#### Fertility, Mortality, and Population Growth

A simple fictitious example contrasting the experiences of rich and poor countries

Prepared by Louis Hotte

▲□▶ ▲□▶ ▲□▶ ▲□▶ □ ● ●

- Total Fertility Rate (TFR): The average number of children that a woman would have if she lived past the age of procreation.
- **Mortality Rate** (MR): A measure of people's longevity. To simplify, use (*a*, *b*) where
  - a is probability of dying before age 15;
  - b is probability of living past age 40.
- Net Reproduction Rate (NRR): The average number of daughters that a girl is expected to have taking into account her life expectancy.

- Total Fertility Rate (TFR): The average number of children that a woman would have if she lived past the age of procreation.
- Mortality Rate (MR): A measure of people's longevity. To simplify, use (a, b) where
  - a is probability of dying before age 15;
  - *b* is probability of living past age 40.
- Net Reproduction Rate (NRR): The average number of daughters that a girl is expected to have taking into account her life expectancy.

- Total Fertility Rate (TFR): The average number of children that a woman would have if she lived past the age of procreation.
- **Mortality Rate** (MR): A measure of people's longevity. To simplify, use (*a*, *b*) where
  - a is probability of dying before age 15;
  - *b* is probability of living past age 40.
- Net Reproduction Rate (NRR): The average number of daughters that a girl is expected to have taking into account her life expectancy.

- Total Fertility Rate (TFR): The average number of children that a woman would have if she lived past the age of procreation.
- **Mortality Rate** (MR): A measure of people's longevity. To simplify, use (*a*, *b*) where
  - a is probability of dying before age 15;
  - *b* is probability of living past age 40.
- Net Reproduction Rate (NRR): The average number of daughters that a girl is expected to have taking into account her life expectancy.

- Total Fertility Rate (TFR): The average number of children that a woman would have if she lived past the age of procreation.
- Mortality Rate (MR): A measure of people's longevity. To simplify, use (*a*, *b*) where
  - a is probability of dying before age 15;
  - b is probability of living past age 40.
- Net Reproduction Rate (NRR): The average number of daughters that a girl is expected to have taking into account her life expectancy.

Fertility, Mortality, and Population Growth

# The case of today's richer countries

A constructed example

period	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1800-1850	2,000		(1/4,3/4)	3/4*5*1/2=1.875
1850-1900	4,000	4	(1/8,7/8)	7/8*4*1/2=1.75
1900-1950	10,000		(0,1)	1*3*1/2=1.5
1950-2000	25,000	2	(0,1)	1*2*1/2=1

1850: First comes a drop in the MR due to better nutrition. Population growth jumps up as the TFR is unchanged.

1900: After a delay, the TFR begins to drop in response to the lower MR. The MR keeps on dropping as sanitary investments are made.

1950: The TFR keeps on dropping in response to lower MR, higher income, and returns to education, especially for girls. MR drops further due to health care access and medical advance.

## The case of today's richer countries

A constructed example

period	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1800-1850	2,000		(1/4,3/4)	3/4*5*1/2=1.875
1850-1900	4,000	4	(1/8,7/8)	7/8*4*1/2=1.75
1900-1950	10,000		(0,1)	1*3*1/2=1.5
1950-2000	25,000	2	(0,1)	1*2*1/2=1

1850: First comes a drop in the MR due to better nutrition. Population growth jumps up as the TFR is unchanged.

1900: After a delay, the TFR begins to drop in response to the lower MR. The MR keeps on dropping as sanitary investments are made.

1950: The TFR keeps on dropping in response to lower MR, higher income, and returns to education, especially for girls. MR drops further due to health care access and medical advance.

# The case of today's richer countries

A constructed example

period	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1800-1850	2,000	5	(1/4,3/4)	3/4*5*1/2=1.875
1850-1900	4,000	4	(1/8,7/8)	7/8*4*1/2=1.75
1900-1950	10,000		(0,1)	1*3*1/2=1.5
1950-2000	25,000	2	(0,1)	1*2*1/2=1

1850: First comes a drop in the MR due to better nutrition. Population growth jumps up as the TFR is unchanged.

