



# Global Demography Concepts & Population Pyramids

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# Objectives

1. Key Concepts on Demography and Population Dynamics
2. Describe the concept of demographic equation
3. Describe and understand the theory of demographic transition
4. Define, compute and interpret the rates of population increase and population doubling time
5. Describe major sources of population data
6. Describe features of population pyramid and compare the pyramids of developed and developing countries
7. Describe the effect of population momentum on growth of population
8. Explain the phenomenon of migration and its effect on population size
9. Apply demographic concepts in health system

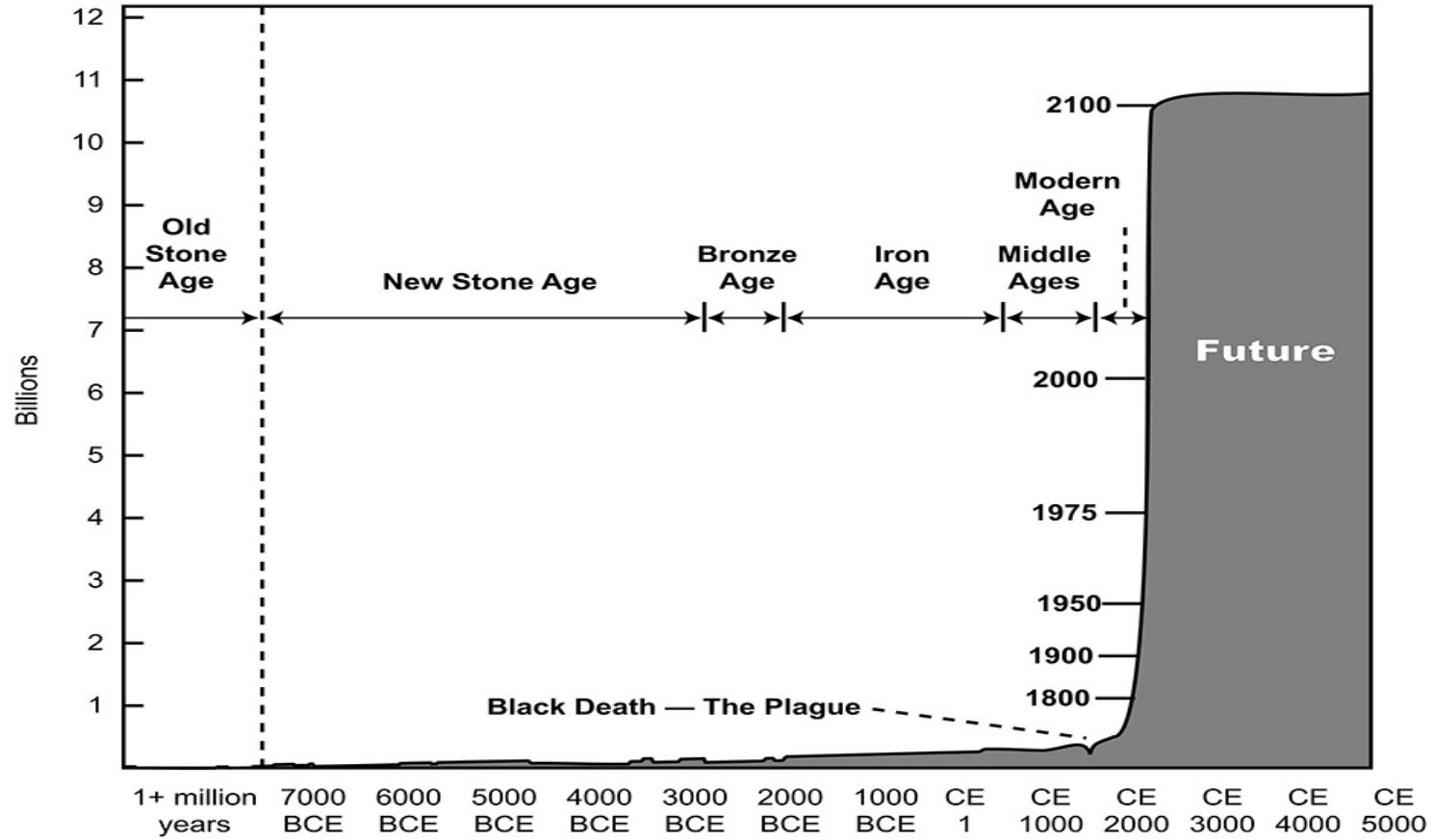
## What is demography?

“Demography is the study of the size, territorial distribution, and composition of population, changes therein, and the components of such changes, which may be identified as natality, mortality, territorial movement (migration), and social mobility (change of status).”

Hauser, P. M., and Duncan, O. D. (Eds.) (1959), *The Study of Population: An Inventory and Appraisal*, Chicago: University of Chicago Press.

**Figure 3-1**

**World Population Growth through History**



Source: Population Reference Bureau, © 2006. [http://www.prb.org/presentations/gb-poptrends\\_all.ppt](http://www.prb.org/presentations/gb-poptrends_all.ppt); and United Nations, *World Population Projections to 2100* (1998). Used with permission.

## Components of population growth

$$P_t = P_0 + (B - D) + (I - E)$$

$P_t$ =  
Population  
at time  $t$

$P_0$ =  
Population at  
current time

Natural increase  
(Births – Deaths)

Net migration  
(Immigration – Emigration)

## Components of population growth

- Population growth happens when:

1. Natural increase is positive:  $\text{Births} > \text{Deaths} \Rightarrow \text{Birth increases or Death declines}$

and/or

2. Net migration is positive:  $\text{Immigration} > \text{Emigration} \Rightarrow \text{Immigration increases or Emigration declines}$

## Law of 70

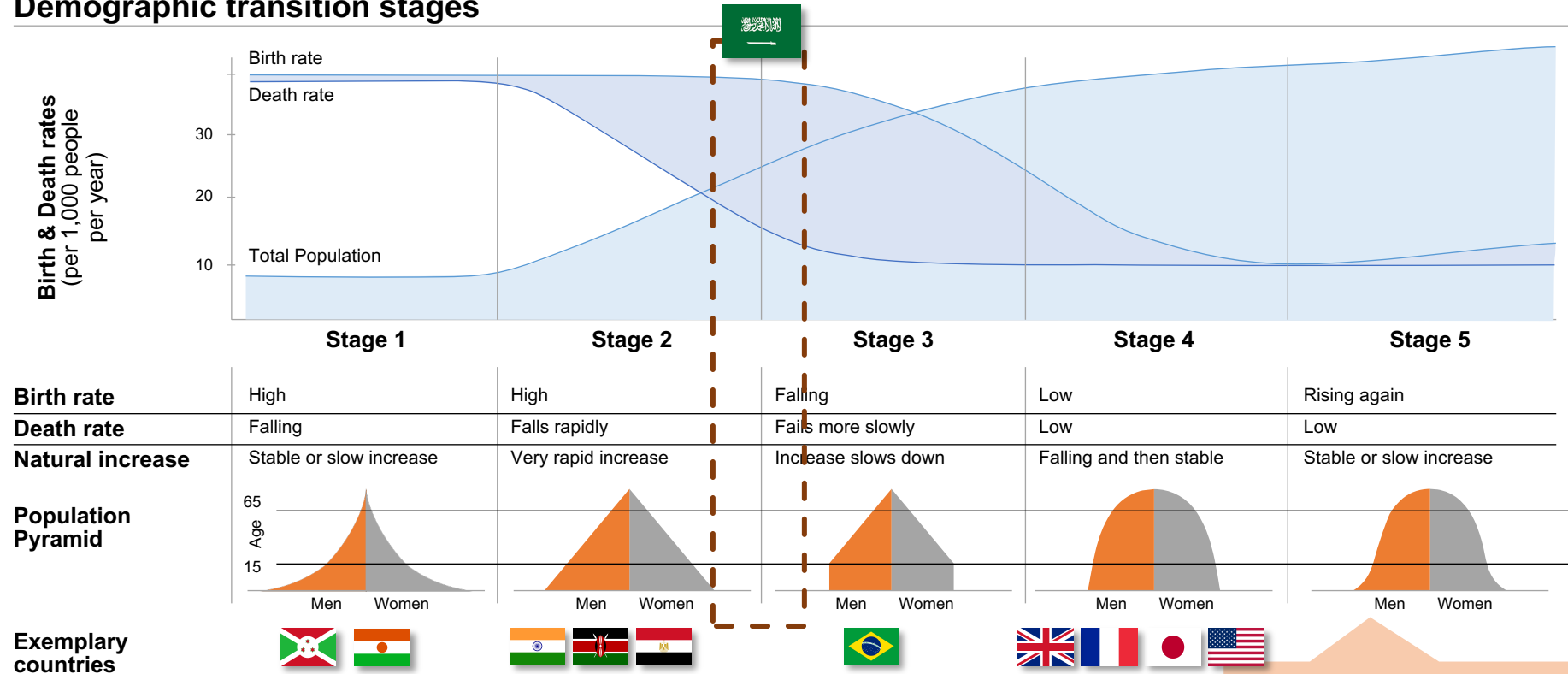
- If a population is growing at a constant rate of 1% per year, it can be expected to double approximately every 70 years
- if the rate of growth is 2%, then the expected doubling time is  $70/2$  or 35 years
- The unprecedented population growth of modern times heightens interest in the notion of doubling time. Calculation of population doubling time is facilitated by the Law of 70.

