Introduction to demography

Ernesto F. L. Amaral

January 14, 2020
Social Demography (SOCI 622)

TEXAS A&M UNIVERSITY

Outline

- Definition of demography
- Demographic equation
- Demographic models
- Cohorts and generations
- Lexis diagram

Definition of demography

- The scientific study of human population
- The term was coined by the Belgian statistician Achille Guillard in his 1855 book
  - *Éléments de Statistique Humaine ou Démographie Comparée*

Source: Poston, Bouvier, 2017.

Demography is destiny

- This phrase is attributed to the French mathematician and philosopher, Auguste Comte (1798–1857)
  - He is known as the “father of sociology”
  - Demography shapes the world, even if it does not determine it
  - Population change is an underlying component of almost everything happening in the world today, and therefore in the future as well

Source: Poston, Bouvier, 2017.

John Graunt (1620–1674)

- English statistician
  - Considered to be the founder of demography
  - Analyzed vital statistics of the London population
  - Studied the bills of mortality (weekly statistics of deaths) in early modern London
  - More specifically, studied death records that had been kept by London parishes since 1532

- Noticed certain regularities in death phenomena
  - Published in the book “Natural and Political Observations Made upon the Bills of Mortality” (1662)

Graunt's substantive contributions

- Recognized phenomenon of rural-urban migration
  - Urban death rate exceeded rural death rate
- Population was divided almost evenly by sex
  - Male birth rate was higher than female birth rate
    - Less females are born than males
  - Male death rate was higher than female death rate
    - Females live longer than males
- Presented mortality in terms of survivorship
  - He was the first to attempt to construct a life table...

Graunt's life table

Age	Number surviving	Age	Number surviving
0	100	46	10
6	64	56	6
16	40	66	3
26	25	76	1
36	16	86	0

Graunt's methodological contributions

- Paid attention to quality of data
- Exhibited a healthy skepticism
- Questioned the validity and reliability of data

Poston's definition

- Demography is the scientific study of the size, composition, and spatial distribution of human populations

- It investigates changes in population size, composition, and distribution, resulting from fertility, mortality, and migration

Source: Poston, Bouvier, 2017.

Concerns of demography

- Population size
- Population growth or decline
- Population processes/components
- Population distribution
- Population structure
- Population characteristics

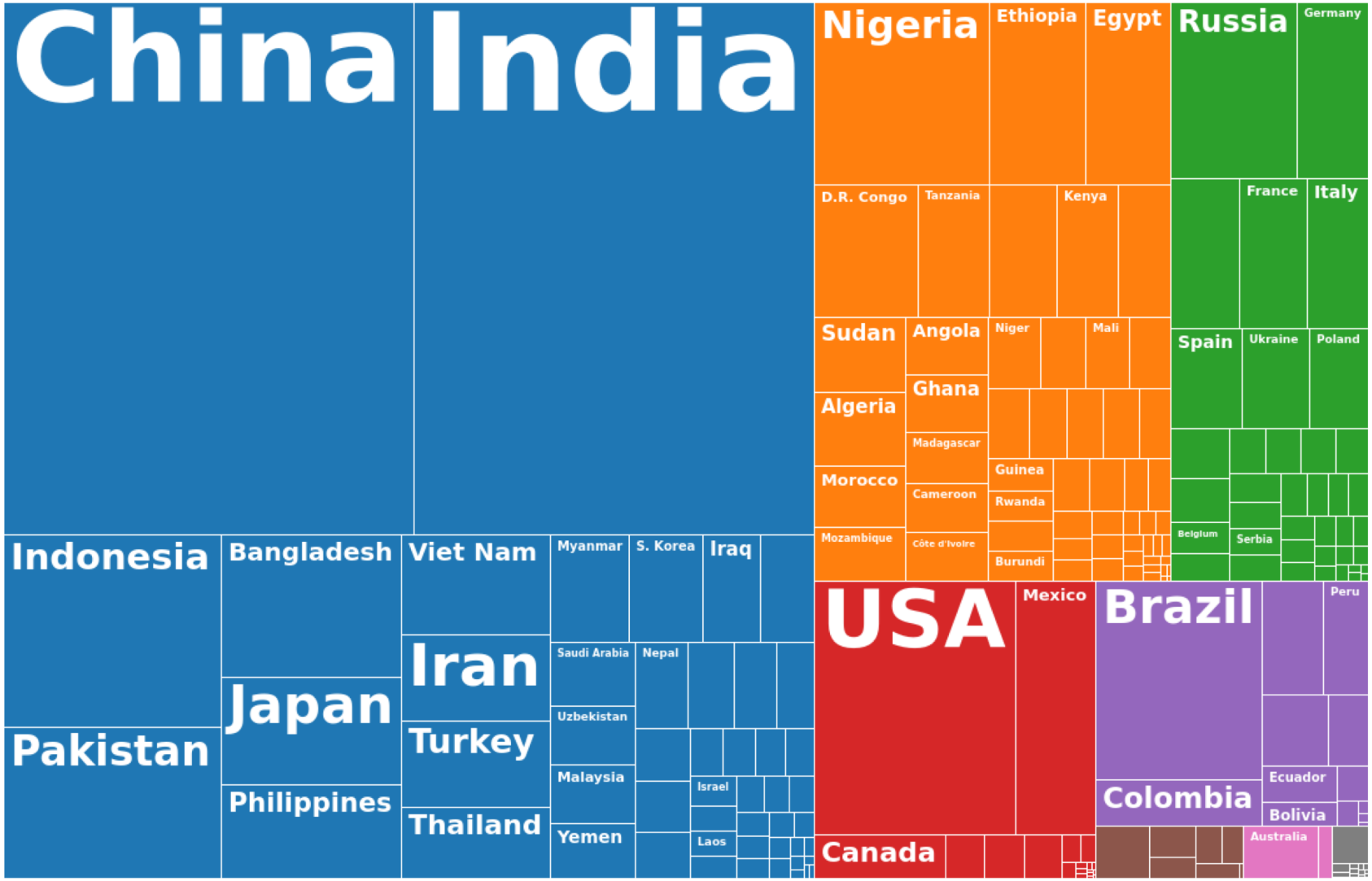
Primary demographic questions

- How large (or small) is the population?
- How is the population composed, in terms of age, sex, race, marital status, and so forth?
  - What are the characteristics of the population?
- How is the population distributed spatially?
  - Populations are not randomly distributed in space
- How population changes happen over time?

