

Lecture notes 4: Population Future Trends

Future Population Trends

- Does the age structure of the population have an effect on a country's income per capita?
- Quality of Forecasts of future population and the assumptions that underlie them?

1. Forecasting Population

1958 UN forecast of 2000 population: 6.3 billion, actual higher by 3.6%. Remarkable accuracy.

World population last 150 years, UN forecast next 150 years.

1950-00: 1.8% per year, 2000-50: 0.9%, 2050-2100: 0.2%.

Forecast tools: survivorship function, fertility function.

Difficulty: projecting future mortality and fertility.

1.1 Forecasting Mortality

- Mortality changes are likely to be much less important for future population growth because all girls live through childbearing years.
- However, reductions in Life Expectancy (AIDS in Africa) will reduce the NRR.
- But MR reductions will increase pop since people live longer. But such effect less important than changes in TFR.

AIDS in Africa

- A worldwide AIDS epidemic, large scope. In 2000: 36 million infected. Three million deaths attributable to the disease.
- More than 90% infected in DEVC, concentrated in sub-Saharan Africa. 7.4% percent of this region infected with HIV, 2/3 of world total.
- 9 African countries have HIV prevalence of 14% percent or more: Botswana, Kenya, Lesotho, Malawi, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe.
- In 9 most affected: LE now is 12 years lower than what it would have been.
- Botswana, worst-hit, 1 out 3 is HIV positive, growth rate of pop fallen from 2.7% to 0.5%.
- Infection high among educated, urbanized classes, destroying scarce Human Capital.
- Social disruption on a large scale: Children's education fell sharply.
- In Cote d'Ivoire families reduced education spending by half.
- Orphans do not get educational investment as other children.
- Reduced investment in physical capital and a decline in growth of Labor Force.
- WB estimate: AIDS reduced growth of GDP Per Capita by 0.5%.

1.2 Forecasting Fertility

TFR consistent with zero population growth is higher than 2.0: because some experience mortality prior to women's child-bearing years, also because slightly more boys are born than girls.

Replacement fertility – about 2.2.

UN assumes TFR would be exactly 2.1 by the year 2050 in all countries.

Fertility in the Rich Countries:

For most DC TFR in 2000 was 1.57.

US-2.1, Canada-1.6, Japan-1.4, Germany- 1.4, Italy-1.2, Spain-1.1, > shrinking populations.

Figure 3

Fertility in Poor Countries:

The future course of population in DEVC will depend on how quickly fertility declines continue.

Table 1: Fertility in the Developing World 1997

	Population (millions)	TFR 1975	TFR 1997
All Developing	4,503	5.0	3.0
Sub Saharan Africa	555	6.7	5.5
Arab States	252	6.4	4.1
EA excluding China	55	3.5	1.7
China	1244	3.9	1.8
South East Asia	501	5.0	2.7
SA excluding India	374	6.6	3.8
India	966	5.1	3.1
LA and Caribbean	490	4.7	2.7

1.3 Demographic Momentum

Number of children born depends on: TFR, number of women in reproductive years.

If the latter rises > number babies born will also rise, even if TFR unchanged.

This phenomenon is known as **demographic momentum**.

- If TFR falls to a constant NRR, number of babies born each year will fall initially,
- Because each woman in her reproductive years will be having fewer children,
- But over time number babies born will rise since the number of women in their reproductive years will continue to rise.
- Only after several generations will the effect of this DM wear off, at which point the growth rate of population will be zero.

A useful measure of the extent of DM: the fraction pop under 15.

- 78 countries, 45 in Africa, have more than 40% of pop under age 15.
- In US-22%; Japan-15%.
- Because of DM future growth of population is almost inevitable.
- If NRR=1 in 1995, DM will lead world pop to 8.4 b-by 2050, 9.5 b-2150.
- In India, if NRR=1 in 1995, 1.4b-by 2050.
- [India in 2003-1.3b].

1.4 Population in the Very Long Run

Figure 5. Viewed over the long span of history, will the episode of pop growth in last 200 years appear as a spike?

Uncertainty about the future level of pop. In the Malthusian period we knew more about the long-term.

How Many People Can the Earth Support?

- In 1968, the biologist Paul Ehrlich published a book called *The Population Bomb*, describing the dangers of overpopulation.
- In Ehrlich's view, 3.5 b in 1968 already larger than the planet could sustainably support.
- Predicted imminent mass starvation and ecological disaster as a result of overpopulation, in DEVC and in DC.

- The subsequent three decades have not matched Ehrlich's predictions.
- World pop almost doubled, yet Standard of Living have risen in most of the world,
- The kind of environmental meltdown envisioned was not realized.

Ehrlich's analysis was part of a long tradition in which economists, demographers, scientists, and others have grappled with the question "how many people can the earth support?"

