

POPULATION GROWTH, CLIMATE CHANGE AND YOU : THE ANSWER

SUMMARY

- Q. Who said: *"The world population is still growing enormously. Nobody seems to want to tackle that problem?"*
- A. Sir John Mason FRS, former Director General of the Meteorological Office (UK), in evidence to the House Of Lords Select Committee on Science and Technology on The Greenhouse Effect (HL Paper 88-II, HMSO, 1989).

Here is explained the world population growth mechanism and its knock-on impact on the greenhouse effect and global prosperity (or otherwise). A possible fiscal-cum-socioeconomic device is proposed to contain population growth and to enable mankind to prosper in a largely stable world able to withstand the rigours of predictable natural climate change. Attention is also drawn to the likely consequences of not so doing within the next generation or so.

INTRODUCTION

It's a small world and getting smaller at an ever-accelerating rate. It will disappear completely in the year 2030AD. Not a lot of people know that - yet.

Now read on.

We all know there's an ominous shadow hanging over us. Some see it as global recession, some as the greenhouse effect or the hole in the ozone layer, some as creeping pollution, some as loss of biodiversity, some as Neighbours or the Wogan show. Me? - well, I have a strong suspicion the cat's pregnant again.

We are talking about serious problems here. Unbelievably serious. Runaway population growth. Global overheating. Drought. Famine. Wipe-out.

More populist scaremongery? I don't think so. But I should be more than delighted to have any reader demonstrate why the following arguments are wrong. Personally I like life and the scenario below scares me witless. Now let's try to find a solution.

POPULATION GROWTH : the facts

The year is 1798 AD. Thomas Malthus, a Professor of Economics, part-time Anglican priest and well-known ferret-down-the-trousers aficionado, wrote a challenging treatise on population growth, called *An Essay on the Principle of Population*. In summary this said that mankind has always and will always expand its numbers so that demand for resources (mainly food) just outstrips supply. He used this as an excuse for slamming up the poor, who were seen as consummate absorbers of resources, in the work-houses that he thoughtfully invented for the purpose.

Another way of looking at this is that man is unwittingly predisposed to quantity rather than quality of life. Whenever we get a bonus we squander it on trivia like a new Madonna LP or declaring war on Russia. In macro-economic terms bonuses might be seen as technological revolutions or vice versa. Pardon? Now what's he on about?

Well, every so often we have a bright idea. Not like deciding not to tell your Bank Manager that he could contribute to economic revival by retiring but something really special. These milestones which truly change the course of history, direction of society, etc., are known as technological revolutions: collectively they contribute to cultural evolution. There have been quite a few which historians recognise from the past.

Let us start with the discovery of a means of creating and maintaining fire (or inventing the wheel or whatever it was) about 26,000 years ago. Dead handy that, especially as we were up to the ear-holes in Ice Age at the time. At last pre-Stone Age man had worked out how to defrost his Tesco's mammoth-burgers: *homo sapiens* took his first great step on the road to

destruction with a sudden burst of procreation.

Then what. About 4300BC man got seriously stuck in to the first agricultural revolution. He tamed animals, planted plants (what else would you do with them?) and established the first branch of ADAS. Oh, and also invested some of his new found husbandry skills on accelerating world population growth again.

The next significant expansion had to wait until the Iron Age began about 1000BC. Man discovered the knife and fork (except in China, Japan and various other parts of the Far East): no more greasy fingers after polishing off a ferret and chip takeaway. Suddenly we had tools to manipulate the environment. We also had our fist real nail in the coffin awaiting our demise.

With just a few retrograde hiccups along the way - such as the so-called Dark Ages when the miners went on strike - not a lot happened after that until about 1000AD. Then another burst of population growth took place, largely attributed (e.g. by McEvedy, C and R Jones (1978): Atlas of World Population History, Allen Lane, London) in history to the development of effective shipping in Europe and agricultural advances in China. This growth stage proved to be somewhat fragile however: no sooner had Kenghis Khan finished beating the daylights out of the Chinese in the thirteenth century than bubonic plague swept across Europe about a hundred years later, in both cases killing about a tenth of the world's population.