Source: Poston, Bouvier, 2017.

List of countries ordered by their population size

Total: 7,794,798,729 Year: 2020



PopulationPyramid.net

Why is demography important?

- Demography helps understand what the past says about the future, given expected population changes
  - Population change is a prime force behind social and technological change, because societies must adjust to demographic change
  - Population change is often provocative, bursting other dilemmas that face human society

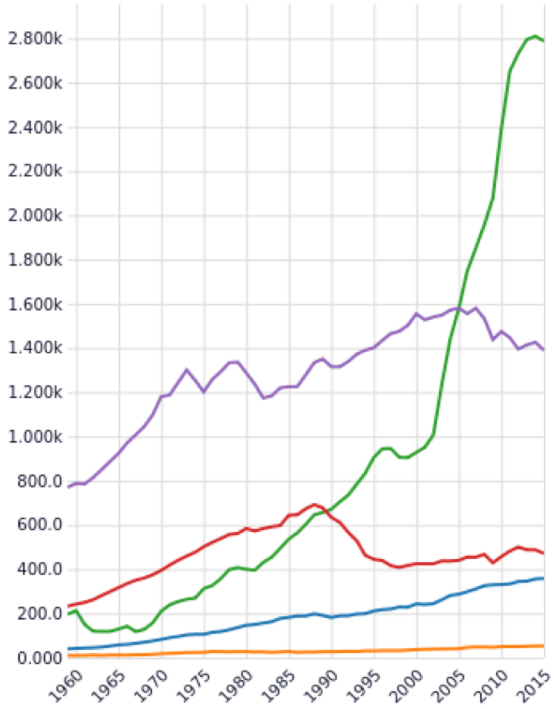
Population and earth's resources

- How will we feed an even larger population than we currently have?
- Will we have enough fresh water?
- Where will we get energy to sustain our lifestyle?
- Who will build housing and infrastructure for an increasing urban population?
- How do we minimize the environmental impact?

