

Technological Changes, the Reversal of Age Pyramids and the Future of Retirement Systems

By

Yehuda Kahane *

Abstract

The design of optimal retirement systems requires a good understanding of social, economic and demographic trends that are by-products of profound technological changes with the power to completely reshape our environment, our needs, and our way of thinking. The essay summarizes the theory of technological waves, and focuses on the impact of these waves on the family, demography, the social structure and our health. We emphasize the growing cost of the age-related processes that mainly affect well being during the retirement period, and the need to countermeasure them by early preventive treatment.

We then examine the future retirement system. The current retirement systems, which are in the form of nationalized social security, and union pension funds, are products of the past and urgently need major revision. Although retirement may not seem to be the most urgent of issues in developing economies, it needs to be addressed without delay, as it is the key to financing the other more immediately pressing problems of these economies. The future retirement system will take the form of mandatory privatized plans, to be supported by some form of governmental social security system which will take care of special cases that cannot be handled by the private sector.

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Introduction

In the heated public debate of recent years on the problems of social security, pension plans, retirement systems and the aging population, the financial viability of social security systems in modern economies (and especially in the U.S.A.) has been the focus of particular attention. Whatever the arguments in the debate, our environment is clearly changing rapidly and dramatically, and currently popular solutions to the retirement problems are very soon expected to become obsolete and unsuitable. If we are to stop “fighting the last war” and get ready for completely new challenges, we have to ensure that the solutions remain valid and relevant for people over a relatively long period, and this requires a good understanding of the future economic and social trends.

The purpose of this essay is to briefly examine these future trends, and the ways they are going to affect the required retirement systems. Moreover, as they are the by-products of the profound technological changes that are taking place in the world, it is essential to understand the relationships between technology, the environment, the changing needs, and the desired solutions.

Toffler’s seminal book **Future Shock** (1970) opens with the following statement: “In the next three short decades, between now and the twenty first century, millions of ordinary, psychologically normal people will face an abrupt collision with the future. ... Not merely an individual, but an entire society, an entire generation ... are suddenly transported into this new world“. We are already at the beginning of the twenty first century and most of the trends that Toffler (1970, 1980), Kahn (1976), Kahn and Wiener (1967) and others predicted 30 years ago are being realized and shaping our new reality.

Technological waves have the power to completely reshape our environment and to create “shocks” as the product of the greatly accelerated rate of change. Technological waves are affecting every aspect of our lives: the family structure, the social and political structure, the economy, the way we live, work, eat, spend time, consume, learn, travel and communicate. They affect the demography, and at the same time they affect our needs, desires, and way of thinking. As a result we need new instruments to deal with the new environment. The old tools are quickly becoming obsolete and unfit.

The difficulties in predicting the future environment are obvious and the failures of past forecasts have been many. Nevertheless, as the predictions made in this essay are based on trends that have already started, and on driving forces that are already in action, we feel quite confident about the statements made.

In our examination of the links between major technological changes and important factors related to future retirement systems, the term retirement system will refer to the insurance against all risks of life: premature death, disablement and old age. Due to mortality changes the old age risks are becoming the dominant factor. It will be shown that major changes are taking place in a variety of areas such as employment patterns, financial instruments, saving patterns, life expectancy, demography, societal forms, dependency ratios, family structure, etc. We will examine their effects on the current social security systems and other retirement programs and offer possible future trends of the retirement systems around the world. To a great extent the article continues the earlier works of Orio Giarini (1975, 1980), who coined the concepts of the "Four Pillars" and the Service Industry through the Geneva Association. These concepts were developed further by many other researchers, among the prominent ones are Kessler (1988) and Giarini and Liedtke (1997).

In the first section, we briefly summarize the technological wave theory. The second section focuses on the impact of these waves on the family, demography, the social structure and health issues. The third section deals with mortality and the longevity risk. The fourth section deals with the impact on savings and the economy, and with the future retirement system, showing that the current retirement systems in the world, which are the product of the past waves, are now obsolete and urgently need a major revision. We demonstrate that although retirement does not seem to be an urgent issue in developing economies, it needs to be addressed by them without delay, as it may be used as the key to financing other more immediately pressing problems. We argue that the future retirement system will take the form of mandatory privatized plans, to be supported by some form of governmental social security system which will take care of special cases that cannot be handled by the private sector.

1. Toffler's Wave Theory and the Retirement System

Toffler's theory in the **Future Shock** (1970) and **The Third Wave** (1980) is based on the analysis of certain patterns in human history. Despite the complexity of the issue, he managed to identify three great advances or waves that triggered profound changes in the world's social structure and economy: the agricultural revolution, the industrial revolution, and the information revolution (the **Third Wave**). He showed the enormous strength of these waves, and pointed out the problems that will result from the accelerating frequency of future technological waves following in the wake of the information revolution. In **The Third Wave** (1980) he related mainly to the developed countries, which have, however, since then experienced one or two additional technological waves, as forceful as the previous ones, while the less developed countries have been exposed to enormous changes and are having to adjust to all these waves almost simultaneously within a very concentrated time span.

In the following paragraphs we briefly describe the waves, while emphasizing parameters that have special importance for the discussion of retirement systems.

The First Wave: Agriculture

The first human society was based on nomadic people who found their living by gathering, hunting and fishing. They had the ability to make basic tools to help them in hunting and fishing, and in preparing their food. The society was based on small families, probably with some sort of organization for more complex hunting missions. People who lost their ability to hunt as a result of injury, sickness or old age were probably not able to survive. In such a society there was no strong need for a “retirement system”.

The first technological wave began about 10,000 years ago when man discovered the possibility of planting a seed and nurturing its growth. The age of agriculture began, as people abandoned nomadic hunting and wandering and began to cluster into villages, to develop culture, and to create more sophisticated tools, products and ventures (ploughs, mills, jars, oil and wine presses, canals, dams, roads, etc.). It was a change that triggered the evolution of some sort of organization and management (irrigation systems, and an extended family form of life). It also led to the wider spread of written documents and languages, and increased the ability to record and document. At the same time, the dependence on weather resulted in the development of religion, of temples, and the study of astronomical phenomena.

In an agrarian society the family provides the individual with protection against existential risks. There is no need for a sophisticated pension, social security or any other form of retirement saving scheme to handle the risks of premature death, injury, sickness, and old age. In an agrarian society there is typically no way to store food and supplies over extended periods, as a precaution for a “rainy day”. Also the use of money, and monetary saving instruments, is not that common. The economy is by and large autarchic, supported to a limited extent by some barter. Therefore, the “retirement system” in such an economy is simply based on the support within the (extended) family.

If you tell a person in an agrarian economy about social security or a pension fund, the response will probably be a raised eyebrow and the comment: “I don’t see the need for such a ridiculous idea. I cannot believe that the government will be able to take better care of me than my children and family”.

In agrarian societies we typically do not find any organized retirement plans (such as social security or work-related plans). In the ancient world, the examples of retirement systems are rare, and they all relate to non-agrarian occupations. For example, Alexander the Great (at end of the fourth century BC) secured some sort of a pension plan for his soldiers. The Roman army followed by building special colonies and by allocating lands or certain concessions to retired soldiers. Some guilds in medieval times also had some primitive retirement arrangements.

The spreading of the first wave was slow. Due to poor communication and the resistance to change (and sometimes also the wish to keep secret technologies from competitors and enemies) it took a long time for new technologies to move from one part of the world to another. For example, the same type of ancient ceramic oil lamp

was in use for more than 500 years, and that model was gradually replaced by another model that was in use for another 500 years (see Figure 1). Later models were gradually introduced, with intervals of several centuries or decades between each design. Even during medieval times it sometimes took centuries for a technological transfer to occur. During the Mongol Empire around the thirteenth century, Europe had unbelievably little knowledge about the developments made in the eastern part of the world. The Chinese inventions of gunpowder, printing and fine porcelain were known for centuries before they were imported to Europe (and then it took decades for the European countries to copy them). It was quite a different world from today, when we see in real time what is happening almost anywhere around the globe.



Figure 1: Ancient oil lamps: The four-nozzle type shown on the right was in use in the Middle East between around 2250 and 1750 BC, whereas the single-nozzle type shown on the left was used between 1750 and 1200 BC (author's collection).

The Second Wave: The Industrial Revolution

It took thousands of years for the second wave to arrive, this time, in the shape of the Industrial Revolution, which began towards the end of the eighteenth century. The slow adaptation of the world population to the change is reflected by the fact that until some 30 years ago, about three quarters of the world's population, in some of the largest countries in the world like China, India, Pakistan, Indonesia, and Brazil, to name a few, were still living according to the old, agrarian way of life.

The major social change accompanying the industrial revolution is the move of people leaving the peasant culture of farming and coming to work in city factories. In the agricultural countries today a small percentage of the population (typically, less than a quarter) live in cities, whereas in the developed countries more than 75% live in urban areas. The industrialization resulted in the creation of huge metropolitan areas (such as London, New York and Paris in the past, Istanbul, Mexico City, Beijing, Shanghai, Delhi, Bombay, and Rio today). In the developed countries about one third of the population lives in such mega cities.

The ability to harness forces like steam and water and later electricity and atomic energy to the production of goods created major changes in the economy and in the entire social structure. The industrial revolution is characterized by mass production, that is, the ability to manufacture large quantities of similar products, with less manpower. It has led to the concept of standardization and mass production, mass

merchandising, and has helped to create huge multinational corporations and mega markets. It enables us to ship the products in relatively inexpensive ways to all parts of the world. It enables us to store food by canning or refrigeration. It has created far better mobility of goods and people (by trains, ships, airplanes). It has enabled people to get water in remote areas, to separate sewage water from drinking water, to get decent medical treatment, and to save people from all kinds of medical problems that threatened their lives in earlier times. And last but not least, it has been accompanied by a dramatic decline in illiteracy, which has improved beneficial communication.

On the down side, the industrial revolution has also produced some derogatory effects: some of the fiercest wars known to mankind, the dropping of atomic bombs over Japan, a major pollution problem, global warming, etc. In addition, the common assumption that the rural population is primarily poor and that the urban population is relatively rich, is not always true. The urbanization following industrialization has not always improved the economic conditions of many people.

The industrial revolution was responsible for major changes in the social structure. The extended family was replaced by the small nuclear family: husband, wife and children. In contrast to the seasonal work in the farm, people had to work longer hours all year round. The proletarian class was created. The economy became less autarchic, and thereby more dependant on money and trade. The tough conditions at the work place, the crowded housing, and the bad sanitary conditions created more cases of sickness, injury, disablement and death, and a family whose breadwinner suffered from such eventualities faced serious economic problems. This led to the creation of the parish charity system by the churches, which managed to give only a partial and insufficient economic solution to the problem. It was these conditions that led to the development of the ideology of Socialism and later to Communism.

Education was also affected by the second wave. The industrial revolution created an educational system that viewed teaching as a factory activity and young human beings as products to be processed. Children were supposed to be taken care of while their parents were in the factories. They were also expected to get used to wake up at an early hour, to do things that they did not necessarily like to do during the day, and get disciplined in preparation for their future employment in factories. At the same time they were expected to learn to read and write, and gain required know-how in a variety of areas. So illiteracy declined dramatically in countries that underwent the industrial revolution.

The rise of Socialism, with its threat to the governments and the rulers in Western Europe, was the direct result of the industrial revolution. In order to pre-empt the revolution, Bismarck, the German Chancellor, enacted the first social insurance and health insurance programs, at the beginning of the 1870s, and most West European countries had followed with social security arrangements by the First World War. This led later on to the development of early forms of work-related pension programs. The Russian revolution, which is a definite by-product of the industrial revolution, led to the introduction of the Communist system in Russia and its later spread to a large part of Central and East Europe, and Trans Siberia. In these parts of the world, the state took the full responsibility for retirement risks.

Retirement plans in the industrial revolution era are characterized by two major features. They are often work-related programs (premiums are typically proportional to the salary or wage), and they typically rely on the participation of both employer and employee in the financing. Run by either governments or by the labor unions, they reflect the concept of mass merchandising: very uniform programs with very little flexibility. The typical plan is based on the mutual support between the spouses (reflecting the typical nuclear family, based on a husband and a wife).