# Demographic Transition

## Definition of Demographic transition

Movement of death and birth rates in a society, from a situation where both are high (in the pre-transition stage) to one where both are low (in the post-transition stage). Transition is the interval between these two stages during which the population increases oftentimes rapidly, as births exceed deaths.

## Demographic transition stages



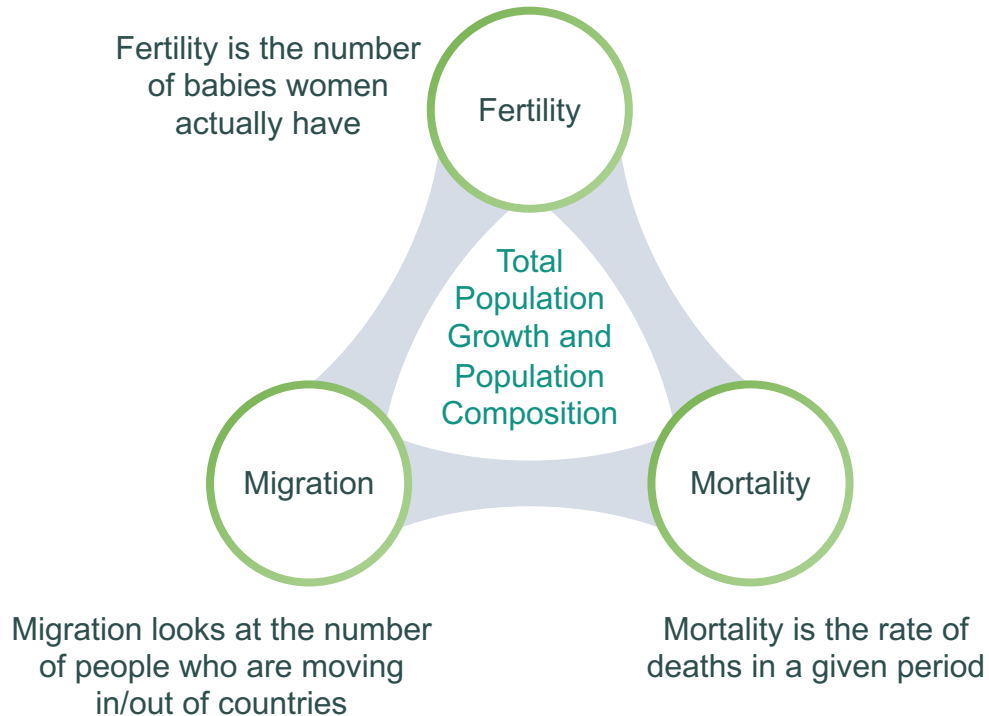
Source: Our World in Data; UNFPA

*Evidence suggests rising fertility at very high development levels - however no country fully reached level yet*



Population dynamics studies the size and age composition of populations and the biological and environmental processes driving them

**Three factors contribute to population dynamics:**



**Population Drivers**



**Key Questions**

1. What is the link between population growth and healthcare system utilization ?
2. Is population growth in the Saudi context a real problem and why?

# Fertility

Crude birth rate is the number of live births in a year per 1000 of the population.

$$\text{Birth rate} = \frac{\text{N of live births}}{\text{Mid - year population}} \times 1000$$

Example:

Number of live births in Country A = 85,000

Mid-year Population = 10,000,000

*Crude Birth Rate = (85,000/10,000,000) x 1000 = 8.5 live births per 1000 population*

# Fertility

The child-bearing capacity of the population represented by women between the ages of 15 and 49 years.

There are three indicators for fertility that are used world wide:

1. General fertility rate.
2. Age-specific fertility rate.
3. Total fertility rate

# Fertility

## 1. General fertility rate.

General fertility rate (GFR): number of live births per 1000 women between the ages of 15 and 49 years.

$$GFR = \frac{\text{N of live births}}{\text{Mid - year female population aged 15 - 49}} \times 1000$$

Example-country's GFR:

Number of live births in 2019= 90,254

Mid-year female population aged 15-49 = 2,374,912

$$GFR = \frac{90,254}{2,374,912} \times 1000 = 38.0$$

# Fertility

## 2. Age-specific fertility rate.

Age-specific fertility rate: number of births to women of a particular age (a year or age group). E.g. females in the age group 20-24 years.

$$\text{Age - specific FR} = \frac{\text{N of live births of mothers aged 20 - 24 years}}{\text{Mid - year female population aged 20 - 24 years}} \times 1000$$

# Fertility

## 3. Total fertility rate.

Total fertility rate (TFR): average number of children a woman would bear during her reproductive lifetime (15-49 years), assuming her childbearing conforms to her age-specific fertility rate every year of her childbearing years.

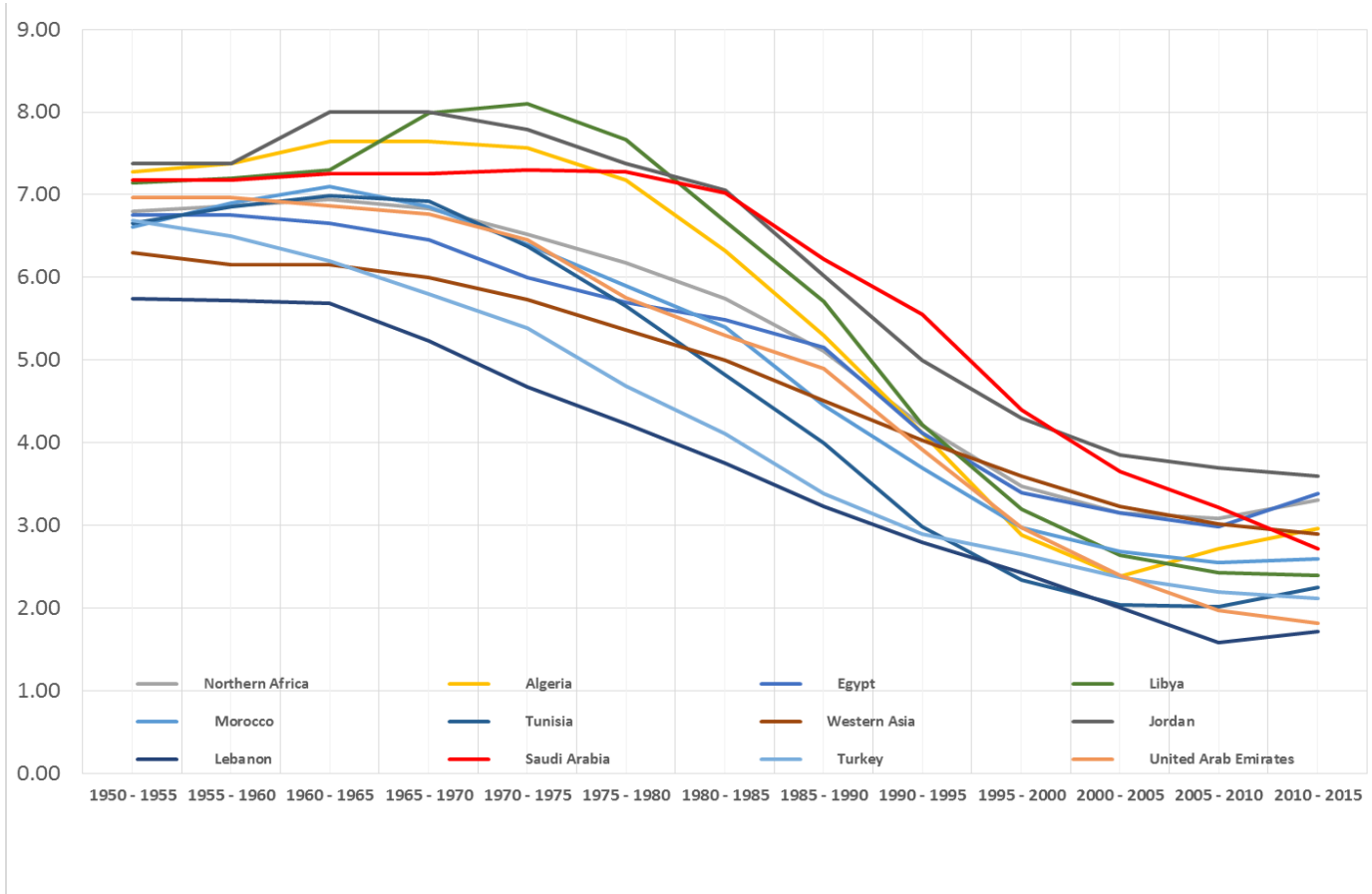
	Life year categories						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
N. of children	5 220	12 668	25 090	31 489	13 438	2 271	78
N. of women	287 568	314 375	335 856	401 619	388 074	346 058	301 362
Fertility rate	0,02	0,04	0,07	0,08	0,03	0,01	0,00
N. of children/women in five years	0,10	0,20	0,35	0,40	0,15	0,05	0,00

