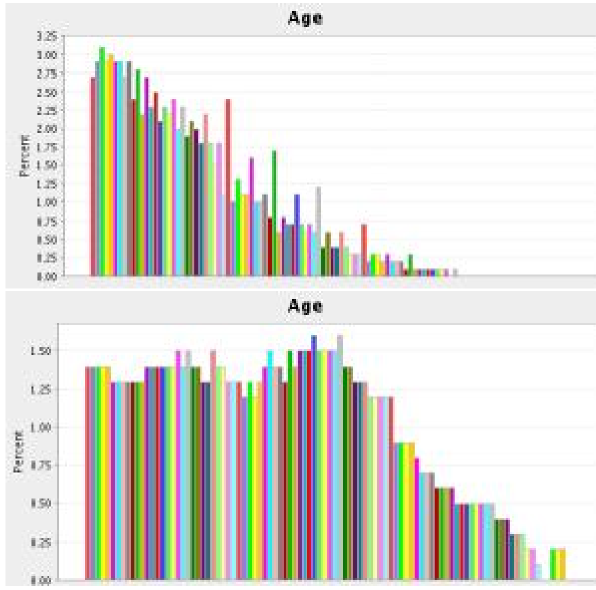
Week 3: Sources and Methods

1. Age Distributions and Age Pyramids
2. Basic Principles of Demographic Measurement
3. Life course and cohort measures

1. Age Distributions and Age Pyramids

1850

2007



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Determinants of Age Distribution

- Fertility
- Mortality
- Misreporting (e.g., age heaping)

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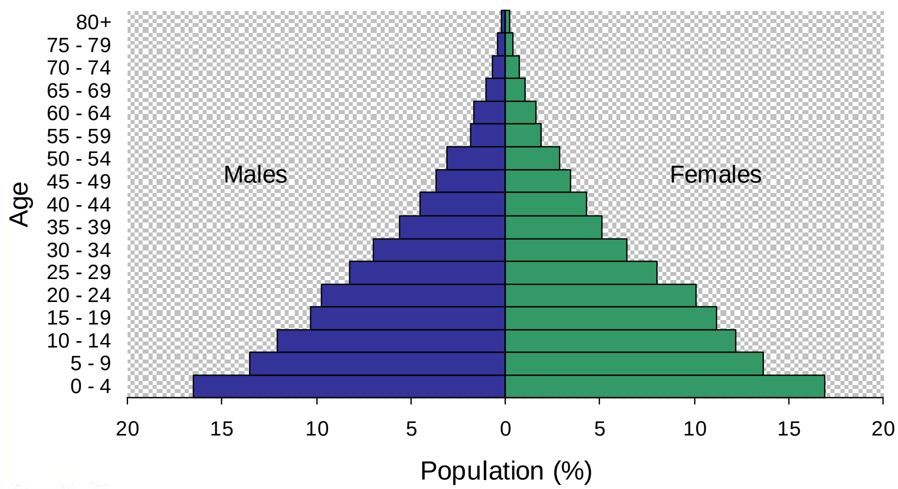
Population Pyramid: U.S. 1850



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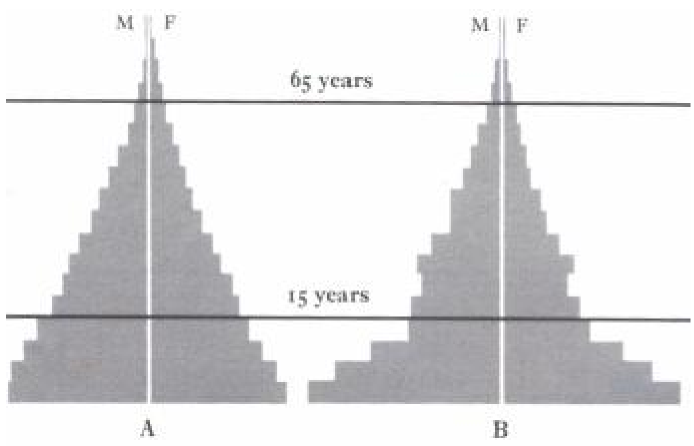