2. The Economic Consequences of Demographic Change

2.1 The Slowdown in Population Growth

Table 2: Average Annual Growth Rates of Population by Country Group

	1950-2000	2000-2050
Most Developed	0.8	0.0
Less Developed	2.1	0.8
Least Developed	2.4	2.1

Apply Solow model to look at economic effects of these changes in population growth:
pop growth lowers the Income Per Capita (through physical capital dilution).

Using the SS equation and taking the ratio of two countries, i and j:

$$(1) \quad \frac{y_i^{SS}}{y_j^{SS}} = \left[\frac{\delta + n_j}{\delta + n_i} \right]^{\frac{\alpha}{1-\alpha}}$$

Use (1) to show how y compares at two points in time for a single country:

Consider DEVC case, pop growth is forecast to fall from 2.1% to 0.8%.

$$(2) \quad \frac{y_i^{SS}}{y_j^{SS}} = \left[\frac{0.05 + 0.021}{0.05 + 0.008} \right]^{\frac{1}{2}} = 1.11$$

Slowdown in pop growth > raise y by 11% in steady state.

If $\alpha=2/3$:

$$(3) \quad \frac{y_i^{SS}}{y_j^{SS}} = \left[\frac{0.05 + 0.021}{0.05 + 0.008} \right]^2 = 1.50$$

y will rise by 50%.

2.1 Population Aging

Over next 50 years median age is forecast to rise from 26.5 to 36.2 years.

- Results from declining MR and TFR.
- The effect of MR decline is straightforward.
- The effect of TFR decline is more subtle: reductions in TFR lower pop growth; lowers ratio of young to old > an increase in the average age of the population.

Figure 6A-C: decline in share of children, an increase in share elderly, diff in timing of change

Definition of “working age”? In many DEVC children make a significant economic contribution:

- Extent to which elderly remain in the LF also varies .
- Among DC, pop fraction aged 15-64 is forecast to fall from 67% to 59% in next 50 years,
- Among DEVC, working-age fraction is forecast to rise from 55% to 68%.

Figure 7: working-age fraction of pop in US over 1950-2050:

- The working-age fraction fell in the 1950s as the postwar baby boom raised the fraction of pop made up of children.
- It then rose over period 1965-1985, as these baby boomers entered the labor force, and is forecast to fall again over the period 2010-2030, as these same baby boomers retire.

2.2 Redrawing the World Map

Figure 8: important changes in relative population sizes:

- By the year 2050, Africa is projected to be three times as populous as Europe.
- In many DC, the prospect is for shrinking populations.
- By contrast, in a number of DEVC, the combination of slowly falling TFR and demographic momentum almost guarantees a massive increase in population.

Examples:

- in 1950, pop-Pakistan (40 m) was less half of Japan's (84 m).
- By year 2000, Pakistan's pop was the larger of the two (141 vs 127 m).
- In 2050, the pop are forecast to differ by a factor of three (Pak-344 m, Jap-109 m)

Going for the Gold.

Rich Countries earn more Olympic medals because their citizens have more time to devote to athletics, better facilities for training, and also because they are healthier generally .

Countries that are more populous win more medals because in a larger pop there are likely to be more superb athletes.

Economists Andrew Bernard and Meghan Busse analyzed data on how many medals different countries won in order to assess the relative roles of population and income per capita.

They found that both factors were important, with population being the more important by a very small margin.

Specifically, they found that doubling a country's population will raise its share of Olympic medals by 1.1%, while doubling a country's level of income per capita will raise the its share of Olympic medals by 1.0% .

Because these two effects are so similar in size, a reasonable approximation is that what is most important for winning a lot of medals is a country's *total* GDP, that is, the product of GDP per capita times total population.

Redistribution Effect of Population Growth

Table 4: The effect of population redistribution in reducing the average growth rate of income in the world is called the **composition effect**.

	<u>2000</u>			<u>2050</u>			Growth Rate of GDP per Capita 2000-2050
	Pop	GDP (b)	GDPPC	Pop	GDP (b)	GDPPC	
More Developed	1,191	22,711	19,060	1,181	60,616		2%
Less Developed	4,207	15,108	3,591	6,312	610,113	9,666	2%
Least Developed	658	669	1,017	1,830	5,009	2,737	2%
World	6,056	38,488	6,355	9,323	126,637	13,583	1.50%

- The fact that the fraction of the world's population living in countries which are *currently* rich will fall does not mean that the fraction of the world's population living in rich countries will fall.
- The reason is that more countries are *becoming* rich over time.
- Thus the overall balance between rich people and poor people in the world depends on which force is more powerful: the higher population growth rates of poor countries, or the growth in income that takes place in these poor countries.