$$TFR = 0,10 + 0,20 + 0,35 + 0,40 + 0,15 + 0,05 + 0,00 = 1,25$$

***TFR greater than 2 means growing population  
TFR less than 2 means decreasing number of  
the population***

Fertility

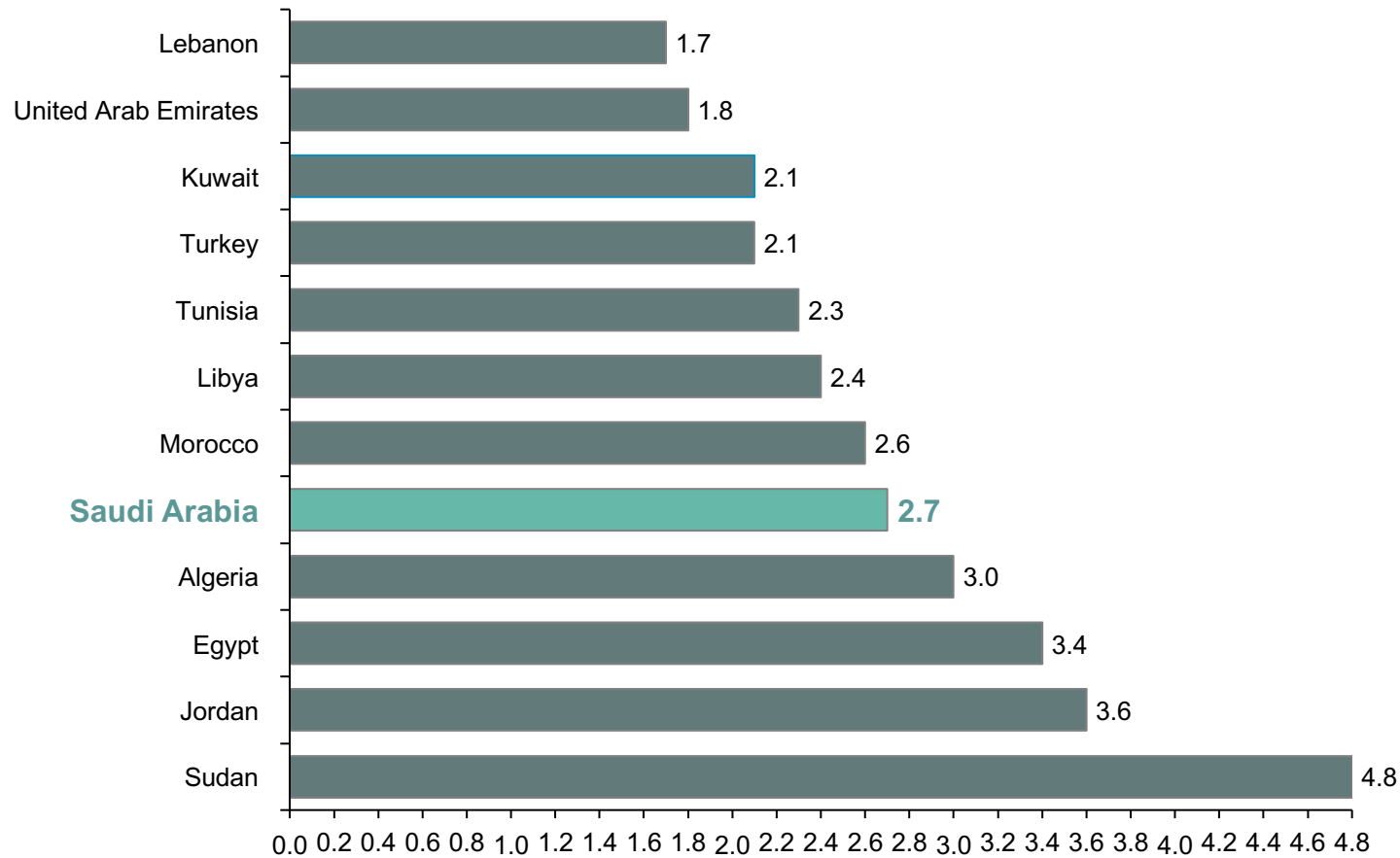
# Total fertility rate, 1950-2015



- Fertility replacement rate for total population is about 2.1; thus current fertility rate is slightly above replacement
- Replacement fertility rate results in zero population growth in the long run; in short term, demographic inertia may result in continued growth
- If fertility is kept constant at levels by 2050 there will be an increase in population size of more than 6 million



# Total Fertility rate by country, 2010-15



- Very few countries have registered such a steep decline of fertility in such a short time, and the trend is likely to continue
- Fertility projected to decrease to the point of replacement level (2.1 children per women) by 2030, in only 12 years
- Fertility higher among Saudis than among non-Saudis. Since the non-Saudis may not stay in the country in the long run, the demographic dividend in the KSA is less advanced than shown previously



# Mortality

Mortality is a relationship of death cases to the whole population. Two basic types of mortality:

1. General (crude) mortality rate or death rate
2. Specific mortality rates:
  - Age and sex related (special rates: infant mortality and fetal losses)
  - Cause related (diseases, injuries, suicide, homicide)
  - Life expectancy (sex and age related)

# Mortality

Crude death rate (or mortality rate) is the number of death cases in a year per 1000 of the population.

$$\text{Crude Mortality Rate (CMR)} = \frac{\text{N of death cases}}{\text{Mid - year population}} \times 1000$$

Calculation of Example-country's CMR: number of death cases = 135,000 and the mid-year population = 10,000,000.

$$CMR = \frac{135,000}{10,000,000} = 0.0135 \times 1000 = 13.5$$

# Mortality

***Age and sex related mortality rate:*** CMRs can be computed for both genders and age groups. The age group under 1 year is separately treated (the infant mortality).

General population between 40-49 years:

$$CMR_{40-49 \text{ years}} = \frac{\text{N of death cases of the cohort}}{\text{Midyear population of the cohort}} \times 1000$$

# Mortality

**Infant mortality rate:** is the number of deaths of infants under one year (365 days) old in a given year per 1,000 live births occurred in the same year.

$$\text{Infant Mortality Rate} = \frac{\text{N of infants died in the first 365 days}}{\text{N of infants born in a given year}} \times 1000$$

# Mortality

- ***Maternal mortality*** :
- special case of sex-related mortality.
- Represents death cases of women who die during pregnancy and childbirth inclusive of the first 42 days after the delivery (WHO definition).
- The number per year is relatively small (developed countries), thus maternal mortality rate is computed per 100,000 live births.
- ~ 11/100,000 in the developed countries.

$$\text{Maternal mortality rate} = \frac{\text{N of maternal deaths}}{\text{N of infants born in a given year}} \times 100,000$$

# Mortality

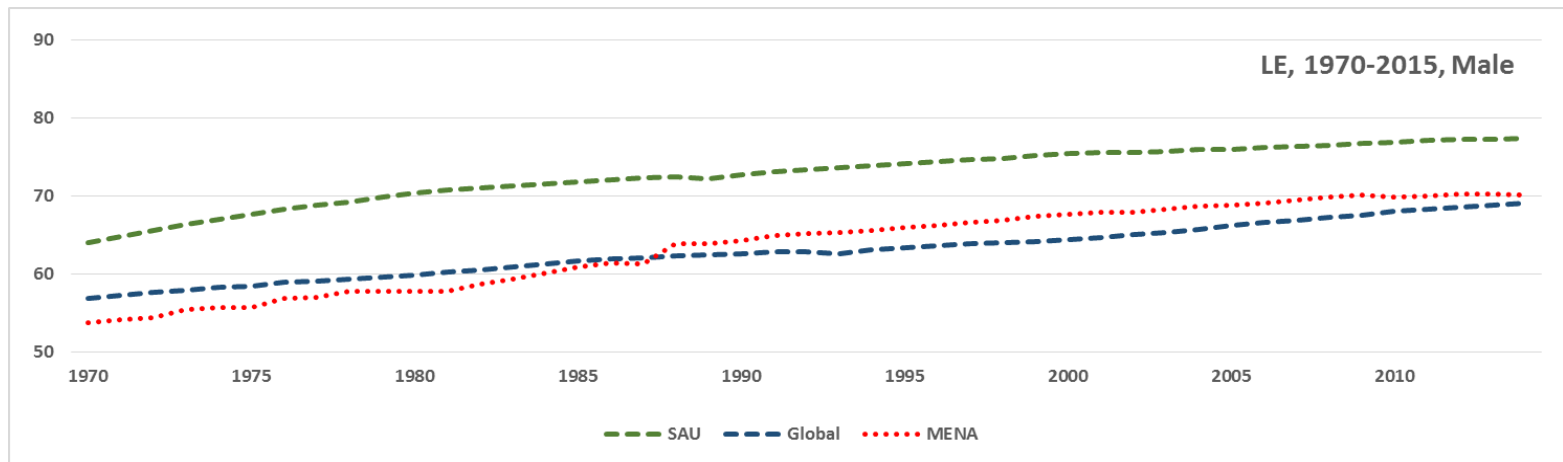
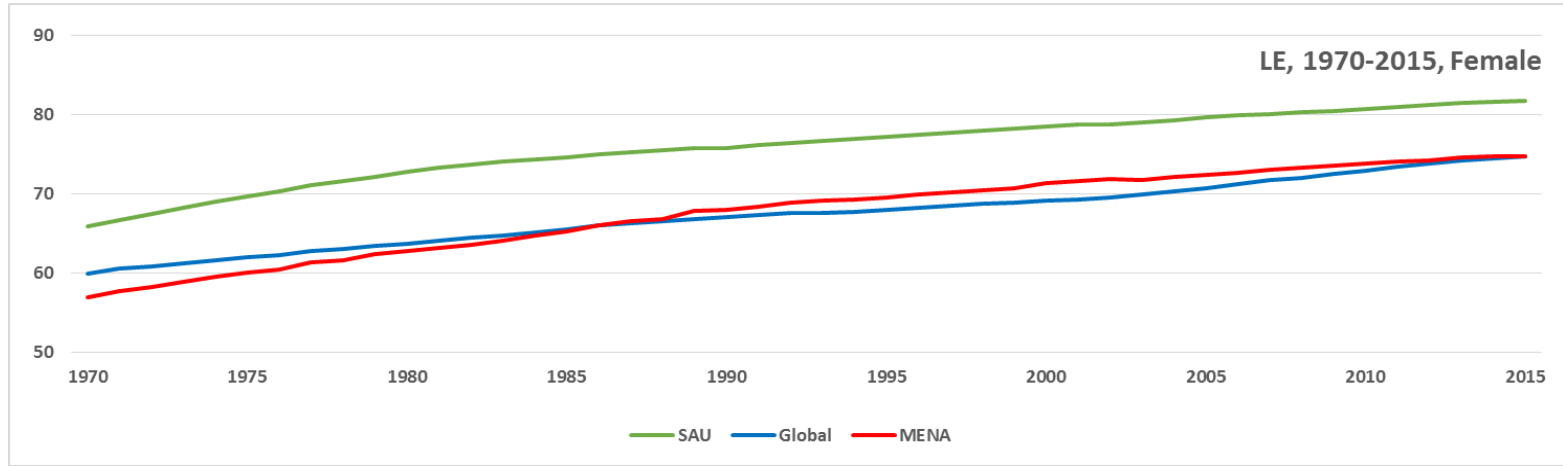
- Life expectancy:  
the average number of years an individual of a given age is expected to live if current age-specific mortality rates continue to apply. Every cohort had different experiences in its earlier life that might have influenced its mortality rate in a given year.
- Life expectancy at birth:  
Average number of years a newborn is expected to live if current mortality structure persists throughout its life.