1900: After a delay, the TFR begins to drop in response to the lower MR. The MR keeps on dropping as sanitary investments are made.

1950: The TFR keeps on dropping in response to lower MR, higher income, and returns to education, especially for girls. MR drops further due to health care access and medical advance.

# The case of today's richer countries

A constructed example

period	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1800-1850	2,000	5	(1/4,3/4)	3/4*5*1/2=1.875
1850-1900	4,000	4	(1/8,7/8)	7/8*4*1/2=1.75
1900-1950	10,000		(0,1)	1*3*1/2=1.5
1950-2000	25,000	2	(0,1)	1*2*1/2=1

1850: First comes a drop in the MR due to better nutrition. Population growth jumps up as the TFR is unchanged.

1900: After a delay, the TFR begins to drop in response to the lower MR. The MR keeps on dropping as sanitary investments are made.

1950: The TFR keeps on dropping in response to lower MR, higher income, and returns to education, especially for girls. MR drops further due to health care access and medical advance.

# The case of today's richer countries

A constructed example

period	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1800-1850	2,000	5	(1/4,3/4)	3/4*5*1/2=1.875
1850-1900	4,000	4	(1/8,7/8)	7/8*4*1/2=1.75
1900-1950	10,000	3	(0,1)	1*3*1/2=1.5
1950-2000	25,000	2		1*2*1/2=1

1850: First comes a drop in the MR due to better nutrition. Population growth jumps up as the TFR is unchanged.

1900: After a delay, the TFR begins to drop in response to the lower MR. The MR keeps on dropping as sanitary investments are made.

1950: The TFR keeps on dropping in response to lower MR, higher income, and returns to education, especially for girls. MR drops further due to health care access and medical advance.

# The case of today's richer countries

A constructed example

period	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1800-1850	2,000	5	(1/4,3/4)	3/4*5*1/2=1.875
1850-1900	4,000	4	(1/8,7/8)	7/8*4*1/2=1.75
1900-1950	10,000	3	(0,1)	1*3*1/2=1.5
1950-2000	25,000	2	(0,1)	1*2*1/2=1

1850: First comes a drop in the MR due to better nutrition. Population growth jumps up as the TFR is unchanged.

1900: After a delay, the TFR begins to drop in response to the lower MR. The MR keeps on dropping as sanitary investments are made.

1950: The TFR keeps on dropping in response to lower MR, higher income, and returns to education, especially for girls. MR drops further due to health care access and medical advance.

Fertility, Mortality, and Population Growth

date	У	TFR	MR	NRR
<1900	1,000		(1/2,1/2)	1/2*5*1/2=1.25
1900-1950	2,000		(1/8,7/8)	7/8*5*1/2=2.19
1950-2000		4.5	(1/8, 7/8)	7/8*4.5*1/2=1.97

1900: In a typical LDC, the demographic transition begins later (for some reason).

1950: Similar to richer countries, first comes a drop in the MR. But it is more drastic due to simultaneous improvements in nutrition, investments in sanitary systems and access to medical advance. But again, the TFR does not respond immediately. Thus a larger population growth.

Fertility, Mortality, and Population Growth

date	У	TFR	MR	NRR
<1900	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1900-1950	2,000		(1/8,7/8)	7/8*5*1/2=2.19
1950-2000		4.5	(1/8,7/8)	7/8*4.5*1/2=1.97

# 1900: In a typical LDC, the demographic transition begins later (for some reason).

1950: Similar to richer countries, first comes a drop in the MR. But it is more drastic due to simultaneous improvements in nutrition, investments in sanitary systems and access to medical advance. But again, the TFR does not respond immediately. Thus a larger population growth.

Fertility, Mortality, and Population Growth

date	У	TFR	MR	NRR
<1900	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1900-1950	2,000	5	(1/8,7/8)	7/8*5*1/2=2.19
1950-2000		4.5		7/8*4.5*1/2=1.97

1900: In a typical LDC, the demographic transition begins later (for some reason).

1950: Similar to richer countries, first comes a drop in the MR. But it is more drastic due to simultaneous improvements in nutrition, investments in sanitary systems and access to medical advance. But again, the TFR does not respond immediately. Thus a larger population growth.