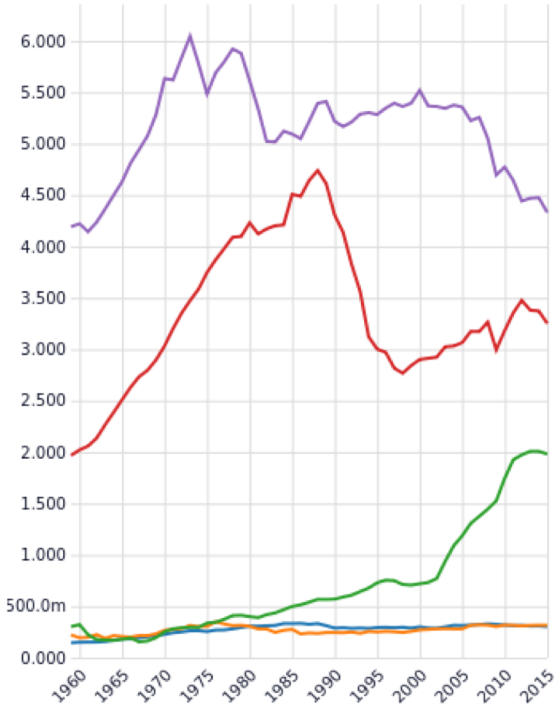
Carbon emissions

AFRICA | Central America | China | Russian Federation | United States of America

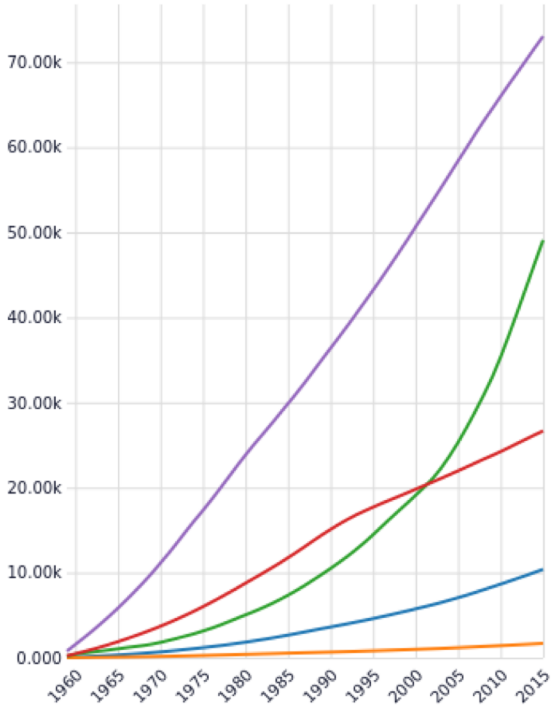
Annual Emissions



Per-person Emissions



Cumulative Emissions



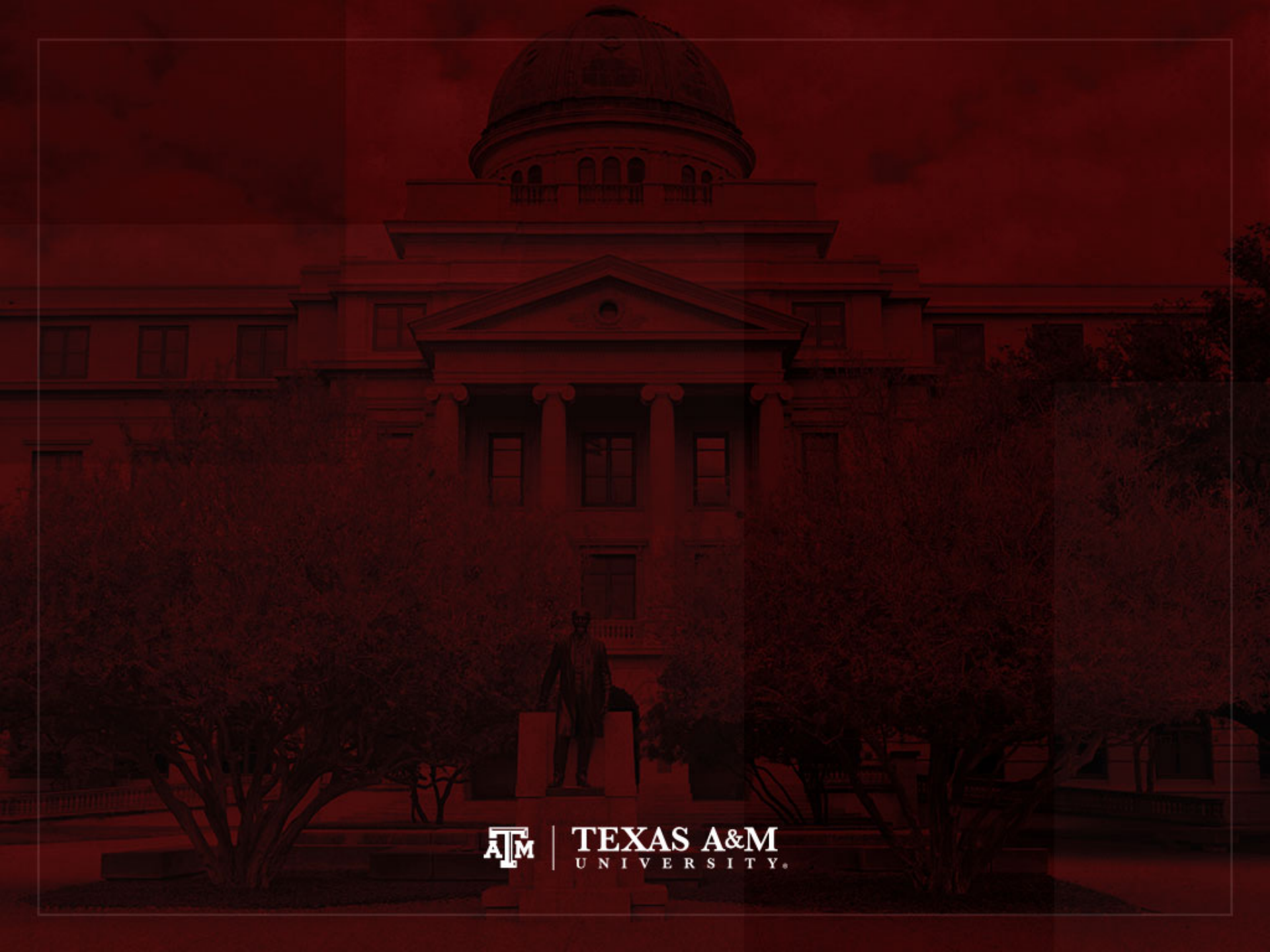
Annual and cumulative emissions in million tonnes of carbon. Per-person emissions in tonnes of carbon.

PopulationPyramid.net

Answers to these questions

- These demographic questions are answered in terms of the three demographic processes (components of demographic change)
  - Fertility
  - Mortality
  - Migration

Source: Poston, Bouvier, 2017.


TEXAS A&M
UNIVERSITY

Demographic equation

- Population size can change only through the processes of fertility, mortality, and migration
- Two ways of entering a population
  - Being born or moving into it
- Two ways of leaving a population
  - Dying or moving out of it
- Population can only change by way of a limited, countable number of events

Source: Poston, Bouvier, 2017.

Basic demographic equation

$$P_{t+1} = P_t + B_{t \text{ to } t+1} - D_{t \text{ to } t+1} + I_{t \text{ to } t+1} - E_{t \text{ to } t+1}$$

- P_{t+1}: population at time $t+1$
- P_t: population at time t
- $B_{t \text{ to } t+1}$: births between times t and $t+1$
- $D_{t \text{ to } t+1}$: deaths between times t and $t+1$
- $I_{t \text{ to } t+1}$: immigrants (or in-migrants) to the population between times t and $t+1$
- $E_{t \text{ to } t+1}$: emigrants (or out-migrants) from the population between times t and $t+1$

Source: Poston, Bouvier, 2017.

Components of equation

- $P_{t+1} = P_t + B_{t \text{ to } t+1} - D_{t \text{ to } t+1} + I_{t \text{ to } t+1} - E_{t \text{ to } t+1}$
- Natural increase: $B_{t \text{ to } t+1} > D_{t \text{ to } t+1}$
- Natural decrease: $B_{t \text{ to } t+1} < D_{t \text{ to } t+1}$
  - Negative natural increase

Source: Poston, Bouvier, 2017.