## Example: Life Expectancy in Saudi Arabia

Index	Male		Female	
	1990	2015	1990	2015
Life expectancy at birth (years)	72.3	77.4	75.9	81.3
Maternal mortality ratio (per 100,000 live births)	-	-	21.4	14.2
Infant mortality rate (per 100,000 live births)	39.3	9.9	35.4	8.8

# Life expectancy at birth

Saudi Arabia vs. the world and MENA region, 1975-2015





# Sources of demographic data

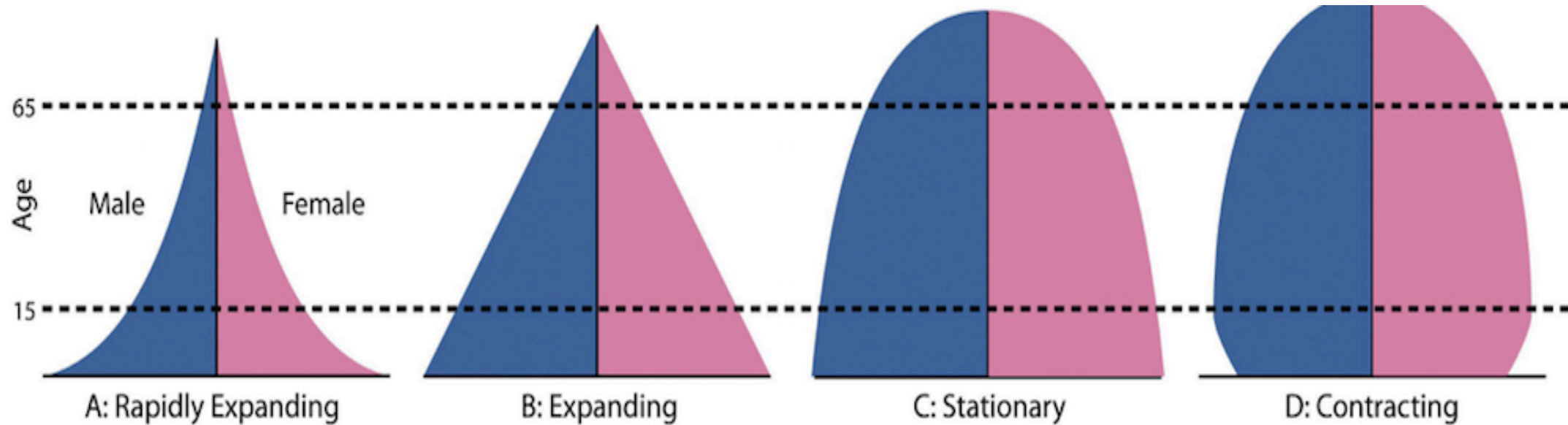
- Population Census (Usually executed every 10 years)
- Household surveys (Demographic Health Survey; Every 5 years)
- Calculations and Projections
- Registration of births and deaths (civil registration)
- Location of residence registry (National Address Registry)
- Causes of death – death certificate (ICD)
- Marriage and Divorce Registries
- Contraception practices and prevalence

# Sources of demographic data

Presented as

- sex distribution (females and males) and sex ratio
- population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- female population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- male population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- age structure of population by life-years or five-year age-groups
- age structure of female population by life-years or five-year age-groups
- age structure of male population by life-years or five-year age-groups
- age composition, dependency ratio, ageing index
- Distribution by nationality, socioeconomic status, education level etc..

