

The Incredible Shrinking Planet

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The incredible shrinking planet. Rest assured that I have no intention of talking about the size of our celestial orb. Nor for that matter do I intend to muse upon the geopolitical implications of evolving global communication systems. No, with typical human hubris I will be referring only to the population of our wonderful species on a planetary scale. Because I will be throwing around a lot of numbers, I am passing out a collection of graphical material for you to use to visualize some of the facts and concepts I will be discussing.

Three hundred years ago Thomas Malthus created quite a stir by announcing that, since human population increased geometrically while food production only increased arithmetically, we would soon outstrip our food supply, and great famine would befall the species, leading to shrinkage of the population back to a sustainable level. As recently as 1968 Paul Ehrlich predicted in his influential book *Population Bomb* that the Malthusian disaster was soon at hand, predicting hundreds of millions of deaths from starvation in the world, and even food rationing in the US and Europe, all to occur within the following decade of the 70's. While there are certainly many undernourished people in the world, United Nations figures show that average per capita caloric intake worldwide has actually increased by 27% over the past 40 years, thanks to a remarkable increase in agricultural productivity and an overall increase in standard of living.

Actually both Malthus and Ehrlich were right in one sense, but for the wrong reasons and in the wrong time frame. World population will peak and begin a long decline in this century. However, the cause will not be famine, plague, war or other disaster, although I am not saying those will not occur. Rather the individual voluntary actions of billions of people will accomplish this long held goal by reducing family size, for a variety of reasons which we will get into soon.

Demography is sometimes overlooked as an academic discipline. Typically grouped among the social sciences, it is far more scientific than social. Yet it does not comport comfortably with the physical or life sciences either. Since demography makes assumptions about human behavior (God forbid!) it is not elevated to the lofty ranks of pure science. And yet, demography holds an enormous importance in predicting large scale and long-term trends that will impact our economic and political life in the future. And on a much smaller scale it is the means by which actuaries construct life insurance policies and politicians draw their legislative districts.

Demographic reality is also the bane of politicians who must juggle short-term political pressures with the long-term interests of their country. It was the blast of hot air coming out of Washington over Social Security that first led me to attempt to understand the factual basis behind various claims. This quest has opened for me a vast database of information with huge long-term implications for all of us, or at least for our descendants. In brief, much of the developed world is locked into an inevitable shrinking population trend as we speak, and the less developed world will soon also peak and begin to decline.

Demography gives us the tools to be able to make these bold assertions. The fact is, that total world population will begin to contract in some of your lifetimes, for the first time in human history, with the exception of the Black Plague. The implications of that changing face of the planet form the basis for my talk.

Demographers love trend lines. Using relatively hard data such as census figures, and birth and death rates, they can project population trends going far into the future. Adding in the biological fact of female fertility limited to about thirty years beginning in mid-adolescence they can determine a very useful figure known as the Total Fertility Rate, or TFR. This is the average number of live births per each female of a given population study, or cohort, in her lifetime. A moment's reflection should help you understand how greater accuracy of measurement of fertility arrives from measuring uterine output than testicular output.

Allowing for early deaths prior to the age of fertility, it is generally accepted that in order for each couple to replace itself they must produce 2.1 children. In other words, for the United States to maintain a steady state population, absent immigration, we would have to maintain a TFR of 2.1. In fact, our current TFR is just below that figure. You can see this on Figure 2 of the handout. And we are actually the only country in the developed world that has a current TFR even close to the replacement rate.

The most comprehensive resource for accumulating population statistics on a global scale is the United Nations Population Division. As recently as thirty years ago they were predicting that the earth's population would peak at 15 billion. Since that time each successive report has reduced that number. They now project world population will peak at less than 10 billion, and the peak will be reached in this century. You can see the graph of their projections in 2002 shown in figure 1 on your handout. For the near-vision challenged, the horizontal axis represents decade markers starting in 1950, and the vertical axis represents billions of global population. Most of my graphs are copied from the UN Population Division data as printed in Ben Wattenberg's excellent book,

Fewer, published in 2004. Some scholars, including Wattenberg, feel that even those figures are too high and the timeline for reversal is too long. The environmental, political and economic consequences of this debate are huge. Let us look into the substance of that debate and explore the implications.

