JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Population Growth

Nan Astone, PhD
Johns Hopkins University

Objectives of the Lecture

- At the end of this lecture and after reading the texts that accompany it, students will be able to:
  - Explain the demographic balancing equation
    - Define natural increase and net migration
  - Define *population momentum*
    - Interpret a population pyramid

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Section A

The Demographic Balancing Equation

Demographic Balancing Equation

- $P_{t2} = P_{t1} + (B - D) + (I - O)$
  - Where …
    - P_{t2} = population at time 2
    - P_{t1} = population at time 1
    - B = births
    - D = deaths
    - I = in migrants
    - O = out migrants

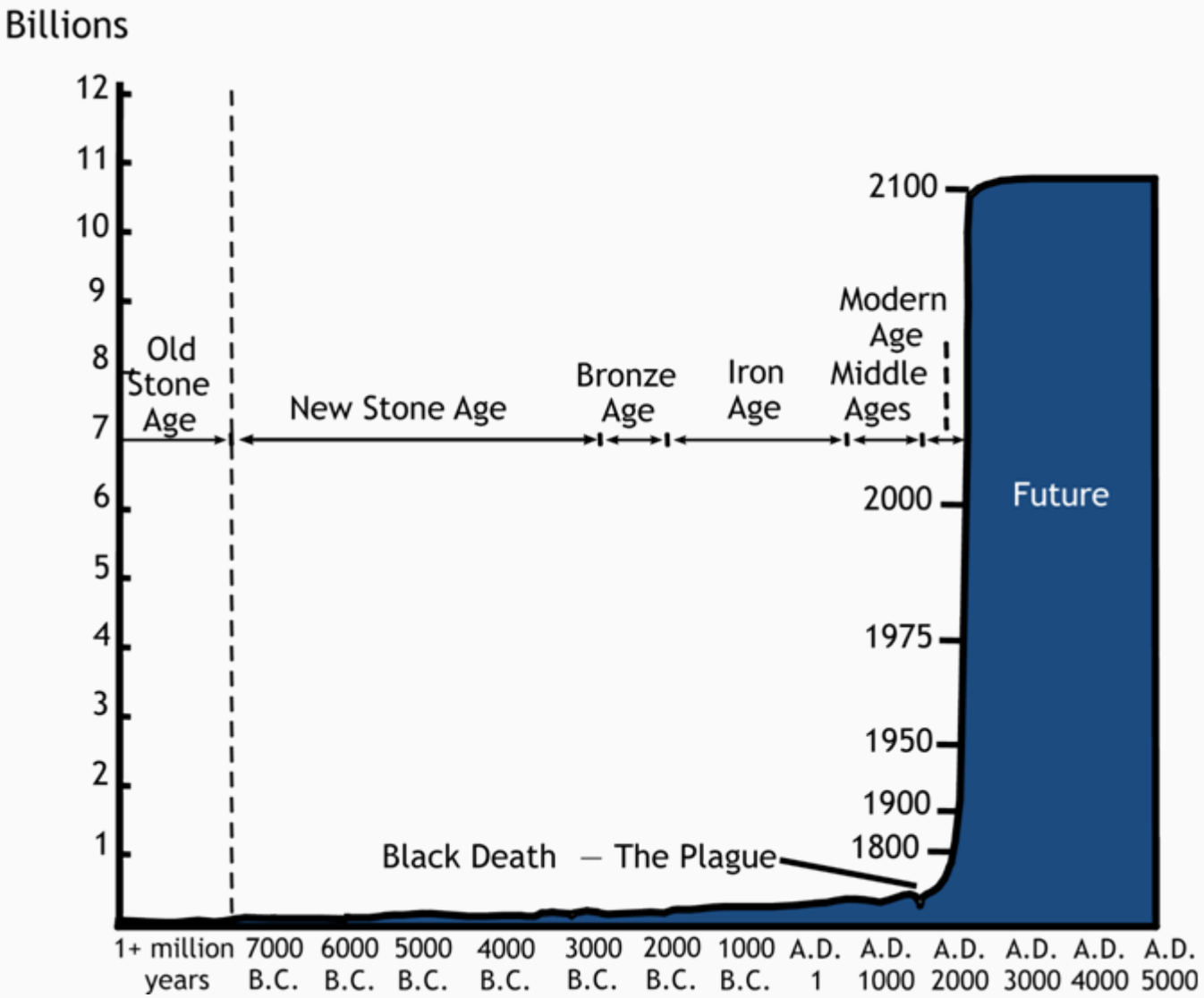
Demographic Balancing Equation

- $P_{t2} = P_{t1} + (B - D) + (I - O)$
  - (B – D) is referred to as **natural increase**

For Most of History, Natural Increase Was 0

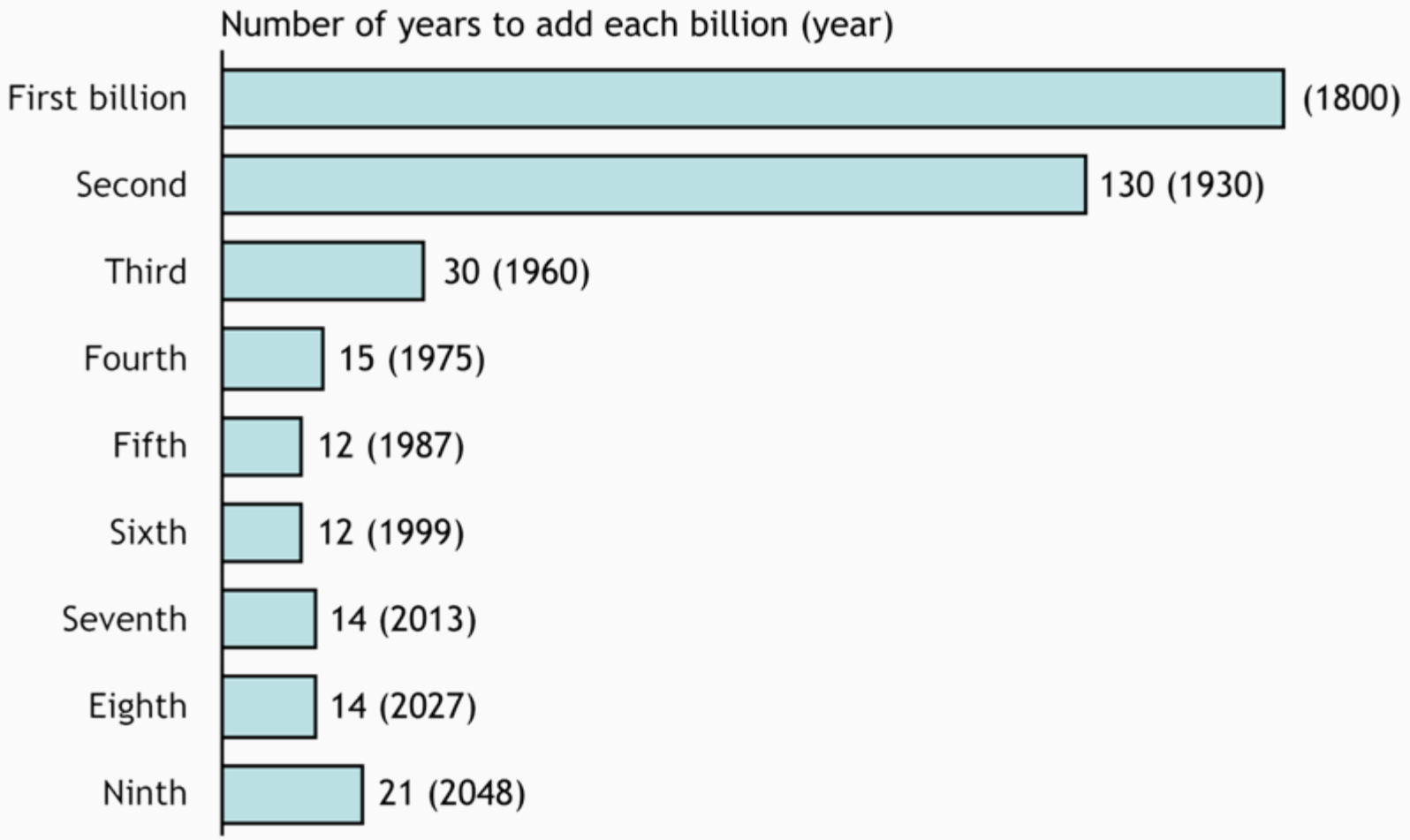
- Births = deaths until about 1000 CE
- Then, gradually as the ability to store food and trade increased, births began to exceed deaths
  - Famines and epidemics were periodic setbacks