# Population Pyramids

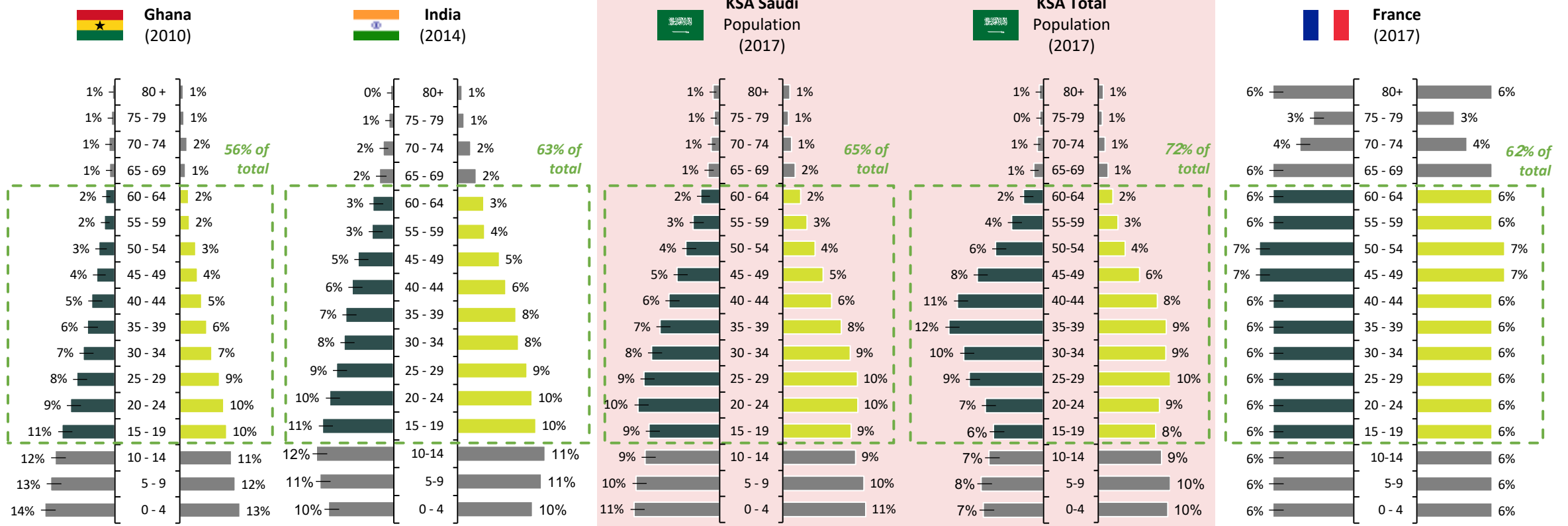


# Population Pyramids

## Demographic structure in selected countries (By gender and age group)

Source: General Authority of Statistics

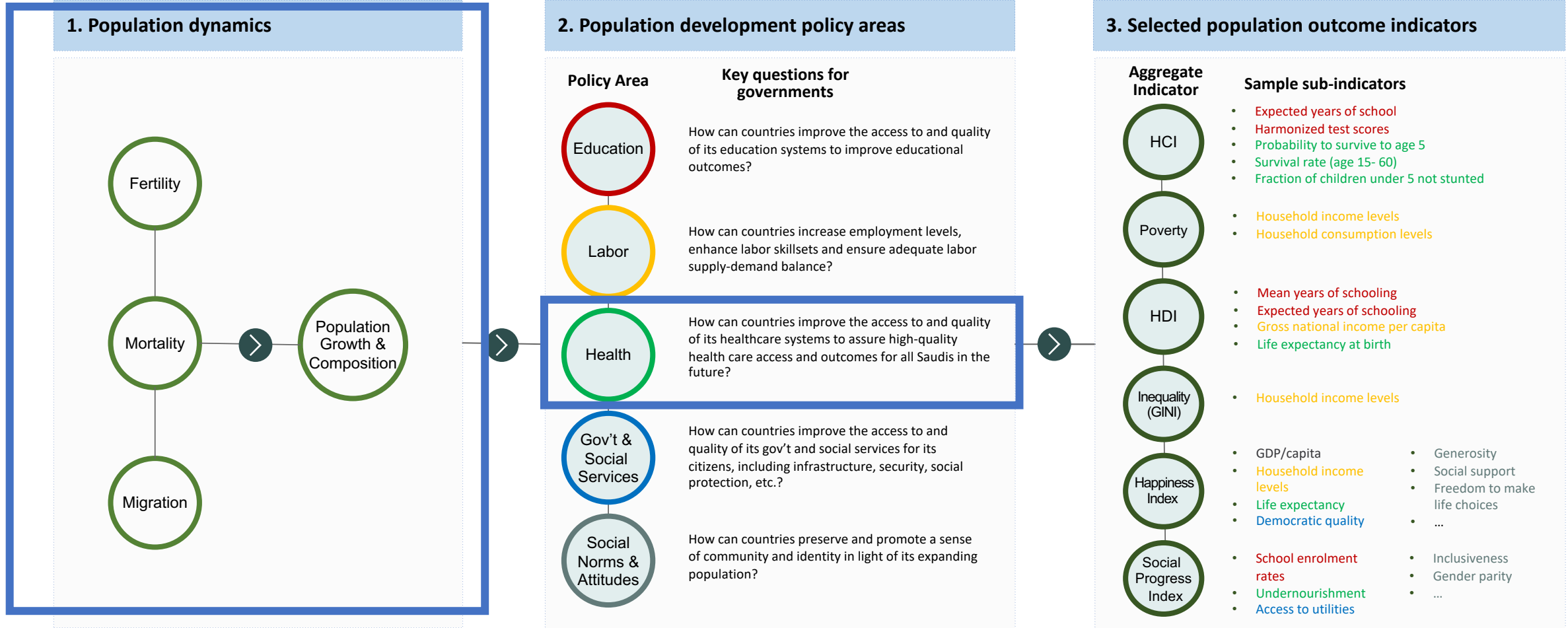
■ Males ■ Females



Demographic Transition →

# Population studies consider three key elements: population dynamics, policy areas and outcome indicators

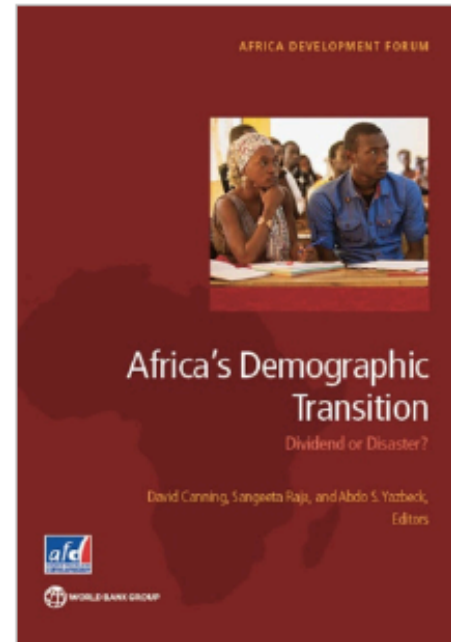
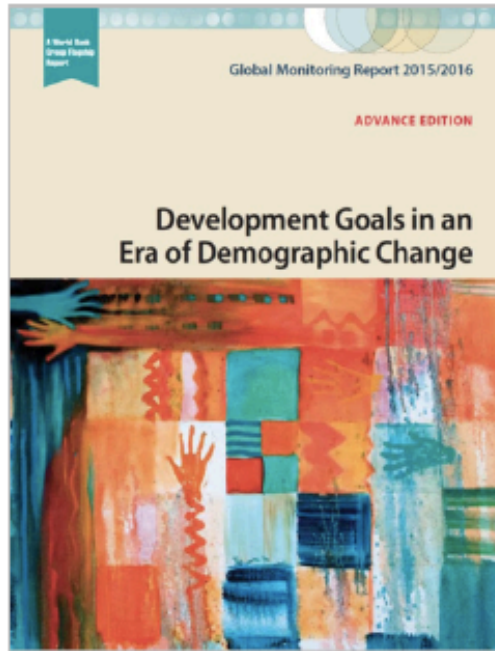
## Framework for analyzing population dynamics



# Appendix

# Population Is Central to Development

From global and regional knowledge to country action



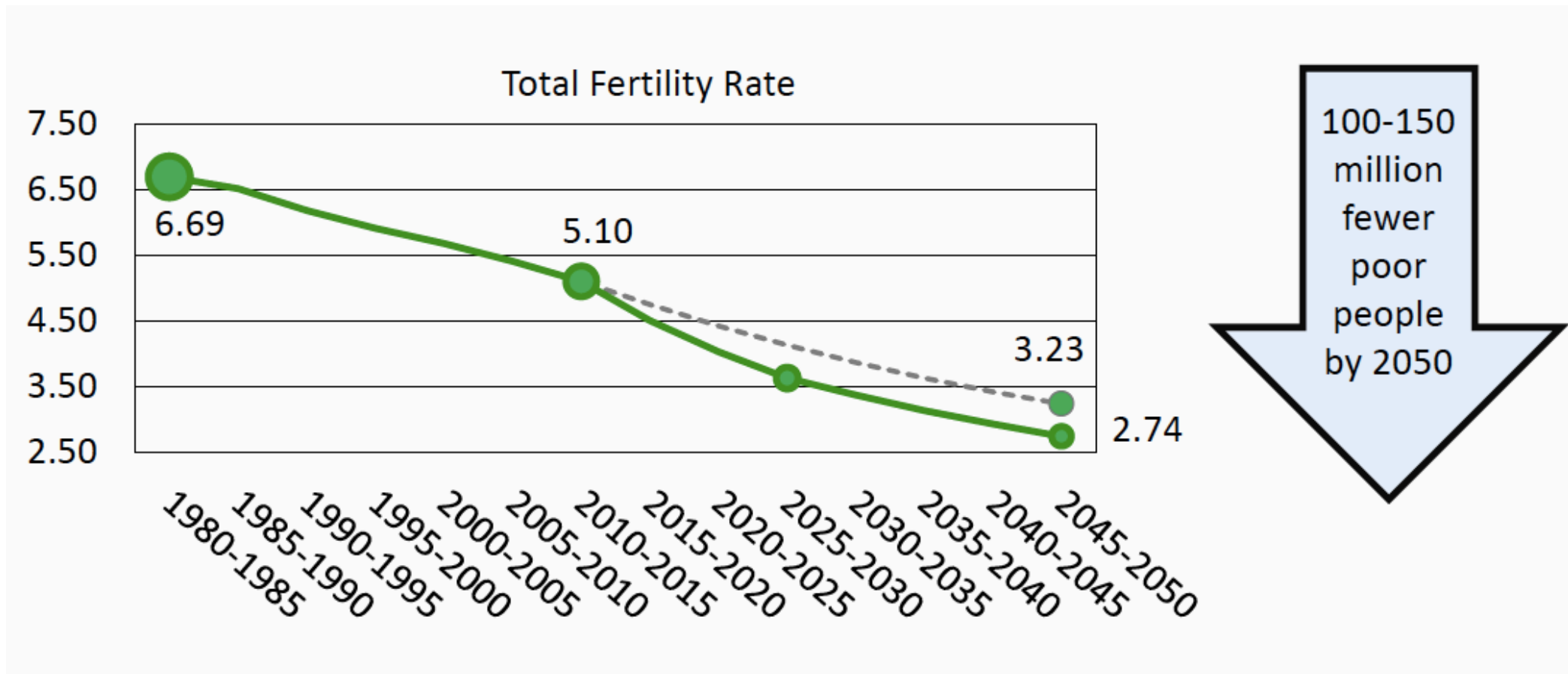
Sources:

World Bank. (2015). *Global Monitoring Report 2015/2016: Development Goals in an Era of Demographic Change*. ISBN 978-1-4648-0669-8.

Canning, D., Raja, S., & Yazbeck, A. S. (Eds.). (2015). *Africa's Demographic Transition: Dividend or Disaster?* ISBN 978-1-4648-0489-2.

In Search of the Demographic Dividend in Mozambique. Unpublished.