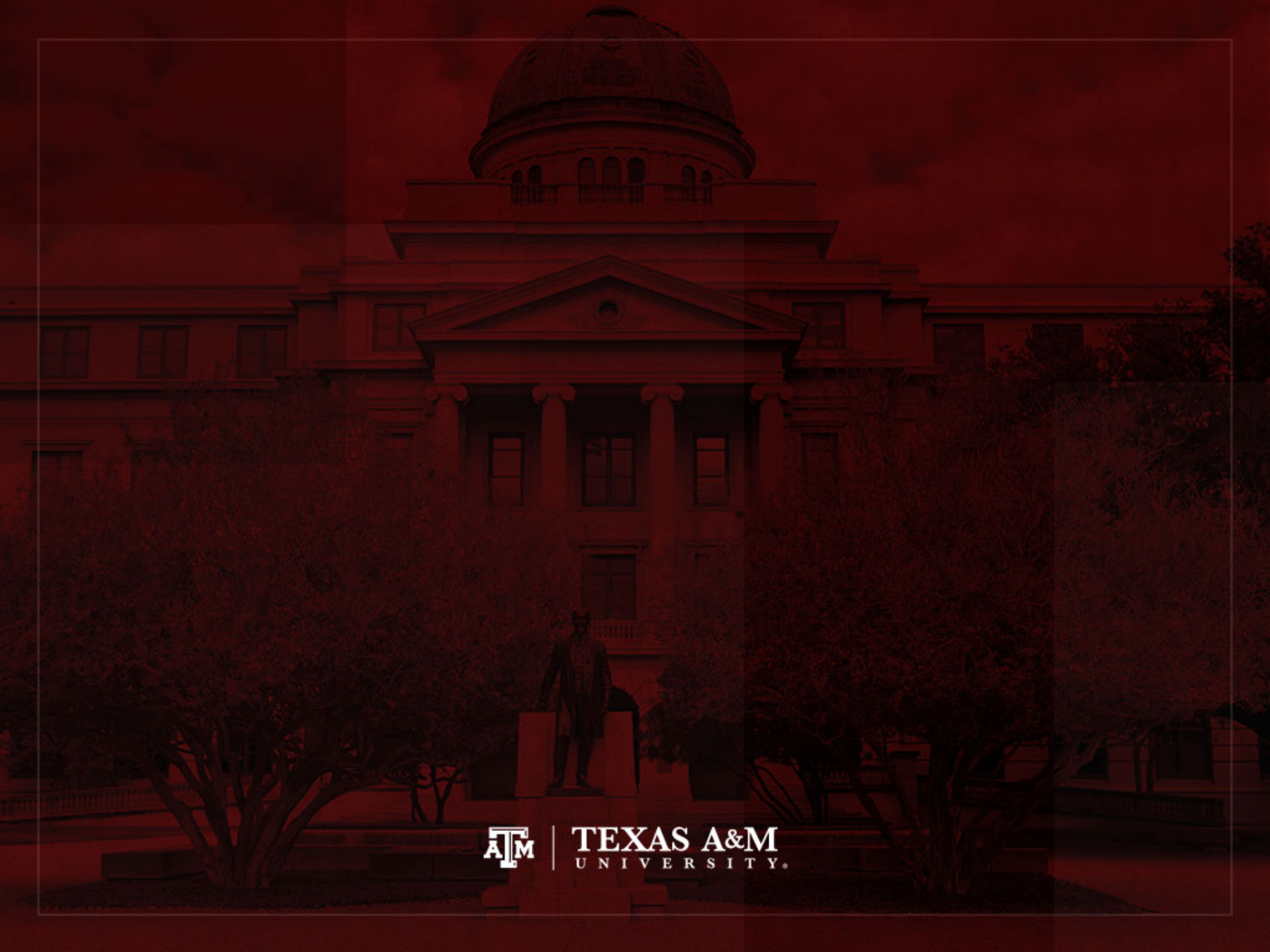
Migration components of equation

- $I_{t \text{ to } t+1} - E_{t \text{ to } t+1}$
  - Net international migration
    - Immigration minus emigration
  - Net internal migration
    - In-migration minus out-migration

- $I_{t \text{ to } t+1} < E_{t \text{ to } t+1}$
  - Negative net international migration (sending countries)
  - Negative net internal migration (net out-migration)

- $I_{t \text{ to } t+1} > E_{t \text{ to } t+1}$
  - Positive net international migration (receiving countries)
  - Positive net internal migration (net in-migration)

Source: Poston, Bouvier, 2017.


TEXAS A&M
UNIVERSITY

Demographic models

- Formal demography
- Population studies I
- Population studies II

Source: Poston, Bouvier, 2017.

Formal demography

Independent variable		Dependent variable
Demographic	→	Demographic
Examples		
1. Age composition	→	Birth rate
2. Birth rate	→	Age composition
3. Sex composition of in-migrants to a city	→	Sex ratio of the total population of the city

Source: Poston, Bouvier, 2017.

Population studies I (social demography)

Independent variable		**Dependent variable**
Non-demographic	→	Demographic

Examples

1. Social class (sociological)	→	Death rate
2. Attitude about motherhood (social psychology)	→	Number of children
3. Annual rainfall (geographical)	→	Population density
4. Economic opportunity (economic)	→	Migration

Source: Poston, Bouvier, 2017.

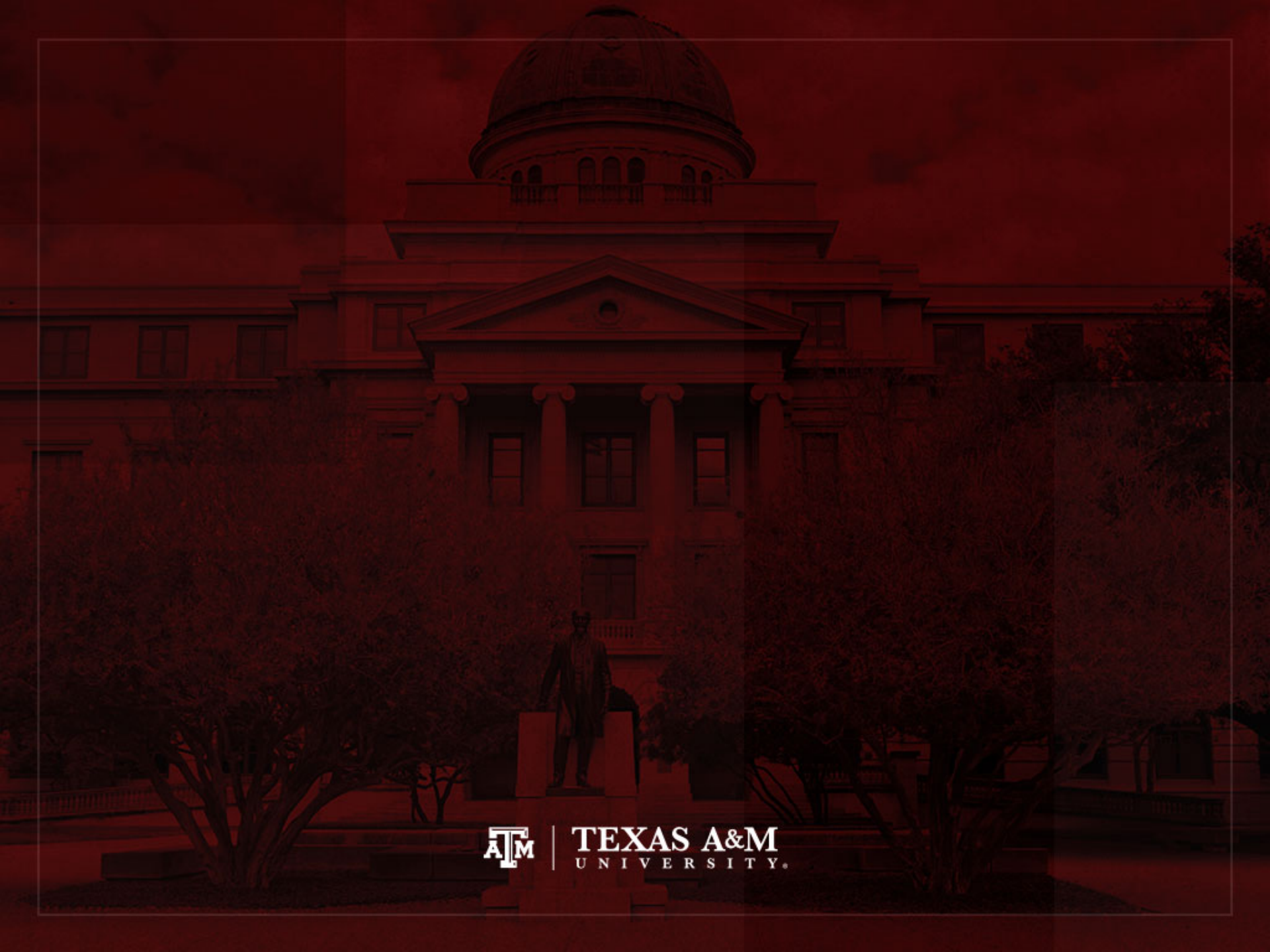
Population studies II (social demography)

