UNDERSTANDING POPULATION: A SHORT PRIMER AND A GLOSSARY OF TERMS

By Douglas N. Ross

Four separate but interrelated population components — size in relation to resources, growth rate, acceleration and momentum — need to be understood if business and government leaders are to utilize demographic data effectively in population-related decisions.

Population Size: A Problem of Balancing Wealth and People

Although the focus is on the twentieth century, Chart 1 shows the recent nature of the very rapid growth in world population. In 1900, the world's population was about 1.7 billion persons. Today, it is over 4 billion.[1]

The earth is a limited space but the earth's bounty, so far, has proved to be expandable. Economic development is the process by which people — working-age adults — convert what they have into forms of wealth they want and enjoy. Improving the quality of life is the overall goal of this process; it includes items such as better health and education, and increased longevity. While use levels per person of such things as food, durable goods, and communications are prima facie indicators of development, there is no way to determine the optimum ratio between physical resources and people. In part, this is because resources are brought into being by people with capital and know-how, working with natural wealth, and thus both the supply of resources and the amount of effort can expand or contract.

In the developing countries of Latin America, Asia and Africa there have been increases in total gross national product and agricultural output. Through these increases the less-developed nations had hoped to relieve widespread poverty, with its accompanying malnutrition and unemployment. However, the rate of population increase has more than offset the GNP gains.

[1] There has never been a census of all the people in the world. Some nations — such as Ethiopia — have never enumerated their population; in other cases, census reliability is questionable.

In an early formulation of the resources-population dilemma, T. R. Malthus claimed that if resources were fixed while population grew, the only check to the ultimate size of population was starvation and misery. While Malthus underestimated the rate of technological change and the development of human ingenuity, the hypothesis does state the diluting effect on the creation of wealth of changes in population size.

Population Growth: A Problem of the Rate of Population Increase

Until modern times, the population growth rate — the difference between the birth rate and the death rate — was about 560 persons per year for each million

Chart 1: World Population, Size and Growth, 1400 to 1975

Billions of People
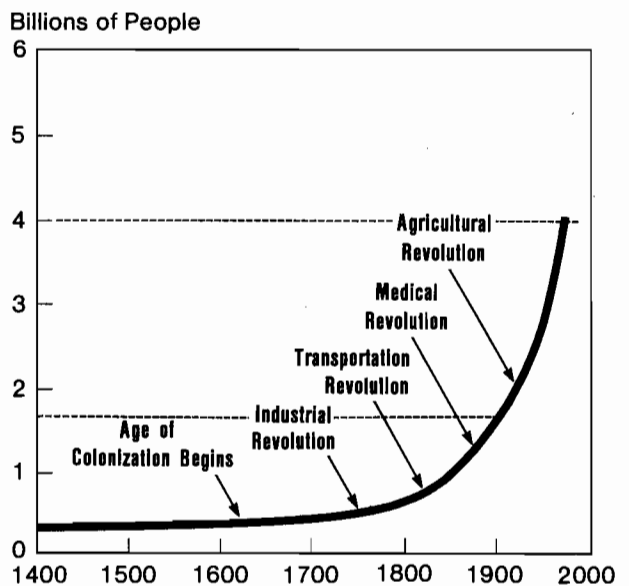
Source: U.S. Bureau of the Census and
The Population Reference Bureau

population (or .056 percent).[2] In eighteenth century Europe, this rate increased first to .5 then to 1.5 percent — or to 5,000 and then to 15,000 per million — due primarily to a decline in death rates. Instead of taking 1,000 years to double the population, it doubled within 100 years; and at the opening of the nineteenth century the earth's population had reached 1 billion persons.

However, the twentieth century has seen the population growth rate of most industrialized countries in the temperate zone fall back to a range of .6 to 1.3 percent: 6,000 per million in Europe; 11,000 per million in Japan; and 13,000 per million in the United States and Canada. The effect on the United States is still the addition of 25 Philadelphias (population 2.3 million) between now and the year 2000.

From A.D. 1 to 1750, the world's population increased by about 500 million (from 300 million to some 800 million). From mid-1965 to mid-1975, the increase was about 660 million; and from mid-1975 to mid-1976, the world's population grew by an estimated 70 million.[3] Current estimates place the world's population growth rate at about 2.2 percent a year, which means that the world's population may double in about 33 years.[4]

If the world's birth rate could be lowered from present levels to the replacement rate of two children per family, then the world's population could stabilize at about six billion by 2020 (see Chart 2).