This sharpened up the mind a bit, not least among demographic historians who really began to get their act together with more accurate estimates of world population after that. Perhaps that is because there were more of them about. About 1390 the world began the steady stepwise progress of the modern population era, heralded by the invention of guns and marked improvements in ships to enable discovery and colonisation of pastures new.

With the speeding up of technological advances contingent upon increasing numbers the next population explosion was not long in coming. This is attributed to the second agricultural revolution which became effective about 1710 with the realisation that it was possible to store enough food to enable all cattle to be kept over-winter instead of barbecuing them in the autumn: this was, of course, the origin of the Guy Fawkes bonfire night, but that is another story.

We are nearly up to date now. By 1870 the industrial revolution had struck, witnessed by Queen Victoria's attempt to over-populate the world single-handedly. After this there was no looking back.

In the middle of the present century the last clearly distinguishable growth phase so far occurred - as a rider, the 1990 world population was five billion and rising, some say accelerating, again. This coincided with the communications revolution around 1950, encouraged by the Second World War and the birth of Terry Wogan.

Where does this leave us? Well, let's look at **Figure 1**. This shows the world population growth over the last 300 years according to McEvedy and Jones (see earlier). The dots are from the historical record. The curve, which passes smoothly through most of the dots, represents the following theory.

POPULATION GROWTH : the theory

From the historical record one can deduce that world population in 1390 was about 312.5 million; in 1710, 625 million; 1870, 1250 million; 1950, 2500 million and 1990, 5000 million. The dates are separated by 320, 160, 80 and 40 years respectively so that the population has doubled in ever-halving time. Why?

Let us go back to Thomas Malthus and his idea that man wastes the rewards of technological revolutions on population growth. Technological revolutions are the fruits of bright ideas. Where do bright ideas come from? That's too difficult. But it is not too difficult to come to grips with the rate at which they happen.

Let us consider our erstwhile Stone Age genius lurking about wondering whether to invent the wheel or not. He was not alone. He was surrounded by Og and the lads who were still grappling with the concept of not living in trees. Geniuses are likely to have been as thin on the ground then as now. Let us consider that they were, in fact, exactly as scarce then as now.

This would mean that if a given population could boast one genius then twice that many people would harbour two of them. If a British Standard genius routinely turns in an eight hour day including lunch and tea breaks (soon to be abolished), holidays excepted, then the chances of a given number of people coming up with a bright idea via their champion genius is twice as good as only half that number. Alternatively, rearranging this same concept a little, a given number of people would have the bright idea that leads to the next technological revolution in only half the time it took the previously half-sized population. That exactly fits the curve in **Figure 1**.

So we have a reliable model of world population growth (represented, for the mathematical inclined, by the equation

$$P = 2 \times 10^{11} (2030-t)^{-1}, \text{ in which } P = \text{World Population and} \\ t = \text{Date AD (date BC is negative)}$$

- grossly at odds with the United Nations and World Bank models - and an explanation of it (unlike the UN and World Bank who have no idea why their models don't work): for details of the analysis see the Appendix of Denness, B (1990): *Determining natural and manmade climate change: historical review and implications for the 1990s and beyond IN Greenhouse Effect, Sea Level and Drought* (eds R Paepe et al), Kluwer Academic Publishers, Dordrecht. Now what? If the growth continues in the same mould as history dictates what will happen? Just continue the series above: 1390, 312.5; 1710, 625; 1870, 1250; 1950, 2500; 1990, 5000;now go on halving the time

difference and doubling the population. Anyone who gets beyond 2030AD for an infinite population wins a lemon. Unless, of course, he or she proposes the following solution.

POPULATION GROWTH : the solution

2030AD. That's not far ahead. Even the writer's sell-by date may not be exceeded by then, world population permitting. But infinity is a bit big. Tesco's would be packed. So to avoid having to wait literally forever at the checkout what can we do to disrupt the historical population growth pattern? Well, for starters how about the developed world taking on board a slice of reality and reviewing a concept that has lost popularity recently for no good reason other than intellectual fashion?

