Fertility

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Outline

- Introduction
- Conceptualization and measurement of fertility
- Proximate determinants of fertility
- World fertility trends and patterns
- Fertility changes in the United States
- Adolescent fertility
- Nonmarital fertility
- Childlessness
- Male fertility

Introduction

- Intercourse, conception, and fertility are all influenced by social and cultural factors

- Several types of fertility analysis
  - **Cross-sectional (period) perspective:** based on a particular point or period of time
  - **Cohort analysis:** based on fertility patterns of a group (cohort) of women who go through childbearing years at the same time
  - **Micro analysis:** fertility analysis of persons
  - **Macro analysis:** fertility analysis of groups, e.g., countries

Conceptualization and measurement of fertility

- Fertility: actual production of male and female births

- Reproduction: actual production of female births

- Fecundity: biological capability of producing live births

- Childbearing years

  – Women in age group 15–49: these are the main ages when women are able to give birth

  – Sometimes the age group of 15–44 is used, especially in developed countries, because so few births occur to women ages 45–49

Fertility terms

- Fertility: actual production of births

- Infertility: childlessness either voluntary or involuntary

- Fecundity: ability to reproduce
  - Subfecund: definitely sterile, probably sterile, semifecund, and fecundity indeterminate

- Infecundity: sterility

- Menarche: beginning of the female reproductive period (first menstrual flow)

- Menopause: end of reproductive period (termination of menstruation)

- Postpartum: period of infecundability following a pregnancy; a function of the duration and intensity of lactation
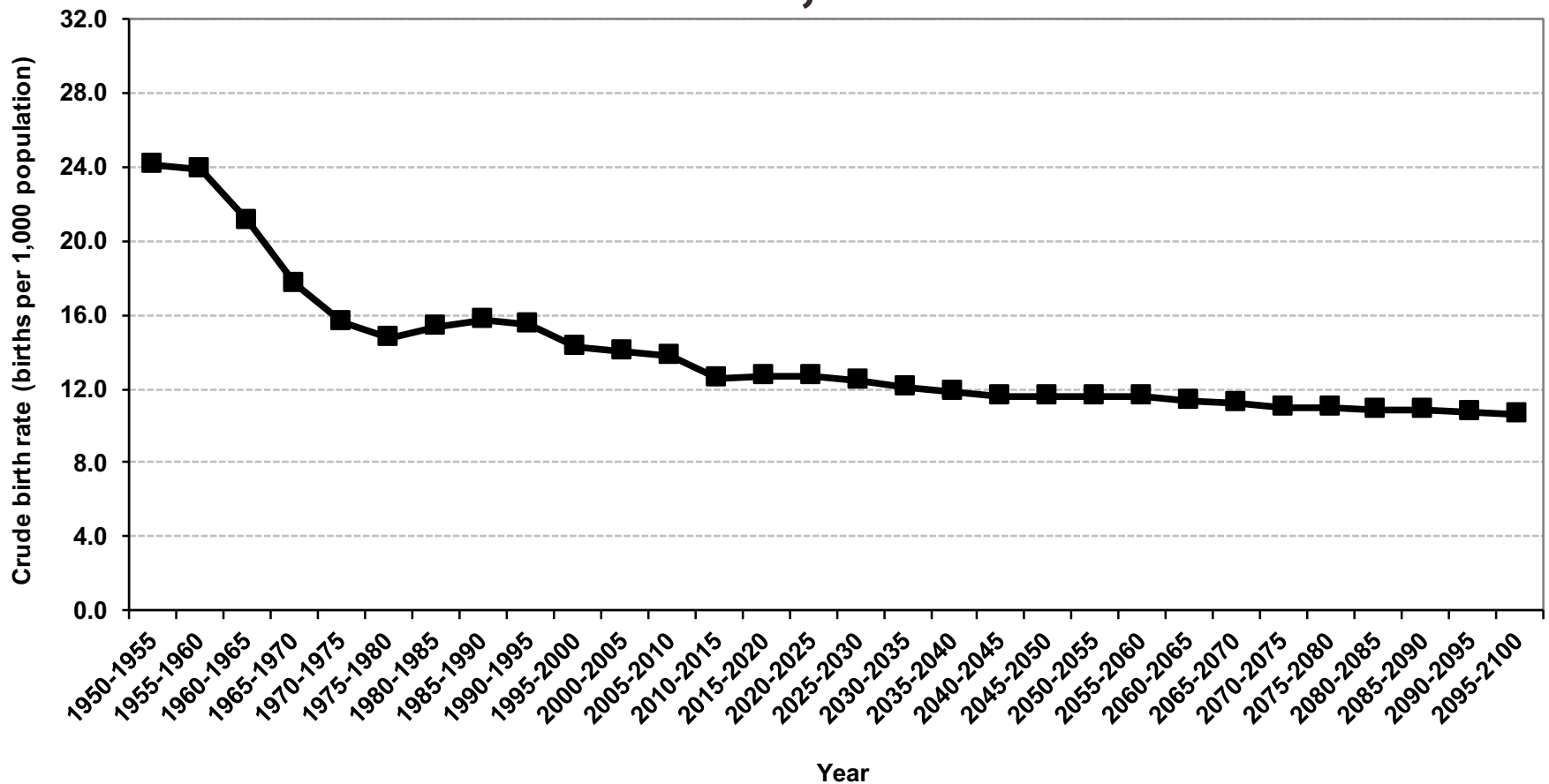
Crude birth rate (CBR)