On the other hand, if present population growth rates continue, then by the year 2000 the Population Reference Bureau estimates a world population of 7.2 billion, 75 percent of whom would be living in the developing countries.
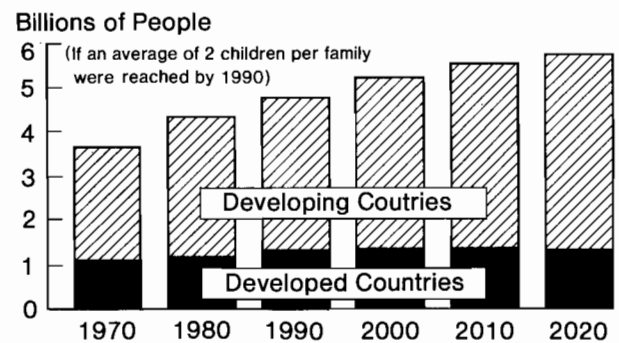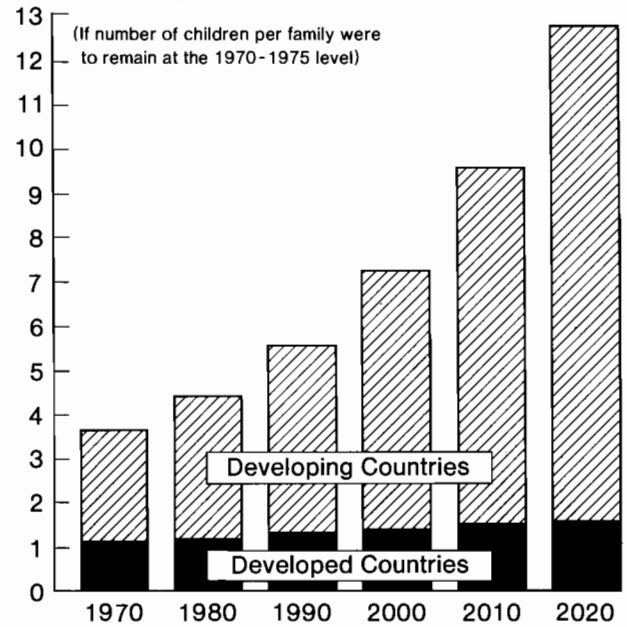
In the "development race" between a growing population and increasing wealth, the absolute size of a country's population is less important to its economic well-being than is its rate of growth. It is important to distinguish between them. A "large" or "small" popu-

[2] Ansley J. Coale, "The History of the Human Population," *Scientific American,* September, 1974.

[3] The Population Reference Bureau estimates a 52 million increase between mid-1975 and mid-1976; the Environmental Fund estimate is 96 million.

[4] These are United Nations estimates. However, U.N. data are taken as given by member countries, without adjustment. For example, the 1974 population of Mexico was 58.1 million; expert sources claim that this figure may be inflated by as much as 20 percent, or nearly 12 million, depending upon the number of persons thought to be in the United States. There is nothing to substantiate any information on China, so whatever assumption is made greatly affects world totals and averages.

Chart 2: World Population Growth, 1970-2020
Billions of People

(If number of children per family were to remain at the 1970-1975 level)

Developing Countries

Developed Countries

Billions of People

(If an average of 2 children per family were reached by 1990)

Developing Coutries

Developed Countries

Source: United Nations and the Population Reference Bureau

lation refers to the total size of the population — or labor force — relative to the availability of natural resources and domestic capital. Thus an economy with low capital per worker is likely to have a small consumption level and a miniscule savings rate. When a "large" population also has a high population growth rate, as in India, the population-economic situation is at its worst.[5]

The advantage to a population growth rate below the rate of increase in GNP is that per capita income can increase. At the same time, a larger percentage of the populace will be of an age to enter the work force. The

[5] Stephen Enke, "Economic Consequences of Rapid Population Growth," in M. Keeley, (ed.), *Population, Public Policy and Economic Development,* New York: Praeger Publishers, 1976.

danger in a high population growth rate lies in the difficulty of increasing per capita wealth, thus handicapping the country in its development race.