As recently as the 1950's every single developed and undeveloped country was reproducing at well above its replacement rate, with the exception of brief pauses for war or natural catastrophe. Since that time all developed, and many undeveloped, countries have fallen below, and some way below, their replacement rate. As we speak, Europe is losing over 700,000 people per year. Russia is losing close to one million people per year. With such a sharp change in what had been a relatively straight-line upward trend since the beginning of the Industrial Revolution, how do we project the future?

Actually we can predict short-term population trends fairly accurately. The present cohort of females between ages 15 and 44 is the only source of newcomers to the planet. They will reproduce at a rate over their lifetimes close to the current average TFR. The problem comes with predicting what their daughters (and sons) will do when they reach adulthood. Will they choose a family size similar to their mother's, or will they change their behavior toward larger or smaller families? There is considerable evidence to suggest that, on average, they will choose to have smaller families. Also, the calculated TFR of the current cohort used by the UN in making the projections shown in figure 1 averages the fertility of the whole range of ages. It seems clear to me that the current 20 year olds within the cohort will have fewer children in their lifetimes than the current 40 year olds did. There is no example anywhere in the world to suggest that there will be a trend to larger families.

Another problem in predicting the future comes from the principle of compounding. The variability inherent in predicting population 5 years into the future of a nation with a TFR of 2.0 versus 2.1 is not very great. But that same small difference over 50 years is substantial. In other words, each successive generation magnifies, or compounds, the difference. Thus a small increase or decrease in TFR will accelerate its effect on the population with each passing generation. Since the UN figures for TFR have consistently been amended downward after further analysis, there will most likely be an accelerating downward trend in total population.

Demographers have another important principle called the momentum effect. This has particular importance to us at this time because it shields us from seeing the full significance of the changes I have been describing. We look at, through the press and politicians, population changes on a year-to-year basis. And, of course, population is still growing in absolute numbers in most parts of the world despite falling TFR. Recall that we are currently experiencing

population growth in large part as a result of children who are currently being born to the women who are the products of the higher TFR of 30 years ago. That puts what Wattenberg indiscreetly calls a “fat cohort” of reproducing women into the system. However, those women are having fewer children than their parents did. So they are producing fewer future contributors to population growth. But because there are more of them, the population will continue to grow for a while, even at a TFR below the replacement rate. Similarly, even if the women of a specific cohort, or nation, were to suddenly change their reproductive behavior upward, an increase in the rate of population growth would not appear for decades.

Wattenberg argues that the United Nations projections are inflated upward for a variety of reasons, some of them political. We have an inherent tendency to look at their projections as shown in Figure 1 and say “I’ll take the middle road”, or, as they term it, the Median Variant. But in constructing their projections they made some assumptions that may not be valid. For their Median Variant they assumed an ultimate global TFR of 1.85, revised downward from a TFR of 2.11 in their previous report. While this would reflect a continuing downward trend of TFR in less developed countries, it also assumes a drift upward of TFR in the developed world. There is considerable evidence to support continued decline in TFR of undeveloped countries, but there is no example to date of either an upward trend, or even a leveling off, of TFR in developed countries (other than the US).

If you are the representative on their Population Division from, say, Russia, or Japan, or Italy, and a dispassionate projection of your current population trend shows (as it does) your nation vanishing in a few generations, you will naturally, even instinctively, assume that changes will occur to reverse that trend. Most things in life and in the physical world are cyclical in some fashion. Human population up to this point in history has shown no such cyclical nature. We are truly venturing into uncharted territory.