- Cross-sectional

- The number of births occurring in a population in a year per 1,000 persons

CBR = number of births/midyear population*1,000

Crude birth rates,
United States, 1950–2100

Source: United Nations, World Population Prospects 2017
https://esa.un.org/unpd/wpp/Download/Standard/Population/
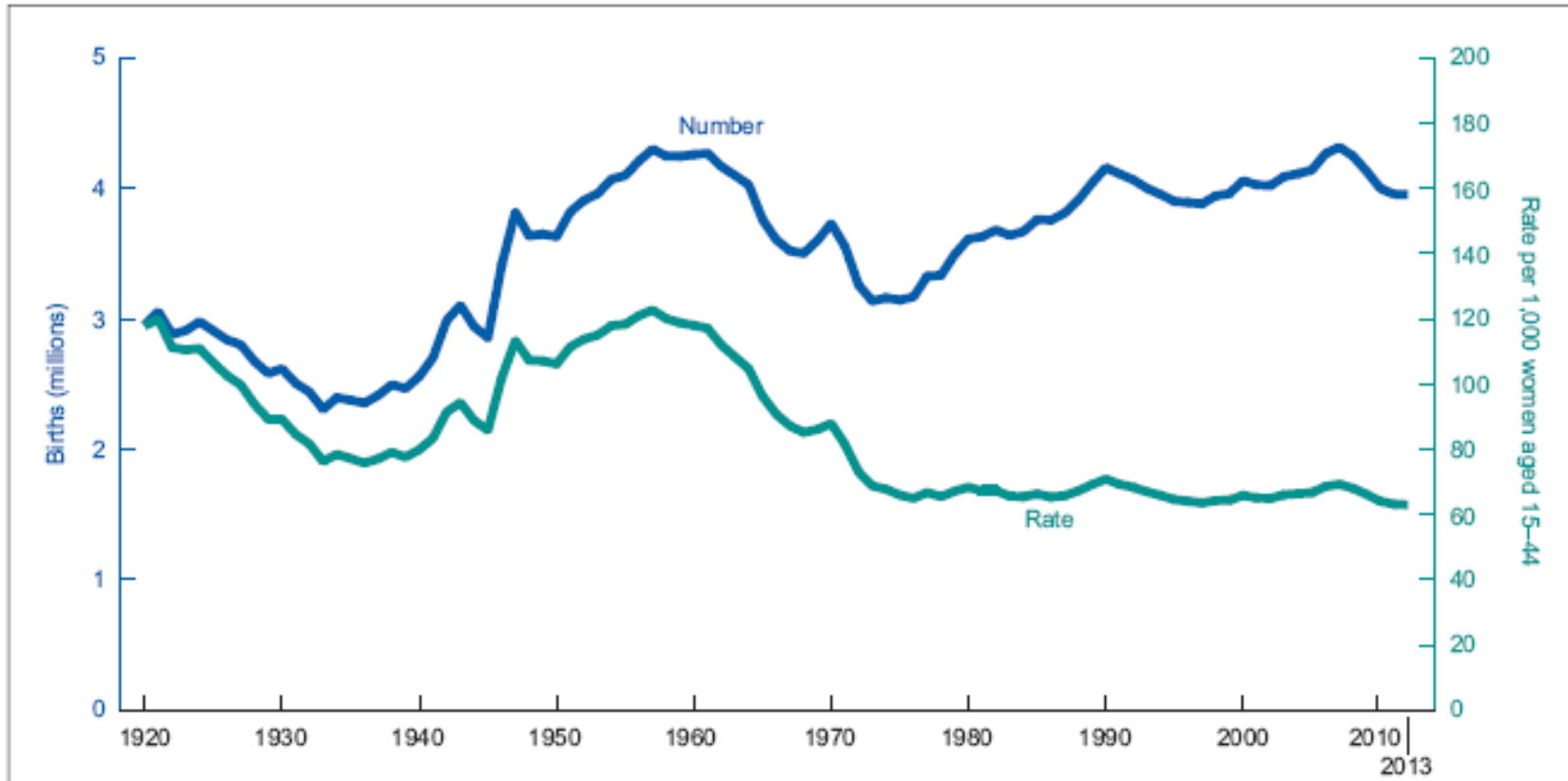(medium variant).

General fertility rate (GFR)

- Cross-sectional

GFR = number of births/midyear female population age 15–49*1,000

GFR = CBR*4.5, if data for CBR are only available

Live births and GFR

Live Births and General Fertility Rates,* 1920 to 2013

*The denominator of the General Fertility Rates is women aged 15-44.
Source: Martin, Hamilton, and Osterman, 2015: 3.

Age-specific fertility rates (ASFR)

- Births rates of women according to their ages

- Usually calculated for women in each of the seven 5-year age groups

  - 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49
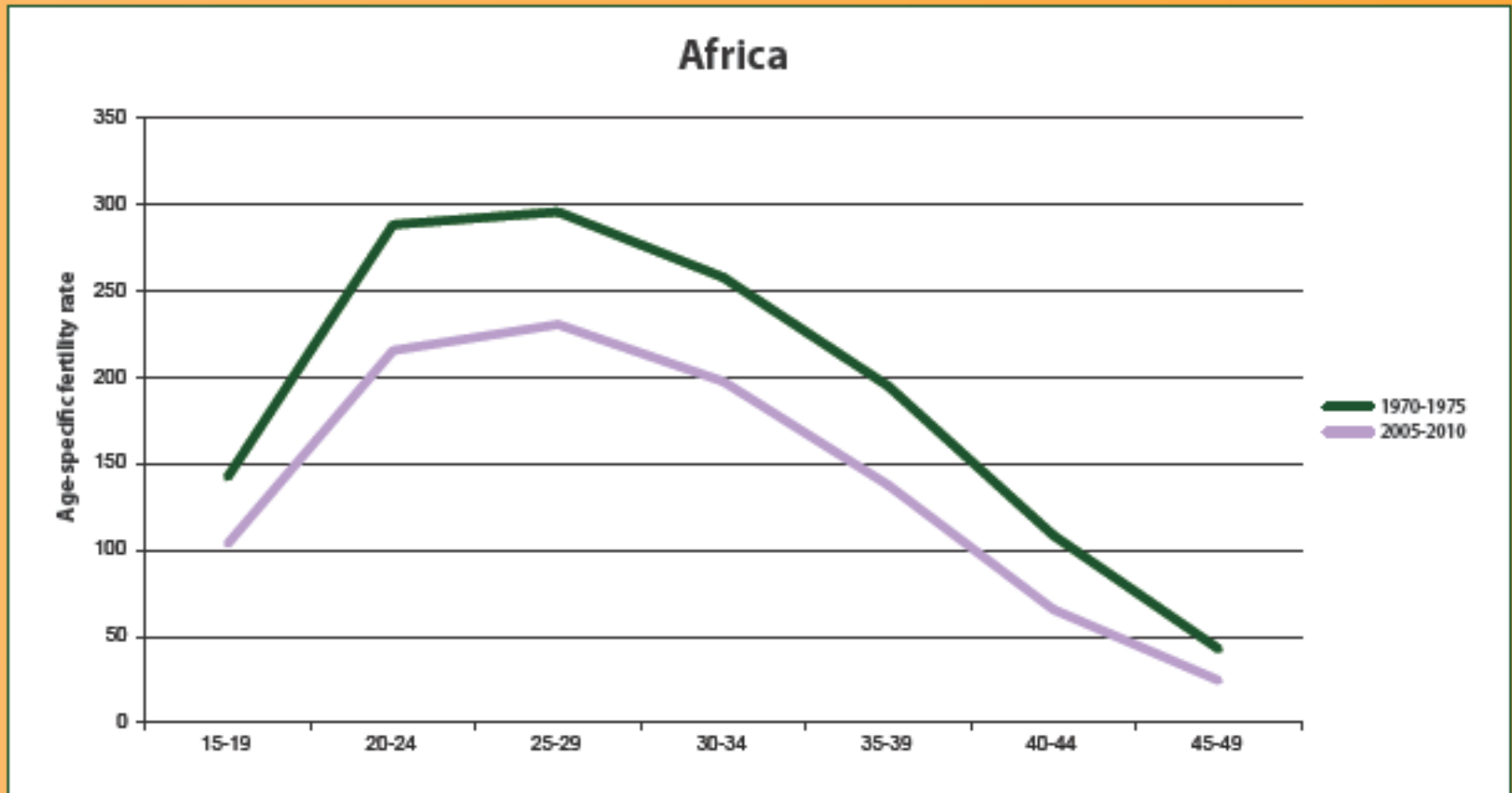 - Sometimes 35 single-year age groups are used

$$\text{ASFR}_{x \text{ to } x+n} = \text{births}_{x \text{ to } x+n} / \text{females}_{x \text{ to } x+n} * 1{,}000$$

- Age curve of fertility: the seven plotted ASFRs usually have an inverted U shape