World Population Growth through History



Sources: Population Reference Bureau; United Nations. (1998). *World population projections to 2100*.

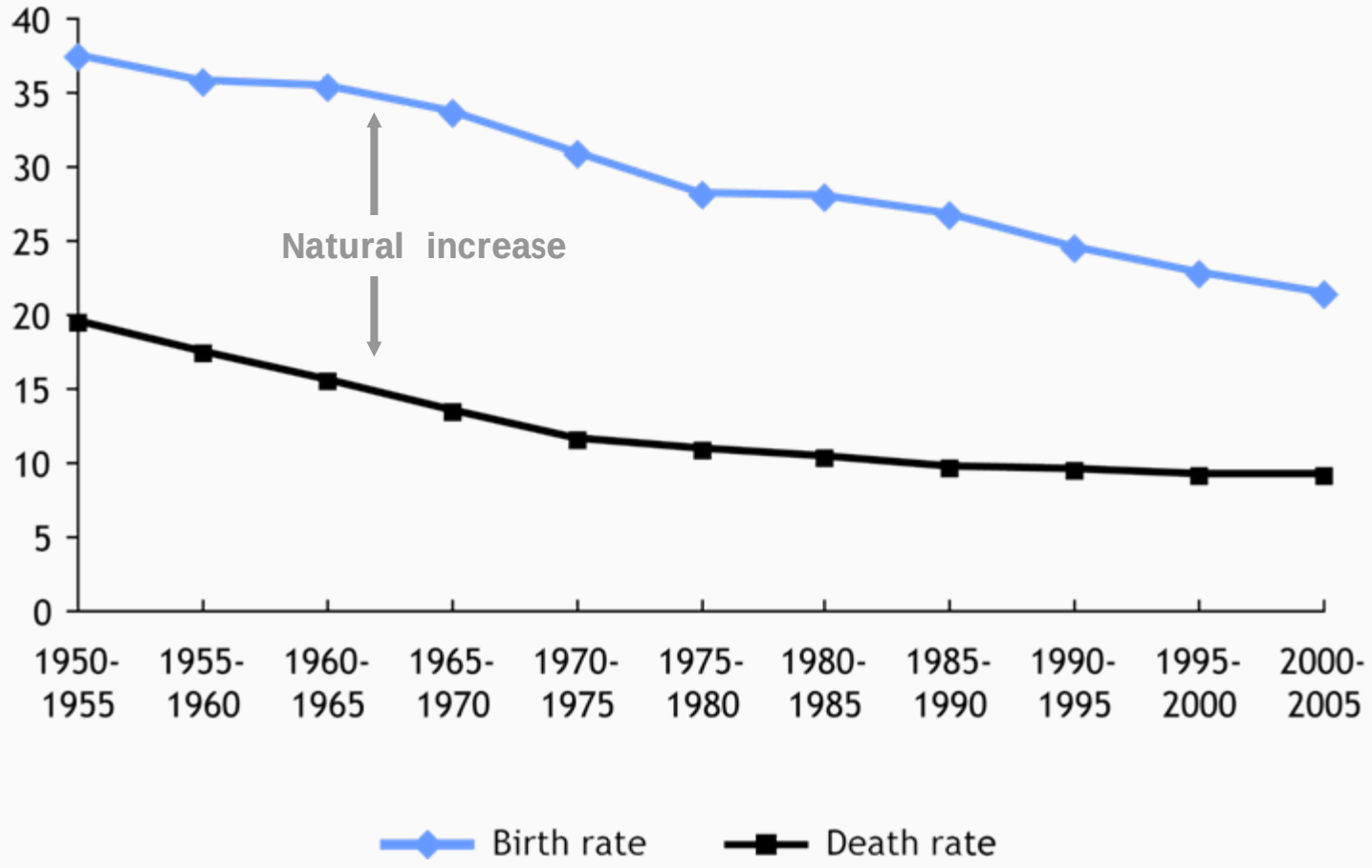
Number of Years to Add Each Billion



Sources: First and second billion: Population Reference Bureau; Third through ninth billion: United Nations. (2005). *World population prospects: the 2004 revision (medium scenario)*.

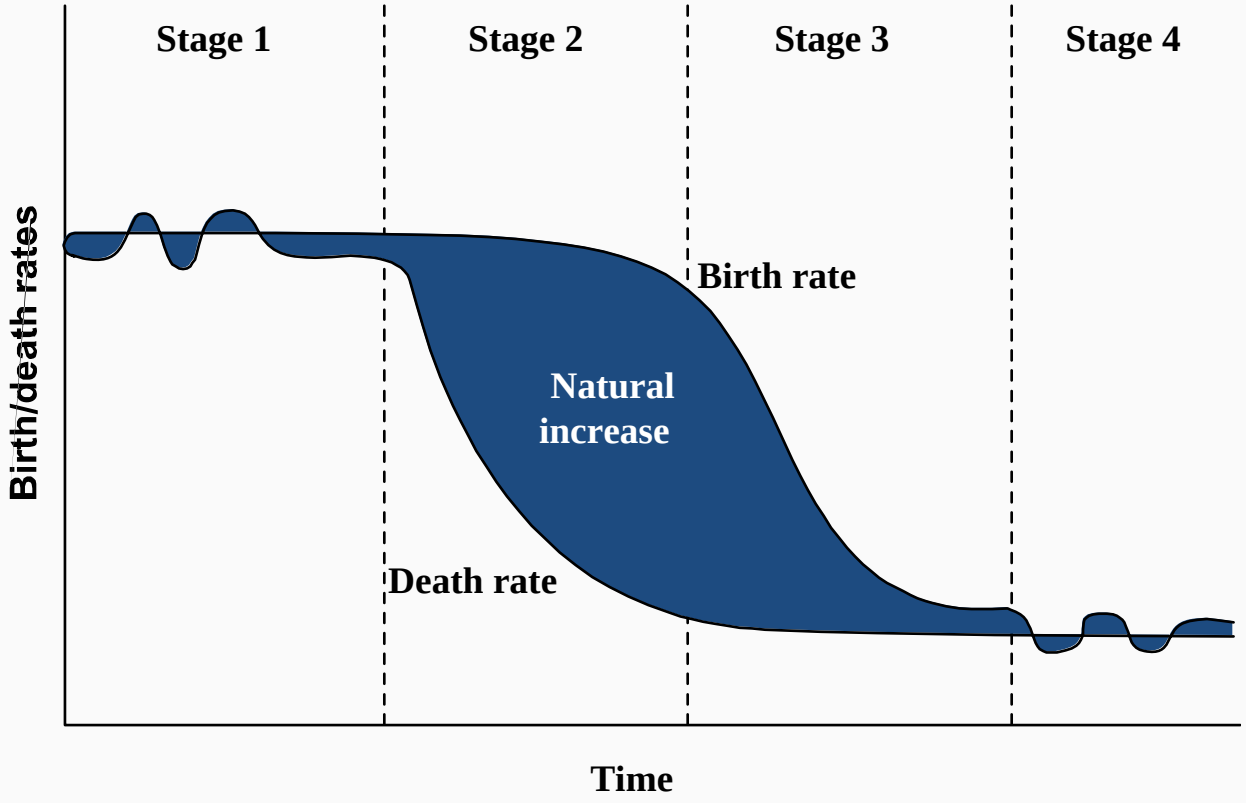
Rates of Birth, Death, and Natural Increase