The Post-Industrial Revolution: the Third, Fourth and Fifth Waves

Just as the machine seemed to be invincible, the signs of a gathering new wave, based not on muscle but on information processing, were coming: the wave of the post-industrial revolution.

The post-industrial revolution is actually composed of a series of several distinct waves: the wave of information technology, the wave of communication technology, and the wave of knowledge. Like the previous waves, each of the new waves is very powerful, and is followed by drastic changes in the economy, by globalization of markets, by automation of industries and an exponential increase in the amount of information generated.

The post-industrial revolution is characterized by a shift from an industry-based culture, to a culture based on information, communication and knowledge, where services are taking a substantial part of all activities. The technology and culture have a clear impact on our economy (how society earns its living), but they also present significant new challenges to the way that people and organizations think, operate and are managed. At the same time they are responsible for remarkable demographic and social changes.

The post-industrial economy is based on quick communication, on the ability to deliver information at an unprecedented speed and to transfer, store and process huge databases at very low cost, and on the ability to make machines that design and build other machines. These features are not restricted to the business or manufacturing environments. They are already affecting our homes, cars, our entertainment and health. And they have a great impact on society and how society views itself and the world.

The new communication and information processing and storage capabilities open up a tremendous potential for a wide variety of retirement and insurance products. At the same time, the demographic changes, and the new ways of thinking result in changing needs.

The waves of the post-industrial revolution are accelerating and the time interval between the waves is getting drastically shorter. It took millennia for the agricultural wave to spread, it took two centuries for the industrial revolution to spread, and has taken only about a decade for each of the post-industrial waves to “flood” the world. The rate of change is being influenced by the information technology, and it keeps accelerating. We hardly get used to one wave, and the second is already storming the door. (Just think about the punched cards and telex machines of the 1960s, the IBM ball typewriter and the electronic calculator of the 1970s, the PC and word processors

of the 1980s, the fax machine, and the email of the 1990s, and the World Wide Web and cellular phones of recent years).

The acceleration is even more noticeable in countries that are joining the process now. Due to the communication technology wave, information flows fast and even the most remote countries cannot stay outside of the process. In other words, the industrial revolution that took one to two centuries in Europe will take just a few decades and maybe only a few years, in the countries joining the process now. Moreover, the newcomers will also have to deal simultaneously with the more recent waves as well. This means that the social and economic pressures that accompany the development process will be far stronger in these countries. Like wave interference in physics, the acceleration of technological wave frequencies creates potential clashes between the waves, were the post industrial waves hit a society that has just started its industrialization stage. Such acceleration strengthens social and economic pressures within the country and may also incite political and economic tensions with their neighbors.

What Will Happen after the Post-Industrial Revolution?

The technological waves are a multi-faceted phenomenon. Technological developments are strongly connected with economic progress, with demographic changes, with social and political changes, and even with religion and cultural issues. In his seminal book Huntington argued that the world should be viewed as a set of several cultural "civilizations", showing that economic progress and modernization does not necessarily mean Westernization. He has also shown the increasing threat of violence arising from renewed conflicts between countries and cultures that base their traditions on religious faith and dogma.

The technological waves do not spread evenly over the world. They are typically delayed at certain invisible border lines. These border lines, which can be seen by viewing the geographical distribution of countries by their developmental stage, typically coincide with the border lines of the civilizations (the cultural and religious features that tie a certain region together). There are many indicators that can show the level of development that a country has reached: mortality, GDP per capita, health indicators, etc. On the world map, they all follow quite similar patterns, as the following figures on the distribution of phones (number of lines per 1000 people) and life expectancy at birth show. These rankings generally agree with the ranking by many other indicators, and are quite similar to the border lines of Huntington's civilizations.

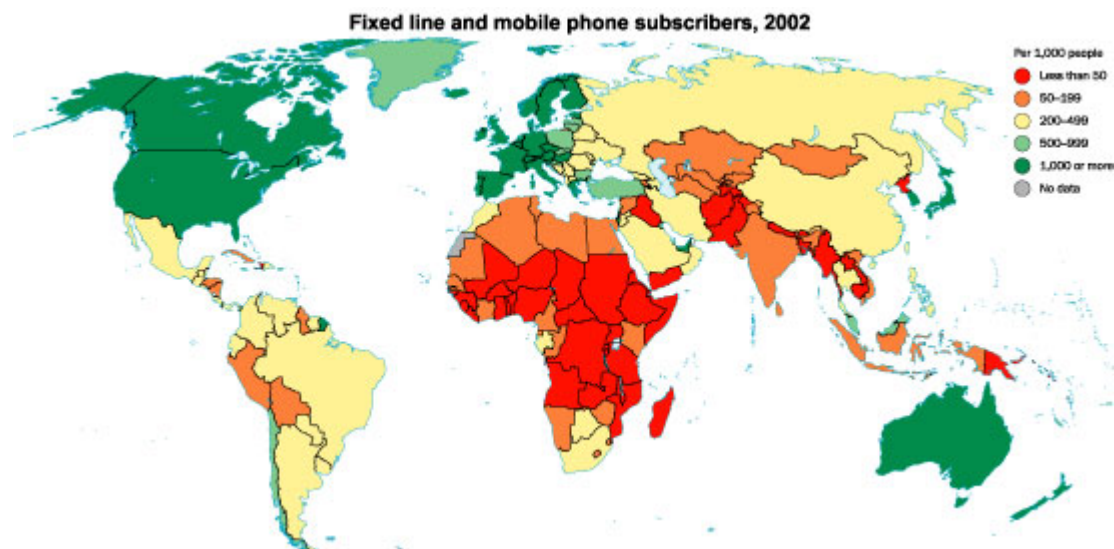


Figure 2: Fixed Line and Mobile Phone Subscribers, 2002

Source: World Bank

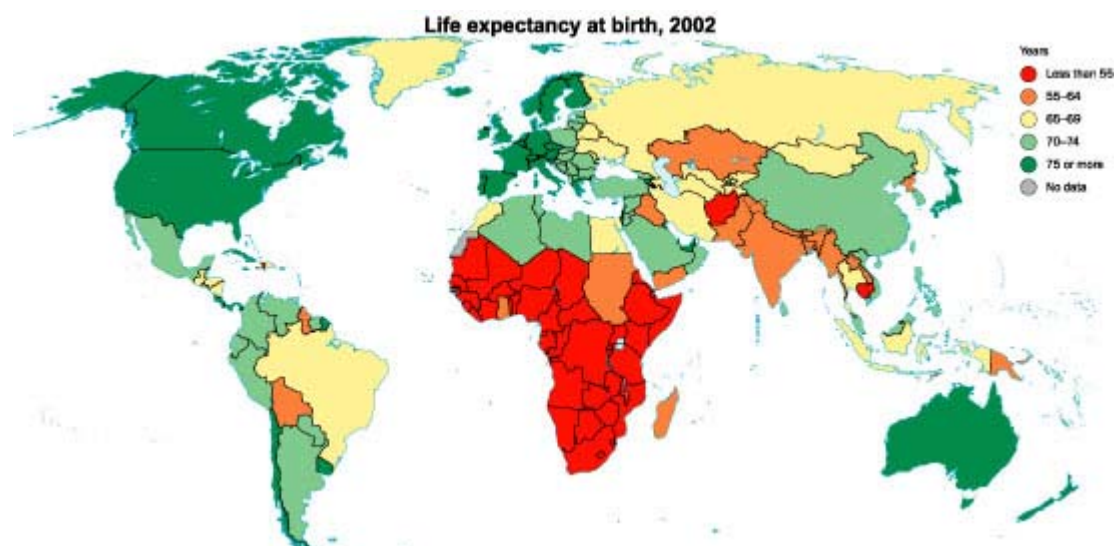


Figure 3: Life Expectancy at Birth, 2002

Source: World Bank

It is quite difficult to predict what will happen next. Assuming that we will experience other, very frequent, new technological waves, and that this will happen simultaneously with fast and accelerating absorption of the recent waves by the currently less developed countries, any one of several conflicting scenarios may result.

On the one hand we may find a very developed new world, which has a common culture, and in which the authoritarian regimes (both right and left) will generally be

replaced by liberal capitalistic democratic governments. This may lead to Fukuyama's (1992) "last man" capitalistic utopia – a highly technological world, with growing economies, and mild capitalism which is strongly tuned to social desires and needs. The main thing that is required in order to reach this utopia is a way to harness the restless desire of people for recognition, and prevent it from leading humanity to chaos.

On the other hand, the continuing development may create very strong tensions between cultures, accompanied by economic tension between the "haves" and the "have not" that may lead to Huntington's (1993, 1996) clash of civilizations, or to Fukuyama's "first man" nightmare – where people are continuously engaged in pointless bloody fighting.

The Power of Information and its Effects on Employment

The post-industrial waves are being driven by a new emerging force: information and knowledge. Until the industrial revolution, the economy was driven by the traditional three factors of production: land, labor and capital, which are limited, exclusive and diminishable. The problem of the economist was driven by the need to allocate scarce resources, and this led to the "limits to growth" theory (Meadows et al. 1972). This is no more the case when we talk about knowledge. Information and knowledge are new factors of production. They are unlimited, renewable, endlessly interchangeable and reusable resources. When one downloads software, the original still remains where it was, and can still be used there, whereas whenever a company ships a tangible product, like a desk, a computer, a car, these items leave the company's possession and cannot be used again by the company.

In a world dominated by the post-industrial revolution, the concept of mass production and mass merchandising is replaced by the concept of manufacturing and selling one unit at a low price. In this new world with its huge diversity, the consumer, swamped with products and information, is exposed to the problem of "over-choice".

One of the emerging results of the new waves is a drastic change in the social demands for greater freedom and individuation, which prevented the realization of George Orwell's "1984" nightmare. The post-industrial era is characterized by enormous changes in the social and political way of thinking, one of its manifestations being the weakening and even decay of political parties. Interests are now split between splinter groups, each being focused on a narrow, specific target, which will eventually lead to a new political system. Socialism was motivated by a reaction to the evils of the industrial revolution, and it managed to make remarkable political, social and economic changes in the world. It collapsed due to its inability to adjust to the dramatic and quick changes that came with the technological waves of the post-industrial revolution.

The post-industrial revolution has had profound effects on the family and social structure. The family unit has undergone dramatic changes. We now have single-parent families, zero-parent families, same-sex families, families of remarried, blended families, virtual families, families of convenience, etc. In addition, a large proportion of women are being attracted to employment outside of their homes. The

old concept that a man must be the primary bread winner of the family, while the spouse is supposed to take care of the home, is dying. Both men and women work and take turns taking care of the home and family, depending on whose job pays more or who is working (this is sometimes referred to as the "androgynous family"). In this context, telecommunication can also help some people do much of their work from their homes. Thus, it is quite obvious that a traditional retirement system, based mainly on the husband financing his wife's old age, is no longer relevant and valid.

Employment, too, has gone through major changes. One can no longer expect to be engaged in the same occupation throughout one's lifetime. Most people will have to change their occupation and profession several times during their career, and will change workplaces quite frequently throughout their lives. Industries will rise and fall, get merged, acquired, go through major reorganization, and sometimes collapse within fairly short periods, if they are not capable of continuously changing and adapting to the new markets, new competitors, new products and new methods. Where are so many of the world's leading firms of the 1970s, 1980s and 1990s?

Organizations today believe in the manager as a leader of change, promoter, coordinator and facilitator, rather than the sole decision maker, the god, the commander. People no longer believe that a single individual can provide the wisdom and authority to guide a large enterprise. In the post-industrial organizations good ideas are expected to come from anywhere and anyone. The employees are not supposed to be treated like dummies. The typical modern organization is seldom stable. There are constant changes in ownership, people, products, employment patterns, forms and processes. Moreover, competition is fierce and the firms have to remain competitive, and to be alert to the extremely dynamic markets, to new competing products, etc. A firm can build a new plant and very soon find out that it is already obsolete! Such an environment creates new opportunities for many employees, but it also creates a very fragile and unstable employment environment. The changing employment patterns must lead to new concepts of retirement financing, to be discussed later.