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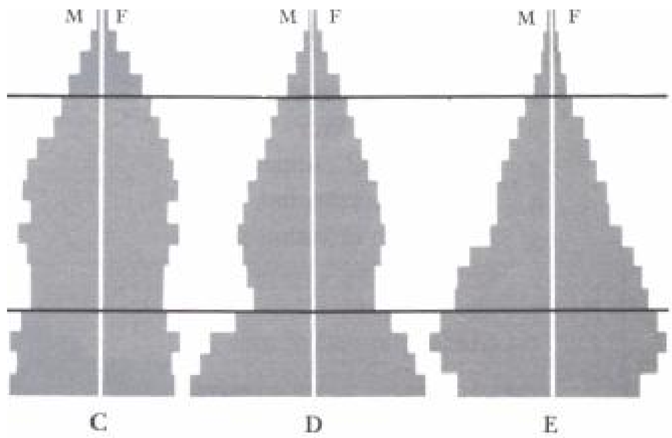
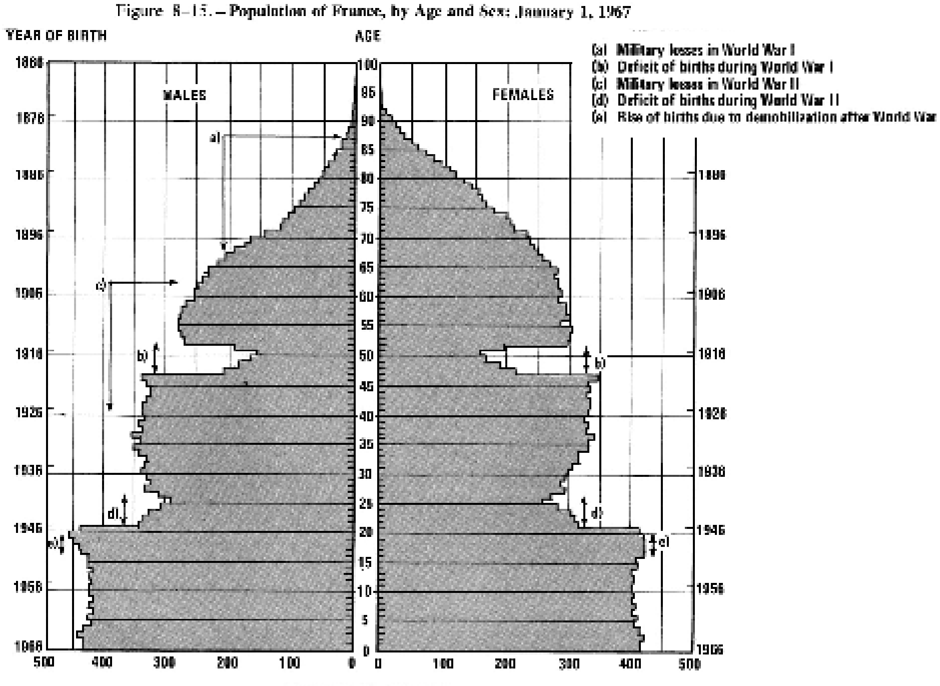


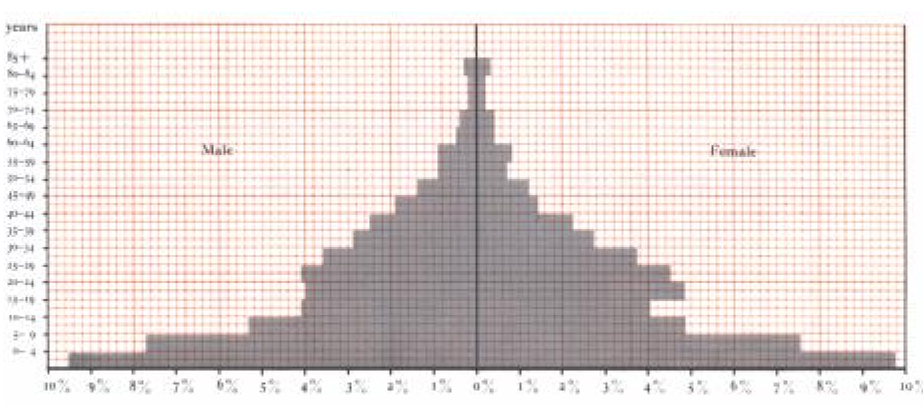
Figure 8-15. – Population of France, by Age and Sex: January 1, 1967