Let us look at some of the background data that supports Wattenberg’s contention that there will be a more rapid decline in population than has been previously projected. In Figure 4 you can see the trend of Total Fertility Rate over the past fifty years in Japan and Europe. These two lines represent essentially the entire developed world besides the US and Australia. You will note that, with the exception of a momentary blip in Japan’s rate in the 1970s, the trends lines are straight down. Both areas are now at slightly more than one-half the TFR needed to sustain their current population.

To a demographer these are very alarming trends. From a long-term perspective, a shrinking population threatens social and economic stability. However, the decisions that lead to these trends are made individually, in the

privacy of the bedroom, and not in the seats of government or in corporate boardrooms.

I am one who feels that a great deal of human behavior can be explained by economic motivation. In an era when people were living directly off the land, there was great economic motivation to have large families. Many children died at a young age, and working children were part of a family's survival. Figure 7 shows the correlation between declining child mortality and decreasing TFR. Children were also the source of continued sustenance of their parents when they were too old to support themselves. As more children made it to adulthood, there was less need to have large families.

Mechanized agriculture caused families to relocate to urban areas, where children were no longer an economic asset. Indeed, they became a significant economic liability, especially teenagers in the Bullard High School district. You can see in Figure 8 that worldwide, as the urban population percentage increased from 33% to 47% over the past 40 years, the TFR dropped almost by half.

While the less developed countries still are largely agrarian, there is a massive relocation to urban areas going on worldwide. Associated with this shift is a startling rate of decline in TFR in those countries as well. You can see in Figure 3 the dramatic drop in TFR in selected underdeveloped countries from their peak year, around 1960, to the current time. While some less developed countries still have a TFR above the replacement rate, the worldwide average drop in all those countries over the past 50 years is shown in Figure 5. There is no reason to believe that these countries will not continue to follow the decreasing fertility path seen in all developed countries.

Along with urbanization come several other factors that contribute to a declining TFR. At one level, the education of women bears a strong relationship to family size. Figures 10 and 11 demonstrate the inverse correlation between female literacy and secondary education on the one hand with TFR on the other. A correlate of education is greater conscious control of fertility. Contraception and abortion have spread dramatically in recent years. Call me naïve, but I was surprised by the high level of contraception use worldwide, about two-thirds, as shown in Figure 6.

Given the tools to control fertility one would have to try hard to come up with any personal motivation to reverse the trend to smaller family size among urbanized educated people. That is not to say that individual nations do not have a motivation to reverse their declining birth rate. Indeed, several European and Southeast Asian nations have tried to create incentives to increase fertility, but the trend lines continue downward despite their efforts.

Appeals to patriotism or national power are unlikely to have much influence on individual family size choices when the economics of the individual situation point to different choices. Even in the United States, where we are faced with a much smaller depopulation problem, we build in economic incentives in our tax code that encourage childbearing. However, I doubt the one thousand dollar per child tax exemption is significantly responsible for our bucking the downward trend in TFR of all the other developed nations.

Along with urbanization has come in many countries the spread of democratic government and free market economies. This has led to dynamic economic growth in most countries that have followed that path. One of the more dramatic examples of the interaction between economic growth and TFR is South Korea. In Figure 9 you can see that since 1960 there has been a tenfold increase in real per capita income in that country. At the same time the TFR has dropped to less than one-third of its starting level, and it is now well below the replacement rate. (Interestingly, the UN still classifies South Korea as a less developed nation, while Russia, with a fraction of Korea's per capita income, is classified as a more developed nation). A Rand Corporation study found that between 25 and 40 percent of South Korea's economic growth is attributable to smaller family size. With fewer mouths to feed and young brains to educate, workers have more disposable income with which they can buy stuff, save and invest, providing capital to the economy. This added investment leads to increased worker productivity, and thus to increasing wages and a higher standard of living.

In the developed world there are somewhat different motives to have smaller families. To return to my economic incentive theme, the availability of disposable income creates a consumer economy. That forces decisions between having another child and, say, getting a new house or car. When you add in the need for longer formal education before entering the workplace, parents are left with a substantially increased period of economic dependency of each additional child, compounding the additional cost.