Some areas believe they would benefit from a "high" population growth rate. Brazil is a case in point. It and many other nations have large empty lands — such as Brazil's Amazon basin — making the need for additional population seem plausible. However, skilled adult workers with adequate capital and determination make the best pioneers. Children do not settle empty lands. The United States grew by immigration, as well as by increasing birth rates.

Population Acceleration: A Problem of Increases in the Rate of Population Growth

A "demographic transition" is the process by which a population with high mortality and high fertility rates changes to one of low mortality and low fertility rates. Causes of the declining death rates are thought to be better sanitation and public health, and more available food supplies.

Rapid change in the death rate can upset millenia of social history. Public health measures have in some measure succeeded in eliminating killing epidemics and diseases, such as cholera and maleria. To illustrate, in 1944, the introduction of DDT into then-Ceylon led to the elimination of malaria-transmitting mosquitoes and a death-rate decline of 35 percent in two years. In general, rapid death-rate declines have occurred throughout the developing world.

Chart 3: Antecedents of the Population Explosion

Rate Per Thousand
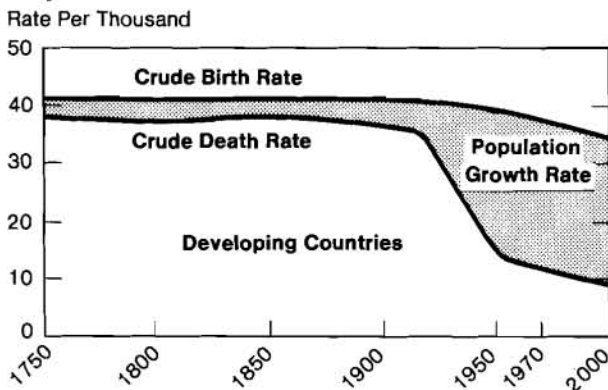
Note: Data for 1750 to 1900 are based on average estimates by Carr-Saunders Wilcox, as Modified by the U.N. in The Determinants of Population Trends. Estimated future based on U.N. population projections.

Source: TEMPO, "The Economics of Slowing Population Growth" (Santa Barbara, California: Center for Advanced Studies, 71 TMP-42)

Causes of the birth-rate decline are more likely related to economic development, family planning, and education. These change very slowly through time. The developing countries are well into the first phase of transition. They have moved from high mortality to low mortality, but are still maintaining high fertility rates (see Chart 3). Their present population growth rate is estimated at 3.0 percent, or 30,000 per million — or nearly double that of preindustrial Europe. Where specific developing countries — for example, Taiwan, Sri Lanka, Costa Rica, and Egypt — do report birth-rate declines, it is unclear whether this is because of real economic progress or population programs, or both.[6] It is well to remember that England did not register an unambiguous decline in fertility for nearly 100 years after the decline in the death rate.

Population Momentum (the lag effect): A Problem of the Age Composition of a Population