ASFR

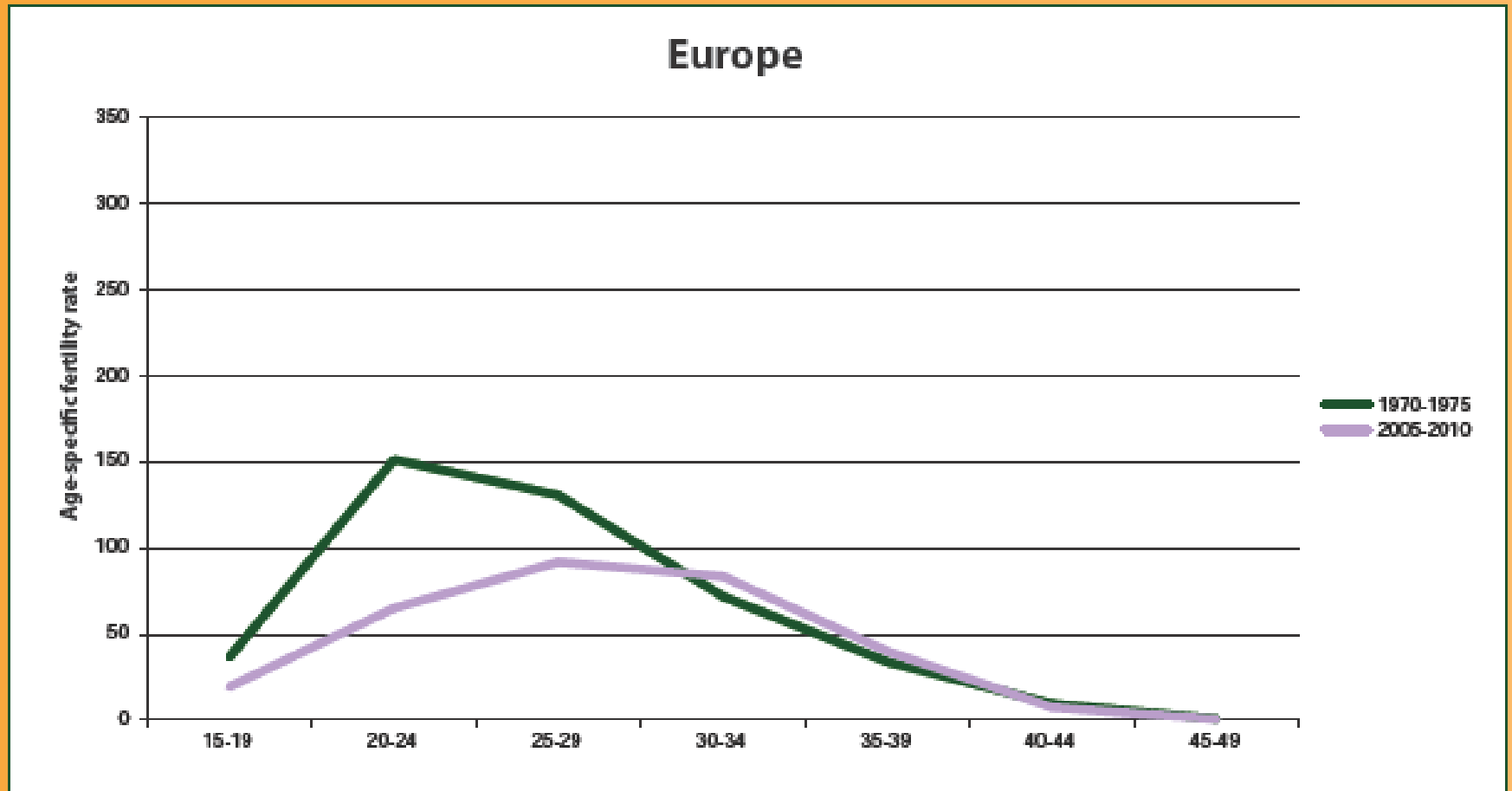Age-specific Fertility Rates, Africa, 1970-75 and 2005-10

ASFR

Age-specific Fertility Rates, Europe, 1970-75 and 2005-10

Source: United Nations, 2014a.

Total fertility rate (TFR)

- The most popular measure of fertility

- Mostly cross-sectional, but also calculated for cohorts

- Definition
  - Number of births that a hypothetical group of 1,000 women would produce during their reproductive years
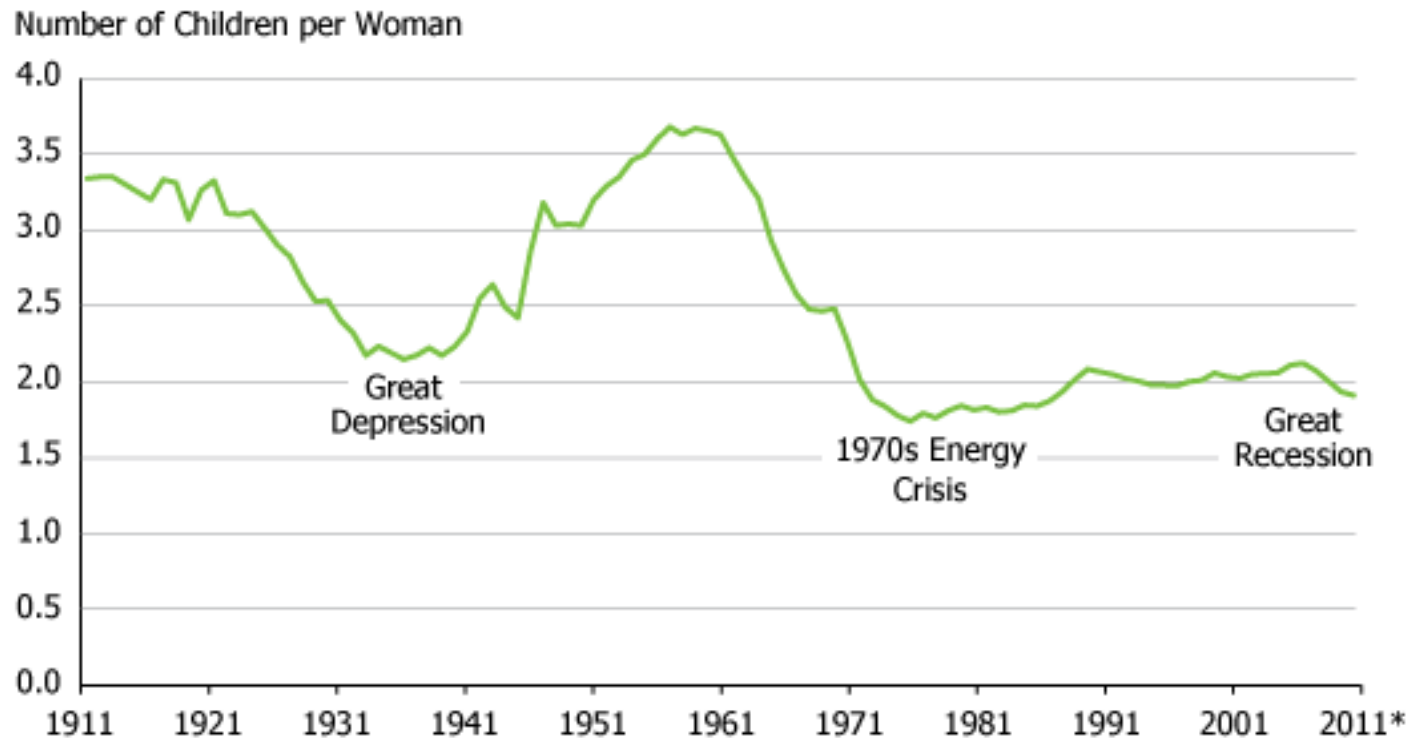 - Between the ages of 15 and 49

$$TFR = \sum(ASFR_{x\ to\ x+n} * i)$$

  - i = width of the age group, usually 5
  - TFR can be divided by 1,000 to obtain the average number of births to a single woman

TFR

Total fertility rates, United States, 1911 to 2011.

Source: Mather, 2012 (reprinted with permission of the Population Reference Bureau).