Fertility, Mortality, and Population Growth

date	У	TFR	MR	NRR
<1900	1,000	5	(1/2,1/2)	1/2*5*1/2=1.25
1900-1950	2,000	5	(1/8,7/8)	7/8*5*1/2=2.19
1950-2000	3,000	4.5	(1/8,7/8)	7/8*4.5*1/2=1.97

1900: In a typical LDC, the demographic transition begins later (for some reason).

1950: Similar to richer countries, first comes a drop in the MR. But it is more drastic due to simultaneous improvements in nutrition, investments in sanitary systems and access to medical advance. But again, the TFR does not respond immediately. Thus a larger population growth.

## The case of today's richer countries

period	У	TFR	MR	NRR	у	TFR	MR	NRR
<1800			(1/2,1/2)	1.25			(1/2,1/2)	1.25
1800-1850	2,000		(1/4,3/4)	1.875	1000		(1/2,1/2)	1.25
1850-1900	4,000	4	(1/8,7/8)	1.75	1000		(1/2, 1/2)	1.25
1900-1950	10,000		(0,1)	1.5	2,000		(1/8,7/8)	2.19
1950-2000	25,000	2	(0,1)	1		4.5	(1/8,7/8)	

## The case of today's richer countries

period	У	TFR	MR	NRR	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1.25	1000	5	(1/2,1/2)	1.25
1800-1850	2,000		(1/4,3/4)	1.875	1000		(1/2,1/2)	1.25
1850-1900	4,000	4	(1/8,7/8)	1.75	1000		(1/2, 1/2)	1.25
1900-1950	10,000		(0,1)	1.5	2,000		(1/8,7/8)	2.19
1950-2000	25,000	2	(0,1)	1		4.5	(1/8,7/8)	

## The case of today's richer countries

period	У	TFR	MR	NRR	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1.25	1000	5	(1/2,1/2)	1.25
1800-1850	2,000	5	(1/4,3/4)	1.875	1000	5	(1/2,1/2)	1.25
1850-1900	4,000	4	(1/8,7/8)	1.75	1000		(1/2,1/2)	1.25
1900-1950	10,000		(0,1)	1.5	2,000		(1/8,7/8)	2.19
1950-2000	25,000	2	(0,1)	1		4.5	(1/8,7/8)	

## The case of today's richer countries

period	У	TFR	MR	NRR	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1.25	1000	5	(1/2,1/2)	1.25
1800-1850	2,000	5	(1/4,3/4)	1.875	1000	5	(1/2,1/2)	1.25
1850-1900	4,000	4	(1/8,7/8)	1.75	1000	5	(1/2,1/2)	1.25
1900-1950	10,000		(0,1)	1.5	2,000		(1/8,7/8)	2.19
1950-2000	25,000	2	(0,1)	1		4.5	(1/8,7/8)	

## The case of today's richer countries

period	У	TFR	MR	NRR	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1.25	1000	5	(1/2,1/2)	1.25
1800-1850	2,000	5	(1/4,3/4)	1.875	1000	5	(1/2,1/2)	1.25
1850-1900	4,000	4	(1/8,7/8)	1.75	1000	5	(1/2,1/2)	1.25
1900-1950	10,000	3	(0,1)	1.5	2,000	5	(1/8,7/8)	2.19
1950-2000	25,000	2		1	3,000	4.5		1.97

## The case of today's richer countries

period	У	TFR	MR	NRR	У	TFR	MR	NRR
<1800	1,000	5	(1/2,1/2)	1.25	1000	5	(1/2,1/2)	1.25
1800-1850	2,000	5	(1/4,3/4)	1.875	1000	5	(1/2,1/2)	1.25
1850-1900	4,000	4	(1/8,7/8)	1.75	1000	5	(1/2,1/2)	1.25
1900-1950	10,000	3	(0,1)	1.5	2,000	5	(1/8,7/8)	2.19
1950-2000	25,000	2	(0,1)	1	3,000	4.5	(1/8,7/8)	1.97



#### ◆□ ▶ ◆□ ▶ ◆ 臣 ▶ ◆ 臣 ▶ ○ 臣 ● のへで