Education systems also have to get adjusted to the third wave, a painful process with a relatively slow adjustment rate. The post-industrial economy needs people who are equipped with other qualities besides a high IQ rating: imagination, motivation, courage, energy, entrepreneurship, emotional intelligence, communication skills, ability to improvise and to adjust to changing conditions, street wisdom.

In the agrarian and industrial eras it was taken for granted that most people had to work in order to be able to generate the food or income they and their families consumed. It was implicitly assumed that anybody willing to work was entitled to get work. However, whereas in an agrarian economy the majority of the population is employed in agriculture, and they typically find it difficult to supply enough food to feed the entire population, in the post-industrial era a small number of people, something like 2% of the population, can produce and manufacture all the products needed to feed the entire population. The theories of Malthus (1798) about the inability to feed the fast growing population did not come true (Neurath, 1994), but the need to fight the machines may soon be regarded as somewhat more relevant.

It is not that clear that in the post-industrial era all people will be employed. We will probably have to get used to continuously high unemployment rates, and may therefore need to structure a new system which enables unemployed people to obtain what they require for decent survival during the period that they are in the working age group. In other words there is a need to take care of people not only throughout their childhood and old age, and the social security systems will have to take care of more complicated problems, beyond the traditional retirement and old age needs. These points will be discussed below in greater detail.

Though the impact of the post-industrial revolution on retirement planning is still blurred, certain things can be said for sure: it is clear that the changing family and patterns of employment need a new framework.

2. Demographic Changes – Life Expectancy and the Reversal of Population Pyramids

The industrial revolution triggered drastic changes in birth and mortality patterns, which, in turn, resulted in dramatic changes in life expectancy, the age structure of the population, and the dependency ratios. These effects have been augmented during the post-industrial revolution through additional changes in family structures.

A country passing the industrial revolution faces significant declines in both mortality and birth rates. The improved sanitation and health, improved nutrition, the increased use of hospitals, the better accessibility to doctors and many other developments cause an almost immediate drop of mortality rates. Mortality rates in pre-industrial countries tend to be high. A significant number of children die around birth and during their first years. In the least developed countries 15-25% of the children die before they reach age of five. In industrial and post-industrial countries, on the other hand, infant mortality is low (the probability of dying before the age of five is often lower than 1%). Also the probability of dying for adults, say between the age 15-60, declines drastically, from a level above 50%, and even close to 100% in extreme cases, in the least developed countries, to levels around 10% and lower in post-industrial countries (13% or lower for males, and below 8% for females).

Birth rates and fertility rates, on the other hand, decline as well, but at a much slower pace. It often takes a few decades for birth pattern (the number of births per mother) to reach a significantly lower level. Birth is not just a technical matter, it is not just a faster spread and wider use of contraceptives, but it is rather a deeper cultural (and religious) matter. The World Health Organization (WHO) statistics show that in many less developed countries the use of contraceptives is limited to just 5-15% of the population, compared to about three quarters of the population in the developed countries. The interaction with the declining mortality means that the number of births declines slowly, but the number of surviving children per mother grows rapidly. The average number of births per woman can be around five to six in the least developed agrarian countries, and this fertility rate slowly declines to around two births per woman in an industrialized country. At fertility rates around two the natural growth of population stops (or even turns into a slow decline). The fertility ratio continues to drop to around 1.5 and less in post-industrial countries – which means that these populations start shrinking, unless there is a significant inflow of immigrants.

The immediate result of these trends of mortality and birth patterns is that a country passing the industrialization process experiences a "baby boom" in the first phase of the industrialization. This is expressed by an almost immediate growth of the number of surviving children. In the absence of major migration the population structure is quite predictable for several decades and almost a century. During the first few years there is a remarkable growth in the number of school children and two decades later a substantial increase in the figures for university students, then another four decades of large work force, followed by a few decades with a large number of retired people. The baby boom turns into a geriatric boom! Together with the decreasing mortality of adults, about 60 years after the beginning of the industrialization, there is a drastic growth in the number of people needing some old age services. Concurrently, by the time the baby boomers get old, the gradually declining birth rates reach their low levels, where the proportion (and often also the absolute number) of young children is at its lowest point.

Population Pyramids

The demographic processes are best perceived through a "population pyramid", a graphical presentation of the age structure of the population (in percentages or in absolute numbers). Since the age structure of the population is typically quite similar for males and females, the graph is almost symmetrical, and looks like a pyramid.

The population pyramid is essential for the understanding of dependency ratios and retirement policy problems. We will discuss these issues after describing at some length the changing patterns of population pyramids in countries that are experiencing the technological waves.

An examination of almost any agrarian economy typically shows a pyramid with a very large base (many young children) and a very pointed top (a very small number of old people). In such populations the older people (over 60) are typically less than 5% of the population, whereas children below 15 can constitute around 40%. The high birth rate creates wide bars for the 0-5 group. This bar is significantly longer than the bar for the 5-10 years group, which started five years earlier at roughly the same size, but declined dramatically due to the high infant mortality. The high mortality rates are also the main reason for the fast shortening of the bars at the higher age groups. These patterns characterize the pyramids of some of the countries that are expected to be among the top 20 largest countries by population within the first half of the twenty first century. The pyramids for Ethiopia serve just as examples of this general pattern and are presented below. Those for Congo (Kinshasa), Nigeria, Pakistan and The Philippines are quite similar.

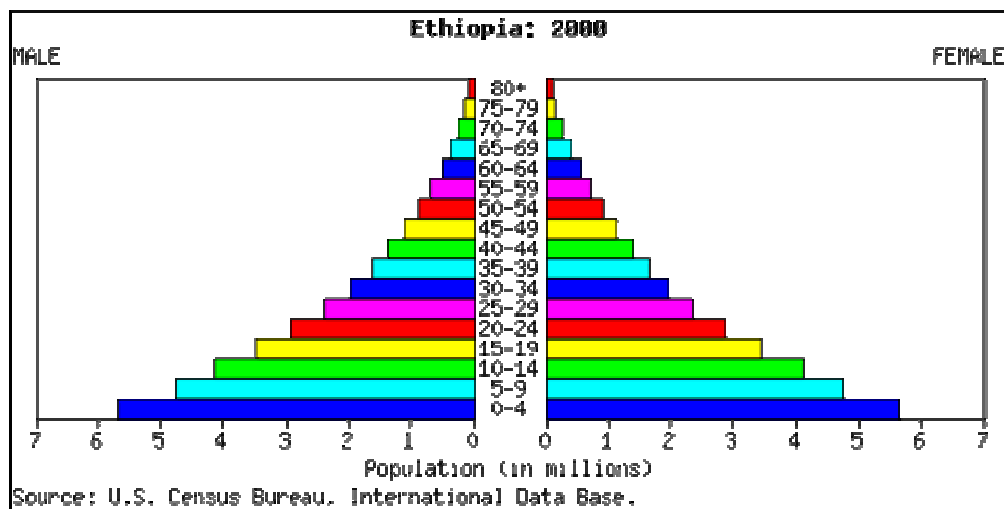


Figure 4: Ethiopia Age pyramid 2000. Note the very wide base.

Observing the development of the population pyramid of a country undergoing the industrial revolution immediately reveals the changing pattern. During the first years, the youngest age group (the base of the pyramid) gets wider due to the sudden reduction in mortality rates, which is not accompanied by an immediate decline in birth rates. The baby boom that follows is responsible for the notable growth of the population. Some of the African states like Ethiopia, Nigeria and Congo are still at this stage. The US Bureau of Census forecasts for Ethiopia in 2025 are presented below, and comparison to the previous diagram can demonstrate these differences. Note the widening of the base of the pyramids due to increased number of surviving children. The next age groups do not decline as fast as before, due to the drastic reduction of infant mortality, so that the length of the bars does not decline as time passes. Note also the widening of the bars at the old ages (the top of the pyramid) due to the generally declining mortality.

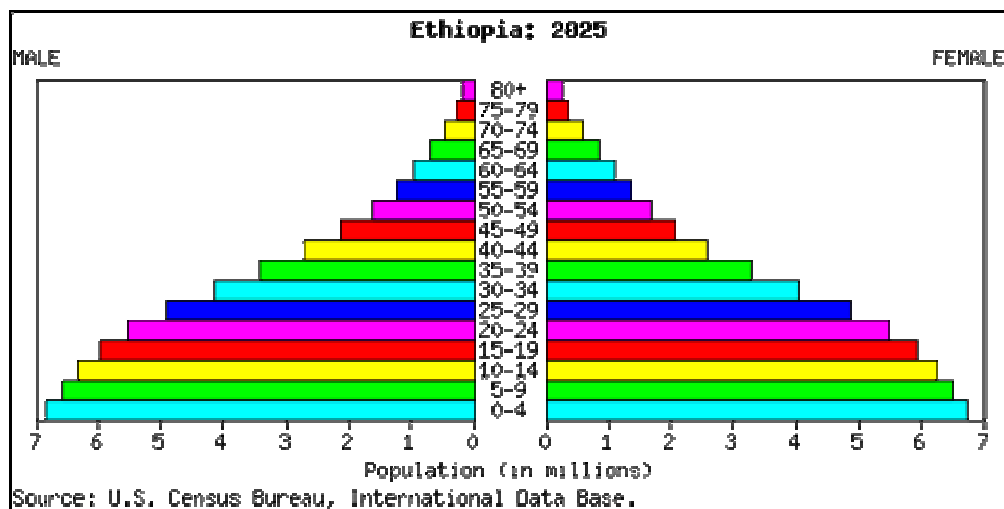
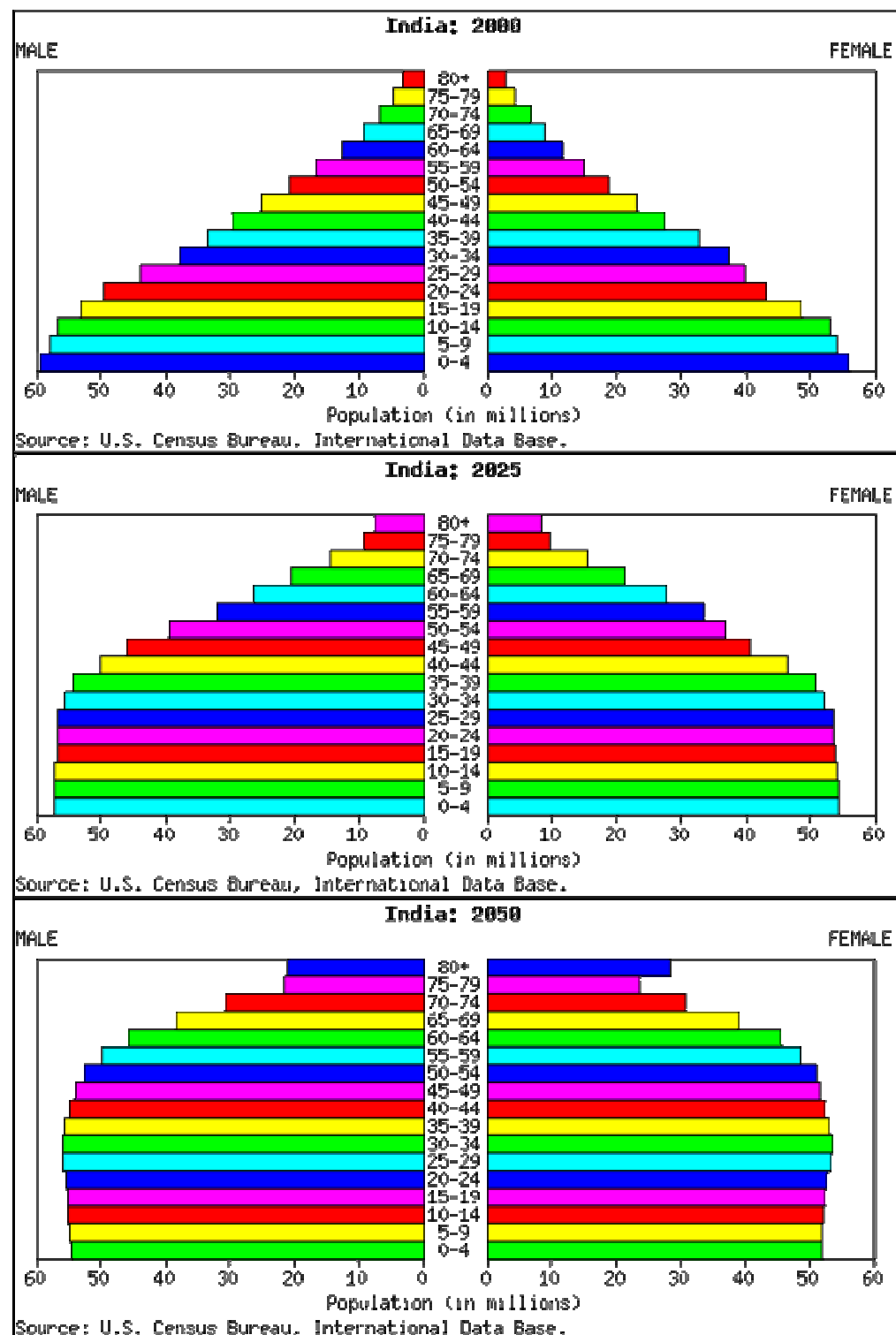


Figure 5: Ethiopia Age pyramid 2025. Note the reduced base.