Higher education for women has obviously increased dramatically in the developed world over the past 50 years. This has led to a marked trend toward delaying both marriage and child bearing. The mother of today who has her first child at age 30 can never match the fertility of her grandmother who may have had six children. Nor, if she wishes to make use of the expensive education she received, will she have time to raise many children.

Up to this point I have not mentioned the two elephants in the room. That would of course be China and India, the only two members of the billionaire club. These two countries will continue to grow in population for several decades. China abruptly reversed course in the 1980's when Chairman Mao

decided that no family should have more than one child because China could not feed the people they already had. Massive political coercion was brought to bear on reproductive behavior with remarkable results.

Prior to this movement the TFR in China was at the average for less developed countries of about 6. By the early 90's they had dropped to a TFR of less than replacement level. The most recent figures show a TFR for China of about 1.65. Wattenberg, however, points out that China's TFR curve is virtually identical to South Korea's over the same time period. And South Korea's change came about mostly from economic development with no significant government intervention. This points out the difficulty we have in coming up with simple explanations for decreasing fertility.

Further compounding the downward pressure on China's population growth is the wide availability of abortion. Because of a strong cultural preference for male children and the availability of prenatal sex determination, the proportion of male to female babies in China has climbed from a normal rate of 104 males to 100 females in the 1970's to 118 males to 100 females in 2000. Families have decided that if they can only have one shot at posterity, they wish it to be a more economically productive boy baby. This will probably have a further depressant effect on total population growth, even without any further decline in TFR, since in 25 years only 45% of the people of reproductive age at that time will be women. The replacement total fertility rate of 2.1 children *per woman* assumes an equal distribution of men and women in the population.

India will actually pass China in population in about 30 years. They have also had a substantial drop in their TFR, but they are still around 3, somewhat above the replacement rate. The most urbanized Indian regions have dropped below the replacement rate, and as other regions urbanize they will most likely follow suit. Indira Ghandi attempted to coerce smaller family size in the 1970's with little success. Her aggressiveness in this regard led in part to her political downfall. India is also experiencing a shift to increasing the percentage of boy babies as seen in China.

To summarize what we have discussed up to this point, a reversal of the current growth in world population is inevitable, barring widespread and unforeseeable changes in individual human behavior. After exploring the various factors involved in the changes currently occurring, all indicators point to further decreases in total fertility rate, and there are no factors that point to a potential increase in fertility. I cannot imagine a scenario wherein people move back to farming, women quit getting more education, contraception becomes less available, or large numbers of people decide to have larger families for any other reason. The UN projections graphed in Figure 1 are more likely to approach the Low Variant than the Median Variant. This would mean that world

population would peak at less than 8 billion in mid-century, and could be back to our current level by the end of this century.

A counteracting effect on the impending numerical decline in population is the substantial increase in longevity. This has been a huge factor over the course of the past century, with average life expectancy at birth worldwide increasing by 18 years in just the past 50 years alone. Unfortunately all of this increased longevity has occurred at the stage of life when we are no longer economically productive. So while we are bringing fewer non-productive children into our society, we are adding many more non-productive senior citizens.

This leads me into the second part of my talk where I will discuss some of the possible consequences of the demographic trends, both for the United States and other developed countries, as well as for world geopolitics.

We have all heard plenty about the jeopardy to the social contract between our government and our retirees for the provision of continued income after we quit working. As you all are painfully aware, our Social Security system was established as a pay as you go plan whereby the government issued checks to pensioners paid for with funds collected from a payroll tax on the earnings of current workers. Up to this point Congress has been able to raise the payroll tax rate sufficiently to stay ahead of the game. The Social Security office has collected excess funds each year, which they figuratively pass to their colleagues down the hall in the Congressional Budget Office to give to Congress to spend on current programs like ethanol subsidies and quilting museums. Congress then asks the Treasury to issue IOU's in the form of government bonds and a thank you note to their friends back in the Social Security office.