In the crudest terms that means people without pensions need to have children as their only realistic means of support when they can no longer provide for themselves. Not so, I hear you say. Since the advent of universal medicine infant deaths have decreased dramatically. There is now every chance that at least one of a matching set of two offspring will survive - probably more. Hence no need for more than two etc., you go on. But haven't you overlooked something here: urbanization and other threats to the nuclear family that once cared for (and usefully occupied) dear old granny? The mere survival of offspring does not guarantee a long-term life support system. So what would?

Pensions.

The developed world generally provides a pension for itself to cushion it against deprivation in old age and infirmity. Whether through a state system or private insurance it volunteers a substitute for absent children. In that case why hasn't the developing world caught on and similarly endowed itself with pension schemes? Simple: it can't afford it. It is too preoccupied just staying alive to be able to divert resources towards providing for the future.

Altruism suggests that if people are unable to look after themselves then better off members of the community should lend them a hand. So does common sense in this case. Remember 2030AD. If the better off nations of the world do not provide pensions for those unable to look after their future then most of us alive today will find ourselves superfluous to requirement in the near future.

How much would it cost?

Not a lot. If we start now.

Let us do some crude sums. At present for every one person in the developed world there are three in the developing world, i.e. one relatively rich, pensioned person to every three unpensioned people. Also per capita income in the developed world (related to the cost of living) is on average about 20 times that in the developing world. Finally let us guess that a pension at the rate in Britain, which now appears to have its population growth under control, is appropriate. One can play

around with these figures at will but one has to start somewhere.

So where does this get us? In Britain, for example, deductions from salary for the provision of a combination of pension and health insurance is about 20%. Therefore, to provide for the whole of the developing world as well would be $20\% \times 3 \times 1/20 = 3\%$ extra. (What do you mean you don't understand it? - just read the last paragraph again.) That's not a lot, is it? It's in the same league as the tax changes meted out in annual budgets. We wouldn't seriously notice. Yet.

However, if we wait another 20 years the ratio of rich to poor will be about double, according to the extension of demographic history, requiring us to cough up a less comfortable extra 6%; by 30 years time it will have doubled again requiring a painful donation of 12%; 35 years, a crippling 24% extra; $37\frac{1}{2}$, a devastating 48% extra and impossible thereafter. It makes you think... and wonder whether or not it makes sense to bite the bullet now before it bites us.

CLIMATE CHANGE

As if the population problem wasn't enough there is more to come. Climate change. Everybody has heard about the dreaded greenhouse effect. If we don't stop our profligate consumption of fossil fuels soon the atmosphere will warm up, the ice caps will melt and we shall all go to Reigate-on-Sea for our holidays, etc., etc. However, that scenario seems a long way off - or is it?

Conventional wisdom would have us believe that the world should have warmed up by about 0.6°C over the last 100 years or so due to the greenhouse effect. And so it has! However, it did it a bit erratically, largely in the first third of this century and the most recent decade: for about 20-odd years in between it actually got colder. Not only that but in the middle of the previous century the world warmed up by a similar amount before there was a greenhouse effect.

There's something odd going on here. There are no prizes for guessing that it has something to do with the natural variability of the climate, quite apart from the greenhouse effect. This is part of the variation that raised the global temperature by about 6°C some 15,000 years ago and brought us out of the last Ice Age. It also caused the sea level to rise by about 100 metres as the ice melted: Clacton must have seemed positively mountainous before that.

All this raises questions about how we can be sure that the greenhouse effect is real at all, i.e. if natural changes have been as big or even bigger than the temperature rise of the last 100 years how do we know that the general trend is due to the greenhouse effect? In fact, it is because experiment and theory come together to suggest that the greenhouse effect should be real. However, until recently it's been somewhat like religion: you had to believe it but couldn't actually prove it. Now you can.