The "momentum" built into the age structure of populations is profound and long lasting. It is the most difficult to visualize of the four interwoven components, and is a result of the time span between date of birth and date of marriage and childbearing. In Chart 4, the horizontal bars are age groups. Over time, the broad base ages move up in the figure. It takes 20 years for babies to become parents; but, once born, the momentum for future births has begun.
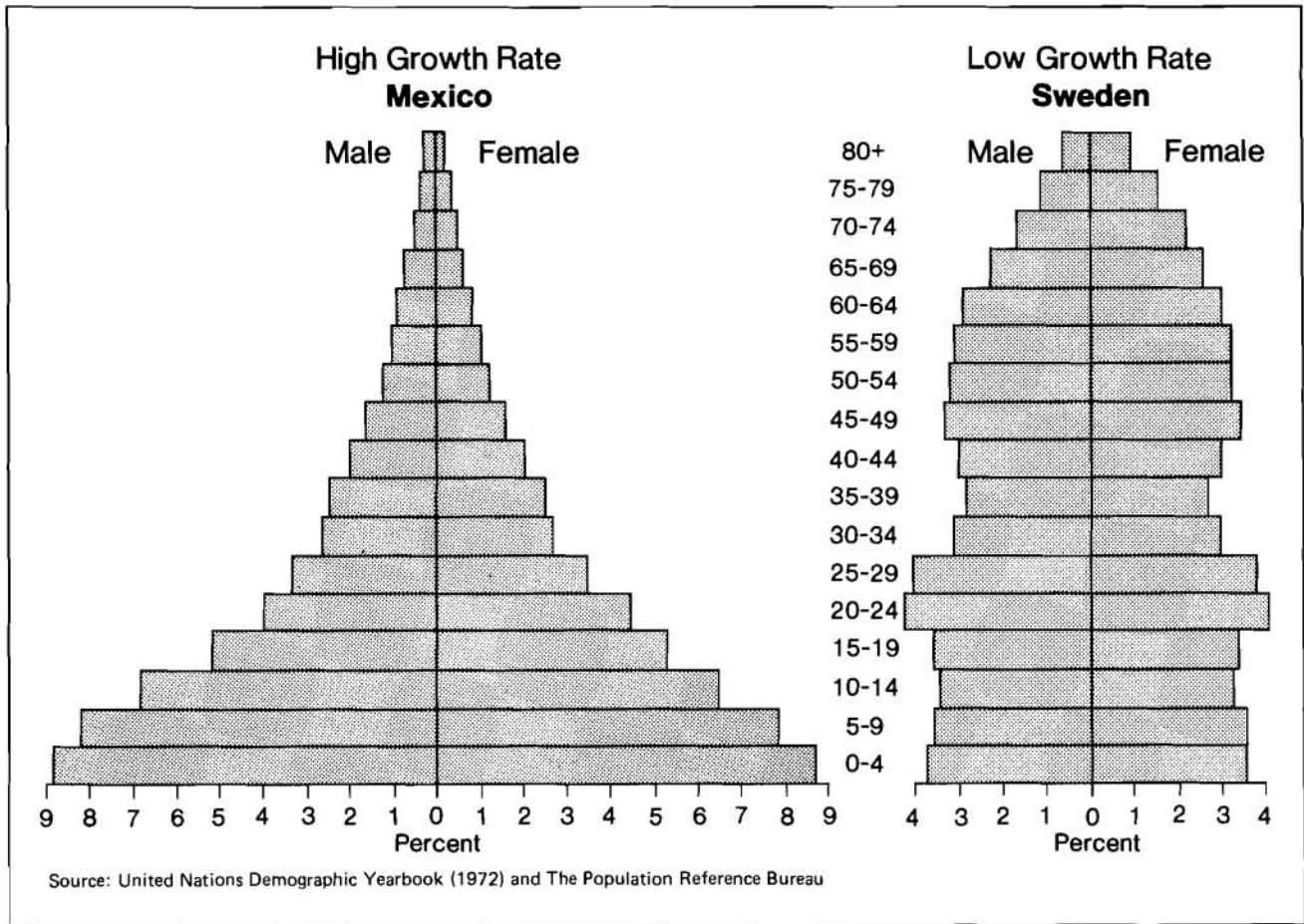
Even after birth rates begin to fall, there will still be an increase in the absolute size of a population because for 20 years persons born before the decline will be producing babies. Because of this factor, if developing countries' birth rates were suddenly to fall to a level that would only replace those now alive, "momentum" would assure an ultimate stable population two-thirds greater than the present level.

A nation's age-distribution profile has numerous implications. Rapid population growth means that the population, on average, will be younger. Nearly 40 percent of all persons in the developing world are less than 15 years of age. The mark of high population growth is a very young "average" age (see Table 1).

The dependency ratio — children and old people per work-age adult — is a measure of this nonproductive burden. For many developing countries it means that eight dependent persons must be supported by ten who are working. (For more developed countries, this ratio is

[6] The Environmental Fund, *Special Report: Questioning the Source*, Washington, D.C., May, 1976.

Chart 4: The Shape of a Nation: Population Composition of Two Countries with Widely Differing Growth Rates

High Growth Rate **Mexico**		Low Growth Rate **Sweden**
Male ▌ Female	80+ / 75-79 / 70-74 / 65-69 / 60-64 / 55-59 / 50-54 / 45-49 / 40-44 / 35-39 / 30-34 / 25-29 / 20-24 / 15-19 / 10-14 / 5-9 / 0-4	Male ▌ Female

Source: United Nations Demographic Yearbook (1972) and The Population Reference Bureau

five of ten; fewer children and oldsters relative to work-age adults, which means more available spendable income.) Yet a "high dependency ratio" of a developing country can be just another arid number. One has to know, for example, that fewer than one-quarter of the population in Chile has sewage facilities, and less than

Table 1: Percent of World Population under 15 Years of Age by Region, 1975

Africa	44%
Asia	37
Europe	25
Latin America	42
Oceania	33
North America	27
World Average	36%

Source: Population Reference Bureau

one-fifth has adequate water supplies; 70 percent of that nation's children are infested by parasites; and the rate of mental retardation approaches 40 percent in severely malnourished social groups.[7] The dependency ratio, then, can include an underworld of poverty that is an almost impossible handicap to development efforts. All nations face questions of: How many people can be sustained? How high should the standard of living be? What kinds of people will they be? Where will they choose to live?