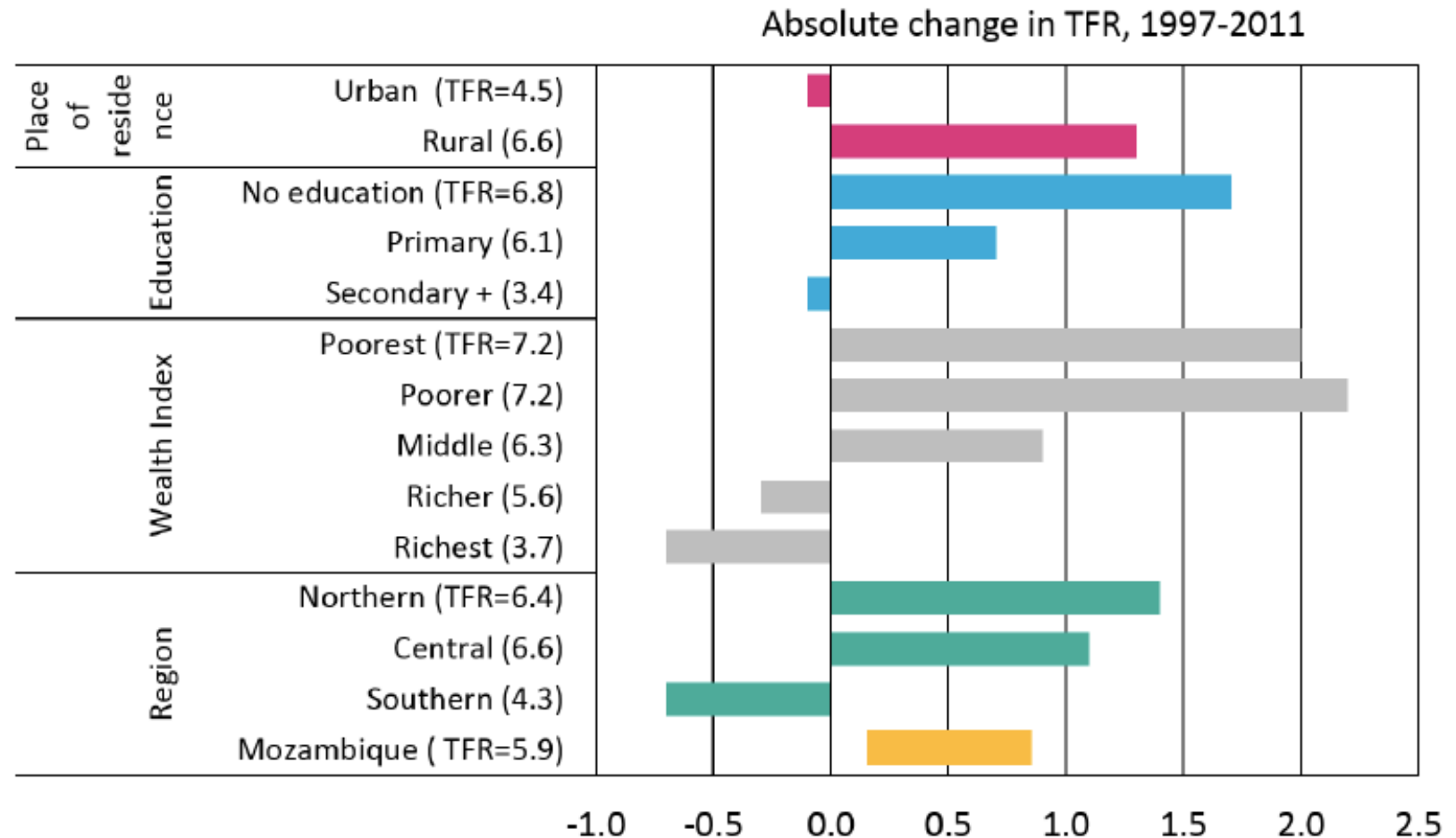
# The Opportunity: Potential Impact of Demographic Change on Poverty Reduction in Sub-Saharan Africa



Additional benefits with reduced infant and maternal mortality, reduced malnutrition and improved early childhood development, and higher education for girls



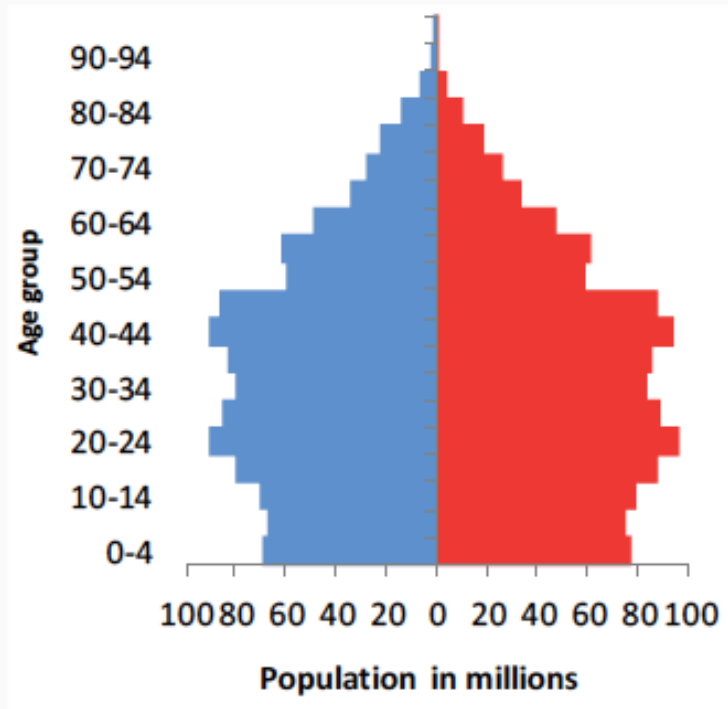
# Fertility Is Increasingly Unequal Across Socioeconomic Groups