Independent variable		**Dependent variable**
Demographic	→	Non-demographic

Examples

1. Age composition	→	Voting behavior (political)
2. Migration	→	Social change (sociology)
3. Birth rate	→	Need for infant & child goods/services (public health)

Source: Poston, Bouvier, 2017.


TEXAS A&M
UNIVERSITY

Cohorts and generations

- Cohort
  - Group of persons who have experienced a common event during a given time interval
  - Birth cohorts are sometimes referred to as generations

- Why study birth cohorts?
  - If you understand what distinctive opportunities and problems you have faced, you can find common ground with others in your generation and in other generations (Elwood Carlson)

Examples of cohorts

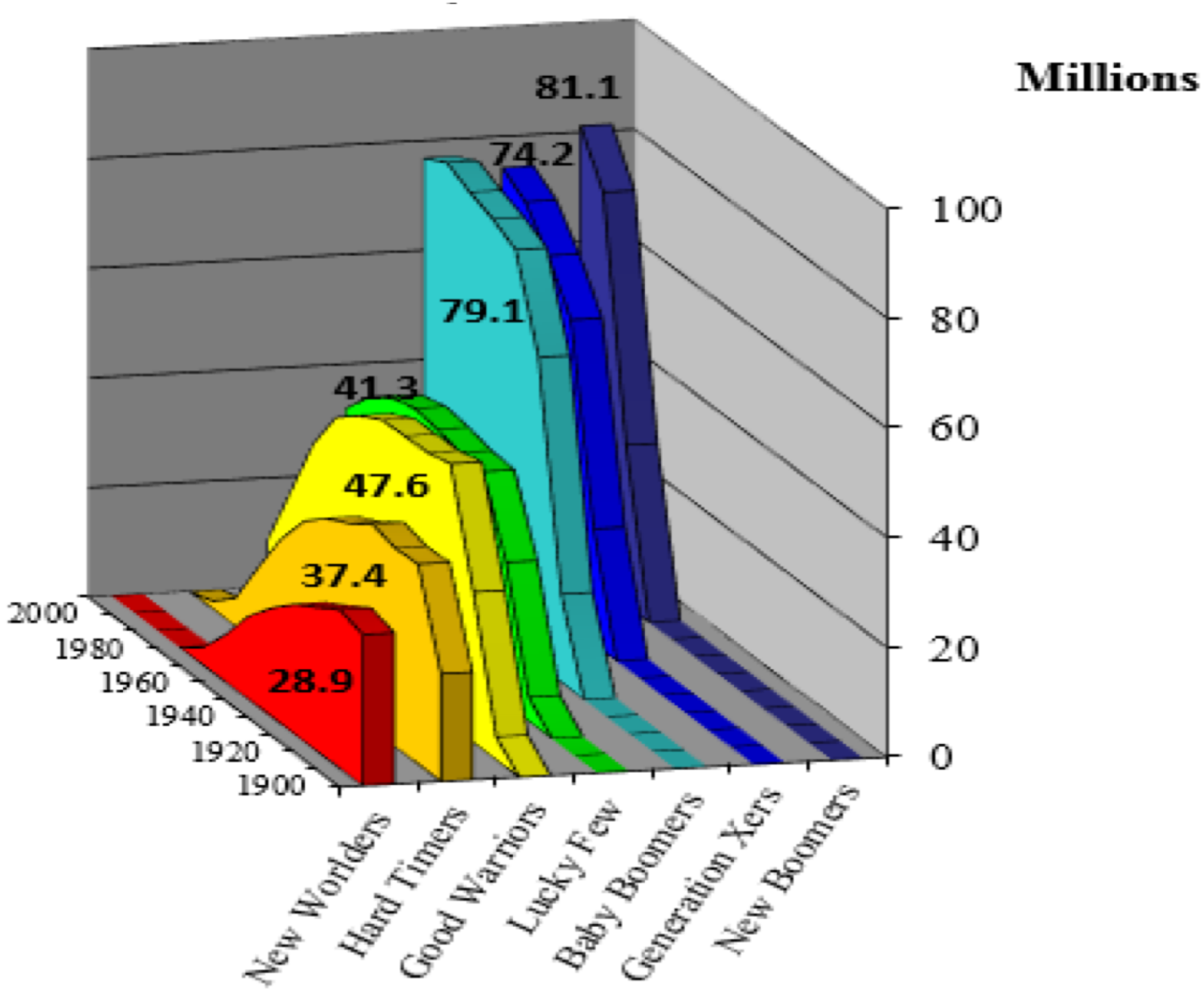
- People born during the same period who experience similar social circumstances throughout their lives
  - Lucky Few: from around 1929 through 1945
  - Baby boomers: between around 1946 and 1964
  - Baby bust cohort (Gen. X): from mid-1960s to early 1980s
  - Millennials (Gen. Y): born in the 1980s and 1990s (or up to early 2000s)
  - Gen. Z: start around mid-1990s (or mid-2000s)