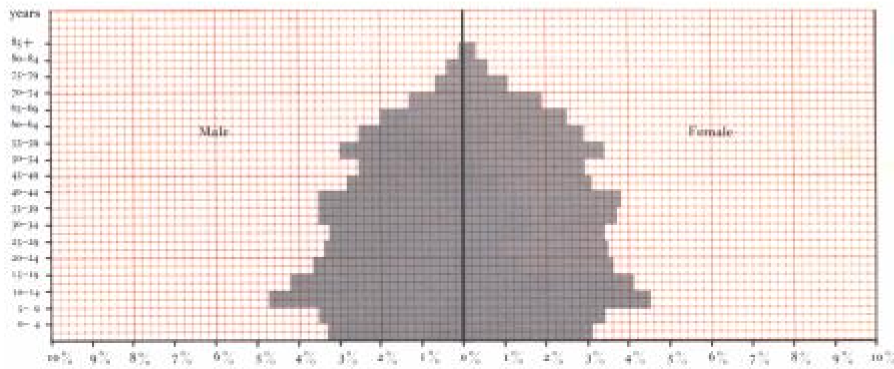
Guess the Pyramid

(1) Hong Kong, 1967
(2) West Berlin, 1967
(3) a central business district
(4) Hungary, 1967
(5) Ghana, 1960