# Few Adults to Sustain Dependents

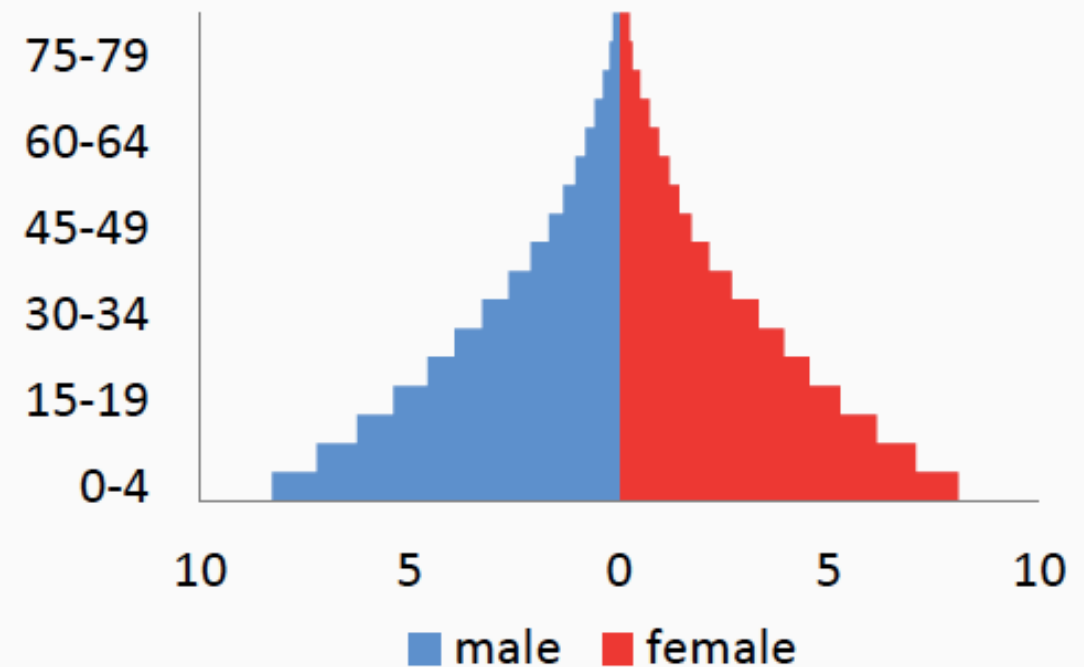
## East Asia

Working-age population / dependents = 2.6



## Sub-Saharan Africa

Working-age population / dependents = 1.2

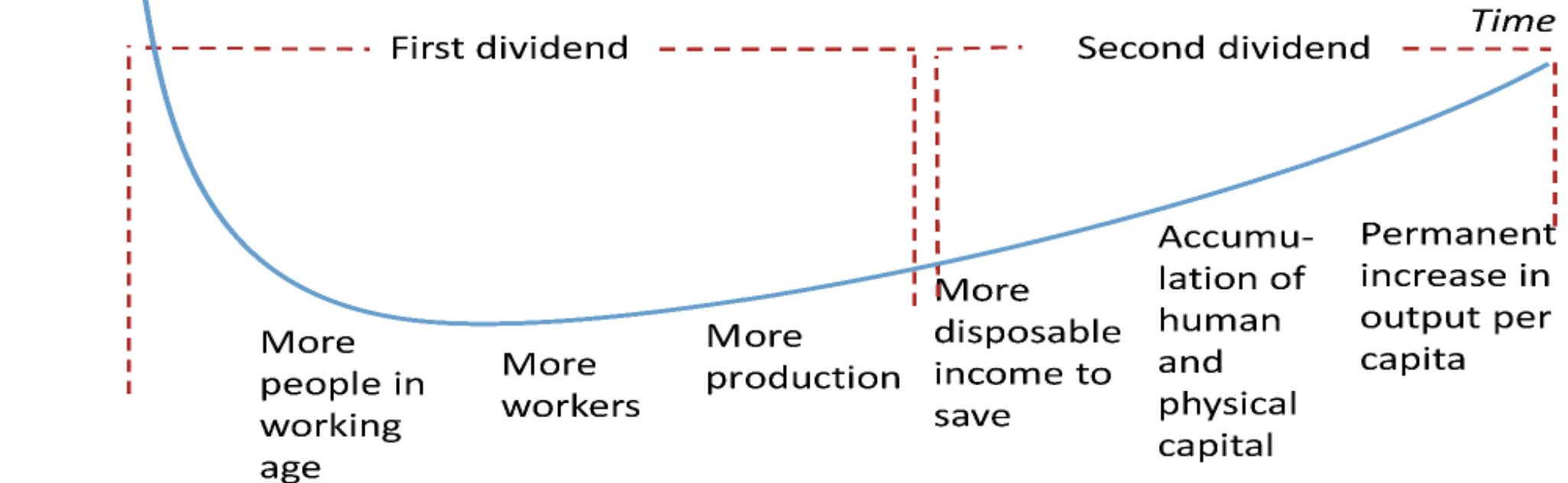


# Demographic Dividend

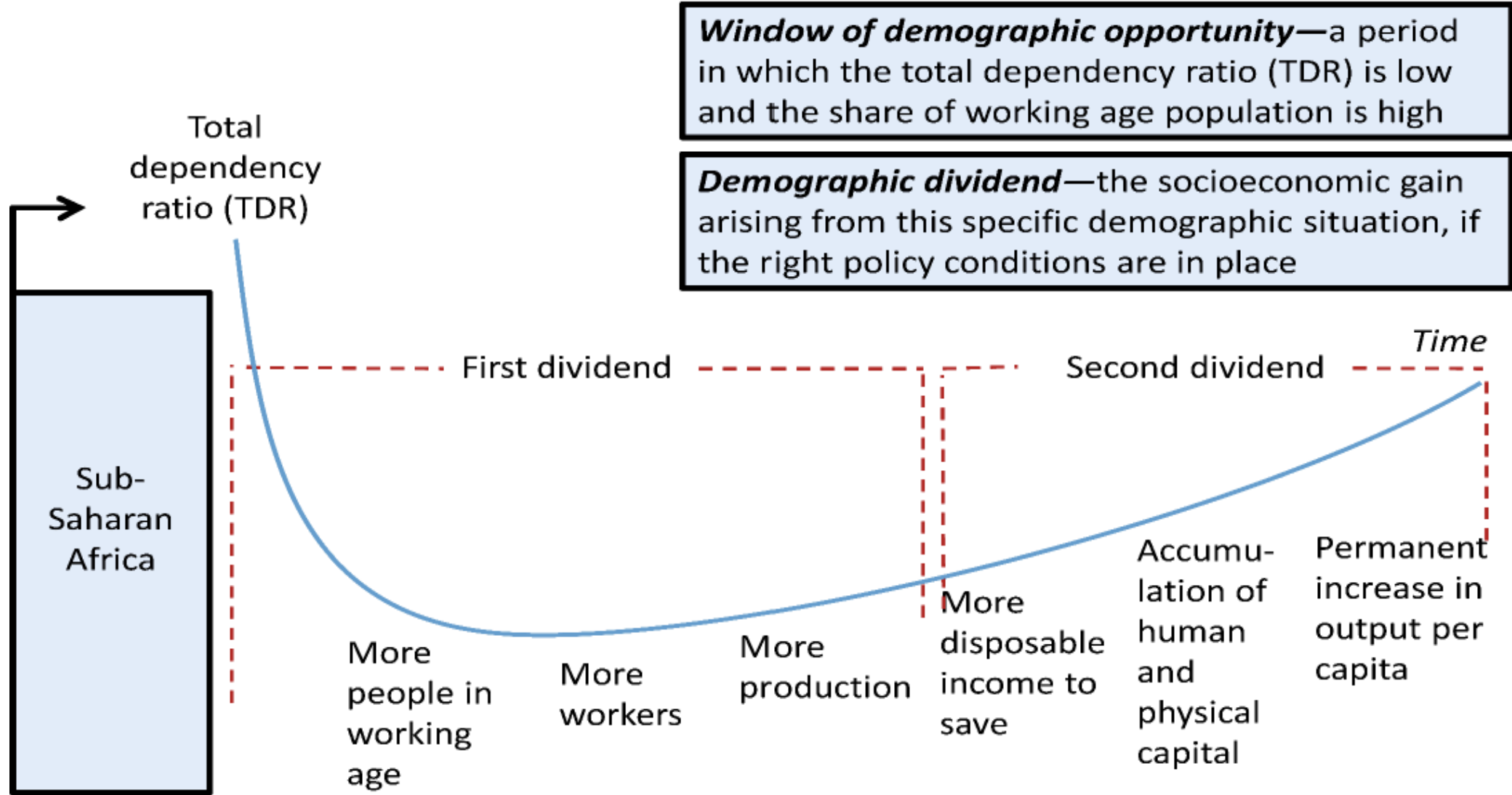
Total  
dependency  
ratio (TDR)

**Window of demographic opportunity**—a period in which the total dependency ratio (TDR) is low and the share of working age population is high

**Demographic dividend**—the socioeconomic gain arising from this specific demographic situation, if the right policy conditions are in place