But a few decades later, as birth rates start to decline, the baby boom comes to its end, and the base of the pyramid gets narrower. Some of the developing countries are already showing this pattern, as a comparison of the above diagrams for Ethiopia's population in 2000 and 2025 demonstrates. The diagrams below, describing the current and future population structures of India, show what has happened in the three to four decades since the beginning of the industrialization process, and what is expected to happen later, when birth rates drastically declines. The same pattern exists in countries like Mexico, the Philippines and Indonesia (not shown here for article length considerations). The case of Indonesia being particularly notable: the previously very wide base of the pyramid has been truncated.

For technical reasons, the top age groups are often grouped together, so we get an abnormal widening of the 80+ bar. This is a reflection of the growing life expectancy that follows industrial development.

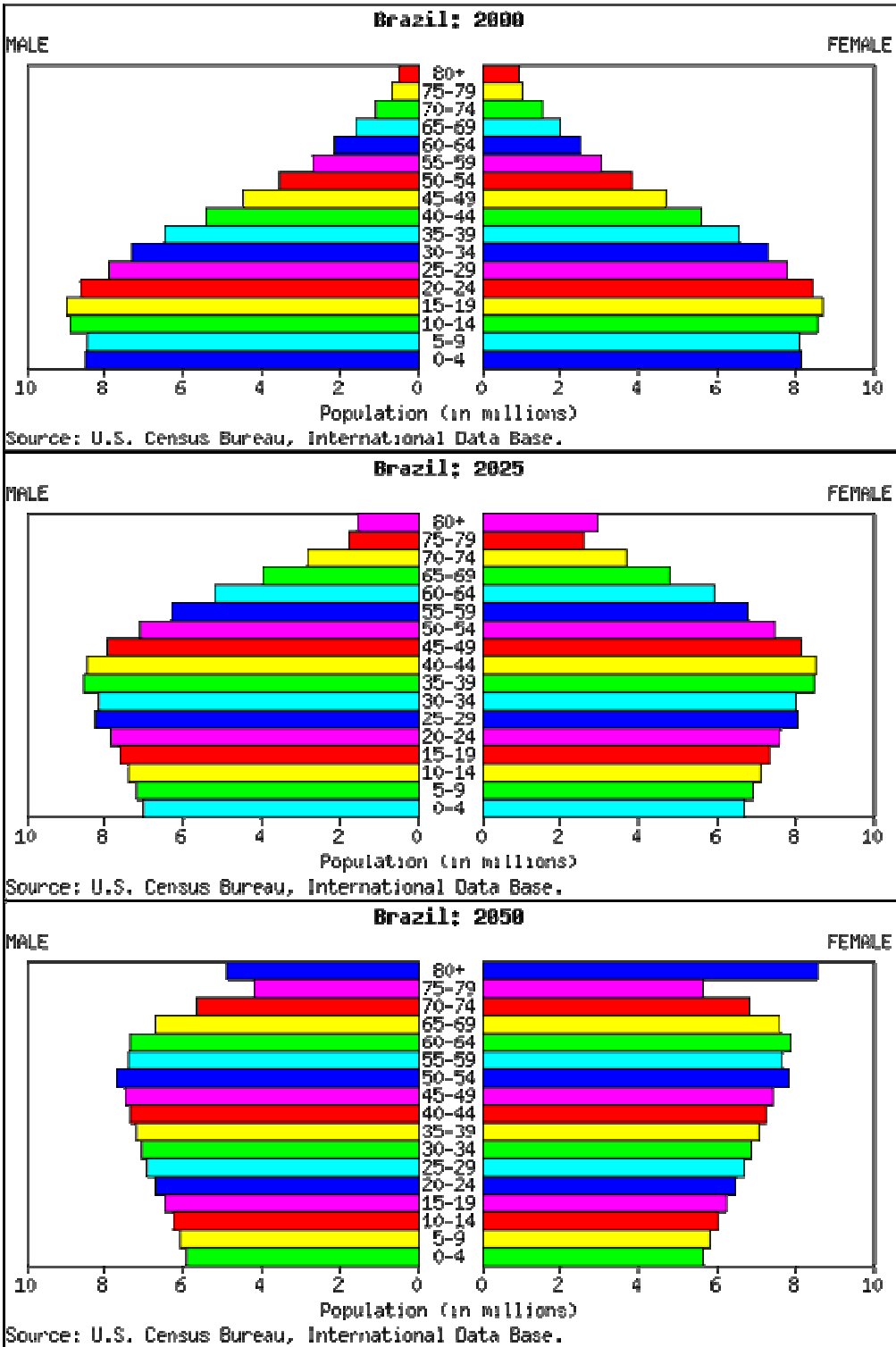
Figure 6: Population Pyramid Summary for India 2000-2050



At the same time, the declining mortality rates quickly lead to a situation where most people who survived the first years continue to live for many years. Therefore, at any future point in time the bars describing young age groups move upward (as the group gets older), but the length of the bar remains fairly constant. This makes the pyramid less and less pointed, and after a few decades, when birth rates are significantly lower, the lower part of the pyramid becomes rectangular, or pillar shaped.

Later on, when birth rates reach a low level, the shape of the pyramid resembles a diamond ("flower pot") shape. The projected pyramids for Brazil, during the first half of the century serve as very good examples. Similar patterns are observed and forecasted for Egypt, Turkey and even Iran, but they are not shown here.

Figure 6: Population Pyramid Summary for Brazil 2000-2050



This trend continues in the post-industrial stage, the substantial drop in birth rates also being connected with the changing nature of the family structure: an increasing number of unmarried people, of families without children, a significantly older age for getting married, career considerations (of women mainly) that determine the size of the family, etc. The drastic decrease of births creates a strange situation. In the post-industrial era the diamond shaped age diagram gradually transforms into a fully reversed age pyramid. Japan could serve as an excellent example of this point. Similar patterns can be seen in the West European countries, though none of them will continue to be listed among the top large countries. The pyramids of Germany serve as good examples of countries in which older people (above 60) are typically more than one fifth, and sometimes even a quarter, of the entire population. France, Italy and the UK populations follow similar patterns, but are not presented here.

Two large countries deserve special mention. China has an age structure similar to that of a matured post-industrial country, and has not experienced the "natural" evolutionary "baby boom", but this is the result of the very strict birth control of recent decades. On the other hand, the USA, though a definite "post-industrial country", still has a rectangular shaped population pyramid rather than an inverted pyramid. The main reason for this anomaly, of course, is the absorption of many new immigrants by the USA.