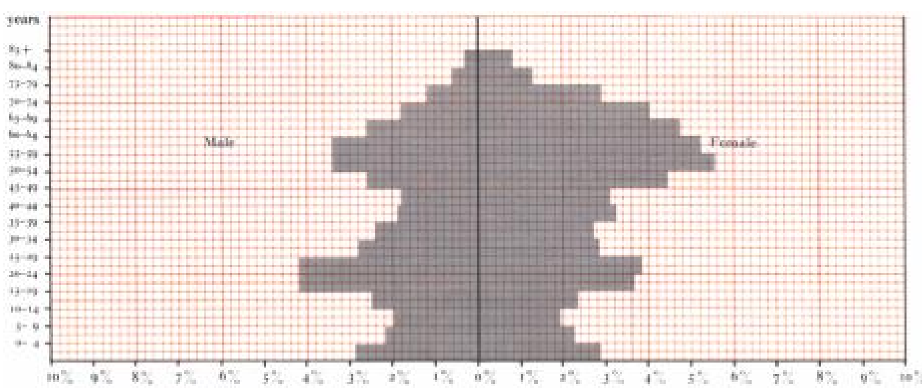
Pyramid A



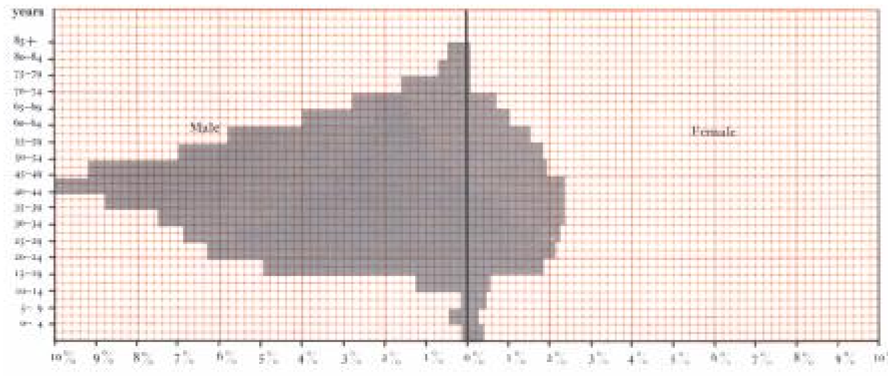
Pyramid B



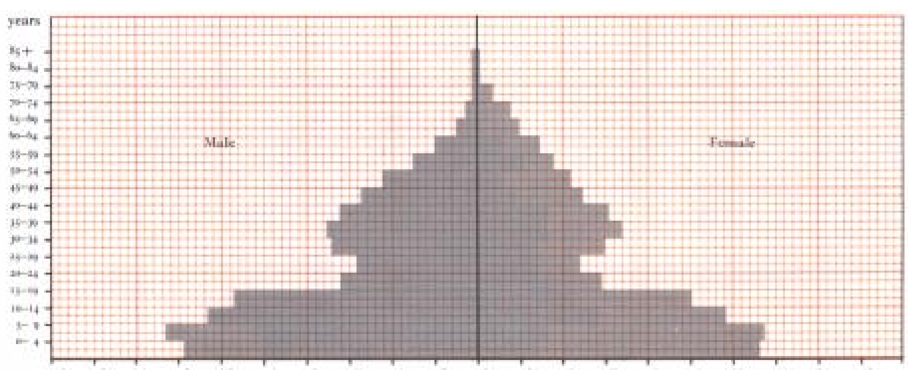
Pyramid C



Pyramid D



Pyramid E



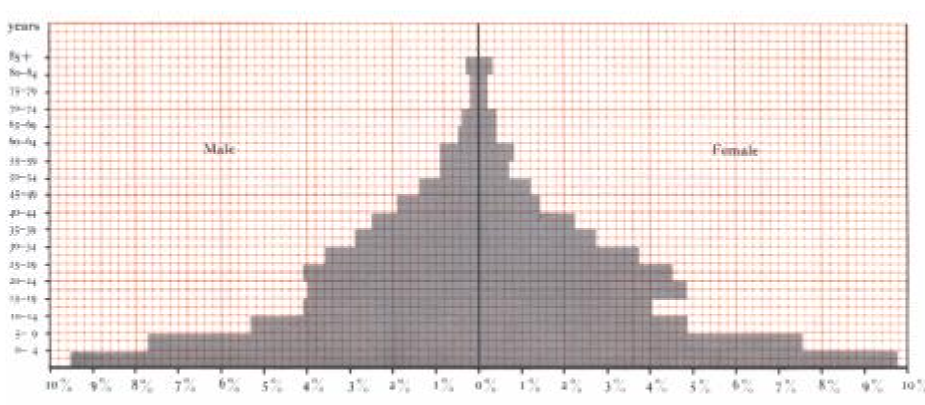
Guess the Pyramid

(1) Hong Kong, 1967
(2) West Berlin, 1967
(3) a central business district
(4) Hungary, 1967
(5) Ghana, 1960

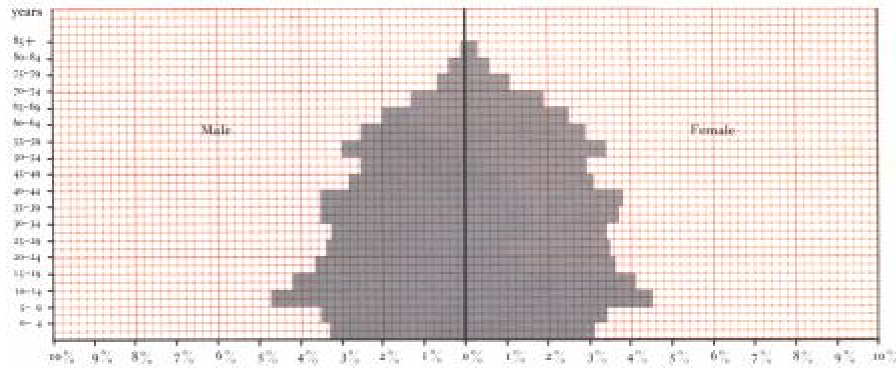
Clues:

- commercial travelers
- First World War
- birth control campaigns
- Japanese occupation
- emigration of young people