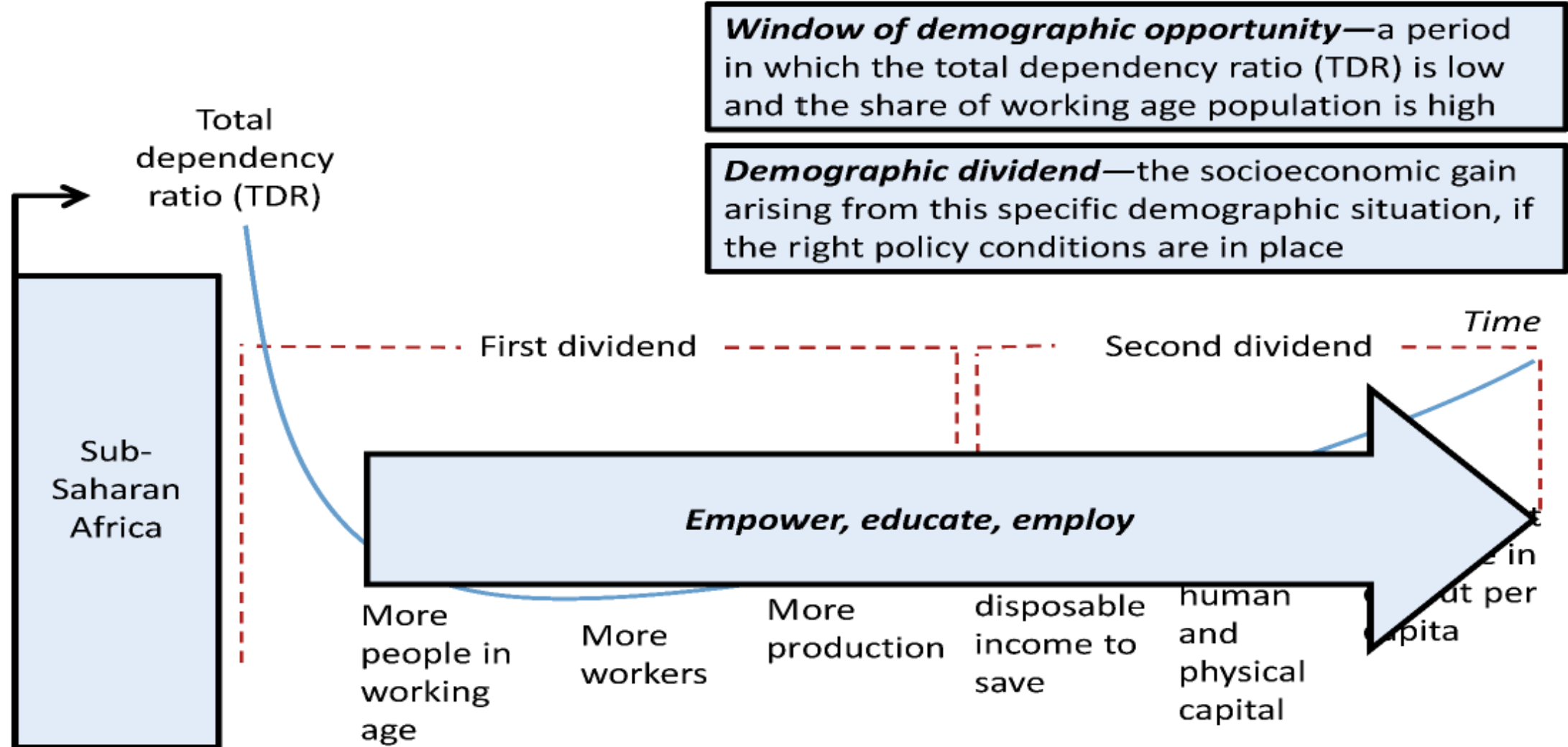
# Demographic Dividend



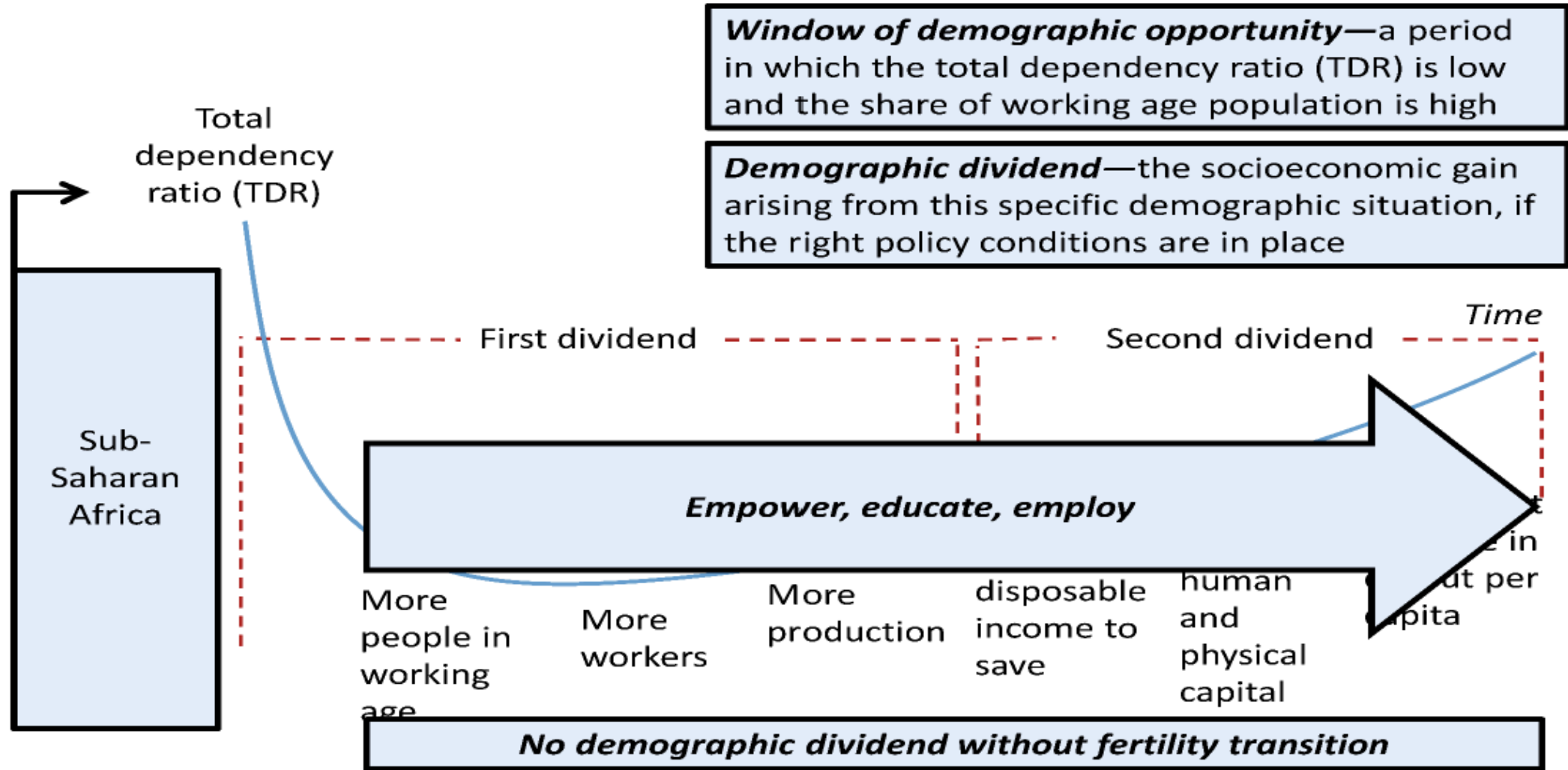
**Window of demographic opportunity**—a period in which the total dependency ratio (TDR) is low and the share of working age population is high

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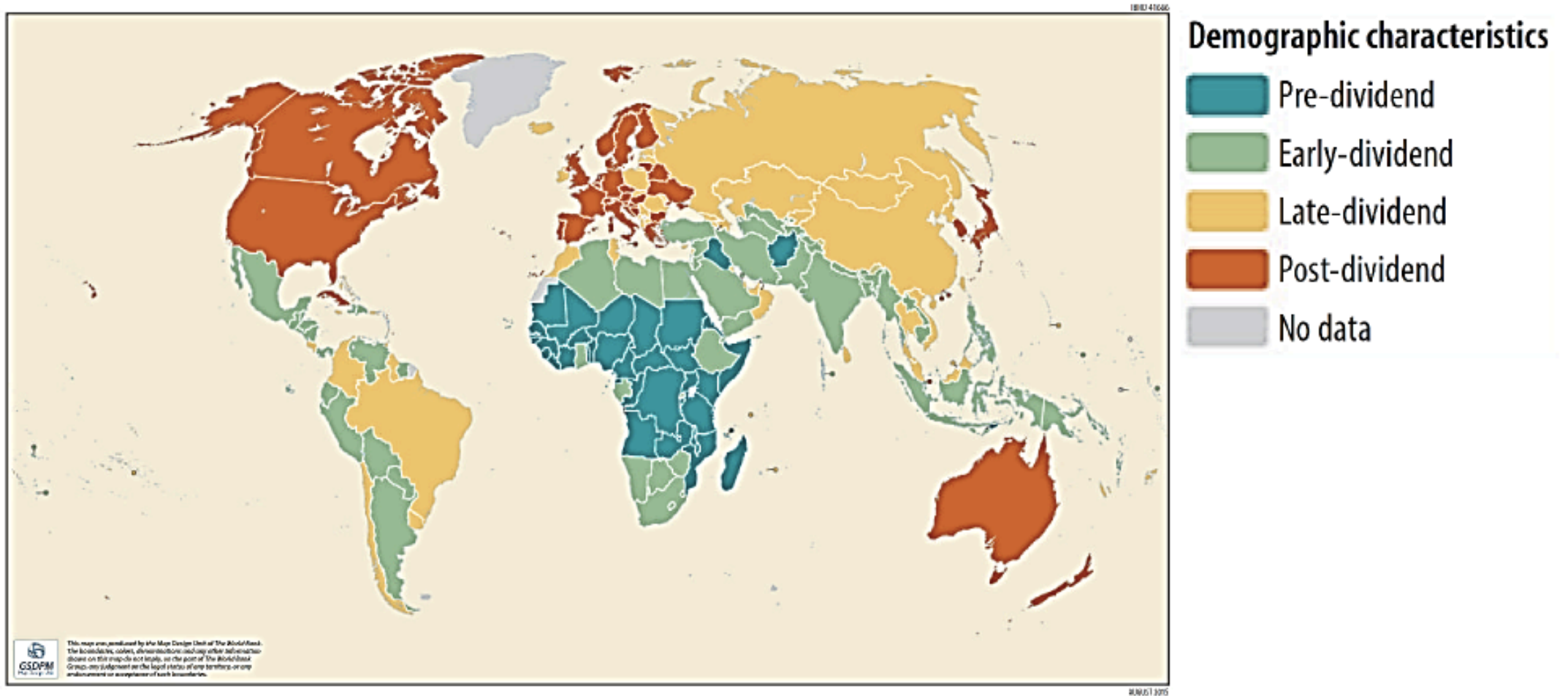
# Demographic Dividend



# Demographic Dividend



# Most Countries in Sub-Saharan Africa Still Have Very High Fertility



Source: World Bank calculations, based on data from UN 2015.

# Most Countries in Sub-Saharan Africa Still Have Very High Fertility

	<b>Total fertility rate (TFR)</b>  (# children/woman)	<b>Adolescent fertility rate</b>  (births per 1,000 women age 15-19)	<b>Contraceptive prevalence rate, modern (CPR)</b>  (% married women 15-49)	<b>Maternal mortality ratio</b>  (modeled, per 100,000 live births)
<b>Burkina Faso</b>	5.8	115	15	300
<b>Chad</b>	7.1	152	2	1084
<b>Côte d'Ivoire</b>	5.0	130	13	614
<b>Mali</b>	6.9	176	7	540
<b>Mauritania</b>	4.8	73	5	510
<b>Niger</b>	7.6	205	12	590



# Most Countries in Sub-Saharan Africa Still Have Very High Fertility

	Unmet needs for contraception (% of women of reprod. age)	Age at marriage (yrs, median)	Youth literacy rate (male) (% 15-24)	Youth literacy rate (female) (% 15-24)	Gender Inequality Index (GII) (rating, rank out of 152 countries)
<b>Burkina Faso</b>	24.5	17.8	47	33	0.607 (133 <sup>rd</sup> )
<b>Chad</b>	28.3	16.0	54	42	0.707 (150 <sup>th</sup> )
<b>Côte d'Ivoire</b>	27.0	19.7	67	44	0.645 (143 <sup>rd</sup> )
<b>Mali</b>	27.6	16.6	56	39	0.673 (148 <sup>th</sup> )
<b>Mauritania</b>	32.0	17.1	72	66	0.644 (142 <sup>nd</sup> )
<b>Niger</b>	16.1	15.7	52	23	0.709 (151 <sup>st</sup> )

# Questions

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