It is hoped that the discussion of the four population components — size, growth, acceleration, momentum — will prove a useful aid to understanding for business and government leaders, and citizens as they seek solutions to these and other difficult population-related questions.

[7] Fernando Monckeberg, *Checkmate to Underdevelopment*, Washington, D.C.: The Embassy of Chile, 1976.

Glossary of Population Terms*

Age-Sex Structure. The composition of a population as determined by the number or proportion of males and females in each age category.

Age-Specific Fertility Rate. Yearly number of live births by age of mothers, usually shown per 1,000 women in each of seven age groups (15-19, 20-24. . . ., 45-49).

Cohort Fertility. The number of births experienced over time by a group of women or men born in the same period (a birth cohort) or married in the same period (a marriage cohort). (See *Period Fertility* for a contrasting measure.)

Crude Birth Rate (or simply "birth rate"). Yearly number of live births per 1,000 population.

Crude Death Rate (or death rate). Yearly number of deaths per 1,000 population.

Demographic Transition. An historical shift of birth and death rates from high to low levels; the decline in mortality usually precedes the decline in fertility, thus resulting in rapid population growth during the transition period.

Demography. The scientific study of human populations, including their size, composition, distribution, and characteristics, and the causes and consequences of changes in these factors.

Dependency Ratio. Number of persons aged 0-14 and 65 and over, divided by number aged 15-64 (multiplied by 100 to give a whole number). Assumes that the latter generally provides support for the former two groups, and hence is a rough measure of the economic burden carried by those in prime working ages.

Fecundity. Physiological capacity of a woman, man, or couple to produce a living child.

Fertility. Actual reproductive performance, or the bearing of a live child by a woman.

General Fertility Rate. Yearly number of live births per 1,000 women of childbearing age (defined as ages 15-44, or 15-49).

Gross Reproduction Rate. Average number of daughters a woman would have if she were to bear children at the prevailing age-specific fertility rates and to live through the entire reproductive span from age 15 to age 50. Equals total fertility times the proportion of births that are daughters.

Infant Mortality Rate. Number of deaths among children under one year of age in a specific year per 1,000 live births in the same year.

Life Expectancy at Birth. The average number of years a newborn child would live if the current age-specific death rates were to prevail throughout his or her lifetime.

Migration. Movement of people across a specified boundary — within or between countries — for the purpose of establishing a new permanent residence.

Morbidity. The frequency of disease and illness in a population.

Mortality. Death to members of a population.

Net Reproduction Rate. Gross Reproduction Rate adjusted to take mortality into account; i.e., some girl babies do not survive to reproductive age and other women die during the reproductive age span.

Period Fertility. The current reproductive performance of a group of women or men, or their fertility during a particular period of time. (See *Cohort Fertility* for a contrasting measure.)

Rate of Natural Increase. Yearly net relative increase in population size due to excess of births over deaths (equals *Crude Birth Rate* minus *Crude Death Rate*). Usually expressed as a percent.

Rate of Population Growth Yearly net relative increase (or decrease, in which event negative) in population size due to natural increase and net migration. Usually expressed as a percent.

Replacement Fertility. Level of fertility at which childbearing women on the average have only enough daughters to "replace" themselves in the population. (*Net Reproduction Rate* = 1.0) A population which has reached replacement or below-replacement fertility may still continue to grow for some decades, since past high fertility may have led to an unusual concentration of women in the childbearing ages and hence total births continue to exceed total deaths.

Sex Ratio. Number of males per 100 females in a population.

Stable Population. Population whose rate of growth or decline is constant, and in which the birth rate, death rate and age-sex structure are also constant.

Stationary Population. Stable population which does not increase or decrease in size.

Total Fertility Rate. Number of children a woman would have if she were to bear children at the age-specific rates prevailing during a given year while living from age 15 to age 50.

Zero Population Growth. The stage at which annual births plus net migration exactly equal annual deaths.