc., play the role of levelling down. Infant mortality, pregnant mortality, dead-issue birth rate, etc., are also very high. Average life span of the people is very low — in some countries it is even lower than 30 years.

Some statistics may illustrate the case

more clearly. According to a study by Dr. R. R. Nair of the Central Labour Institute, Mumbai, over 7000 deaths occur per annum in industrial accidents — three times the toll of the well known Union Carbide massacre in Bhopal. Not only this. The Industrial Fatality Rate in India is 0.14 per 1000 workers, five to seven times that in Japan (0.02), UK (0.03), USA (0.03), etc. [Subhash C. Soni — Workers' Safety Still a Day Dream; Hindustan Times, 16 October 1986]

Another revealing fact. An international organization called "Project Famine" of the USA recently pointed out that 24 persons die out of starvation or malnutrition every minute in the world as a whole. Only in the continent of Africa 5.9 million children vanished from the world in the famine of 1984. [Amar Nath Rai — The World Languishing in Hunger and Undernutrition; Hindustan (Hindi), 16 December 1986]

Then again, in many of these countries female birth is unwelcome in the family, and leads to neglect of care, or, even demonic murder of the female neonates. As a result, the sex-composition of the population is being skewed with a lower female to male ratio, thereby also reducing or retarding the overall population growth rate. Take the case of India, for example. Here female infanticide (being banned in 1870, but practised secretly) has been replaced by a much more modern technique — post-amniocentesis female-foeticide. Man has discovered techniques like ultrasonography to diagnose the sources of troubles in the human body, or to locate the position and study the condition of the foetus in the mother's womb. Incidentally it also helps to know the sex of the foetus-in-womb. And this knowledge is being used to decimate female population. Some 78000 cases of such female-foeticide were recorded in the decennium 1972-82. The ratio of female to male among the Indian population, which stood at 97:100 in the earlier part of the 20th century, gradually dwindled to 93:100 in the 1981 census. [A National Awareness Advertising Supplement; The Times of India, 29 September 1986.] And the more affluent the families the greater the incidence of female-foeticide. According to the Registrar General of Census and UN Population Fund, in many parts of Delhi, the Capital city, the ratio is less than 90:100 and in South Delhi it stands at 84.5:100. [Monobina Gupta — Girl-child graveyard in capital's cradle of rich; The Telegraph, 21 October 2003] It is easy to understand that the situation is not much different in other developing countries.

All these factors together account for the fact why despite repeated forecast by many authorities starting from Malthus in the 18th century to different international forums in the 20th century, vast stretches of land in these countries remain uninhabited or thinly populated, with only some cities overcrowded.

Side by side this, in the industrially advanced countries and among the educated and enlightened people everywhere, the birth rate naturally tends to fall together with the falling mortality and morbidity rates. Education, to the extent it is proper, dispels superstitions, particularly among the women, as regards child bearing. Improvement in the standard of living together with the increase in the average life expectancy at birth eliminates the necessity to produce and ensure extra hands for earnings. Availability of various cultural recreation and mental diversion obviates the need for sex as the only source of pleasure in the midst of drudgery and monotony of daily life. Moreover, realistic and ambitious concern for the future of the child induce the parents against having a large family. Lastly, increasing employment of women in the work force also serves as a counteracting factor against repeated

pregnancy. The situation in some western countries, in fact, has come to such a pass that many married couples nowadays abhor to have a child, and prefer to adopt one. As a result, in most of these countries the population growth curve is on the verge of becoming parallel to the upper asymptote.

On the other hand, the Malthusian speculations about the ever yawning gap between population growth and food production have been proved wrong. In fact, "British and American population", wrote Mr. Frank W. Notestein, President, Population Council, USA in 1958, "have multiplied by five and thirty-five times respectively, since Malthus's essay first appeared, and also achieved a state of general health, education and prosperity that Malthus would never have dreamed possible" in this "worldly state of probation". As against this, "the population of technologically underdeveloped nations, which comprises more than half the world's present total ··· have grown rather slowly since the beginning of the nineteenth century, and often presents a picture of disease, illiteracy and poverty for the masses with which Malthus was wholly familiar." [Frank W. Notestein — "Introduction" to the anthology "On Population" containing three essays by T. Malthus, J. Huxley and F. Osborn]

Criticizing the Malthusian view that "poverty and suffering of the masses ..... arose, not from social injustice, but from natural law" and that "only suffering and the threat of still worser suffering could be relied upon to induce restraint in the masses", Notestein further held: "Yet there is now clear evidence that abysmal poverty induces more of the same, and not prudence. ..... Not poverty and disease, but improved living conditions and rising ambitions motivated the trend towards birth regulation." [Ibid]

Another crucial point. While discussing the problem of population growth in the underdeveloped countries, academicians most often forget the fact that the soaring prosperity of the developed nations has been achieved at the cost of grinding poverty of the underdeveloped nations. They also ignore the fact that the population Western Europe sustains today is many times less than it should have sheltered provided it was unable to transport a large bulk of its population to Africa, Australia, New Zealand, North America and South America, through colonization and occupation.