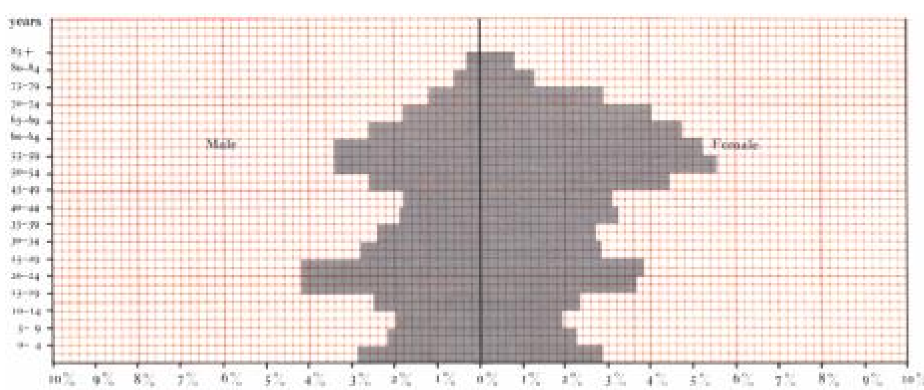
Pyramid A



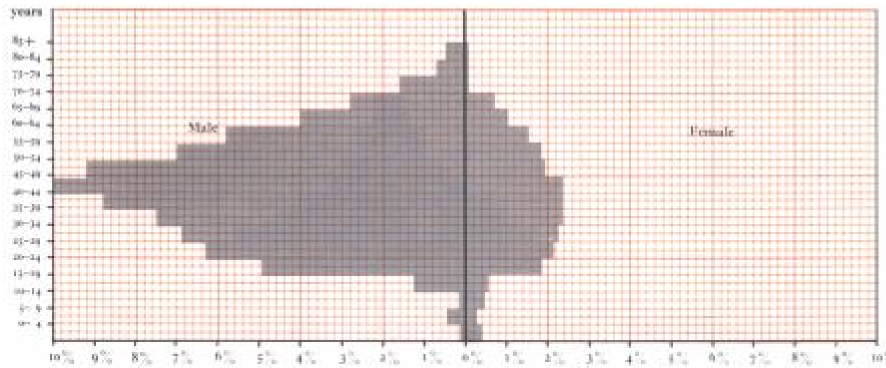
Pyramid B



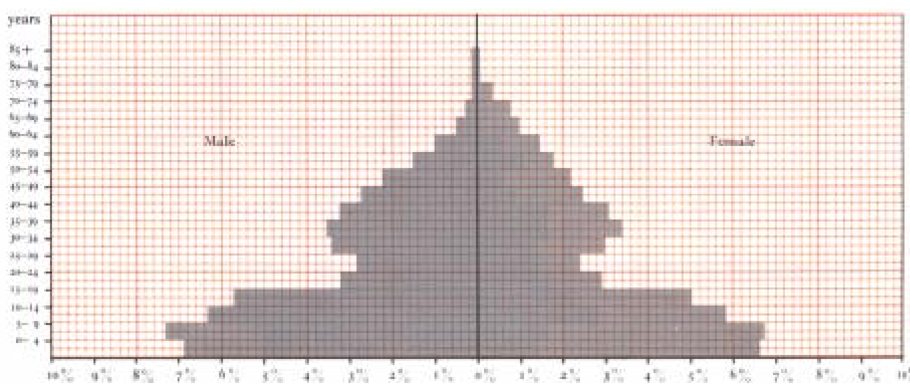
Pyramid C



Pyramid D



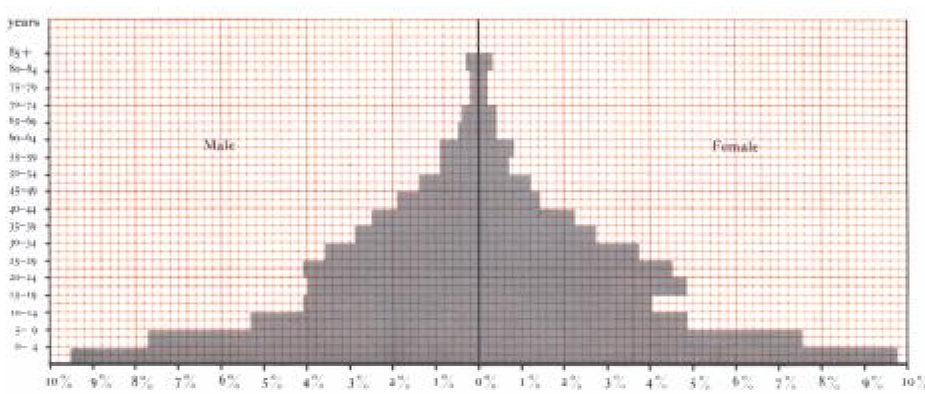
Pyramid E



Answers Revealed

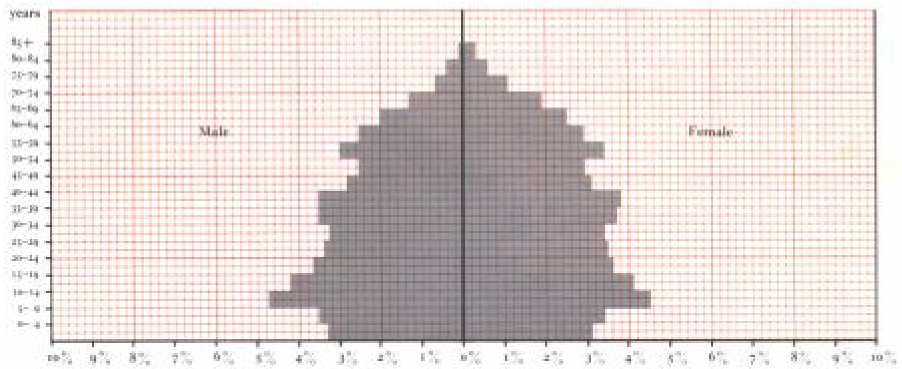
(1) Hong Kong, 1967
(2) West Berlin, 1967
(3) a central business district
(4) Hungary, 1967
(5) Ghana, 1960