Approximation for TFR

- TFR = CBR * 4.5 * 30 = GFR * 30
  - When only CBR or GFR data are available

- Period TFRs are preferred over cohort TFRs due to their currency

Natural fertility

- Natural fertility (Henry 1961, Coale and Trussell 1974)
  - Level of reproduction in the absence of deliberate fertility control
  - Closer to 6 or 7 live births per woman
  - 25% of completed fertility is due to genetics (same as mortality)
- Hutterites had 11 children per woman (1930s)
  - Ethnoreligious group formed in the early 16th century
  - Early age at marriage, good diet, good medical care, regularly engage in intercourse without contraception or abortion
  - Nowadays, almost all live in South Dakota, North Dakota, Montana, and Western Canada

Source: Weeks, 2015.

Age-specific fertility rates
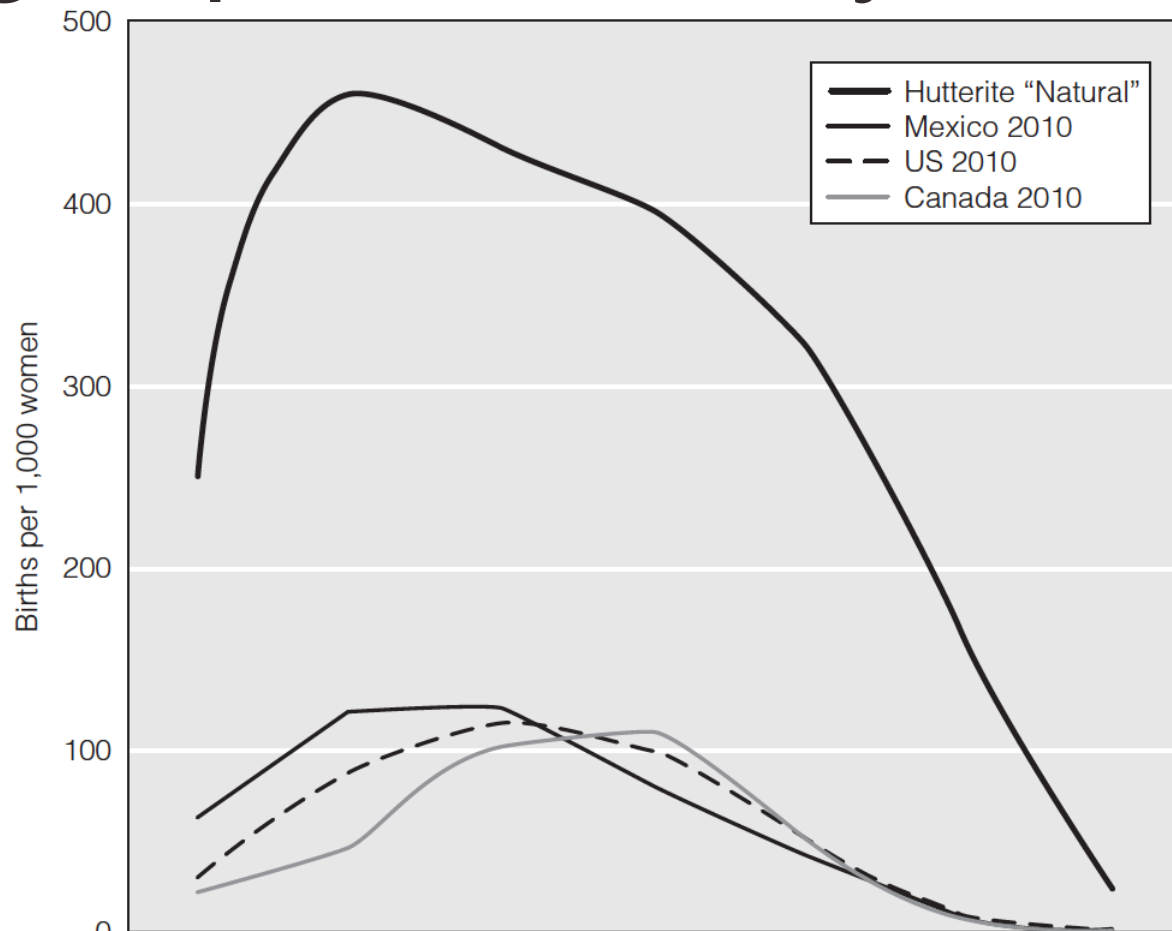
		15–19	20–24	25–29	30–34	35–39	40–44	45–49	TFR
1930	Hutterite "Natural"	250	460	431	396	321	167	24	11.0
	Mexico 2010	63	121	123	80	42	9	2	2.2
	US 2010	31	88	115	99	50	10	1	2.0
	Canada 2010	15	47	102	110	51	8	0	1.7

Source: Weeks, 2015.

Gross reproduction rate (GRR)

- Similar to TFR, but it includes female births only
  - Based on the concept of population replacement

$$GRR = \sum(ASFR^f_{x \text{ to } x+n} * i)$$

  - $ASFR^f$: female births per women in age group

  - i = width of the age group, usually 5

$$GRR = TFR * \text{female births} / \text{births}$$

$$GRR = TFR * 0.488$$

  - The constant 0.488 is based on the sex ratio at birth of most countries

  - SRB = 105 → 1–[105/(105+100)] = 1–0.512 = 0.488

  - If SRB ≠ 105, another constant should be used

Net reproduction rate (NRR)

- It considers the factor of mortality among mothers from the time of births of their daughters
  - Based on the concept of population replacement

$$NRR = \sum(ASFR^f_{x \text{ to } x+n} * L_x/5l_0 * i)$$

$$NRR = \sum(ASFR_{x \text{ to } x+n} * 0.488 * L_x/5l_0 * i)$$

  - $ASFR^f$: female births per women in age group
  - Lx: total number of person-years lived in age group
  - l_0: number of people at age 0
  - Lx / $5l_0$: proportion of people who survive from age 0 to the midpoint of each of the seven age intervals
  - i = width of the age group, usually 5

Mean length of a generation

- Mean length of a generation is the mean age of mothers, giving birth to live daughters, with current age-specific fertility and mortality rates

Mean length of a generation =

$$\sum (ASFR^f_{x \text{ to } x+n} * L_x/5l_0 * i * \text{mid-point of age group}) / NRR$$

- ASFR^f: female births per women in age group

- Lx / 5l$_0$: proportion of people who survive from age 0 to the midpoint of each of the seven age intervals

- i = width of the age group, usually 5

Intermediate variables

- Intermediate variables proposed by Kingsley Davis and Judith Blake (1956)
  - Behavioral and biological variables directly influencing fertility
  - Other social, economic, cultural, and environmental factors influence fertility by operating through the intermediate variables
- They identified a set of 11 intermediate variables, which directly affect fertility and are grouped into three factors
  - **Intercourse:** amount of intercourse is affected by the proportion of persons who marry, length of time married, and frequency of sexual intercourse while married
  - **Conception:** probability of conception is affected by contraception and by voluntary or involuntary infecundity
  - **Gestation/parturition:** probability of a birth depends on the likelihood of miscarriage and abortion

Proximate determinants

- Proximate determinants of fertility proposed by John Bongaarts (1978, 1982)
  - Operationalized proximate determinants of fertility to incorporate them into quantitative reproductive models
  - Designed to facilitate quantitative specification of variables
  - One of the most useful frameworks for studying fertility

- Seven proximate determinants
  - Marriage and marital disruption
  - Contraceptive use and effectiveness
  - Prevalence of induced abortion
  - Duration of postparturm infecundability
  - Waiting time to conception
  - Risk of intrauterine mortality
  - Onset of permanent sterility