A climate model has been developed to take account of both natural climate change and the manmade greenhouse effect. Through a series of papers (e.g. Denness, B (1984): *The Greenhouse Affair, Marine Pollution Bulletin*, 15(10), 355-362; Denness (1987): *Sea level modelling: The past and the future. Progress in Oceanography*, 18, 41-59, etc.) the writer has shown how this deterministic model matches past global temperature variation over all timescales from a few years or less to hundreds of millions of years. Developed in 1980 the model has been used in forecasting mode for more than a decade now. The model forecast that the world would experience its six hottest years on record in the 1980s. And it did (albeit not exactly the same six years!) It also forecast in 1980 that we would enter a deep and long-lasting recession about 1990 for climate-related reasons quite different from those employed by economic forecasters. In addition it forecast that the rise in temperature in the 1990s would be more than double the 0.25°C expected from the greenhouse effect mainly due to natural variation.

Now what would you think if you were the President of the United States or Dan Quail or both when this unexpectedly large hike in temperature takes place - bearing in mind that said gentlemen or gentleman will have been advised by climate experts that increasing global temperature means increased incidence of drought in the Mid West, the bread-basket of the world, as shown in Figure 2? Back to the dust bowl, you would think. End of food mountains and widespread famine in sight, you would think. And this is in addition to all those extra mouths to feed in the developing world.

After all the hype it would be reasonable to suppose that the greenhouse effect was not only real but a runaway phenomenon. Urgent action would appear to be called for. Policies might be embarked upon to curtail the use of all but the bare minimum of fossil fuels, the coal, oil and gas that generate the main greenhouse gas, carbon dioxide. The energy world would be thrown into disarray to complement the beleaguered agricultural scene. All for the wrong reason, because the temperature increase will be mainly natural.

It is as well to recognise this in the calm before the storm. After the event one might be accused of inventing a theory to fit the data. On the other hand, as the greenhouse effect is related to both population size and development and we have seen that world population is hell-bent on doubling itself at ever-halving time intervals, it won't be much further into the future before the real greenhouse effect overtakes natural warming in any case.

Unless, of course, we come to our senses and act very soon to control both population size and the greenhouse effect together. A possible mechanism has been suggested here. It may not be unique but would seem preferable to certain more painful solutions that come to mind.

THE GOOD NEWS

And now the good news. With a steady state population mankind would presumably not stop having the bright ideas that introduce new technological revolutions. But instead of squandering their fruits on increasing numbers, thereby continuously just failing to feed them all (back to Malthus again), he could concentrate on improving their lot. For instance, if we stabilised the population at about 10 billion we would, according to the earlier population growth series, be capable of one technological revolution every 20 years. If this were directed towards economic growth instead of population growth that would imply a doubling of wealth for everyone in 20 years instead of doubling the number of people, most of whom remain impoverished, i.e. an economic growth rate of 3.5% per year.

In turn, if the developed world trod water and allowed this economic growth to be concentrated only in the developing world with its per capita income of about 1/20th that of the developed world, it would take less than 100 years for the developers to catch up economically (i.e. by halving the deficit every 20 years). Then we could all march forward together in a stable world with assured real progress, natural climate change permitting.

One accepts that it is possible to juggle the figures to achieve a scenario to fit one's prejudices or requirements of life. The purpose here is to introduce a mode of thinking rather than specify any particular path: the numbers are merely by way of illustration that the proposals could be realistic - not to set them in concrete.

CONCLUSIONS

This brief article covers a lot of ground: scientific, philosophical and socio-economical. For more profound analytical substantiation the reader is referred to the above reference by Denness (1990) and others to which it leads in order to compensate for what can only be the tip of an iceberg in a general note of this kind.

In summary we have explored one main theme - that man is inextricably linked to his environment and that unless he disrupts his historical growth pattern urgently, which he could, that environment will suffer irreparably. In particular a population growth model has been shown to match historical demographic observations almost exactly. Its consequent forecast for the future therefore deserves to be taken seriously: it forecasts that, if its growth pattern is uninterrupted, the human population would become unsustainable before 2030AD with widespread economic and social disruption before that. To this has been added the effect of both natural and manmade climate change using another forecasting model that separates the greenhouse effect from nature. That model forecast in 1980 that the early 1990s would experience a deep recession: it also forecast generally unexpected climatic events for the subsequent near future, events of potentially major significance for worldwide society.

The encouraging side of the argument is that it need not necessarily be all doom and gloom. A crude fiscal mechanism based on universal pensions has been proposed which, if enacted over the next 20 years, could lead to a stable human population in a world at ease with itself. Simplistic? Naive? Of course it is. But the alternative hardly bears thinking about.