Figure 7: Population Pyramid Summary for Japan

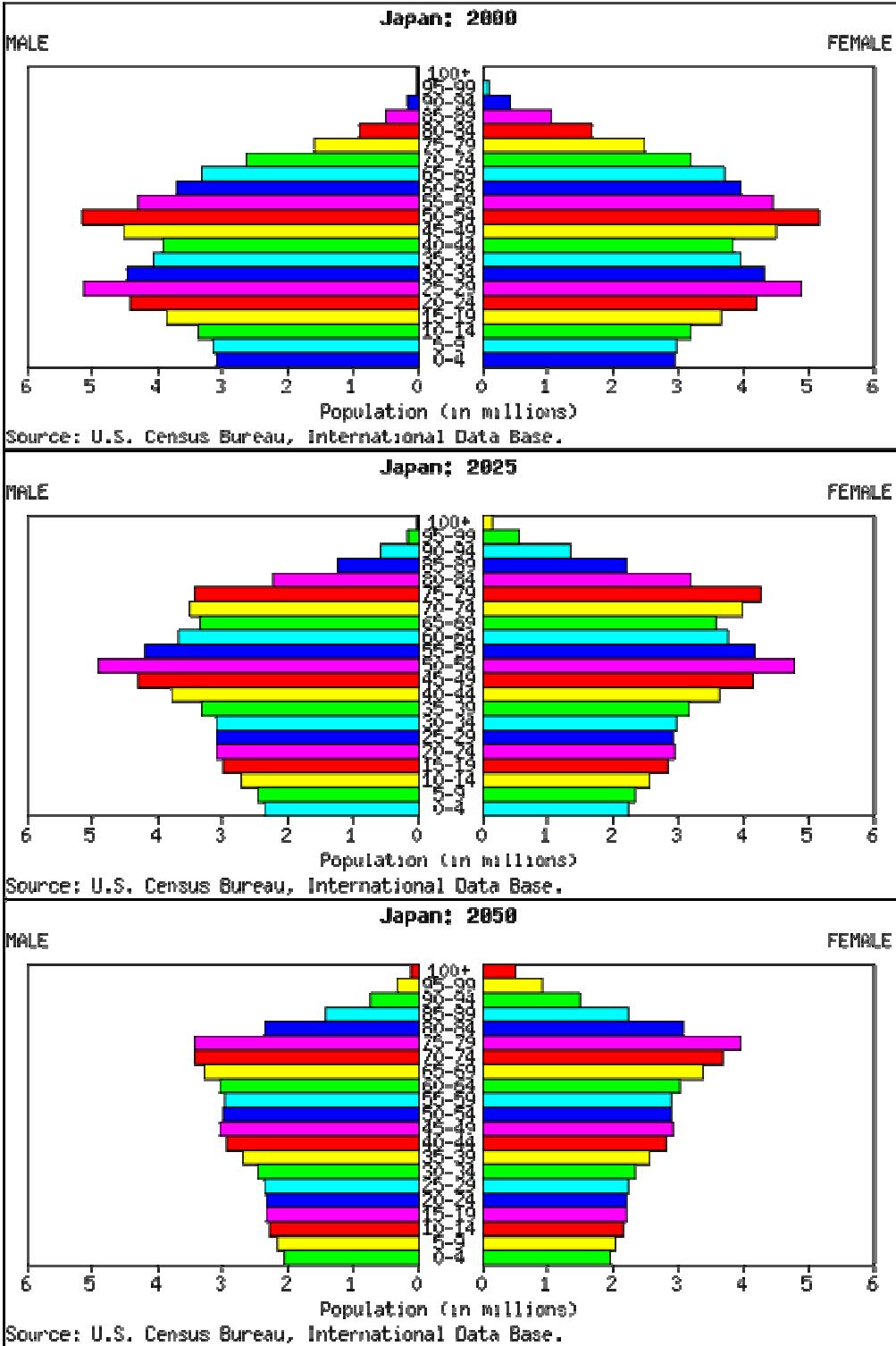


Figure 8: Population Pyramid Summary for Germany

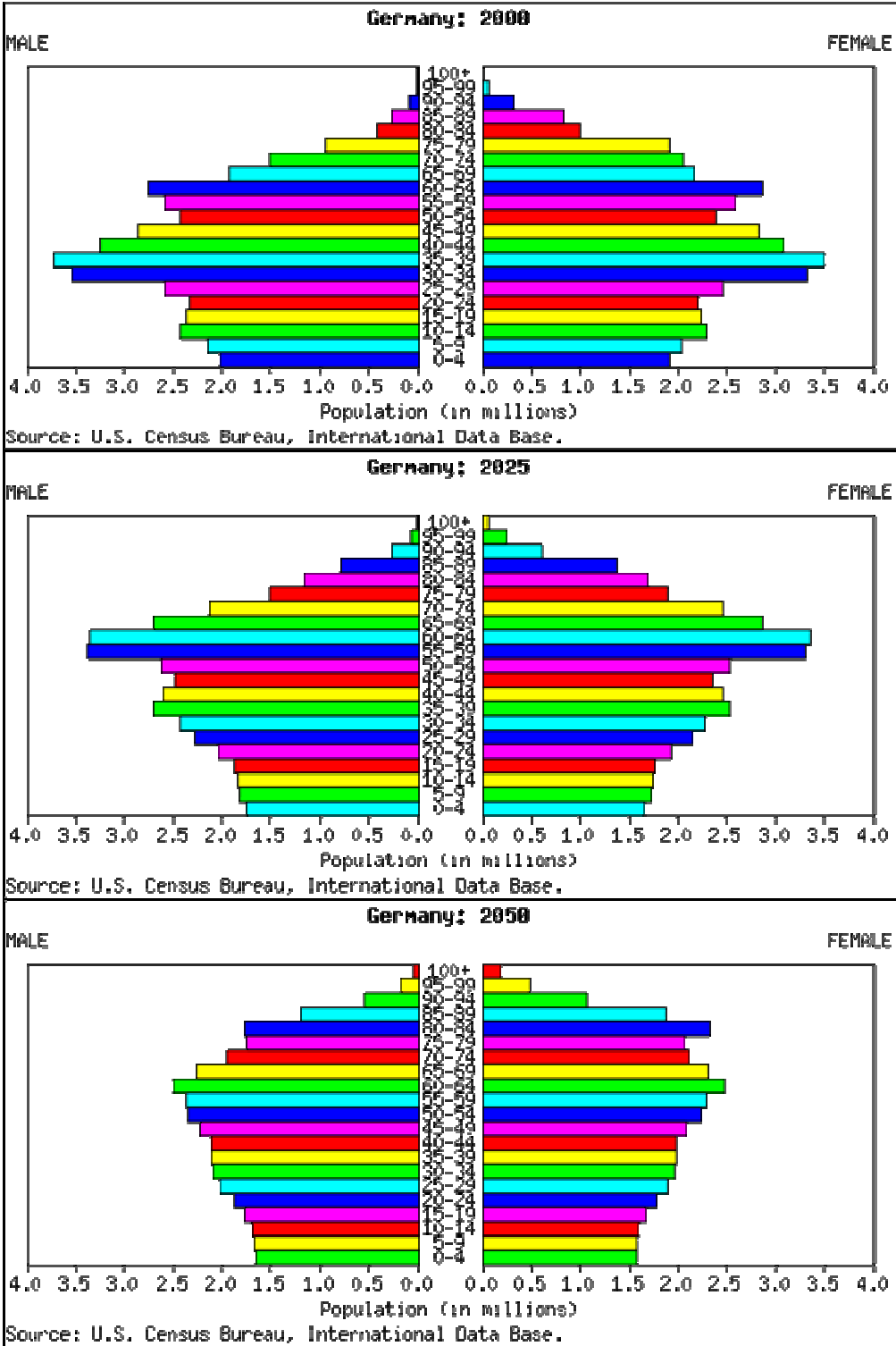


Figure 9: Population Pyramid Summary for China

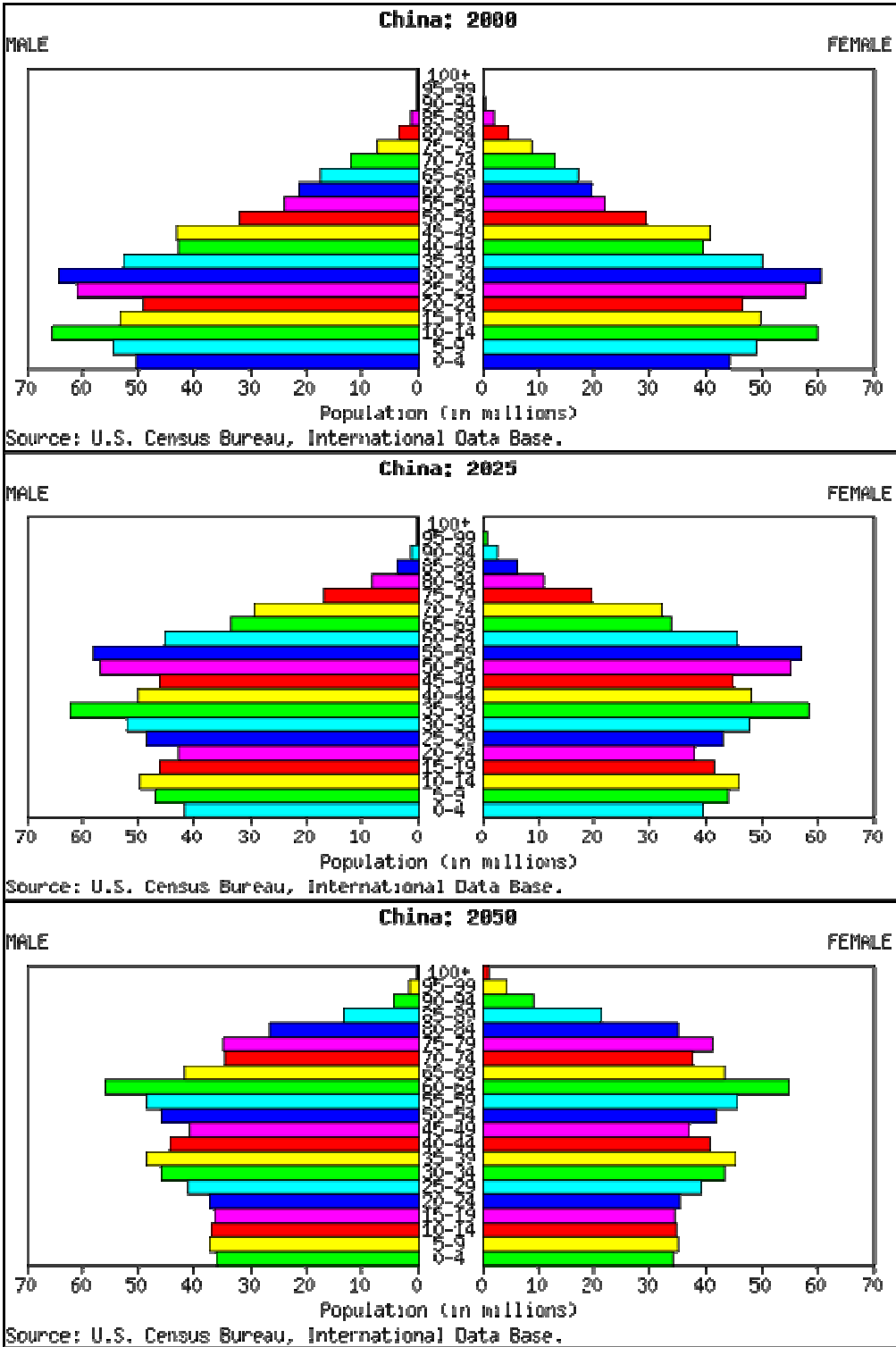
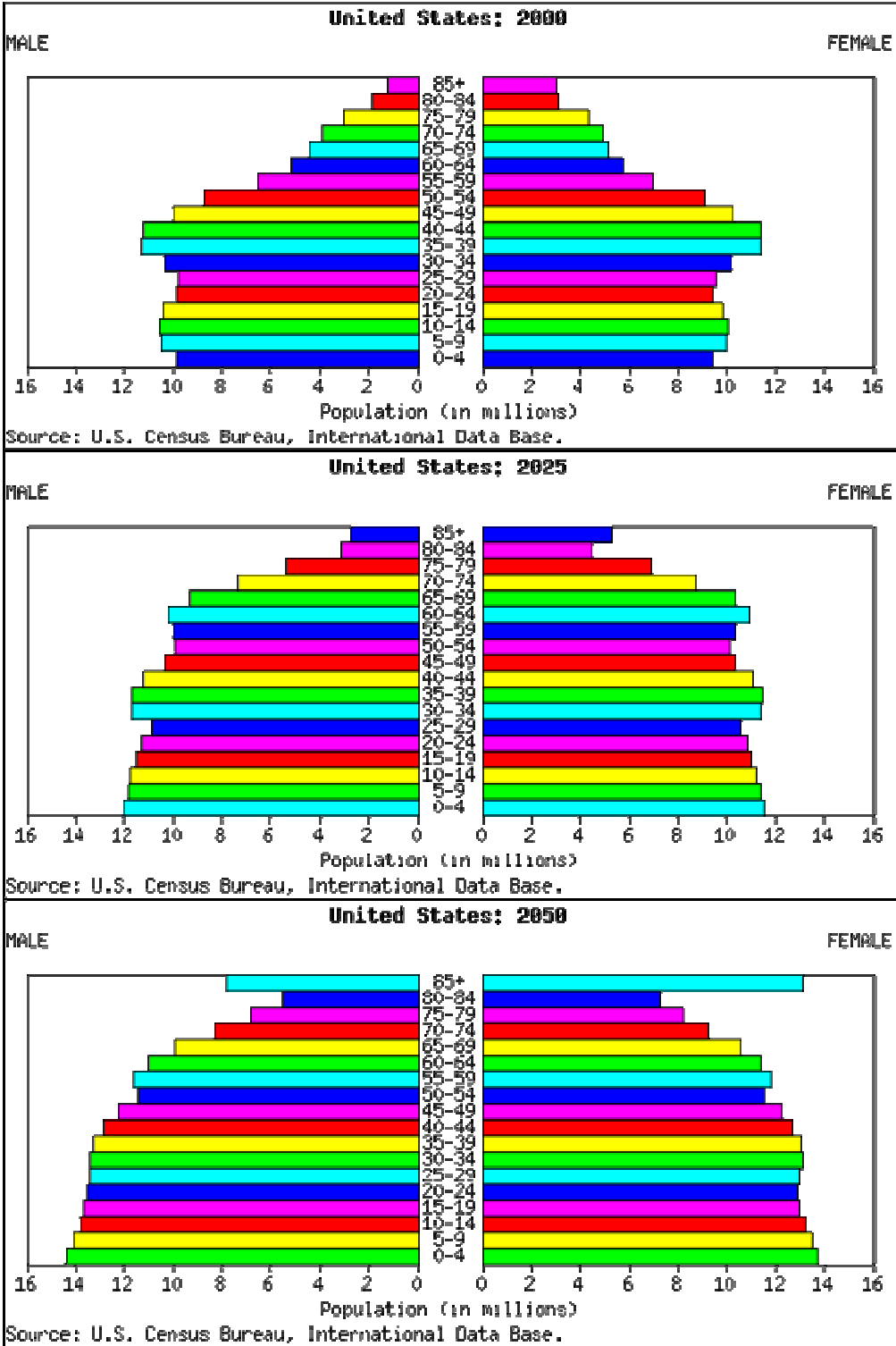


Figure 10: Population Pyramid Summary for United States



During the industrialization process, the interaction between the forces of fast declining mortality and slowly declining birth rates will be responsible for remarkable changes in the size of populations, as shown in the projection below, bringing some countries into the group of the top largest in the world. The countries just joining the industrialization process will accelerate their population growth, while other countries will be affected by the declining birth rates and will experience a slow growth and in some cases even a reduction of their population. The ranking of countries by size exhibits dramatic changes in the first half of the twenty first century, changes that will cause major changes in world politics and economics, and will determine major trends in retirement systems.