- Rates of birth, death, and natural increase per 1,000 population



Source: United Nations. (2005). *World population prospects: the 2004 revision*.

The Classic Stages of "Demographic Transition"



Note: Natural increase is produced from the excess of births over deaths

Brief Digression

- *"The"* demographic transition—nonsense
- *Many* demographic transitions
  - Fertility decline
  - Mortality decline
  - Hurricane Katrina
  - The occupation of the Americas
  - The Great Influenza

Demographic Balancing Equation

- $P_{t2} = P_{t1} + (B - D) + \mathbf{(I - O)}$
  - (I – O) is referred to as **net migration**

Globally, Net Migration Is Always 0

- Globally, net migration is always 0
- At least, most of us think so
- “The truth is out there!”

In Sum

- For most of history, natural increase was 0
- Gradually, between 1000 CE and 1800 (or so), natural increase slowly increased as death rates went down and births began to gradually exceed deaths
- From 1800 onward, escalating sharply after 1950, births began to exceed deaths by a great deal, resulting in dramatic population growth
- And then, fertility began to decline

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Section B

Population Momentum

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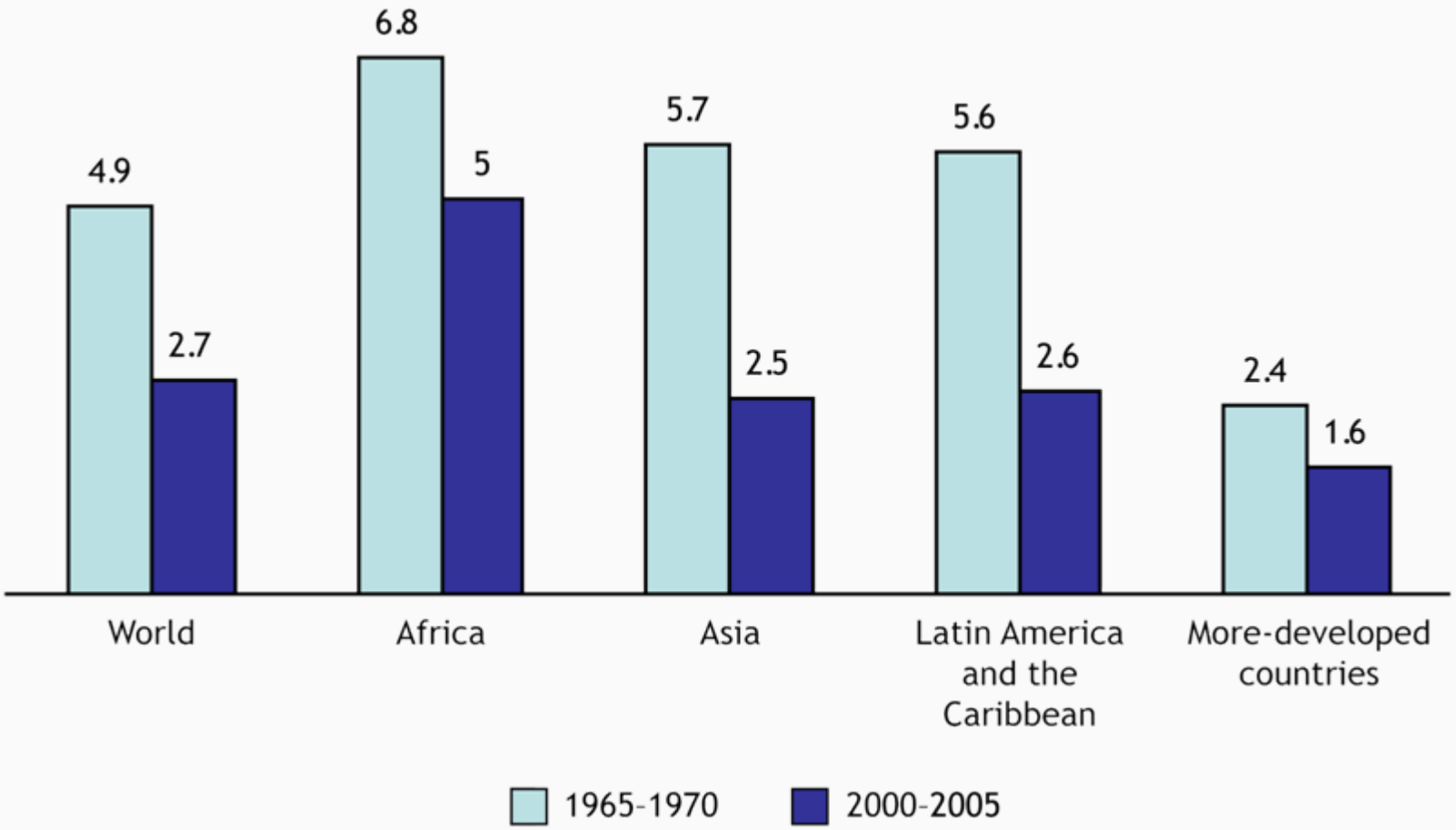
  - Define *population momentum*
    - Interpret a population pyramid