Pyramid A



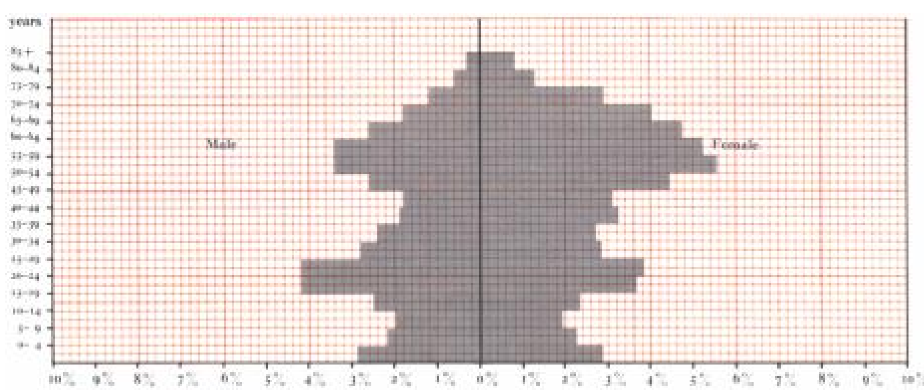
Ghana, 1960

Pyramid B



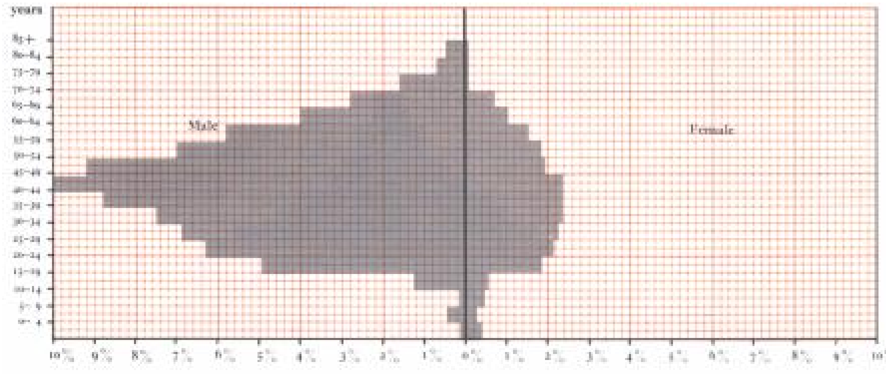
Hungary, 1967

Pyramid C



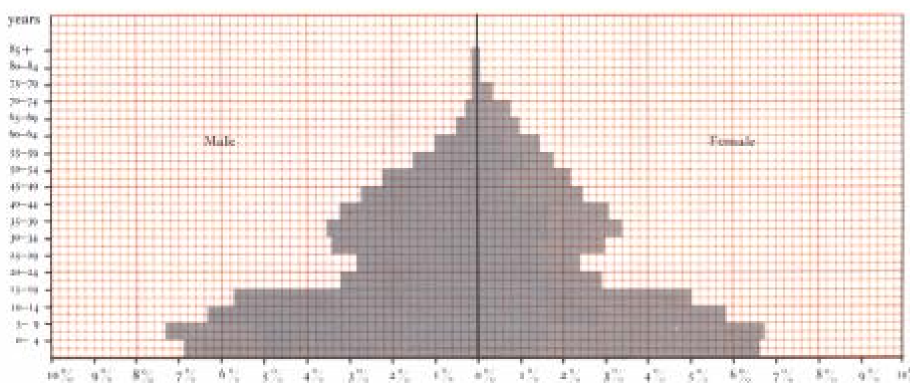
West Berlin, 1967

Pyramid D



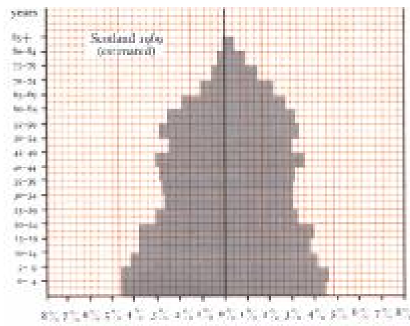
a central business district

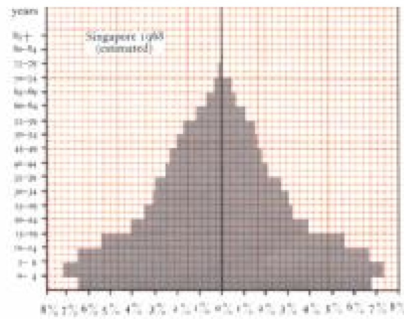
Pyramid E



Hong Kong, 1967

Importance of age distribution for demographic measures





Scotland 1969:
Death Rate 12 per thousand

Singapore 1968:
Death Rate 6 per thousand

Average mortality *at each age* was 50% higher in Singapore

2. Basic Principles of Demographic Measurement

-or-

The Importance of Denominators

Numbers and Comparisons

- A single number is not meaningful in isolation
- Knowing that a medieval king had 10,000 soldiers would not by itself tell us anything about his military strength—it all depends if the next kingdom has 5,000 or 20,000
- Meaningful comparisons are *always* based on comparison of some kind.

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Implicit Comparisons

- In 2003 my wife had 355 students in Hist 1301.
- That is meaningful to me because I have a frame of reference: I know how big other classes are, and I have ideas about how big they should be.

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Isolated counts are meaningless

- Always must have comparison
- Never rely on implicit comparison: audience may have different reference groups in mind (is 350 a *low* number?)
- Comparison should be explicit

The comparison determines the meaning

Philadelphia 1776: 33,290 people (Smith 1990): Big or small?

Oshkosh, Wisconsin, 2000: 62,916 (Census 2000)

Neenah, Oshkosh, Appleton Metarea: 361,000

So, Philadelphia was wimpy . . .

British Empire Cities, 1776

Philadelphia was 2nd largest city in the empire

Bristol, #3, had 28,000

So, Philadelphia was huge.

Which is the appropriate comparison?

It depends on your point:

- Importance colonies had assumed by time of the revolution