Table 11: Largest countries by Population 2005-2050

(millions)								
2005			2025			2050		
Rank	Country	Population	Rank	Country	Population	Rank	Country	Population
Total World		6,451			7,898			9,224
total top 25		4,865			5,858			6,771
1	China	1,306	1	China	1,453	1	India	1,601
2	India	1,080	2	India	1,362	2	China	1,424
3	USA	296	3	USA	350	3	USA	420
4	Indonesia	242	4	Indonesia	300	4	Nigeria	357
5	Brazil	186	5	Pakistan	229	5	Indonesia	336
6	Pakistan	162	6	Brazil	218	6	Pakistan	295
7	Bangladesh	144	7	Nigeria	206	7	Bangladesh	280
8	Russia	143	8	Bangladesh	205	8	Brazil	228
9	Nigeria	129	9	Russia	131	9	Congo Kin.	183
10	Japan	127	10	Mexico	130	10	Mexico	148
11	Mexico	106	11	Japan	120	11	Philippines	148
12	Philippines	88	12	Philippines	119	12	Ethiopia	145
13	Vietnam	84	13	Congo Kin.	108	13	Uganda	133
14	Germany	82	14	Ethiopia	108	14	Egypt	127
15	Egypt	78	15	Egypt	103	15	Russia	111
16	Ethiopia	73	16	Vietnam	100	16	Vietnam	108
17	Turkey	70	17	Iran	83	17	Japan	100
18	Iran	68	18	Turkey	82	18	Iran	90
19	Thailand	64	19	Germany	81	19	Turkey	86
20	Congo Kin.	61	20	Thailand	71	20	Sudan	84
21	France	61	21	U.Kingdom	64	21	Afghanistan	82
22	U.Kingdom	60	22	France	63	22	Germany	74
23	Italy	58	23	Sudan	61	23	Tanzania	72
24	S.Korea	49	24	Uganda	57	24	Yemen	71
25	Ukraine	47	25	Italy	56	25	Thailand	69

Source: U.S. Census Bureau, International Data Base

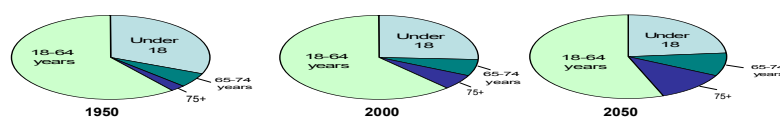
The changing pattern of the population pyramids means that about 60-70 years after the industrial revolution, the "baby boom" turns into a "geriatric boom". The proportion of the older population increases, but due to the baby boom, the absolute

number of old people demonstrates a very sharp increase during the 60-70 years period. The diagrams for Brazil demonstrate this point. In 2000 there were about one million females in the 80+age group. The number is expected to grow to about nine million in 2050, while the population is expected to increase by only 22% (from 186 to 228 million).

The population structure is often translated into "dependency ratios", that is, the ratios of dependants (children and people beyond working age) to the number of people in the working age group. These ratios are quite stable over time, despite the drastically changing population structure (people in the working age groups are typically between half to two thirds of the population – as seen in the U.S. diagram below). In agricultural countries the number of children is large, but the number of old people is small. Dependency ratios tend to be around 75-100%. Countries in the middle of industrialization tend to have even lower dependency ratios (around 50% and sometimes even less). This is the result of complex trends: the birth rate and number of children has already declined, the number of old people has not yet increased substantially, and the baby boomers are already working adults.

The ratio between the older people and the young ones is a more sensitive measure of the developmental stage. It changes drastically: the ratio of people aged 65+ to children below five, for example could be 3.5-4.0 in post-industrial countries, as compared to only 0.3-0.5 in the least developed countries. This ratio gives a better idea of the future retirement problems: since most children are expected to survive until retirement, it shows how many retired people will have to be supported by one person in the working age groups. (As one of my colleagues has pointed out: in China one child will soon have to take care of two parents, four grandparents and, and eight great grandparents...).

Figure 2. Percent of population in 4 age groups: United States, 1950, 2000, and 2050



Centers for Disease Control and Prevention, National Center for Health Statistics. Health, United States, 2004

Figure 12: Dependency ratios diagrams

3. Mortality and the Longevity Risk

The above changes in population pyramids and dependency ratios are accompanied and augmented by the increasing life expectancy, which is the immediate result of the sharp reduction in mortality rates. During the last century the developed countries have experienced an unprecedented increase in longevity, one that has never before been experienced! At the beginning of the twentieth century life expectancy around birth (corrected for mortality in the first few months after birth) was around 45-50 years in most currently developed countries. A century later, at the beginning of the twenty first century, life expectancy is around 76 years for males and approximately 80 years for females. In other words, life expectancy at birth has increased on the average by one year for every 3-4 calendar years! The following figures show the changes that took place in the U.S.A. during the twentieth century. In 1900-2 the life expectancy of white males and females in the U.S.A. was 48.2 and 51.1, respectively. The parallel figures in 2002 are 75.1 and 80.3, respectively.

In a cross-section analysis, the WHO statistics show that life expectancy for the entire population (males and females) is below 60 for pre-industrial countries (in some countries it could even be as low as 40!). On the other hand, post-industrial countries experience life expectancy figures around 77-82 (for the entire population). Life expectancy increases mainly due to developments in health, nutrition and hygiene, but will it continue to increase at the same rate in the future? Is there a limit to the human life span? These are critical questions for retirement planning.

Scientists cannot give us a definite answer yet. Some claim that the body cells are designed to last only for a certain period (for example, heart cells are assumed to have a limited number of beats), others believe that we are on the verge of deciphering the mechanism that determines the aging of cells, and we will learn the way to control it. Meanwhile we experience a continuous increase in life expectancy due to cumulative effect of gradual improvements in a wide variety of medical technologies. Medicine knows how to replace some failing systems through transplants, how to open clogged arteries, how to administer all kinds of drugs in order to fight many diseases.

About half of all deaths of adult males and about a quarter of all deaths of adult females are due to cardio-vascular diseases, hypertension and renal diseases. Another quarter of all deaths of adult males and about half of all deaths of adult females are related to cancer. In other words, about three quarters of the deaths of the adult population are related to these two major groups of sickness. Major breakthroughs in these areas may lead to a remarkable decline of death rates, and this may lead to a further substantial increase in life expectancy (a reduction of mortality probabilities in all age groups by half can increase life expectancy at birth by about five years).

Important advances in medicine are expected in the future due to the improved knowledge and understanding of genetics and complex biochemical processes, better screening devices, smarter surgical technologies, improved medical care (and maybe even due to improved understanding of the balance between body and spirit). All these will affect a variety of medical areas such as cancer, heart diseases, diabetes, strokes, neurology and gerontology, metabolic diseases, etc. Certain factors may

interfere, delay and even stop the development. Among these could be economic and financial forces, global epidemics of new diseases, contamination and pollution, and political factors (wars, nuclear disasters).

Human society is the only one among all animals that values longevity as a target. It is not improbable that this value will be challenged in the future, and that societies finding it difficult to cope with the soaring costs of retirement and of health-related costs will put all kinds of constraints on medical treatment to aged people. This involves ethical problems that go beyond the scope of this essay.

Demography and the Basics of a Retirement System

Longevity is probably one of the most important risks that affect our economies. Planners of retirement systems typically focus on the economic and financial aspects and often ignore the basic demographic considerations. As the following model shows, the drastic changes in mortality and life expectancies should not be ignored.

Assume a very basic model, where people join the labor forces at the age of 20, and retire at the age of 65. In addition assume that life expectancy is 75, and is not expected to change, and that the interest rate can be ignored. Assume also that the annual consumption of a retired person is similar to that of a working person (quite a realistic assumption in view of studies showing that the total consumption is quite stable, though its composition changes significantly with age). These basic parameters seem to generate a simple retirement model: during 45 years of work, people are supposed to accumulate sufficient funds to cover an additional 10 years, that is, put aside about 10/45 of their annual income.

There are two major flaws in this basic model, and both of them stem from a misinterpretation of the concept of life expectancy. First, relying on an average number (life expectancy) may be fine for a financial institution that holds a large portfolio of many insured people. An individual, however, is not supposed to plan her insurance needs according to average figures, but must prepare for the extreme cases. Life expectancy is an average figure. A high proportion of the retired people will live by far longer than the assumed life expectancy (age 75). What will all these people do when the funds are depleted at the end of the assumed 10-year post-retirement period?

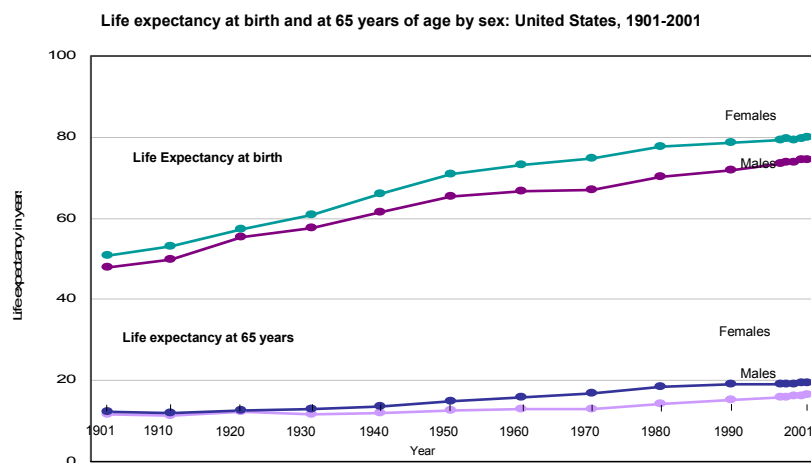
Secondly, when people refer to life expectancy, they commonly refer to the published figure, which is life expectancy at birth (i.e., the average age of death). The remaining life expectancy is a complicated function of age. If life expectancy at birth is 75, the remaining life expectancy at the age of 65 may be substantially higher than 10 years (75 minus 65), insofar as those who reach the age 65 have survived the childhood diseases, the motorcycle accidents, maybe the risks of a military service, etc. The U.S. Vital Statistics, for example, show that the life expectancy at birth of white males in 2002 is 75.1 (Center of Disease Control, 2004). The remaining (conditional) life expectancy at 65 is not just 10.1 years, but rather 18.2 years!

The above figures mean that when the U.S. white male in our model reaches retirement he had better have sufficient funds for 18.2 years, on the average, rather than just 10 years as the model has assumed (and this figure is subject to the first comment about the use of averages in personal planning). Putting aside savings for

18.2 years over 45 years of assumed employment is almost **double** the naïve calculation that assumed a 10/45 ratio!

The problem of females is even more pressing in practice. Females are the biological stronger gender, and their life expectancy at birth is typically longer than that of males. In 2002, for example, life expectancy at birth for white American females was 80.3 (as compared to only 75.1 for males). However, females tend to retire earlier, say at the age of 60, and the remaining life expectancy at that age is 23.6. Earlier retirement, however, also means a shorter working period. Say only 40 years in our model (60 minus 20). Moreover, traditionally many women often spend a few years out of the wage-earning labor force in order to raise the family. So the average working period for women can be reduced to 30 years or less. One needs to be a financial magician to be able to accumulate enough savings to finance a post-retirement period of 23.6 years over approximately 30 years of work!

Figure 13:



Centers for Disease Control and Prevention, National Center for Health Statistics. Health, United States, 2004

One possible way to mitigate the increased longevity problem is by deferring the retirement age (Giarini, 1980). When retirement ages were first determined by Bismarck's government more than 130 years ago, less than 40% of the people survived to the age of 65, whereas today 80-85% of the males and more than 90% of the females in developed countries live beyond that age. People reaching the age of 65 today are often in good physical and mental shape, and are often willing to continue working. (It is noteworthy that the common retirement age of 60 for women, was determined in the 1940s, based on the notion that both spouses should retire more or less at the same time. In those days the wives at time of marriage were about five years younger than the husbands, on average.)

Some countries are acting towards the deferment of the retirement age, and some are already gradually moving toward a retirement age of 67. However, this trend conflicts with another major force of the post-industrial revolution: the declining demand for labor (Giarini and Liedtke 1997). As pointed out earlier, the present production capacity of developed countries is large, and it can be achieved with only part of the potential labor force. Moreover, the developed countries are facing competing imports from the countries that have recently joined the industrial revolution. In order to mitigate the effects of the resulting growth of unemployment, some European countries are reducing the monthly working hours of employees. There is an inevitable clash between the enormous forces driving toward a higher retirement age and the pressures of young populations that have to join the labor force.

Interest Rate Considerations in Retirement Planning

The rough retirement model that has been discussed above ignores the interest rate, changes in the purchasing power of money and changes in the general standard of living, and should be corrected to deal with these factors. This can be done in an accurate actuarial manner, but the following less accurate way gives a better general picture.