Average Number of Children per Woman

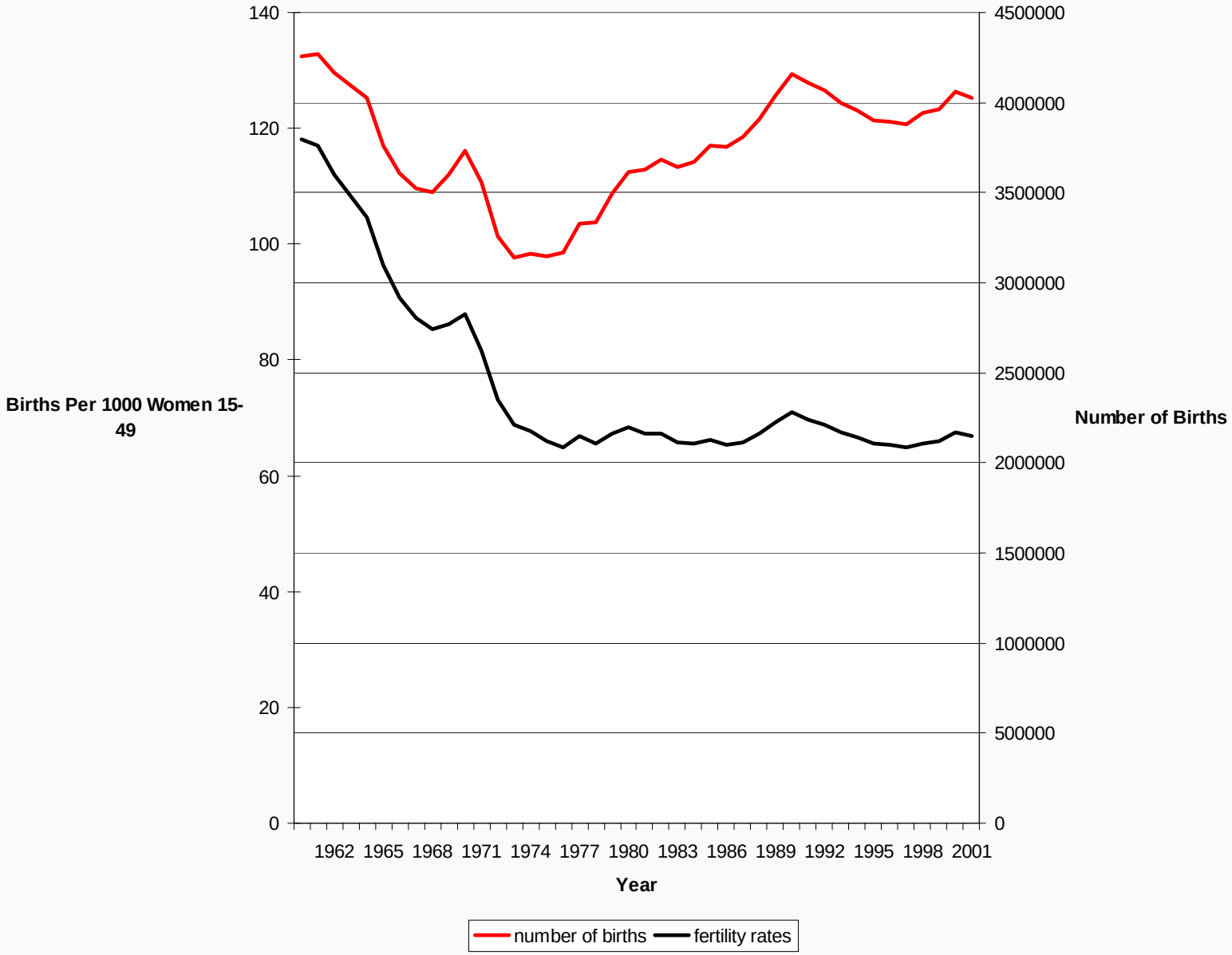


Source: United Nations. (2005). *World population prospects: The 2004 revision*.

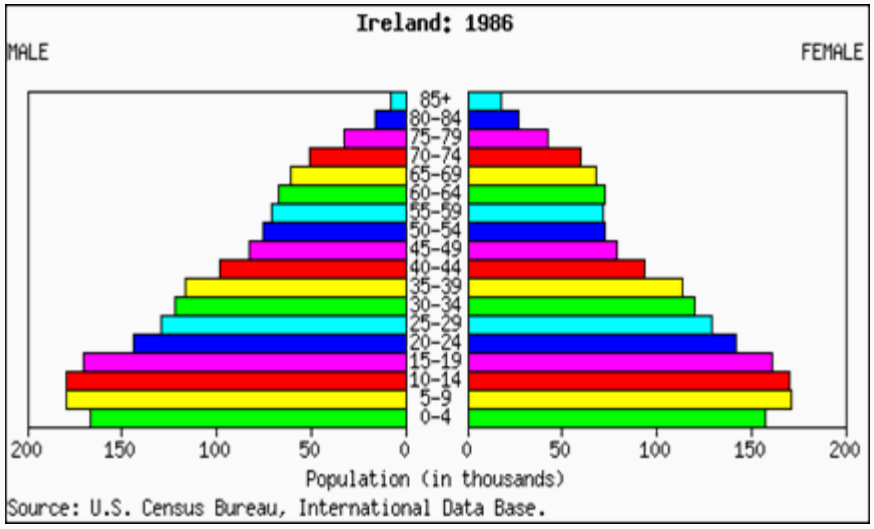
Once Fertility Reaches Replacement

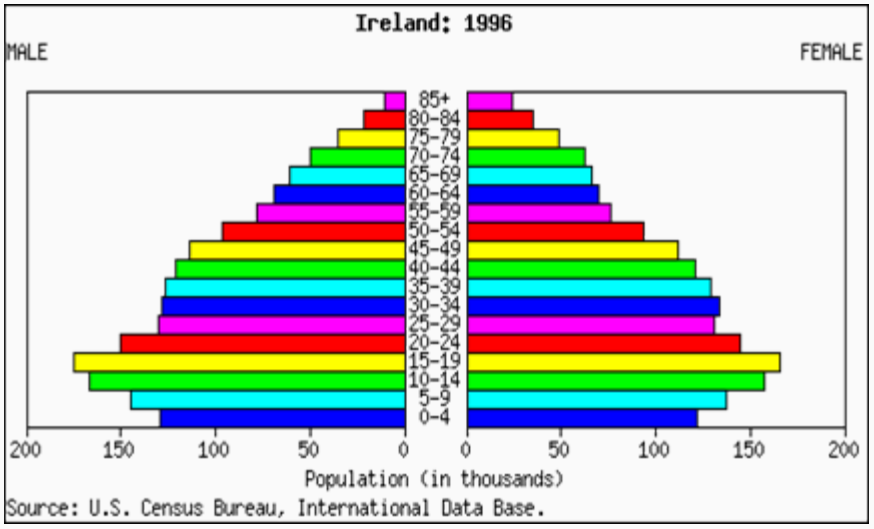
- So, will population be stable once fertility falls (or rises) to replacement?
- Population momentum
  - Population can continue to grow (or decline) even after natural increase has reached 0, because the number of women of childbearing age is very large (or small) because of past fertility rates

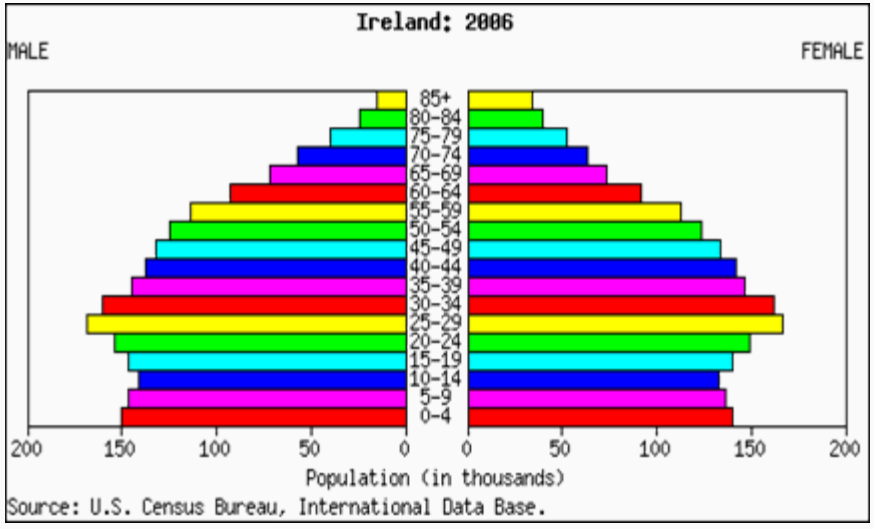
Number of Births and Fertility Rate for the U.S. 1960 to 2001