Lucky Few cohort

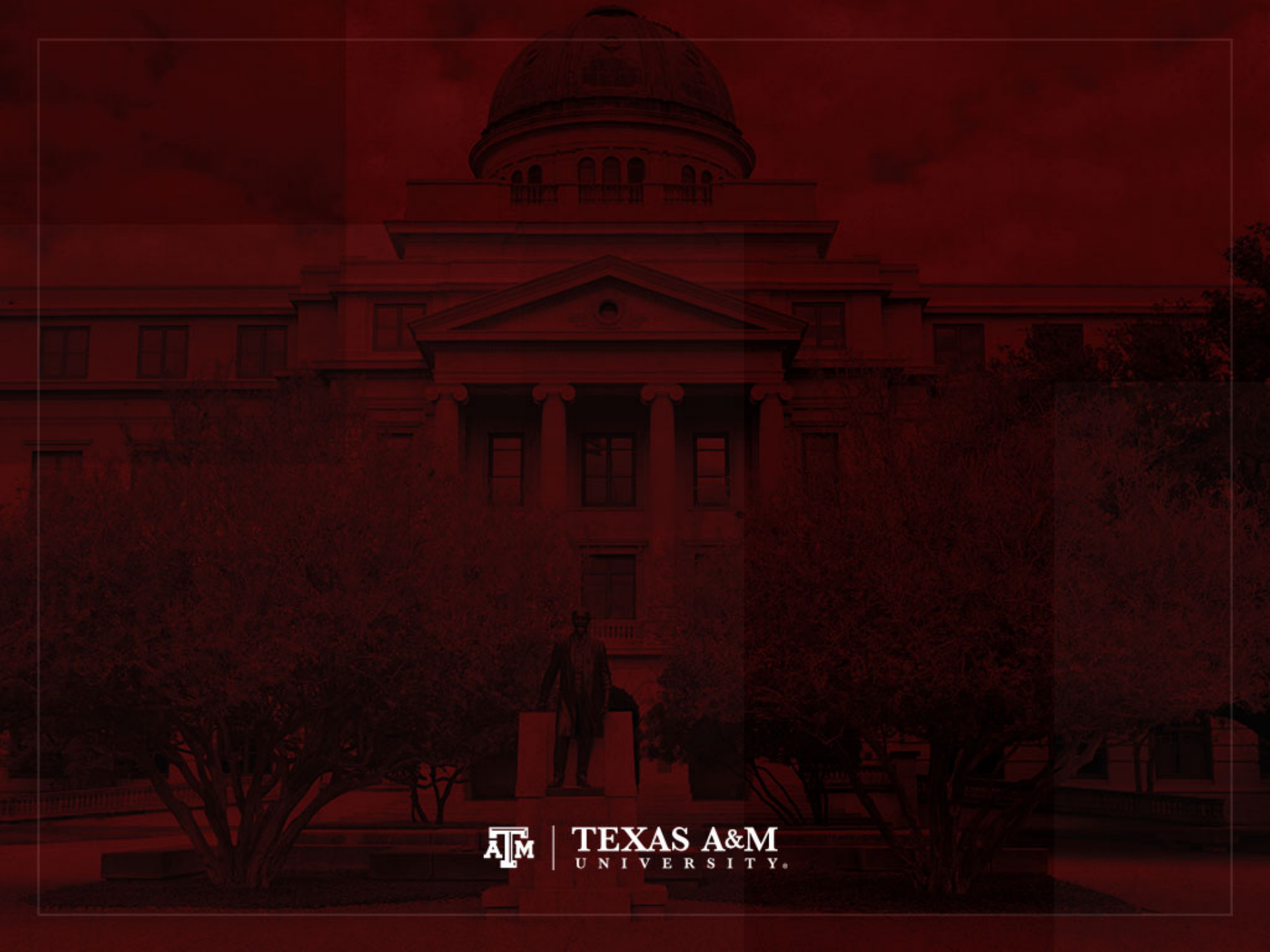
- **Lucky Few cohort**, born between 1929–1945
  - They were fewer compared to the much larger number of persons in the following cohort
  - Baby Boomer cohort, born between 1946–1964

- The smaller size of the Lucky Few has enabled them to experience
  - Higher employment rates
  - Greater variety of social opportunities than members in the preceding or following cohorts