A retirement plan has the advantage that its financing can be spread over a relatively long period: the employment period and the retirement period. Over such a long period, the interest rates should not be ignored. Let us examine some simple interest rate calculations. Assume a person who saves \$1 per year over 45 years. The amount saved by the end of the period depends on the interest rate (the first dollar gained interest for 45 years, the second for 44 years, etc.). If the money is saved at 0% interest, the person will accumulate \$45. At 2% interest the amount saved by the end of the period will be \$72. In other words the total is the principal and an additional 60% financed by the accumulated interest. At 4% per annum the amount jumps to \$121, meaning that for each dollar saved, the (compounded) interest contributes approximately another \$2 ! At 6% the interest effect is even more impressive: each dollar saved brings in close to \$4 in interest. At such high interest the total amount of the savings at the end of the period is about \$212 !

This simple illustration shows that the interest rate should not be ignored in long-range planning. The person has to make a decision: "who should work for my retirement – myself or the interest rate?". And the answer is obvious. Being able to finance retirement throughout 45 years, at an interest rate of 6%, means that the financial burden that we discussed earlier could be five times smaller!

There are a number of caveats to the above discussion:

- a. Compounding has a strong effect when the saving period is long. The person must start the retirement planning at a young age, in order to leave enough time for compounding to have a significant effect. It can be seen in the table that a shorter saving period drastically cuts the part of the interest in the saved fund. Unfortunately, most young people joining the labor force do not think about their retirement, and by the time they start thinking about it, they have to

- do most of the saving by themselves without too much support from the interest rate.
- b. Significant effects are reached only with high interest rates. Factors like inflation or a continuous increase in the standard of living operate in the opposite direction to the incoming interest rate. Deducting such factors from the interest rate and accumulating the savings at the lower real (net) effective interest rate results in lower real savings at the end of the period.

Figure 14: The Effect of Interest Rate on Accumulation of Savings at Retirement
(Future Value of an Annuity)

Saving Period = Period to Retirement	Interest Rate			
	0%	2%	4%	6%
1	1.0	1.0	1.0	1.0
15	15.0	17.3	20.0	23.3
25	25.0	32.0	41.6	54.9
35	35.0	50.0	73.7	111.4
45	45.0	71.9	121.0	212.7

From the individual's point of view, the interest rate is an exogenous parameter. However, there is a very strong connection between retirement savings and the market interest rates. The above discussion demonstrates that people are expected to save a substantial part of their income just to finance their retirement. These savings are a major component of the aggregated national savings, which in turn affect the economy's growth and the market interest rate (Feldstein 1974).

It is hard to predict future interest rates in the world markets without a reliable complex econometric model. One thing, though, seems to be quite certain: most post-industrial countries are going to suffer from a decline of the working-age population, and therefore, with a concomitant decline in the growth potential in these countries. The developing countries, on the other hand, will have substantial population and industrial growth, but they will probably soon be facing limits to their growth due to market limitations. This may indicate that the **real** interest rates will not exceed, say, 3% in the long run, and that the risk factor resulting from interest rate uncertainties is significant.

Low interest rates mean that on the average, the retirement of most people will be mainly financed by the direct contribution (by the employers, employees and the government), and only a relatively small part will be financed by the interest accumulation. And the result will be that the burden of financing the retirement system will remain quite heavy.

Health and Age-Related Processes

On the average, some of the life-time health-related costs are concentrated around the very young ages, but most are concentrated around the last years. Thus, due to the increased life expectancy in the post-industrial countries and the fact that older people often suffer from all kinds of medical problems, health costs are becoming associated more and more with the retirement problems.

WHO statistics show a positive correlation between the developmental level of the economy and the percentage of GDP spent on health-related costs. Typically, health-related expenditures reach 6-13% of GDP in post-industrial nations, compared to 2-9% in the less developed countries. In terms of per capita figures the gap is very noticeable: an average annual per capita expenditure of \$20-200 in the less developed countries, compared to \$1,800-4,000 in post-industrial nations (the dollar values were calculated by WHO by conversion of the local currencies at international dollar rates rather than the actual average exchange rates).

The World Bank and the WHO have suggested a new index to measure the global burden of disease. Named DALY (Disability Adjusted Life Years), it combines weighted information about morbidity and mortality, and is expressed in term of the numbers of healthy years lost. Each state of health is assigned a disability weighting on a scale from zero (perfect health) to one (death) by an expert panel. To calculate the burden of a certain disease, the disability weighting is multiplied by the number of years lived in that health state and is added to the number of years lost due to that disease. Years of life in childhood and old age are assigned lower values in the weighting process. DALY is a discounted figure, to better reflect future burden (an annual interest rate of 3% interest is assumed). It is not a perfect indicator (see Arnesen and Nord, 1999) and has a substantial degree of subjective judgment and uncertainty, but it is a fairly useful instrument for describing a complex problem by a single measure. A complementary measure is the Quality Adjusted Life Years (QALY), which measures the years lived in good health and is used to calculate Healthy Life Expectancy (HALE). Published by the WHO for the entire population at birth, the HALE figures run in the range of 35-45 years for the least developed countries, around 50-60 for more developed countries and around 65-75 for most of the post-industrial nations. The difference between the life expectancy and HALE measures the average equivalent number of years lost due to bad health and disability.

The expectation of lost healthy years at birth does not show a clear-cut border line between the least developed and most developed countries. In some of the least developed countries with the poorest health conditions, the number of years lost due to poor health can be fairly low – even 3-4 years, simply because life expectancy itself is very low (35-40 years). In others it can be as high as 8-11 years, compared to a life expectancy of around 60-65 years. In the developed countries the variation of this figure is somewhat lower, and the expectation of lost healthy years at birth runs around 6-9 years. A better measure might be the ratio between the expected lost years and the life expectancy at birth. For the developed countries this figure typically runs around 10%, compared to 15-18% for the least developed countries.

The main problem in the post-industrial world is that a substantial part of the years lost due to poor health occurs during the retirement period. So a better analysis would

be through the ratio of lost years to life expectancy at retirement (although some lost years relate to the pre-retirement period). Calculation of these ratios with WHO data, for the life expectancy of 60 year-old males, shows that in the least developed countries these ratios are very high (67-100%), whereas in the post-industrial countries they are in the 35-45% range. These ratios show that the health issue is becoming a major part of the retirement issue.

Medical procedures become more sophisticated and very costly. Part of the increased costs is related to the young ages. There are many conflicting factors, some tending to increase the health costs for the young population while others decrease the costs. A variety of factors increase the costs. For example, in post-industrial countries highly paid women may prefer not to have repeated pregnancies, and the use of surrogates for having children may increase. Technological developments may even enable families to have children outside of the human womb. On the other hand, genetic testing is becoming much more precise, and therefore fewer families will have children suffering from physical and mental disabilities. (On the other hand, however, the ability to save the very young fetus increases the prevalence of other birth defects). Future developments may enable us to rectify many birth defects. Abortions will be rarer as contraception becomes automatic and foolproof. At the same time, however, some parents will elect for abortion if their fetus does not meet their wishes (in terms of gender, or other societal standards).

For the older part of the population most factors operate in one direction: towards a continuous increase in medical and health costs. Among these are a variety of surgical procedures meant to replace or fix problems of aging or failing organs (transplants, angioplasty), special aids (like hearing aids, dentals, vision support, special instruments), new and expensive drugs, etc.

With costs escalating, health care is becoming the number one retirement related problem in post-industrial economies. As with all other risks, the most effective treatment seems to be prevention, which can be accomplished in a variety of ways, including dieting, exercising, better balancing between body and spirit, pre-emptive medicine etc. Apparently, some of the sicknesses of old age stem from our behavior at the young ages, if not "childhood diseases", and could probably be treated at that time.

4. Retirement, Saving and the Economy

In the agrarian economies, all risks were handled by the extended family and there was little need for social security. The industrial revolution created the need for another form of protection, in the form of government managed social security arrangements, which were supported by other work-related arrangements (labor unions pension funds etc.). The post-industrial revolution creates new challenges, and calls for re-evaluation of the old schemes, and for the foundation of new forms of protection.

Catering for the new needs must be done in a careful and thoughtful way, insofar as the retirement system is strongly interconnected to major parameters of the economy. There are strong relationships between the retirement system and population patterns, the national savings, the income distribution, the fiscal system, the labor and capital

market and the economic growth of the country. The broad implications on such key parameters must be kept in mind in the creation of new solutions.

We have examined above the effects of technological waves on population growth and its age distribution (the population pyramid), as well as the different problems of the developing countries and the post-industrial countries simply due to their being at different points in the same developmental process. The countries that are now entering the industrialization process have the advantage that they can examine the validity of the solutions that were tried years ago by the developed countries, and can learn from their experience, and avoid repeating the mistakes.

The impressive population growth (baby boom) of a country in the first stage of industrialization brings with it several huge, tough and pressing problems: a quickly growing number of mouths to feed, fast growing educational needs, rapid movement from the farms to fast-growing cities, and a practically non-existent infrastructure (roads, trains, communication, energy, water, sanitation, capital market).

Other problems, like the retirement system, seem to be currently less pressing and their treatment is typically deferred. The experience of the developed countries shows that this could later prove to be a serious mistake, even if the baby boomers will only need an appropriate retirement system to take care of their needs in the far future (say, 60 years time).

Early treatment of retirement needs can help solve two major problems: the seemingly less pressing retirement problem and the huge financial needs that are unmet due to the underdeveloped (often non-existent) capital market. The developed countries that dealt with the issue a century or so ago while they were in the industrialization stage, have developed their capital markets with tools that were appropriate at that time: They introduced national social security plans and additional work-related pension plans (that were typically run by labor unions).

The social security systems in the West European countries, which were based on partial funding, and the pension funds of the labor unions managed to accumulate huge funds, in some countries equivalent to substantial parts of the entire national wealth. Even in the U.S.A., where pension schemes are less developed than in Western Europe, pension funds have become a major source of capital and represent about a quarter of all U.S. equity holdings. Thus, the social security systems and unions became important players in the capital markets and in the investment and growth of their countries, and acquired substantial economic and political power.

The important connections between social security systems and the national savings was already being broadly discussed in the literature 40 years ago, and were the subject of a heated debate sparked by a famous article by Feldstein (1974) arguing that the governmental social security system reduces the total saving in the economy: social security has become a major source of income for retired people, and caused a reduction of their private savings, though the social security tax has not been used for increasing the public saving. Others (for example Schulz 1991) argue that the social security does not reduce the savings, since in the absence of social security people will tend to save only a little.

Most countries have selected partially funded social security systems. A few, and the U.S.A. is the leading one, have selected a "pay-as-you-go" system, with but little accumulation of funds (designed to mitigate slight short-run deviations from the expected values of premiums and payments). In such a plan the financial burden is shifted from one generation to another. In a country undergoing the industrial revolution a pay as you go system is expected to bear an enormous burden when it matures some 60-70 years after its establishment. It is no wonder that the U.S. system introduced in 1934 is currently facing this problem, and that U.S. economists are its loud opponents (see Diamond, 2003; Feldstein, 1998; Mitchell et al., 2002, 2004). With the U.S. experience in mind, Feldstein presents a forceful case for a radical shift from the existing pay as you go social security system to a mandatory funded program with individual savings accounts. Note, that the current U.S. problem is far smaller than the problems expected by newly industrial countries: the U.S. has mitigated the problem by allowing a huge wave of immigration to enter the country over the years, and this has kept the dependency ratios under control.

Today, the developing countries are simultaneously undergoing both the industrial and post-industrial revolutions, and they should, therefore, develop retirement systems that fit the post-industrial stage. The nature of the retirement schemes will be slightly different, but the old idea will prevail: simultaneously creating a solution for both the retirement and the missing capital market problem.

The nature of the new retirement systems must be slightly different from the old one. If in the past, the government played a major part in running the social security system, it can be privatized to a large extent, with the government just needing to create the general framework for the operation of private facilities. The additional solutions provided in the past by the labor unions, through the establishment of union pension plans, also need to be revised. The labor unions have lost much of their power in the post-industrial developed countries, and their ability to offer work-related pension plans has declined. The same is true for the currently developing countries: the unions there are unable to attain the same power that their counterparts in the developed countries had in the past.