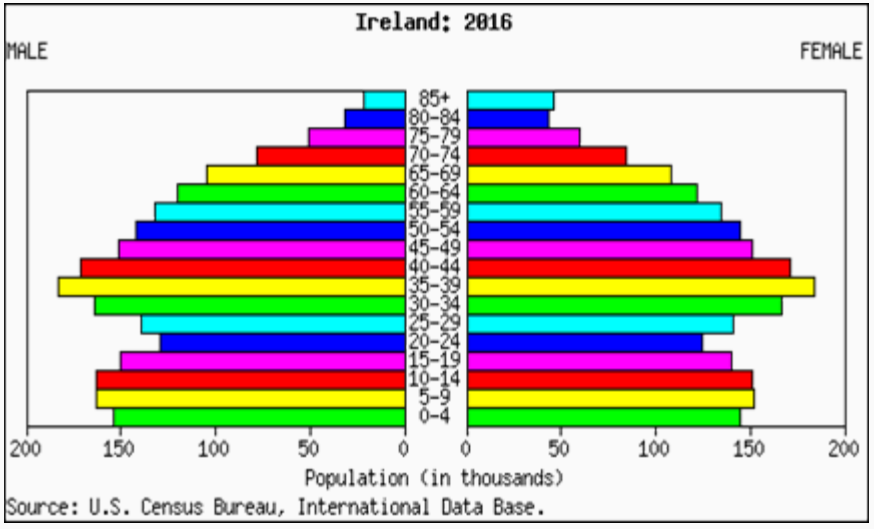


Population of Ireland, 1986 to 2016

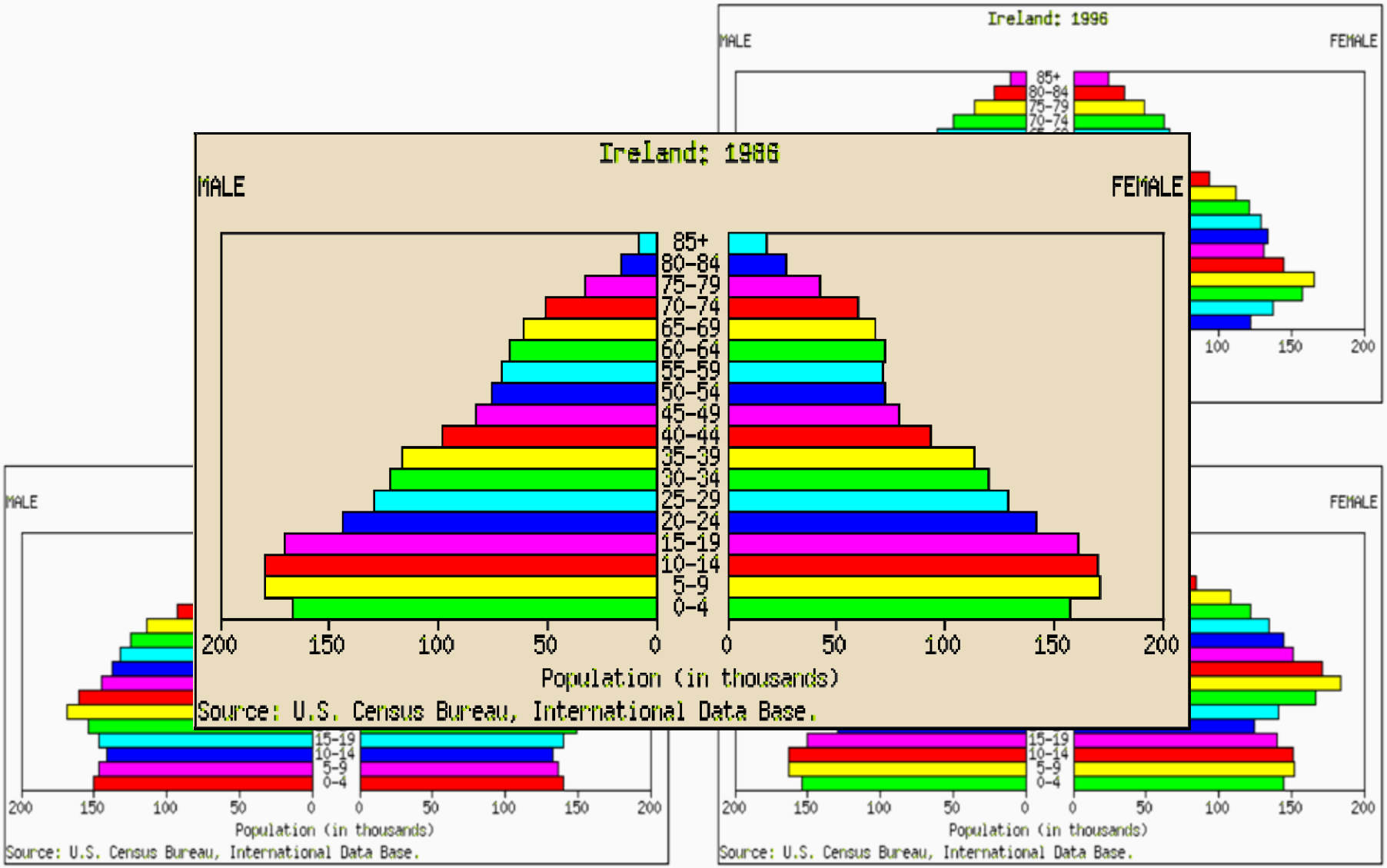




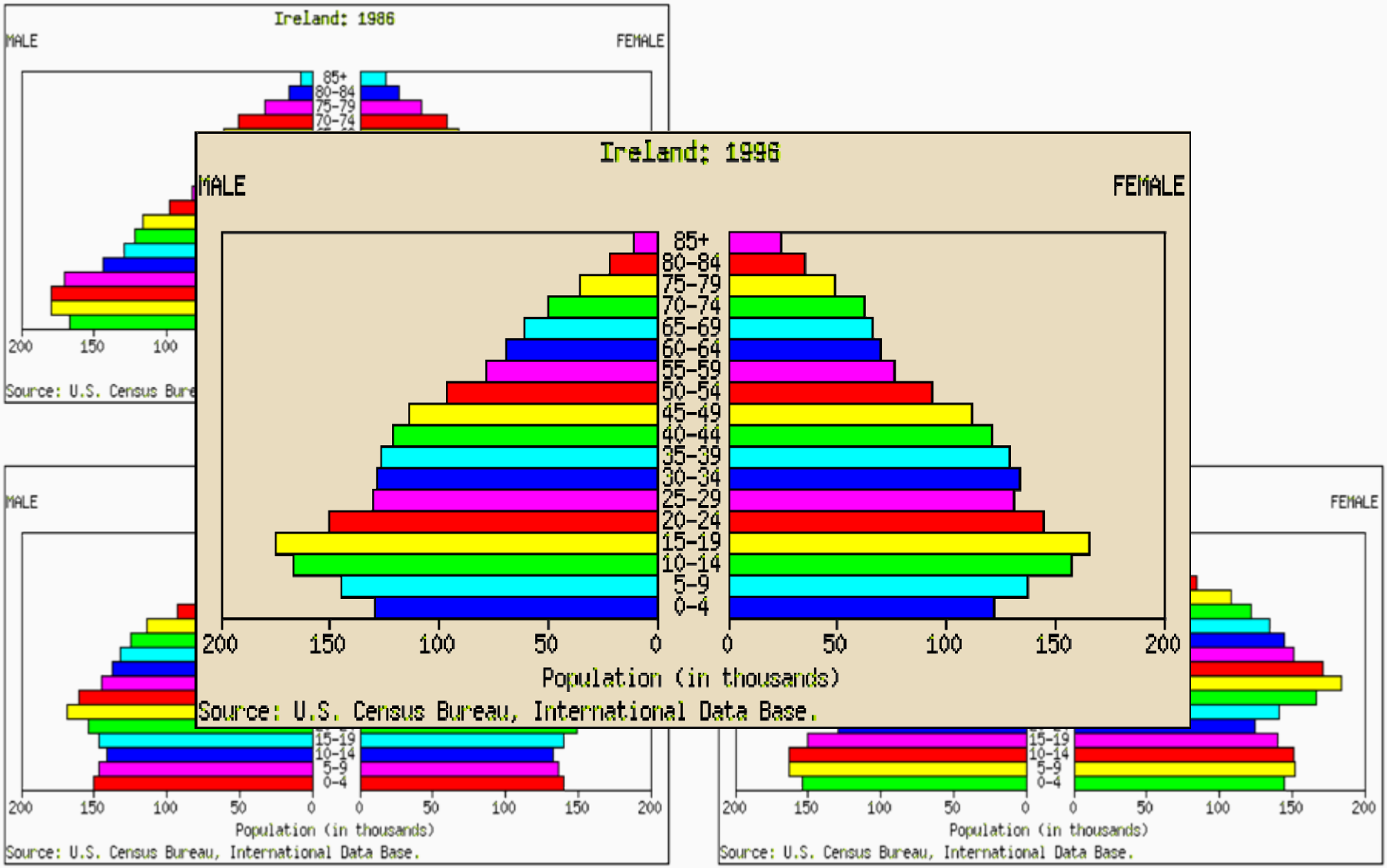




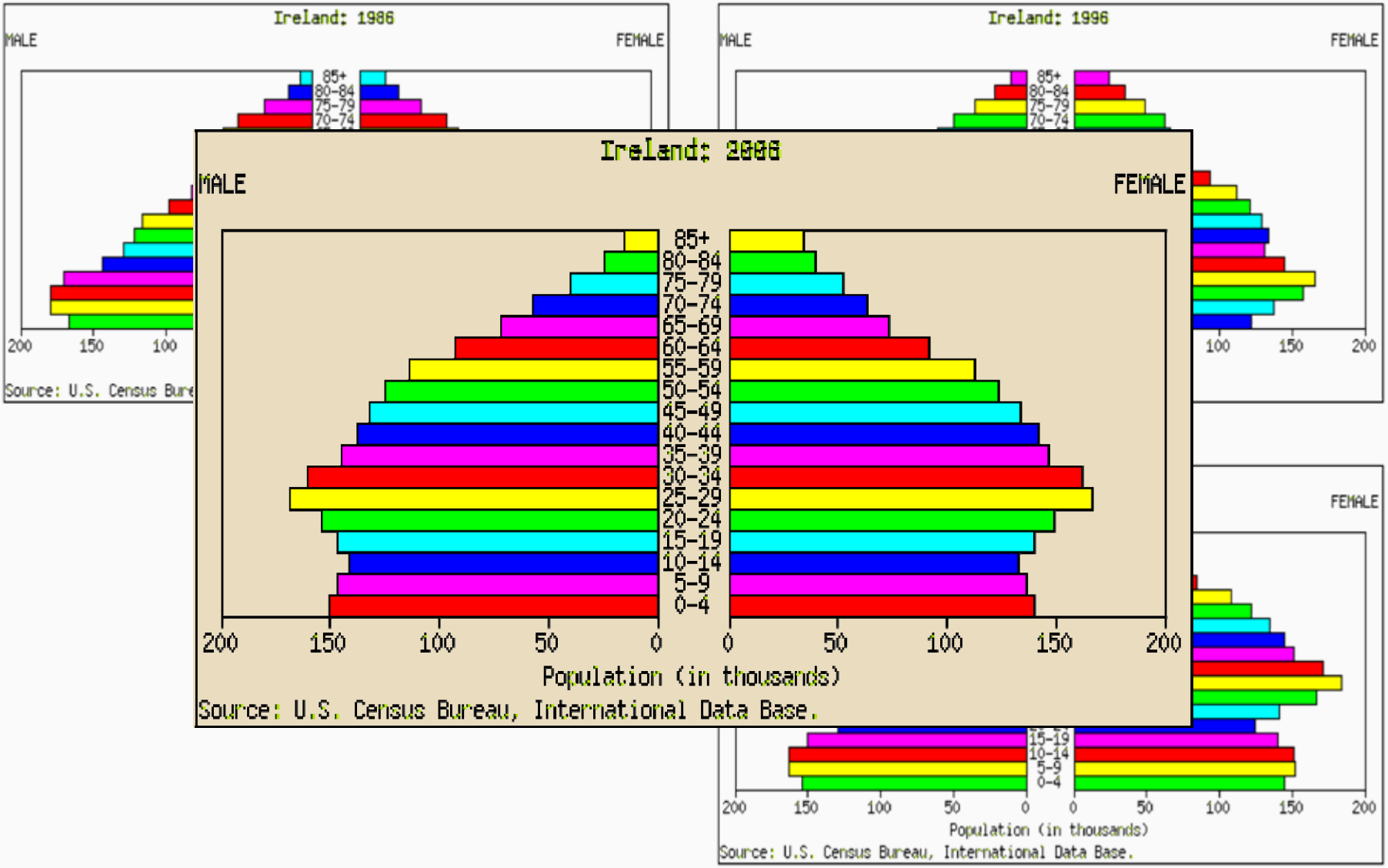