Figure 1: World population growth

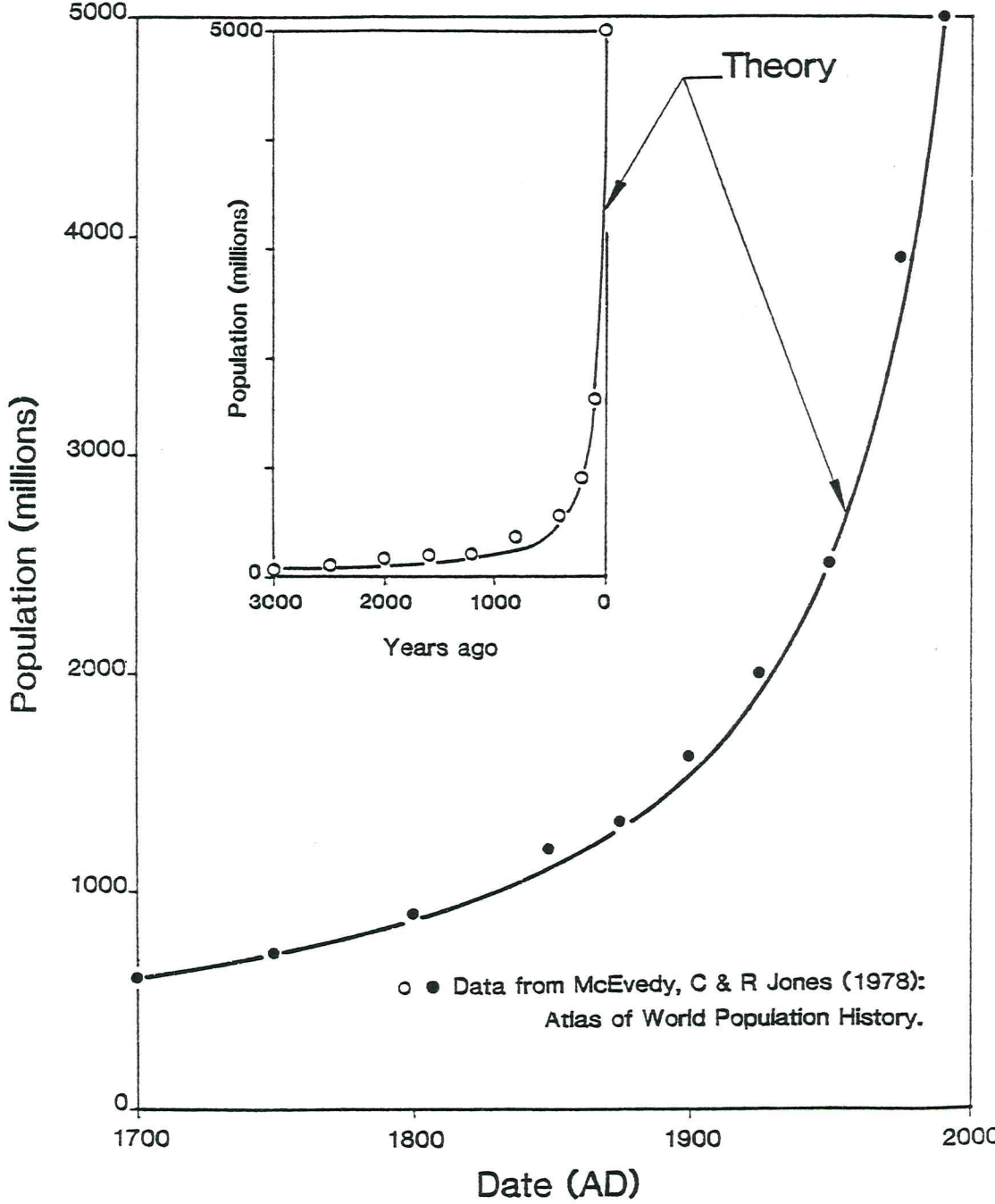


Figure 2: Rainfall in a warmer world