or

- Small scale of cities before the Industrial Revolution

Quantitative Comparisons

Compare Philadelphia to Boston in 1790 Census

Philadelphia:	28,522
Boston:	18,320

Subtraction: 28,000-18,000=10,000

But: is 10,000 big or small?

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Absolute differences depend on size of base

Bangalore, 2000:	5,430,000
St. Petersburg, 2000:	5,420,000

So we need to size of the base to evaluate
Significance of 10,000 population difference

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Comparison by Division

$$\frac{Philadelphia}{Boston} = \frac{28{,}522}{18{,}320} = 1.56$$

$$\frac{Bangalore}{St.Petersburg} = \frac{5{,}430{,}000}{5{,}420{,}000} = 1.002$$

Comparison by division is the basis of all statistics

Percentages are just fractions you have divided out and multiplied by 100

$$p = \frac{a}{b} \times 100$$

$$= \frac{28{,}522}{18{,}320} \times 100$$

$$= 156\%$$

Philadelphia was 156% of the size of Boston

Percent just means for every 100, so this means for every 100 persons in Boston, there were 156 in Philadelphia

We can turn it around:

$$\frac{Boston}{Philadelphia} \times 100$$
$$= \frac{18,320}{28,522} \times 100$$
$$= 64\%$$

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Subtraction and division are often combined:

$$28,522 - 18,320 = 10,202$$
$$\frac{10,202}{28,522} \times 100 = 35.7\%$$
$$\frac{10,202}{18,320} \times 100 = 55.7\%$$

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Even though the absolute difference is 10,202, the percentage difference differs according to the reference group:

Boston was 36% smaller than Philadelphia, but Philadelphia 56% larger than Boston

Numerator (10,202) is the same, denominator differs

Reference group for comparison is the denominator

The denominator provides a point of reference—a standard for meaningful comparison

Which makes more sense:

Boston 36% smaller, or

Philadelphia 56% larger?

It depends on the point we are trying to make.