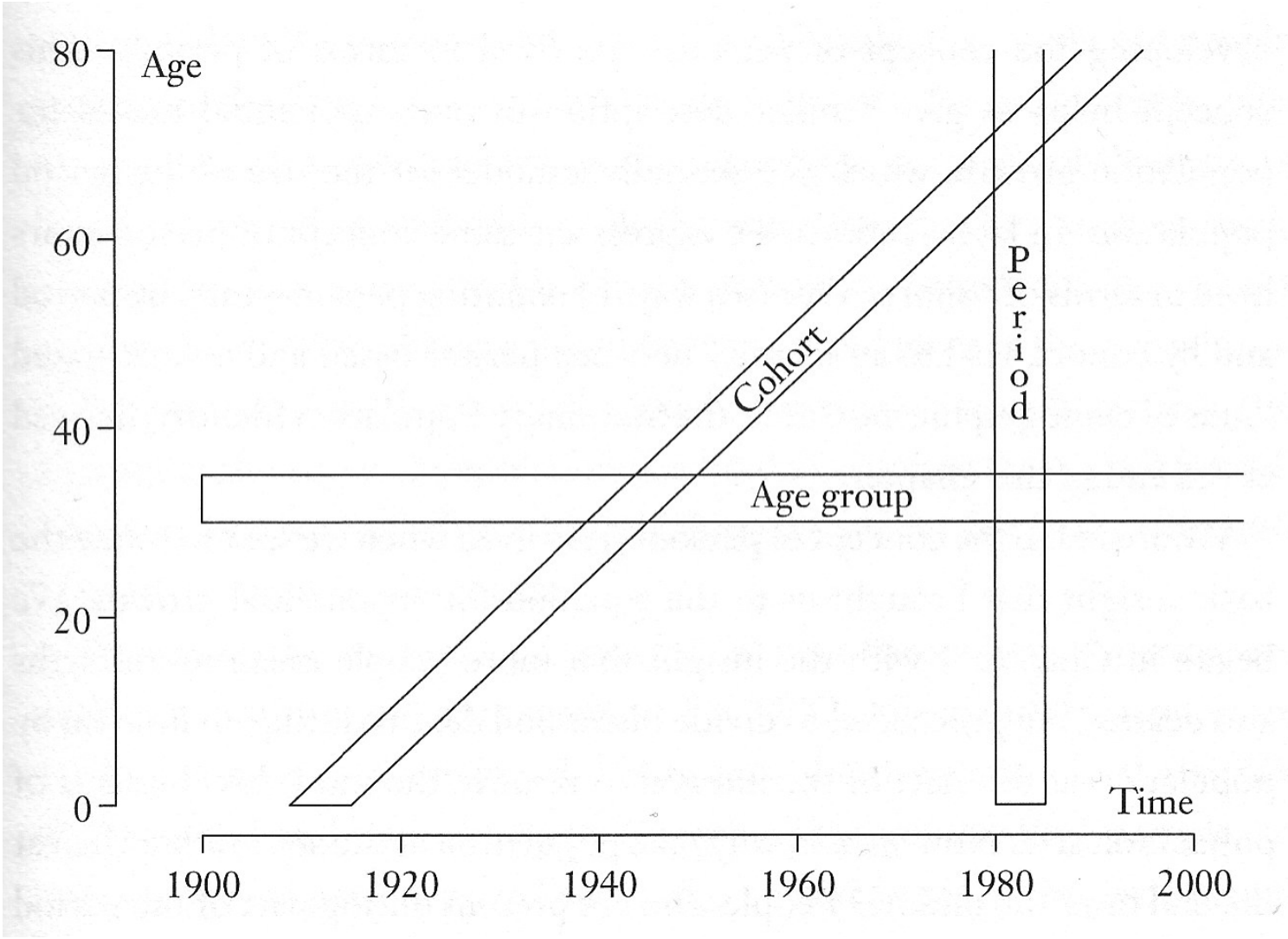
Seven birth cohorts by size, 1900–2010



Source: Poston, Bouvier (2017).


TEXAS A&M
UNIVERSITY

Lexis diagram: Age, period, cohort



Source: Wachter 2014, p.33.

Game of pretend

- When we calculate a period measure, we pretend that age-specific rates we see today for different age groups continue unchanged into the future

- We are creating an imaginary cohort whose life experience is pieced together from the experiences of different people found at different ages in one period of time