VI

Here the question will arise again: In face of all such blatant facts, why was Malthus not forgotten, or left to the place he rightly deserved? Why do his name and wrong theory still feature in the press, the economic literature of the academies, the speeches of the statesmen? And even in educational curriculum?

The answer involves understanding a truism: Truth, when it directly affects the interests of man, is not seen by some and denied by others. The history of science is replete with such instances. Those who deny have a conscious motive — individual and/or class. Those who fail to see may not have any individual or immediate motive, but are guided (or to say correctly, misguided) in their outlook by the former's interests and philosophy — even though unconsciously and unwillingly.

That is the case here.

Man, if correctly viewed, is a great productive and creative force. He has conquered the nature. He has changed the face of the Earth and created the human civilization. He is now going to change the face of the dead masses of the cosmos. Not one or two men. Not in hundreds, thousands or millions. Not for a short while. But billions and trillions of men down the millennia since the prehistoric pleistocene era. Today a thin upper crust of the global pop-

ulation is exploiting and squandering vast amount of natural and mineral resources like coal, oil, metals, and water, forests, etc. Military preparation, imperialist hooliganism, and wars of different scale, are causing still further wastage. If these wastages could be stopped the present world population could have more than sufficient a level of subsistence. It could then also have a direct impact on the future growth of population size.

It is only man, conscious about his present crisis and future prospects, who can really stop this immense wastage of valuable resources for sustaining life. He will not simply submit to a Darwinian law about the constancy of population under the pressure of the blind forces of nature. He will organize his future life with an integrated plan — involving not only volume of production but also size of population. In that sense man is still a great productive force, manpower is the most valuable asset of human society.

Who can fail to see this truth?

Those who are afraid of man and his power.

Who are but afraid .....?

Those groups handful of men who subsist on a parasitic life upon the rest of mankind — the capitalist class, the owners of all sectors of production, who do nothing, not even supervise or calculate their profit (for there are salaried men to do that), but only enjoy the profit. Profit comes from the exploitation of the people. As a result, on the one pole the profit swells continuously, and on the other, real income, the relative standard of living of the people falls simultaneously. Falling income entails diminution of the effective purchasing power of the people, and therefore, the available demand in the market. In face of the shrinking market, production slows down, and economy staggers. Anarchy subsumes plans. Prices go up, inflation plays a free style wrestling with the life of the common masses. Under-production, lockout, layoff, closure, retrenchment, industrial sickness, etc. mock at the official ritualistic call for "more production". Unemployment is the basic feature of economy. Exit policy, VRS scheme, workforce downsizing, etc. are the cry of the business houses, and policy of the government.

It is in such a social mileau that man is seen as a problem, manpower a menace. Growing population means a growing problem, a mounting tension within, and an emerging threat to the existing state of affairs. That is why those who gain herefrom and have lasting interests perpetuating this order of things are afraid of man, of any further growth of manpower.

Not only that. For all their own misdeeds and mischiefs they point to the high birth rate and the rapid population growth as the sole cause. Thus instead of addressing the problem of population as a societal aspect they prefer to leave it as an action of the people and then accuse their number for all the crises of their life.