Indices

- Indices of the first four proximate determinants for women in their reproductive years

- Indices range from 0 (the greatest inhibiting effect on fertility) to 1 (no inhibiting effect)

  - Marriage-pattern index (Cm): 1 when all women are married and 0 when none are married

  - Contraception index (Cc): 1 when no contraception is used and 0 when all women are using effective contraceptives

  - Abortion index (Ca): 1 when there is no induced abortion and 0 when every pregnancy is aborted

  - Postpartum-infecundability index (Ci): 1 when no women are in the period of postpartum infecundability and 0 when all women are

Stover

- Stover's (1998) modifications and extensions to the Bongaarts model to consider demographic realities of modern societies

- Use sexual activity instead of marriage as the indicator of exposure to pregnancy

- Extend the sterility index to measure infecundity from all causes

- Revise the contraception index to consider the fact that users of sterilization could become infecund before the age of 49

- Change the estimate of total fecundity

Variables

- Three major kinds of variables operate through proximate determinants in predicting fertility

- Family planning variables

- Socioeconomic variables

- Attitudinal variables

World fertility trends and patterns

- High-fertility countries with TFRs higher than 3.2
  - Mostly sub-Saharan African countries
  - Gradual decreases expected in a couple of decades

- Low-fertility countries with TFRs of 2.0 or less
  - European, Asian, Latin American, and Caribbean countries
  - Slight increases expected in the lowest-low fertility rates in next two decades
    - Some of the previous decline was a result of postponement of fertility (tempo effect)

Low levels of fertility

- Billari, Kohler (2004)

- "Low" fertility: TFRs between 2.1 and 1.6
  - 43 countries in 2013

- "Very low" fertility: TFRs between 1.5 and 1.3
  - 27 countries in 2013

- "Lowest low" fertility: with TFRs under 1.3
  - 9 countries in 2013, including South Korea, Taiwan, Poland, Portugal, Singapore, Hong Kong, and Macao

Depopulation

- Depopulation is the decline in population size
  - Projected to occur in most countries in 50–100 years

- No population growth in Europe in 2014
  - Rate of natural increase (RNI) of 0.0%

- Examples of countries with zero or negative RNI
  - Bulgaria, Serbia: RNI = –0.5%
  - Latvia, Lithuania, Hungary, Ukraine: RNI = –0.4%
  - Germany: RNI = –0.2%
  - Italy: RNI = –0.1%
  - Russia: RNI = 0.0%
    - Depopulation in Russia expected from 143.7 million (2014) to 134.1 million (2050)

Replacement-level fertility

- TFRs at or near replacement of 2.1 are needed for a population to remain stable

  - In 2013, 79 countries with TFRs at or lower than the replacement level of 2.1

- Some countries with low TFRs do not experience depopulation

  - There are still large numbers of women in childbearing years due to past high fertility

- Lower rates of fertility in African countries, as well as lower rates of mortality and immigration

  - This trend will be responsible for depopulation even in some African countries in the next 50 years or so

Implications of low fertility

- Fertility decline: birth cohorts become smaller

- This pattern and increases in life expectancy lead to aging of a population

  - Larger proportion of the population that is older than age 65

  - Smaller proportion in working ages

- Between 2005 and 2050 (United Nations, 2005)

  - Old-age dependency ratio will double in developed countries from 22.6 to 44.4 percent

  - Healthcare and pension programs not well equipped to handle large increases of elderly population

Fertility changes in the U.S.

- Rapid decrease of TFR from 7 to under 4 between 1800 and 1900

- Early 20th century: sustained fertility decline

  - Rapid economic transition, industrialization, and urbanization

- Declining TFR to be just above or below 2

  - Since the peak at 3.7 in the late 1950s

- RNI of 0.4% in 2014

  - The highest RNI of any of the developed countries

- Aging population as a whole

Adolescent fertility

- ASFR for women aged 15–19

- Potential impacts of early childbearing on women

  - Ending up having more births

  - Premature end to schooling

  - Loses in economic potential

  - Poor health expected for their children

- Adolescent fertility rate (2005–2010)

  - World: 48.9 per 1,000

  - Developed countries: 23.6

    - Switzerland (4.5), United States (39.7), Bulgaria (42.1)

  - Developing countries: 52.7

    - North Korea (0.6), Niger (209.6)

Adolescent Birth Rates by Development Groups, Regions and Subregions of the World, 2005-2010
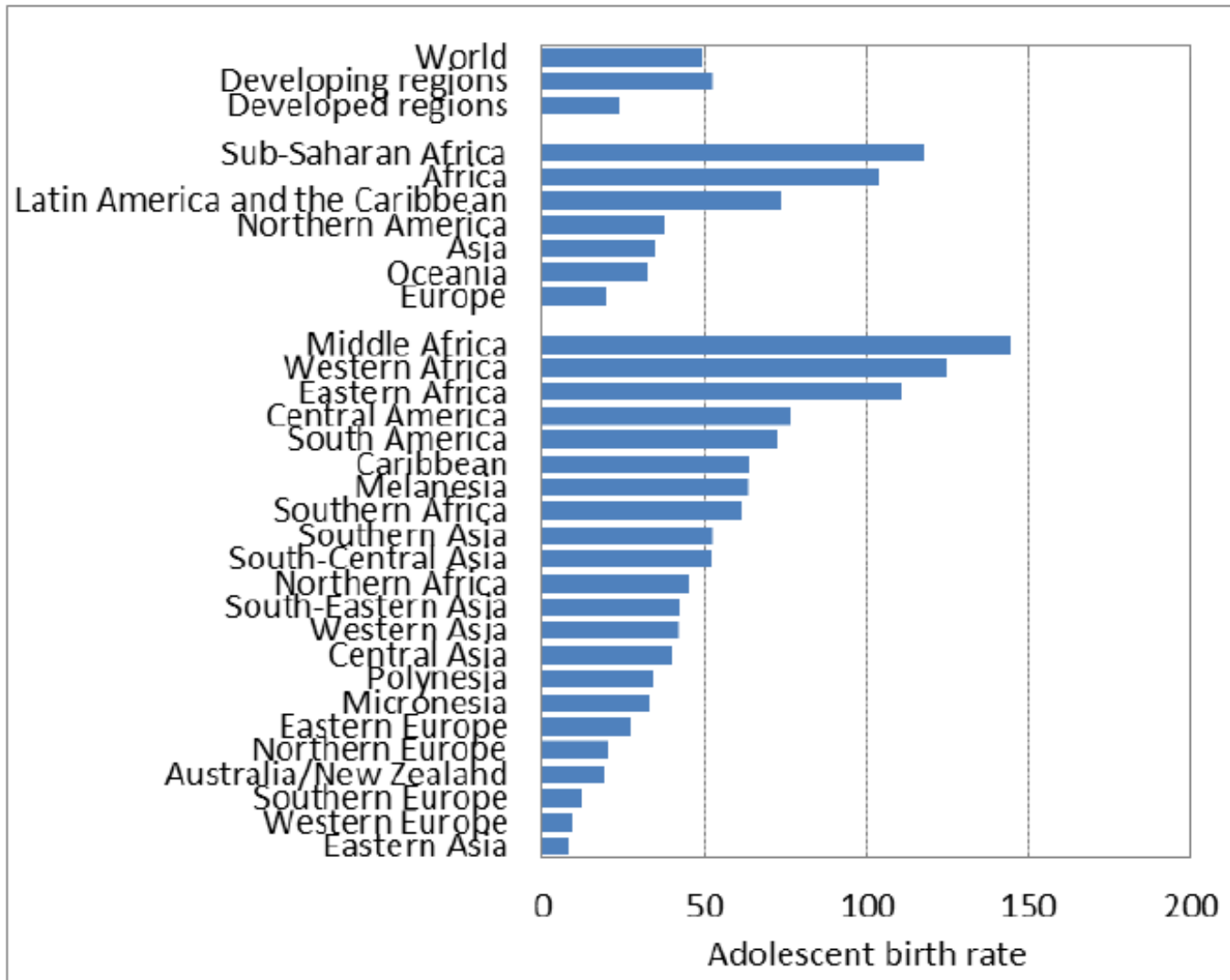
Source: United Nations, 2013a: 4.