Government intervention is still needed, though. In order to expedite the solution, governments have to make the retirement saving mandatory, setting the rules, but leaving the establishment of the retirement programs to private institutions. Young people, especially in less developed countries do not typically think about retirement as a pressing issue; they prefer to spend their money on other current needs, and they lack recognition of and trust in financial institution as a possible vehicle to treat the problems of retirement. Therefore, it is not recommended to wait for the slow and gradual natural development and penetration of private financial instruments into the retirement market. Government intervention will enable the country to start treating both the retirement and capital market problems within a short period of time. This approach is somewhat patrimonial, but making the retirement plans mandatory is essential, given the unsecured nature of developed labor markets, and due to the need to start treating the retirement issue at an early stage in order to enable the savings to be accumulated over a long as possible period.

Another difference from the old social security or labor union systems is in the way retirement systems can be run today. The old systems were the result of the basic way

of thinking and basic tools that were available in the past. Designed for mass production and mass marketing, like the industrial revolution, the old retirement systems were fairly uniform and rigid plans that did not leave much room for adjustments to the individual's particular needs. In addition, as computers did not exist at the time and those introduced in the 1960s were quite primitive. Therefore, the plans were predetermined to a large extent (most plans were based on a "defined benefits" approach). The same was true for the commercial insurance policies of those days: life insurance policies (the most popular at that time were the whole life policies and endowment policies) were designed such that all the parameters of the program (premiums, sum insured, surrender values, etc.) were calculated and predetermined from the inception of the policy.

The development of computers and communication that allow insurers to process and store large databases quickly and at low cost has opened the way for a huge variety of policies: variable premiums, variable coverage conditions, various portfolios in which the premiums can be invested, profit-sharing schemes, investment in a variety of options, etc. The same tools can be used for the new retirement system, allowing the insured to enjoy a free choice of investments (stocks, bonds, mortgages, options, foreign investments, etc.), and letting the premium fluctuate according to the ability, needs and desires of the person, as long as certain obligatory targets are met. This could stimulate private savings and help finance the needed growth of the economy.

The government will have to set the general framework of the system, such that the mandatory savings are a substantial part of the income (probably around 25% of the income). It will have to set the rules for employer-employee participation, and government subsidies could be included (through tax incentives, for example). It will have to set the rules to assure proper governance, transparency and honest management of the system in order to make sure that the huge amounts involved are not stolen or mismanaged. Much flexibility could be given to the selection of investments (subsidies could be given in special cases, for example in order to encourage the local capital market). The managers of the private funds will have a high degree of responsibility, and they will have to find prudent ways to invest the funds. In order to immunize against some of the risks, a maturity matching will be needed. This will probably encourage the creation of a long-term mortgage market (to back up the long-term obligations of the fund), and this in turn will encourage the development and growth of the country's economy.

We believe that the optimal system will be mixed. It must preserve certain elements of the nationalized social security system, possibly in the form of some sort of welfare program that will be responsible for the treatment of disabilities (both disabilities from birth and from uninsurable events), and for the handling of the (growing) number of people who will be unemployed over long periods as a result of the changing nature of the economy. This is a very complicated issue that has to be handled with much care, sensitivity and wisdom.

One last critical point has to be made. The traditional solutions (social security and union pension plans) were driven by the desire to relieve the people of many risks, especially investment risks, which led to a very conservative investment policy (mainly in governmental bonds). In addition, the so-called "defined benefit" plans, which tended to be the norm, are hard to maintain over long periods, especially when

the environment is changing at an accelerated rate. It is quite clear that the main future vehicles will be based on a "defined contributions" approach, meaning that retirement plans will be run like a saving program. The insured will know the amounts that are being saved, but the future value of these savings will depend on the realized return on investment. In other words, the burden of interest risks is entirely shifted to the shoulders of the individual.

The main difficulty with a defined contribution approach goes beyond the fact that the future amount of accumulated savings remains uncertain. Even if it is known, it is not clear how much protection it will be able to buy in the future, as this will depend on a large number of uncertain elements: the prevailing interest rate, the mortality table, the level of the medical costs, and many other unknowns. It is most probable that countries will have to supply some sort of protection against such risks when they come about. There is no way to calculate the actuarial cost of such a program.

In other words, the post-industrial society has to dispense with the illusion of freedom from all financial, demographic and economic risks.

The Future Retirement System

In this essay we have reviewed a large variety of new macro and micro economic factors that must be considered in the designing of retirement systems in a modern, post-industrial economy. For the sake of clarity it is important to summarize some of the most important points again.

- The rapidly changing environment and the continuous acceleration of the changes. This introduces a high level of risk at both the national and individual levels.
- The rapidly changing family patterns. The increasing importance of single-parent families, the rising divorce rates, the high chance that many people will have more than one marriage in their life time, etc., invoke a need for individual plans, and less reliance on spouses in the design of the retirement plan.
- Rapidly changing employment patterns. The retirement systems must be flexible, to allow great mobility between industries, companies, cities, and countries, as people will typically change their employment (and even their profession) several times during their lifetime. Employment becomes more challenging: better opportunities, but large risks and instability. New industries rise and fall quickly due to rapid technological changes, and due to strong worldwide competition, part of which is the result of the currently big gaps between income levels in most advanced and less developed countries.
- The growth of the so called "service economy" based on sophisticated communication and computers, enables the creation of very sophisticated financial instruments which offer a large variety of retirement instruments, which are catered to the individual's desires and needs.
- Unions have significantly less power than in the past, and therefore, they cannot offer good pension systems. In our opinion their time is over. Unlike Blackburn (2002) we do not believe that with the present nature of employment, the union plans have a real chance of revival, and we surely do not see a way in which labor will use these funds as leverage to take control over the economy.

- A growing proportion of females joining the work force, and competing on the declining number of jobs.
- It cannot be taken for granted anymore that every person will be employed continuously throughout the common working period (say, 18-65). The chances are that many people will be unemployed during relatively long periods, which means that countries will have to find ways to assure that unemployed people still have the means to provide for their daily pre-retirement and post-retirement needs. There must be a safety net for these people, and it should be run by the government.
- The design of safety nets for unemployed people (which will take care of the post-retirement period as well) is a very complicated task. There are real problems of building the right criteria and incentives and preventing fraud, the main problem being that high unemployment rates may become an integral part of the post-industrial society, rather than a transient problem.
- Rapidly increasing life expectancies are causing a drastic change in the ratio of the lengths of the period while employed to the post-retirement period, which increases the financial burden of a retirement plan. Assuming a zero real interest rate means that people should save continuously between a quarter and one third of their current income in order to be able to maintain similar standard of living in the post-retirement period. The burden decreases if saving is done at a higher interest rate, and for a long duration. Unfortunately, it seems that there are limits to growth, and there are no grounds to expect significantly higher real interest rates in the future.
- The higher life expectancies make many people capable of and willing to continue working beyond the common retirement age. This trend conflicts with the need to find employment for the young people joining the labor force. Currently this conflict ends up in a situation where the 50 year-old person who loses a job finds it quite difficult to get a new one.
- The increased longevity increases the financial burden of retirement. The burden can be eased by spreading it over a long saving period, enabling the interest compounding process to help build substantially larger savings. Unfortunately, young people typically start thinking about retirement benefits only at an advanced age that leaves only a short saving period. As educating people takes too long and is too slow a process, there is a need for some kind of mandatory saving arrangement.
- A high interest rate is an important factor in easing the financial burden of retirement. Interest rates are determined by a complicated process relating to the country's internal parameters (such as the population age structure, growth, the demand and supply for savings, inflation, etc.), as well as worldwide external factors. Due to the open world markets and the interest parity theorems, the real interest rates of the entire world are interconnected and high real interest rates can be reached only if the entire world economy is growing fast. However, global limits to growth make it unreasonable to expect a continuous and prolonged period of growth.
- Deferment of the retirement age is not solving the retirement problems. It actually increases the conflict between employment to young and older people, and may further aggravate the situation of people who lose their job prior to retirement.

Their chances of finding a new job are slim, and they have to wait longer before they get retirement benefits from the current social security systems.

- The higher longevity is accompanied by significant health costs. Age-related diseases that were barely significant in ancient times are becoming quite relevant to a large number of retired people. A significant part of the retirement period may be spent in relatively poor health and require substantial financial resources. The treatment is often extremely expensive, with a marked trend in the direction of further rapid cost increases. This is a huge financial problem that will probably consume a substantial part of the GNP in the near future. The best solution is probably through pre-emptive treatment at an early stage, before the real problem blows up in our face.
- Countries starting the industrial revolution experience a rapid population increase. This may influence their size ranking, and may affect their world political power, but it is accompanied by the need to feed, educate and find employment for the growing population.
- Population pyramids are changing drastically. Countries starting the industrial revolution have a baby boom that at first generates a rapid increase in the population, and after 15 years is responsible for a significant increase in the labor force (and the consuming society). This baby boom turns into a geriatric boom some 60-70 years later, the increase in the number of aged people being very drastic in comparison to total population growth during the same period. A combination of factors produces this effect: the increased life expectancy and the sharp increase in the number of people surviving the retirement age.
- The changing population pyramids result in changes in dependency ratios. At the beginning of the industrialization process there is a growing need for education for the baby boomers. There is an improvement of dependency ratios 15-20 years later, but 60 years after the boom the dependency ratio tends to deteriorate. There is a need to turn schools into retirement homes....
- There are changes in the perception of people and their desires. The post-industrial person is more individualistic and cherishes personal freedom. The society as a whole is more democratic, but political parties lose their power. The leaders are often focused on narrow targets, and lack the power to lead big changes and revolutions.
- People in the post-industrial world believe in privatization. They expect governments to intervene in the economy as little as possible, serving mainly to regulate the free operation of markets in a transparent and honest way, and to take care of defense and some educational issues. However, at present this is still in the realm of utopia.
- When other countries are not playing by the same rules, governments have to interfere, since the name of the game in such an environment is to improve the terms of trade of your country against the others (for example, if some countries do not protect the intellectual property of others, they may achieve economic advantages over the others). Not doing so, your country is at the risk of "importing unemployment" from competing countries. In other words, as long as there are no uniform and agreed international rules, there is a strong competition between countries.

- Asymmetric behavior, even in areas that seem to be unconnected – such as the retirement system in the country – may affect the economy and world competition. For example, if a country that does not care about retirement risks, and defers the treatment of the problem to the next generations, this may drastically affect the level of wages, and may give that country a competitive advantage over other countries, at least in the short term.
- The fact that currently not all countries in the world are at the same level of development, and that the economies are not run by the same rules, creates enormous risks to the world's economy. It may cause a lot of tension between countries, cultures and civilizations. It may create envy and hostility between the "haves" and the "have not". It may create problems when frustrated, unemployed and starving people in one area are prevented from immigrating to another country; in some cases this may develop into real violence, between countries, cultures and economies. The world is getting smaller and more interconnected, and therefore also extremely fragile and vulnerable. Any inequality – even in what may seem as a remote and unrelated area such as the retirement system – may be the cause of a big problem.

5. Concluding remarks

This essay has attempted to forecast future trends and examine their implications for future retirement systems. We have tried to view the issue from quite a variety of angles and they all point in one direction: social security systems should privatize most of their activities. However, this process must leave a small nationalized part, and the governments must create a well-defined framework for the privatized part. In the countries that are currently undergoing the industrial revolution, the introduction of a mandatory privatized retirement system may be used as an engine to finance their growth. In the already post-industrial countries the change will simply ease some of the ailments of their current systems.

A second point that is of great importance is related to the growing cost of age-related health problems. This is becoming THE major issue of developed economies. About one third of the post-retirement period is wasted on the average in poor health, and the costs are escalating. This calls for preventive medicine in the years prior to retirement. In other words, we must spend money now in order to prevent unbearable costs in the future. One possible way of dealing with the issue is to reconsider the criteria for how far to go in spending resources to artificially prolong lives. This is a complicated ethical issue.

The last point relates to deep philosophic ideas. As most countries will soon become industrialized, and as current technological waves are fast and frequent, the entire world will soon be moving at more or less the same pace. This calls for much more coordination among countries on the governing rules of the system. If not all players act according to the same basic set of rules, imbalances are created and these may shake the world. Indeed, the current situation, where much inequality still exists among nations, creates strong forces that threaten the world, and cultural clashes between civilizations and terrorism are creating major risks to our future.

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