Within a few years the smaller cohort of workers (due to decreased birth rates 20 to 40 years ago) will not be able to pay for the pensions of the larger cohort of retirees known as the Baby Boomers without a substantial increase in their rate of taxation. That will be hard to do politically since most low to middle income workers are paying far more in Social Security than in income tax already. Nor will it be particularly easy to cut off the oldsters who just keep living longer and voting regularly.

This situation will inevitably result in the folks in the Social Security office cashing in their government bonds to have the cash to pay the retirees. Guess where Congress will get the cash to buy back the bonds. Right. They will either raise the income tax rate, or ask Treasury to print more money or probably both. Printing more money will simply create inflation, which will raise the cost of everything, a form of hidden tax. And this is only a temporary measure anyway, since Social Security will run out of bonds to cash in before long.

There is some hope for improvement further down the road. Once the system flushes the bolus of Baby Boomers the smaller cohort of people who follow them will cause a reduced demand on the system when they retire, unless of course longevity continues to increase. But we have to get through the next thirty years or so before we can even begin to see any light at the end of the tunnel.

To help you understand some of these concepts it will be helpful to look at Figure 12. These three graphs represent US population by five-year groupings in 1900, 2000 and projected for 2030. With males on the left and females on the right, the width of each bar represents the total US population in millions for each age group. Since most economic productivity occurs between ages 20 and 65 I have highlighted that range in each graph in yellow. These are the people who are most responsible for the support of the people in the groups above and below. Economists use a figure called the Dependency Ratio to describe the percentage of the total population that falls into my yellow grouping.

The 1900 picture is probably pretty typical of most developed countries prior to the twentieth century. It is a picture of steady state Total Fertility Rate with gradual mortality throughout all the age groups. By 2000 we can see the huge distortions produced by both increased longevity and decreased birth rate, and the substantial bulge of the Baby Boomers. Based on current birth rates and longevity the picture in 2030 has changed considerably. There has been relatively little increase in population in the younger groups, but notice the very large increase from age 60 on up compared to just thirty years earlier.

I will now pirouette away from getting involved in the political management of this problem. But let there be no mistake. It IS a problem, and the longer we wait to resolve it the bigger it gets. The demographers offer us no way out.

To further depress the tone of my discussion, the Social Security problem is minor compared to the Medicare problem. You see, our government's liability for Social Security payments is fixed and easily calculated. The only significant risk variable in that contract is that longevity will increase more than predicted, prolonging payouts a bit.

With Medicare (and Medicaid, for that matter) the payouts are not at all fixed. Instead of promising a check of a certain amount each month like Social Security, Uncle Sam offers to take care of all our medical needs from golf course to grave. With government thus providing much of the capital going into the health care system, there is little incentive for prudence in the use of those services by either patient or provider. Also, cost/benefit calculations in

developing new treatments are much less important than they would be in an open market. Because it CAN be done, it WILL be done, as long as Medicare pays for it. I will not bore (or scare) you with the figures on the unfunded liability of the government for future Medicare costs, but it is many times the unfunded liability of Social Security.

If there is any consolation in these depressing facts it is that our demographic problem is far less severe than similar issues in Europe and Japan. Recall from Figure 4 that both these areas have a TFR of only about 1.3. The US has a current median age of about 30 that will rise to 40 by the year 2050. Japan already has a median age over 40, and it will increase to 50 in the next 20 years. It is clear that the expectations of standard of living among the elderly in those regions will have to be ratcheted down immediately.

European countries are currently coping with the need to enhance their labor and taxpayer base by importing immigrant workers. Most of these immigrants are coming from Muslim countries. With the relative exception of England, European countries are fairly xenophobic, which will inevitably lead to increasing societal stresses, especially when these marginalized immigrants realize they are supporting, through their taxes, the retirees who are resisting their integration into the culture. Japan has historically been very resistant to immigration, so they are unlikely to take that approach to funding their seniors.