U.S. adolescent fertility

- Downward trend since 1940, possibly due to increases in contraception use

- Among teenagers, significant increase in the percentage of births to unmarried teenagers
  - 14% (1940) to 89% (2013)

- Fertility of younger teenagers (15–17) and older teenagers (18–19) in 2013
  - 12.3 per 1,000 and 47.3 per 1,000, respectively

- Differentials by race/ethnicity (2014)
  - Asian and Pacific Islander (7.7 per 1,000)
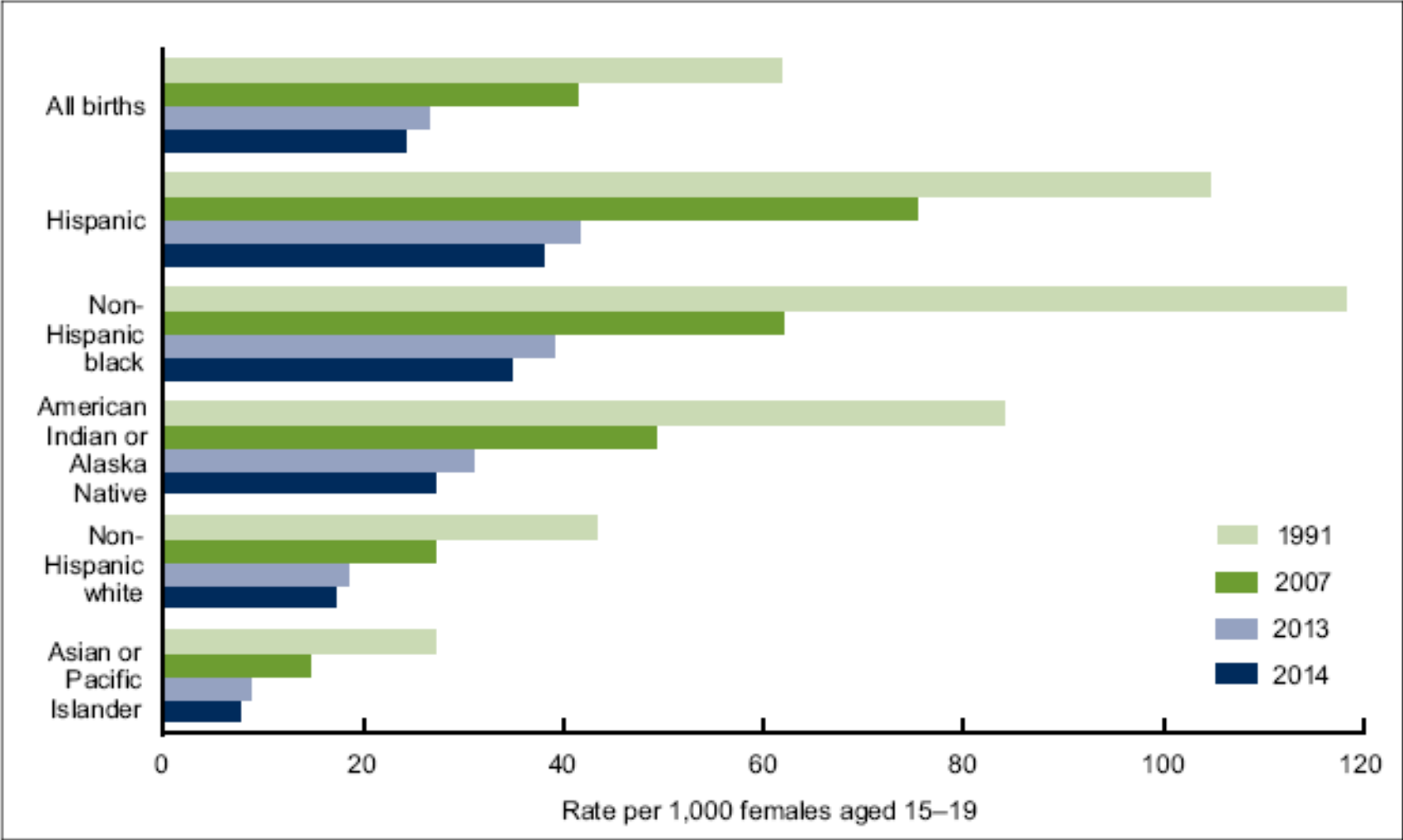 - Hispanics (38 per 1,000)

Birth rates for Teenagers (aged 15–17 and aged 18–19): United States, 1960–2013
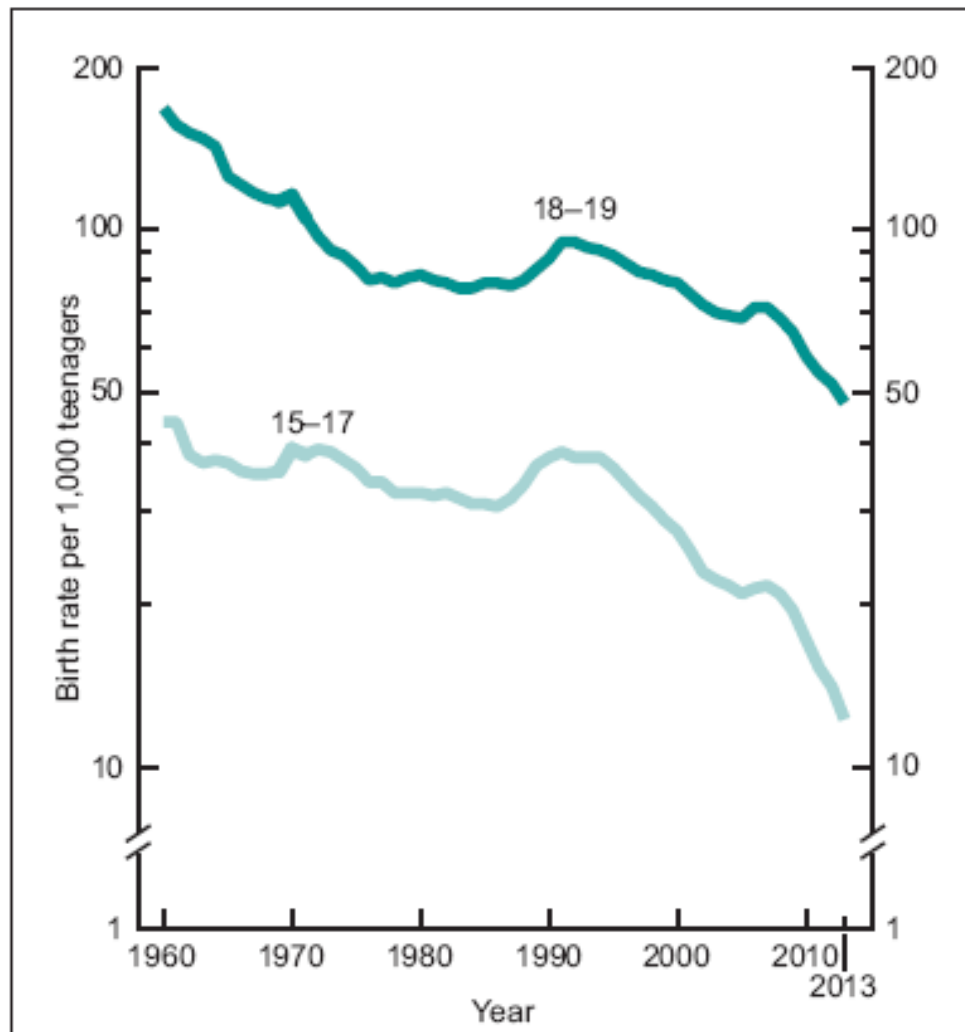
Source: Ventura, Hamilton, and Mathews, 2014: 3.