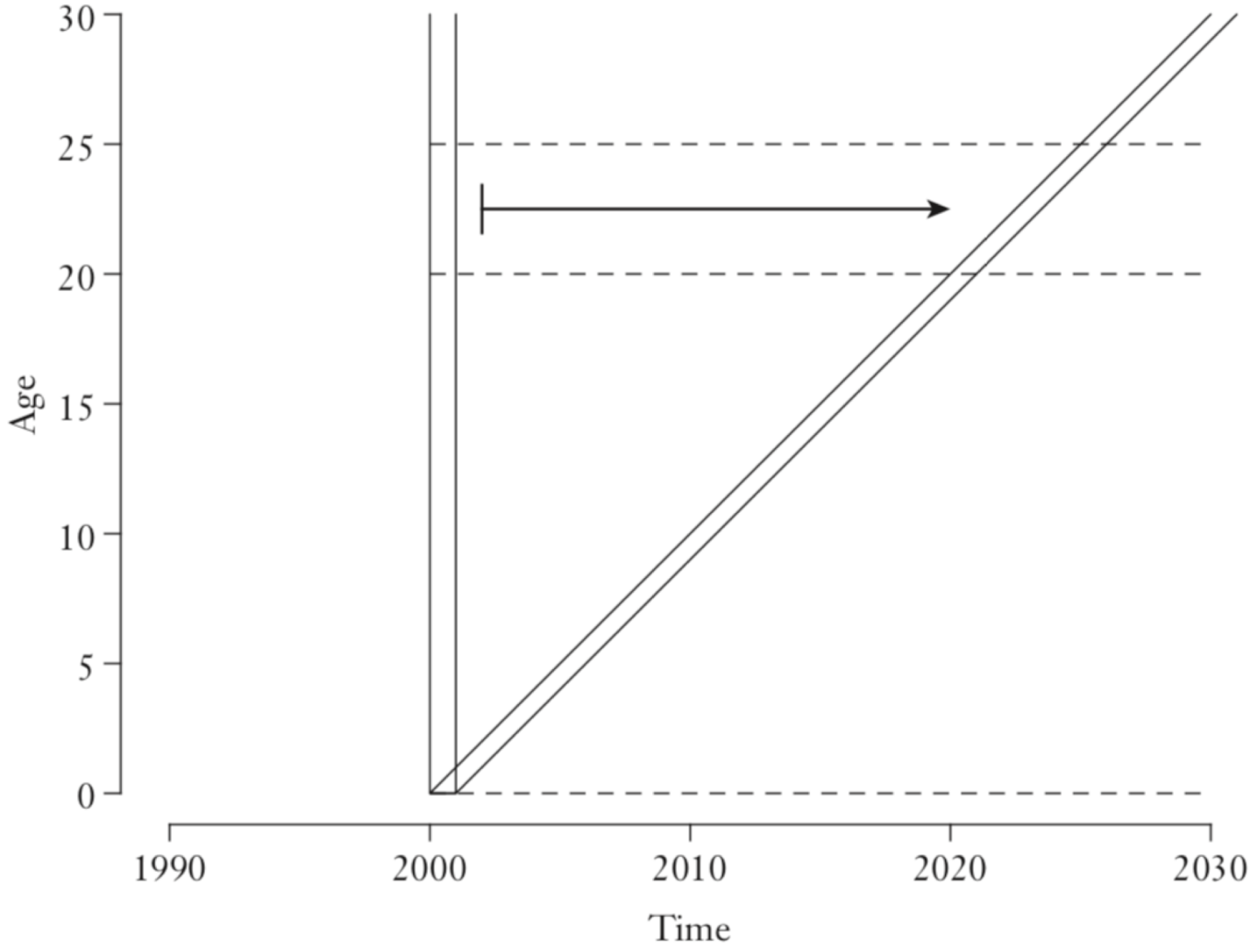


Figure 6.1 From period to cohort on a Lexis diagram

Source: Wachter 2014, p.127.

Synthetic cohort

- We call this imaginary cohort the synthetic cohort
  - *syn*: “together”
  - *thetic*: “pieced”
  - *synthetic*: “pieced together”
- Age-specific cohort rates of the synthetic cohort are the age-specific period rates of the period population
- The concept of a synthetic cohort is central to demography

References

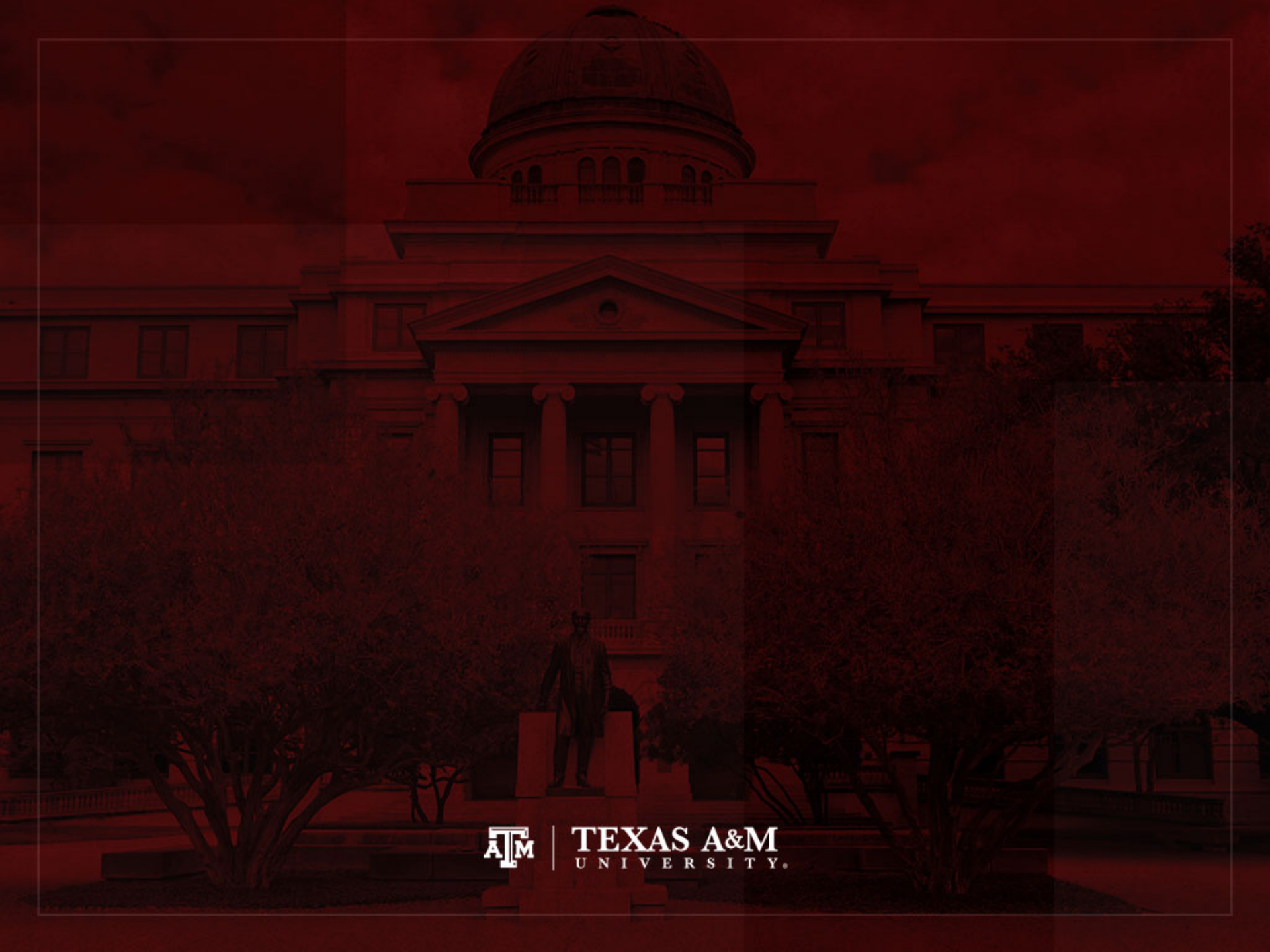
Healey JF. 2015. ”Statistics: A Tool for Social Research.” Stamford: Cengage Learning.

Hugo G. 2011. “Future demographic change and its interactions with migration and climate change.” Global Environmental Change, 21(Supplement 1): S21–S33.

Poston DL, Bouvier LF. 2017. Population and Society: An Introduction to Demography. New York: Cambridge University Press. 2nd edition. Chapter 1 (pp. 3–16).

Weeks JR. 2015. Population: An Introduction to Concepts and Issues. Boston: Cengage Learning. 12th edition. Chapters 1 (pp. 1–24), 2 (pp. 25–57).

Wooldridge JM. 2015. “Introductory Econometrics: A Modern Approach.” Boston: Cengage Learning.


TEXAS A&M
UNIVERSITY