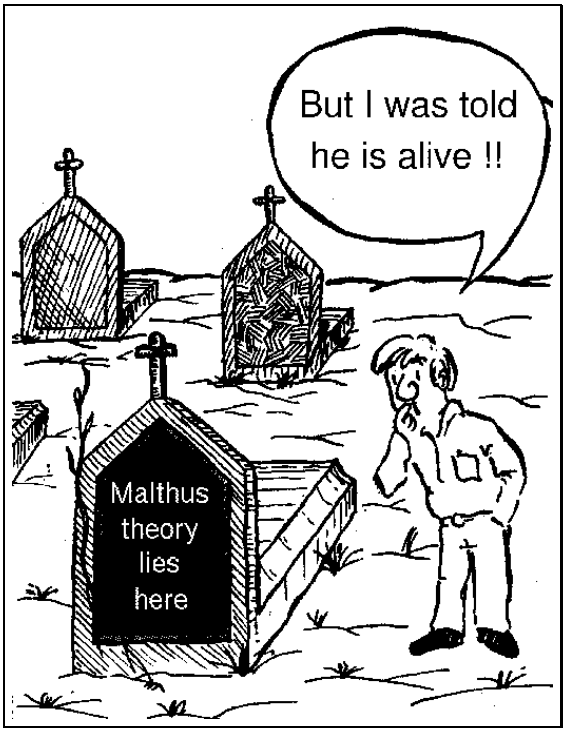
In our country also, the rulers and the administrators are crying hoarse over "small family". The Union Government has been so obsessed with this slogan for decades together that in its new education policy it characterized the "small family norm" as a desirable ethical(?) norm! And the National Council of Educational Research and Training (NCERT) prepared and distributed a course material on Malthusian Population Theory to be compulsorily taught in schools. Billions of rupees are being squandered away from the public exchequer in the name of propaganda for "family planning" or family welfare. But people do not get the minimum health care from the government hospitals and health centres for the real welfare of their families — not to speak of jobs, education, drinking water, etc.

The Government of West Bengal, while talking of leftism and Marxism, has also seized upon the slogan of birth control. In some full-page advertisement they singled out over-population as the sole or main issue for the solution of the problems of their life. [Ganashakti (a Bengali daily published by the WB State Committee of the CPI(M), 16 January 1987]

But before concluding so, some important questions have to be answered:

1. Why do your industries fail to produce upto the installed capacities? How is the population responsible for that?
2. Why do the textile industry suffer from "over-production" when seventy per cent of the Indian population is living unclad or halfclad? Are these due to any "excessive pressure of population"?
3. Why do the countries like France, Switzerland, the USA, etc., which have long attained the zero-growth level in their population size, are also plagued by these same problems as ours?
4. How could China with the highest population in the world, free itself from all such nuisances long back within the lifetime of Mao Zedong?
5. Have your government been able to take care of even that proportion of the population which might have been its total size following the growth pattern you had stipulated?

Honest answers to all these questions show that it is the capitalist class that require the shield of a so-called problem of over-population in order to defend its own narrow sectoral interests. The Malthusian Theory of Population — though proved wrong — is quite a good shield in that sense. So Malthus must be kept alive, his name must be worshiped. On the other hand, any reference to Verlhurst would not only tarnish the image of Malthus before the average man, but also distract his eye from the "good" wrong theory to the correct but unplayable theory. Most of the common people do not know which theory is employed to compute and project population data. Is it not better to keep them ignorant of Verlhurst?



However, there are many others, who are not capitalists themselves, but cannot envision any social order higher than and beyond capitalism, and therefore, fail to see through the game of the population issue and try to defend the Malthusian fallacies with some "buts" and "howevers".

VII

To avoid misunderstanding, let us clearly spell out one thing before conclusion. We do not mean here to oppose birth control or the approach for small family in principle. We

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believe that conscious people will deliberately exercise birth regulation in their families with the desire to improve the health and care of the women and children in particular, and for the betterment of the health and care of the mankind in general. It will be voluntarily enforced among people as they are educated, enlightened and placed in a better and securer conditions of life.

But we oppose the Malthusian contention that poverty of the masses is due to high birth rate. As we have already eloquently shown, Malthus and the Malthusians reversed the order of the cause and effect on this question. *Poverty is not the effect but the cause of high birth rate, and the solution to the problem of over-population, if any, has, therefore, to be sought in the cause behind poverty — the rule of capital*, which is either concealed or justified by Malthusianism.

It may be pointed out here that socialist China first cured her social ills left over from the old feudal and colonial regimes, and only then, in 1971, proceeded to introduce educational as well as practical measures for birth regulation, to slow down the population growth with the slogan of "one-child family". She thereby defeated Malthusianism — both the theory and its apologetics. It was proved that real birth control and planned population growth can be achieved only by putting an end to the profit suckers' rule and rejecting the unscientific trash that stands in its defence.

VIII

A time will come when Malthus and his fads will be consigned into oblivion, and Verlhurst will be given due honour in history. But the mad infatuation of the reactionary forces and ideosyncracy of many academicians over Malthus and his "ism" will never be forgotten, never be forgiven.□