Birth Rates for Teenagers (aged 15–19), By Race and Hispanic Origin: United States, 1991, 2007, 2013, 2014


Source: Martin, Hamilton, and Osterman, 2015.

Nonmarital fertility

- Fertility of women who are not married, widowed, or divorced

  - Used to be called "illegitimate fertility"

- Marital status of the mother

  - Marker of financial, social, and emotional resources

- In 2013, 41% of nonmarital births out of the total number of all births

  - Gradual increase since the 1940s when it was very low (4%)

- Differentials by race/ethnic groups

  - Asians: the lowest, 17% of all Asian births

  - Blacks: the highest, 71% of all Black births

- Nonmarital births also include births to women in cohabiting unions and unmarried women not cohabiting

Number of Births, Birth Rate, and Percentage of Births to Unmarried Women, United States, 1940-2013
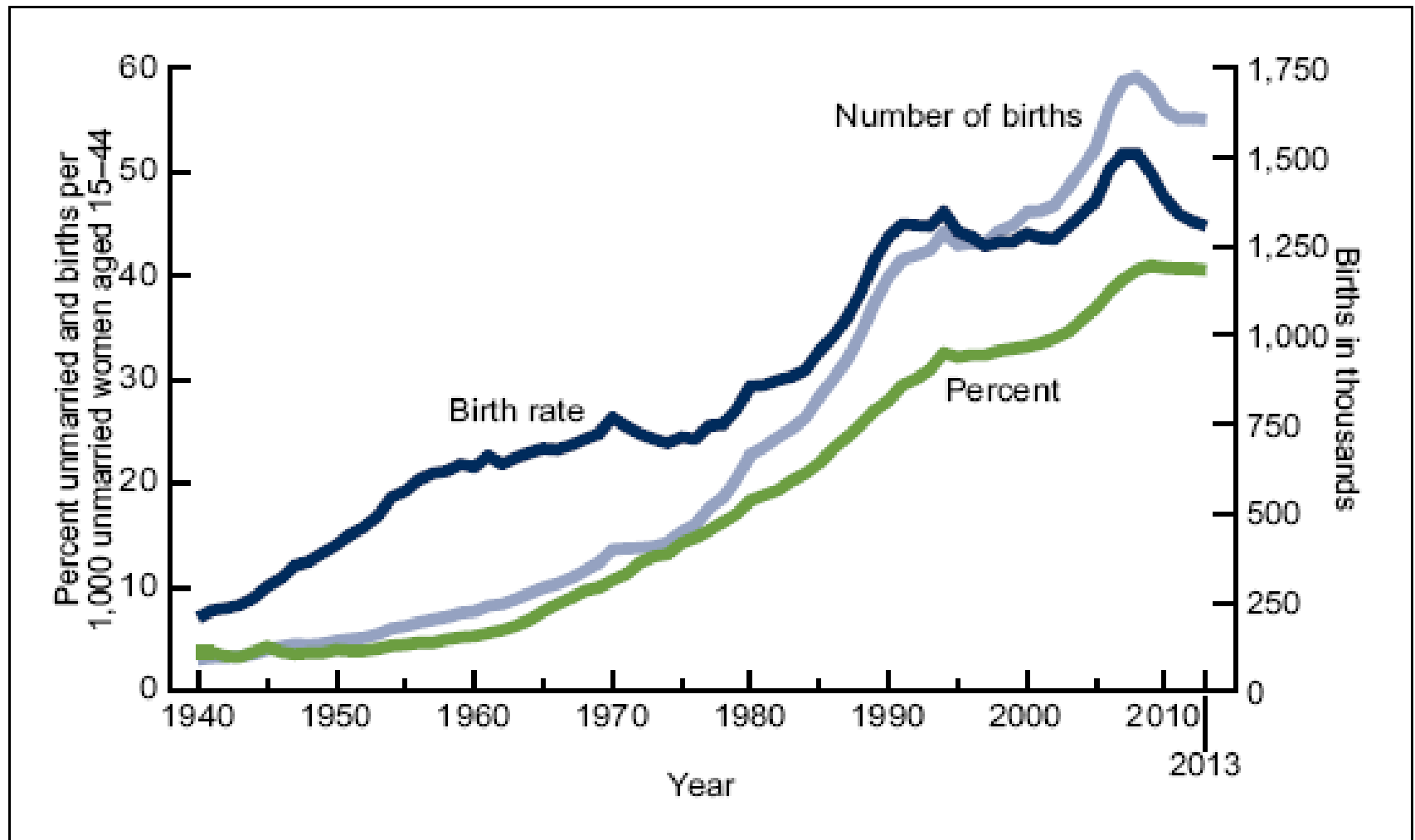
Source: Curtin, Ventura, and Martinez, 2014: 1.

Childlessness

- Women having no children voluntarily or involuntarily

- Voluntary childlessness almost nonexistent between the 1950s and 1960s

- Increasing childlessness in the U.S. since the 1970s

- Mainly due to voluntary childlessness

- Attitudes and norms toward childlessness becoming more positive overall with changes in gender norms