We face some similar problems with our Latin American immigrants, though our “melting pot” ideology will hopefully make the problem less severe here. Demographic trends give us some reason to be optimistic about “problem, or illegal” immigration. The Mexican TFR has dropped from 6.5 to barely replacement level over the past 30 years. And their economy is growing impressively, admittedly with fits and starts. It is likely that these changes will eventually decrease the pool of potential illegal immigrants over the mid to long term.

I made a brief reference to the Muslim world. The implications of the interface of Western and Muslim civilizations goes way beyond the scope of this talk, not to mention beyond the scope of my ability to discuss. However, I can mention some interesting facts related to demographic changes in the Muslim world. Muslims represent about one-sixth of world population. All Muslim nations other than Pakistan have seen very sharp drops in their TFR over the past 30 years. Several are at or just below replacement rate at this time. Projections show that Muslim nations will grow at a faster rate than Western nations, but will peak in mid-century. They will remain about one-sixth of world population because of concurrent growth in China and India.

Given the current US involvement in world affairs, it is tempting to speculate on the influence of a changing population ratio on our geopolitical effectiveness. The dynamics of military strength have changed radically over the past century. Cannon fodder has become an archaic term. We will hopefully never again have to experience the atrocity of a Peloponnesian War or the trench warfare of World War I. Modern warfare requires national wealth and a well-educated military. Financial and human capitals are more important than manpower to the exercise of military effectiveness. In other words, it is more important to have a healthy and growing economy than to have a large population of potential warriors to protect national interests. However, a modern military does require a large number of taxpayers, so a shrinking population can have an effect on military strength.

In most respects it is likely that the importance of Europe in world affairs will decline significantly due to demographic factors. With their shrinking and aging populations and their need to devote their limited resources to sustaining their elderly they are likely to carry even less influence internationally in the future than they do now. This will undoubtedly further increase the burden on the United States to protect the interests of Western civilization.

Another interesting question relates to how the new demographics will influence the economy. People are both producers and consumers. Since the beginning of modern capitalism populations have steadily grown. More people both consumed and produced more goods at a more or less steady rate. Combined with increasing productivity economies have grown consistently. Real estate has increased in value. What will happen when there are fewer consumers and producers? Demand for property and goods will decrease. Will deflation replace inflation as the usual state of the economy? If so, who would want to invest? Will continued increase in productivity of each worker make up for the decline in the number of workers? Nobody knows the answer to these questions, since these conditions have never been confronted before.

The total global population has an obvious environmental impact. I came of age intellectually in Berkeley in the 60's. At that time it was obvious to any thinking person that global catastrophe was near at hand. What was uncertain was whether it would arrive as a result of itchy trigger fingers on the nuclear buttons carried by the madmen in Washington and Moscow, or from the imminent overpopulation of the earth. Writing this talk has alerted me to how I was still of the mindset that crowding of the planet was a real danger. And yet, despite the alarms sounded by environmental organizations, growing prosperity coupled with growing population has actually led to vastly improved environmental conditions in the more developed countries.

The calamity du jour is the relationship of human activity to generalized warming of the planet. While I do not have strong opinions one way or the other on this issue, I do think it is important to recognize that the original claims about human impact on global warming were based on a projected world population of 11.5 billion. It is clear now that we will most likely never come close to that number. I think it is important that during the debate on global warming we make sure that the climatologists are up to date on the demographics.

Well, we have explored a lot of territory in a short period of time. I hope that I have conveyed the fact that, while most of my discussion was related to speculation about effects, there is a factual core that we can ill afford to ignore. We are entering a period of a new demography unlike anything the earth has ever encountered. We will of course continue to make day-to-day decisions based on our perceived self-interest at the present time. And so will our politicians. But I think we must at the same time remember the effect those decisions could have on our succeeding generations. There is very little speculation involved in the demographic projections I have presented. Our children and grandchildren will be living on an incredible shrinking planet.