Population of Ireland, 1986



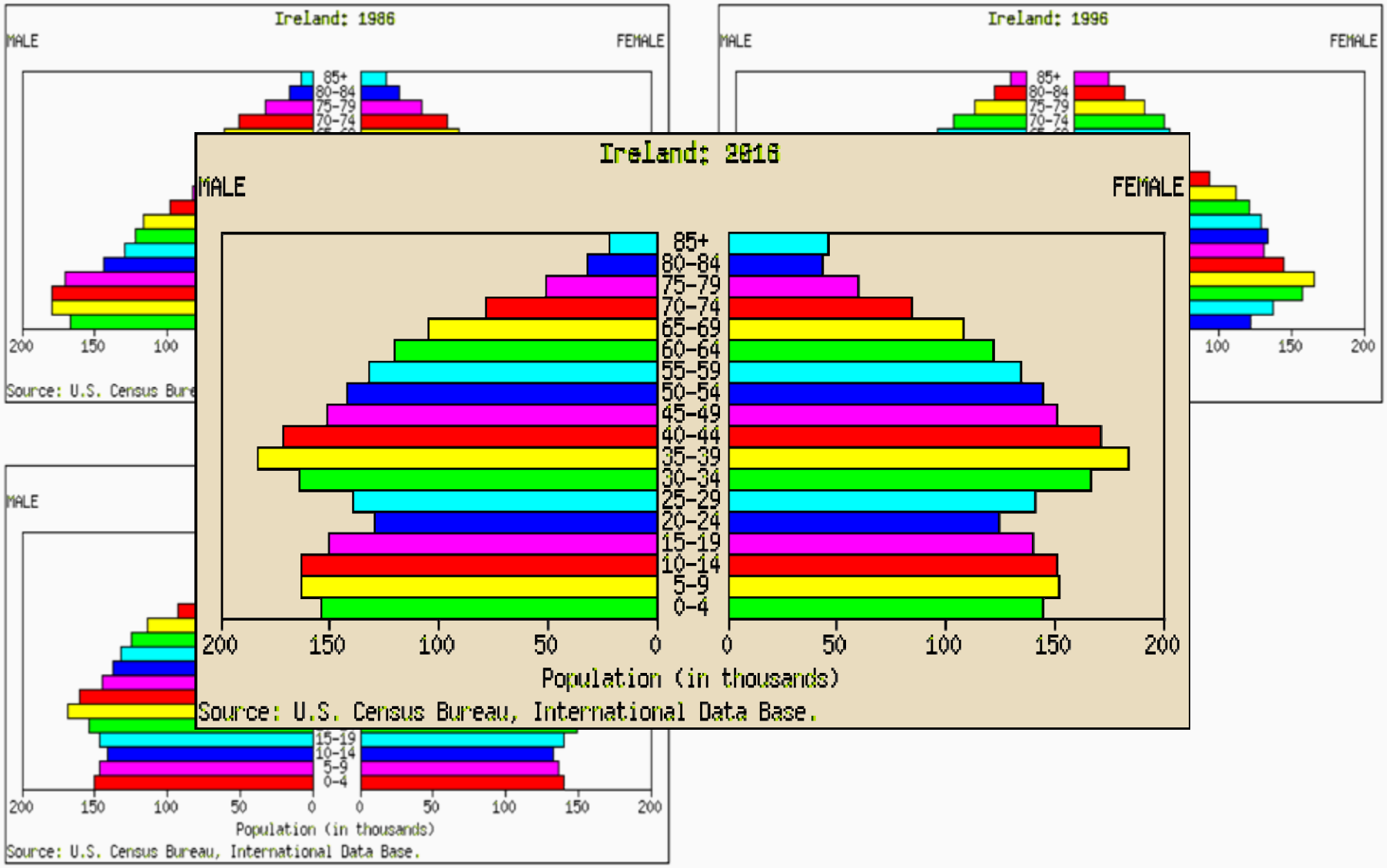
Population of Ireland, 1996



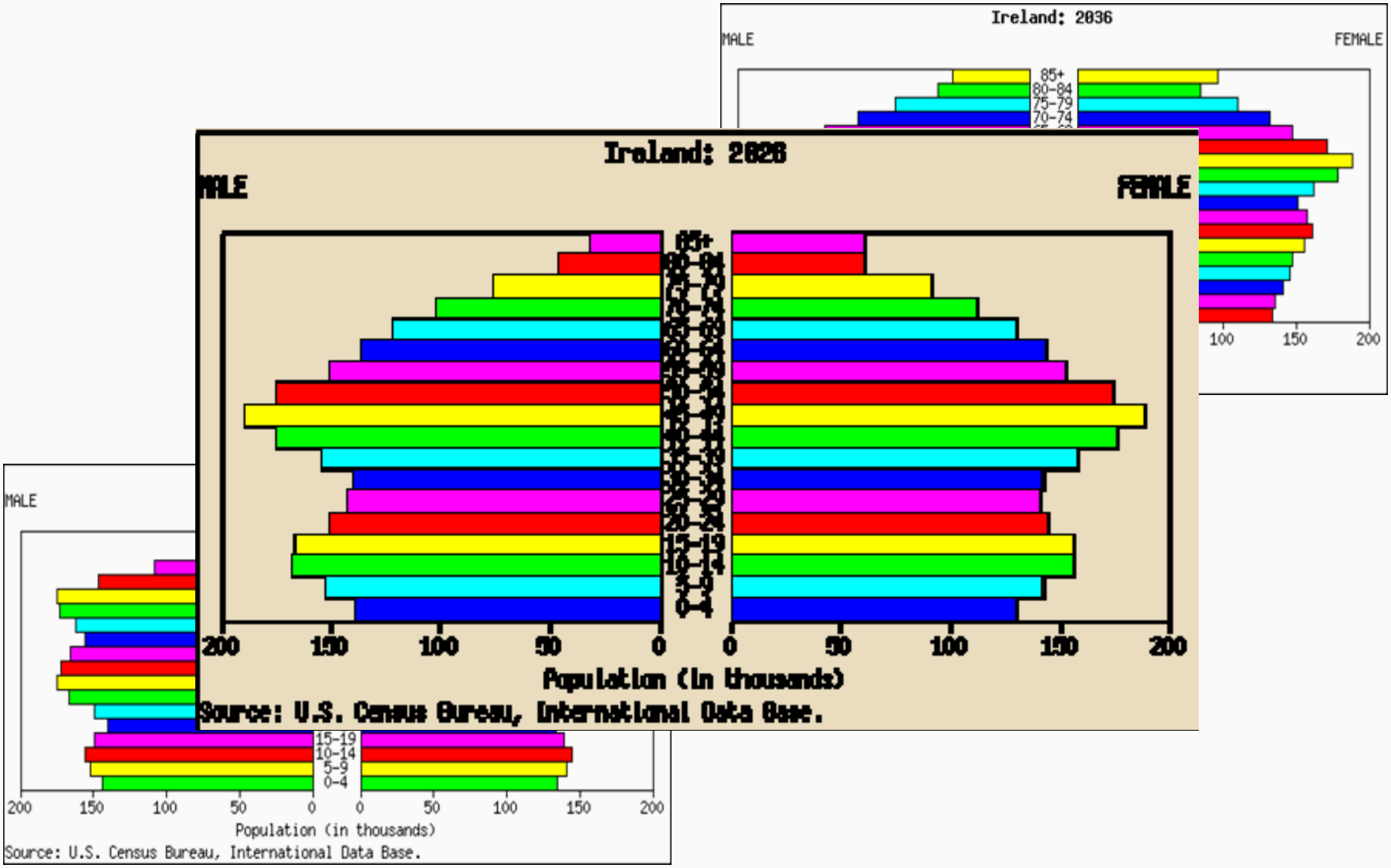
Population of Ireland, 2006