Percentage Rates of Childlessness for Women Aged 30 to 44, United States, 1976-2012
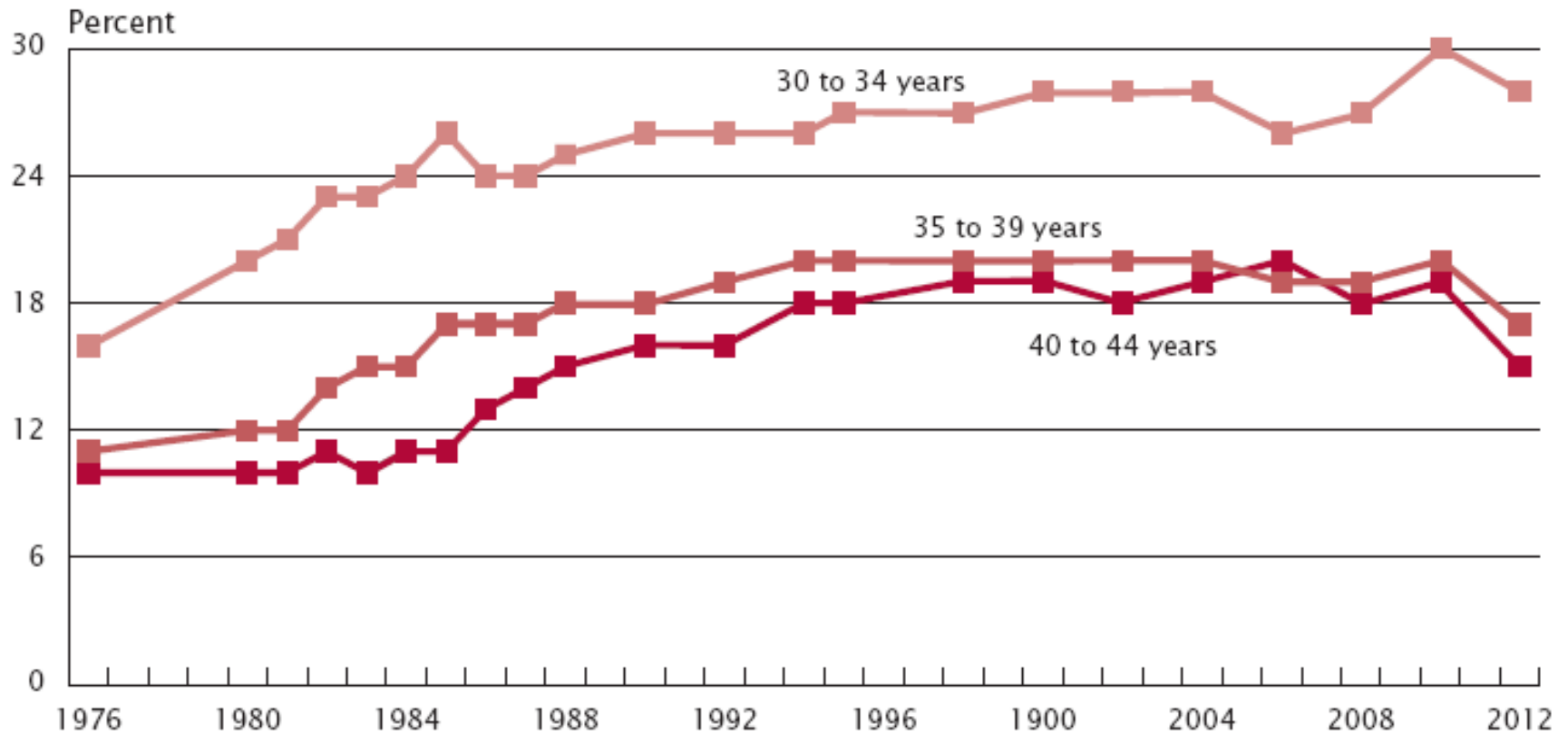
Source: Monte and Ellis, 2014: 7

Male fertility

- Rarely examined in fertility studies
- Reasons for the exclusion of males from fertility studies
  - **Biological:** a wider range of childbearing years (ages 15–79) for males; theoretically no limitation of the number of children males can have
  - **Methodological:** less data available for males than for females (i.e. father's data often missing on birth-registration certificates)
  - **Sociological:** males often regarded as breadwinners, with little involvement in fertility except for impregnating women

Importance of male fertility

- Greater variance contributed by the male sex than the female sex to the next generation

  - Most females reproduce, some males don't, other males have large number of offspring

- Marriage as a fertility determinant

  - Male fertility is likely to be influenced by their marital and employment status

  - Married and employed men usually have higher number of children ever born

- Different patterns of male fertility

  - Age-specific fertility beginning a little later and stopping much later than that of females

  - Male TFRs higher than female TFRs especially in countries with male and female TFRs higher than 2.2
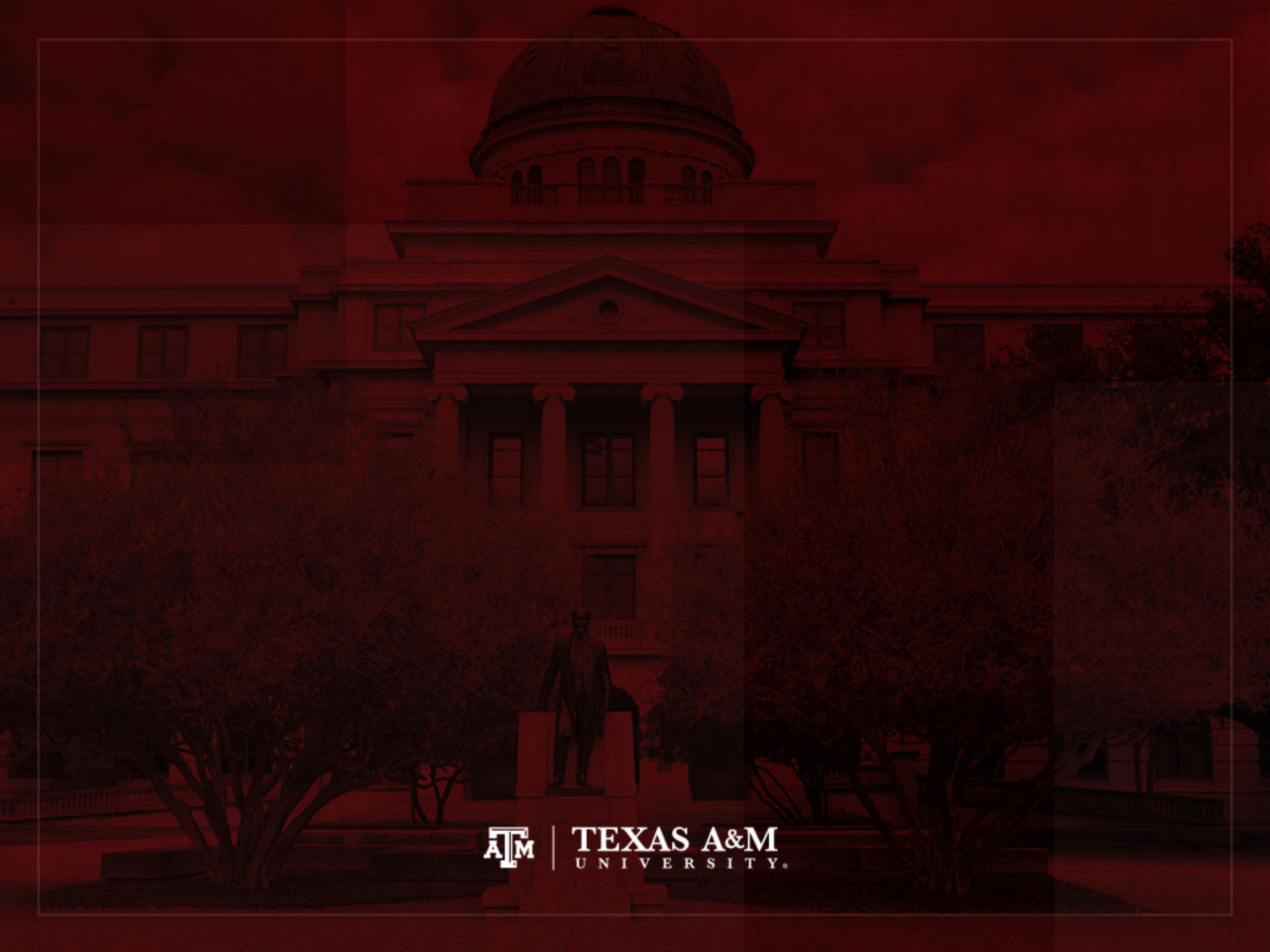
Male and female patterns

- Different cohabitation and marriage patterns
  - Higher tendency of women to cohabit, among those who previously lived alone, are foreign-born, and live in fragmented families, compared to men
  - Stronger negative effects of educational attainment on fertility among women, compared to men
  - Unemployment is related to men's postponement of marriage
  - Stronger religion effect among women than men

- Much-needed incorporation of gender studies into demography
  - Fertility and parenting involving both men and women

References

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