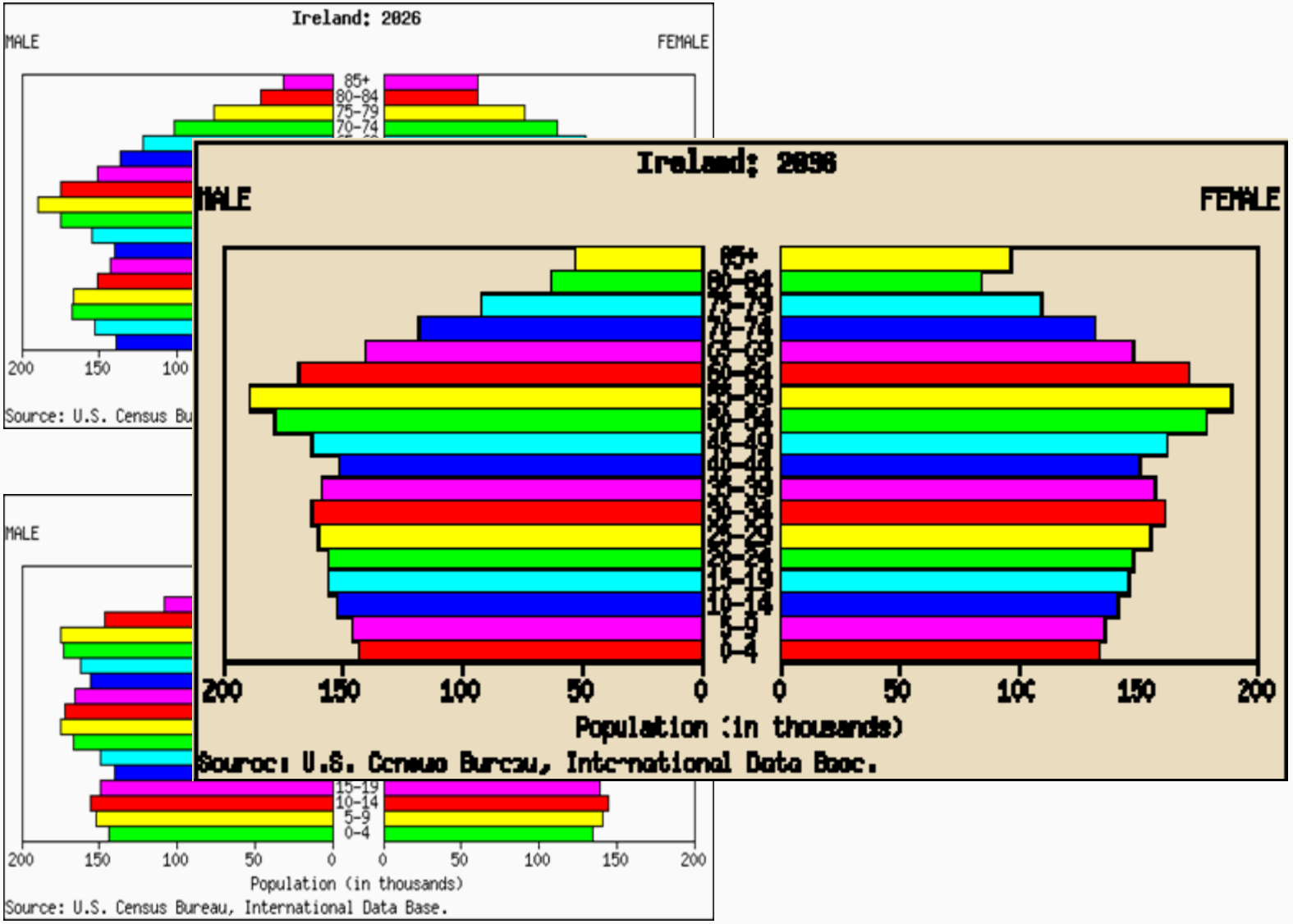
Population of Ireland, 2016



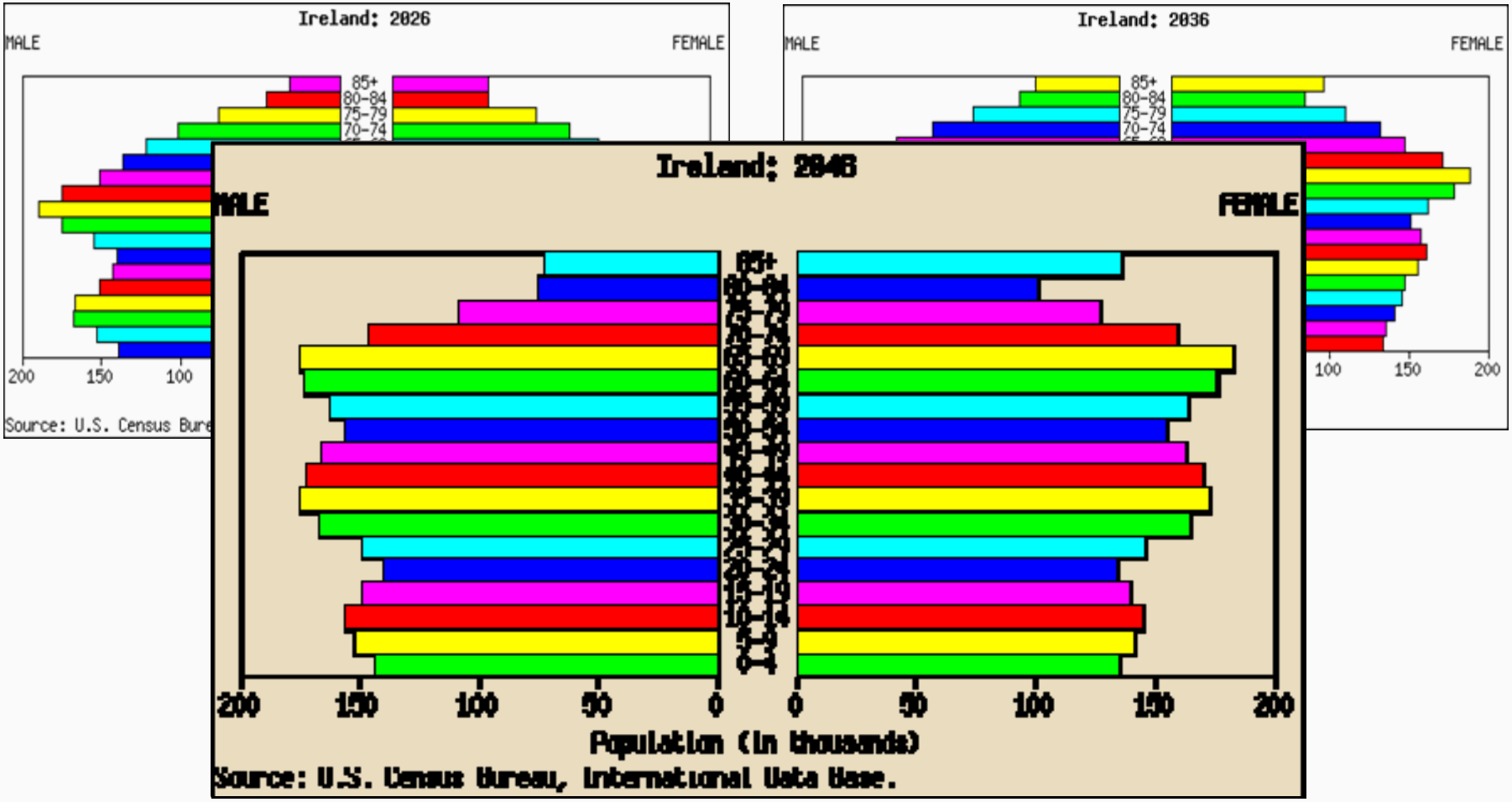
Population of Ireland, 2026



Population of Ireland, 2036



Population of Ireland, 2046



Why Is This Important?

- Just because fertility rates have fallen for any given population doesn't necessarily mean that the distribution of the population by age is going to remain the same