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Percentages are fractions

- Numerator should represent the cases that exhibit the characteristic we are trying to measure
- Denominator provides a standard for comparison
- So if we are studying Boston, Boston should be in the numerator and Philadelphia in the denominator

In most percentages, the numerator is a subset of the denominator

Suppose 10% of men have beards

- Numerator: men with beards
- Denominator: all men

Every member of numerator is also in the denominator

In most cases, the denominator should consist of cases that have potential to exhibit the characteristic measured by the numerator

Population "at risk"

Five-year graduation rate:

10,000 students enter; five years later, 6,000 have graduated

10,000 is the number who had the possibility of graduating—the population at risk

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Measuring denominators is the central problem of pre-19th century historical demography

- Paleodemography: Why can't distribution of age at death misleading tell us about mortality?
- How do we measure mortality from a list of burials?

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Watch your denominators

Beware of the population at risk

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Degrees Earned, 1985 (thousands)

	Bachelors	Masters	Doctorates
Males	477	151	23
Females	461	148	10

Possible questions:

What percent of doctorates were earned by women?

What percent of women warned doctorates?

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Same table, with marginal frequencies

	Bachelors	Masters	Doctorates	Total
Male	477	151	23	651
Female	461	148	10	619
Total	938	299	33	1270

Row percents

	Bachelors	Masters	Doctorates	Total
Male	73.3	23.2	3.5	100.0
Female	74.5	23.9	1.6	100.0

Column percents

	Bachelors	Masters	Doctorates
Male	50.9	50.5	69.7
Female	49.1	49.5	30.3
Total	100.0	100.0	100.0

Some terms

- Variable: characteristic of a population that can vary (e.g., age, which can vary from 0 to about 114; sex, which can vary from male to female)
- Population: any group of things one is analyzing (could be people, could be wills, could be firms)

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3. Life course and cohort measures

Cross-sectional data

- “Snapshot” of a population at a particular moment
- Examples: Census; Tax list
- Limitation: Often can’t tell characteristics of an individual prior to the occurrence of an event (e.g. effects of poverty on divorce for women)

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Longitudinal data

- Continuous or repeated observations about the same individuals
- Allows analysis of the sequence of events

Historical Longitudinal Data

- Linked censuses or *status animarum*
- Population registers (esp. Netherlands, Belgium)
- Genealogies (esp. Asia).
- Family reconstitution: linked baptism, marriage, and death records

Cohort Analysis

- Follow a group of people through successive cross-sections as they age
- Usually defined by cohort of birth
- Can also use marriage cohorts, educational cohorts, etc.

Example: percent of native-born whites residing outside state of birth, 1850-1990

	1850	1860	1870	1880	1900	1910	1920	1940	1950	1960	1970	1980	1990
0-4	.0590	.0599	.0582	.0487	.0434	.0492	.0554	.0434	.0852	.0968	.1077	.1047	.1045
5-9	.1139	.1360	.1139	.0970	.0750	.0860	.0895	.0693	.1221	.1487	.1625	.1826	.1652
10-14	.1669	.1784	.1473	.1353	.0991	.1068	.1134	.0886	.1155	.1653	.1816	.2110	.1981
15-19	.2297	.2277	.2100	.1730	.1305	.1366	.1451	.1183	.1498	.2093	.2182	.2432	.2571
20-24	.2984	.2938	.2818	.2405	.1880	.1902	.2016	.1751	.2209	.2936	.3167	.3044	.3228
25-29	.3461	.3755	.3328	.3100	.2241	.2402	.2372	.2142	.2639	.3014	.3310	.3436	.3574
30-34	.3885	.4040	.3821	.3533	.2711	.2728	.2619	.2491	.2732	.3083	.3310	.3711	.3739
35-39	.4209	.4072	.4197	.3704	.3076	.2939	.2852	.2711	.2776	.3179	.3332	.3846	.3874
40-44	.4244	.4480	.4410	.4062	.3142	.3161	.3007	.2808	.2894	.3145	.3279	.3685	.4033
45-49	.4663	.4525	.4363	.4434	.3564	.3343	.3042	.2901	.3020	.3082	.3312	.3649	.4103
50-54	.4896	.4608	.4669	.4629	.3932	.3604	.3320	.2994	.3078	.3112	.3198	.3585	.3941
55-59	.4987	.4768	.4963	.4735	.4284	.3749	.3381	.3049	.3116	.3180	.3130	.3643	.3859
60-64	.4722	.4866	.4638	.4770	.4638	.4309	.3957	.3385	.3277	.3299	.3325	.3646	.3875
Total	.2507	.2594	.2528	.2392	.2042	.2074	.2046	.1971	.2260	.2506	.2693	.3075	.3295

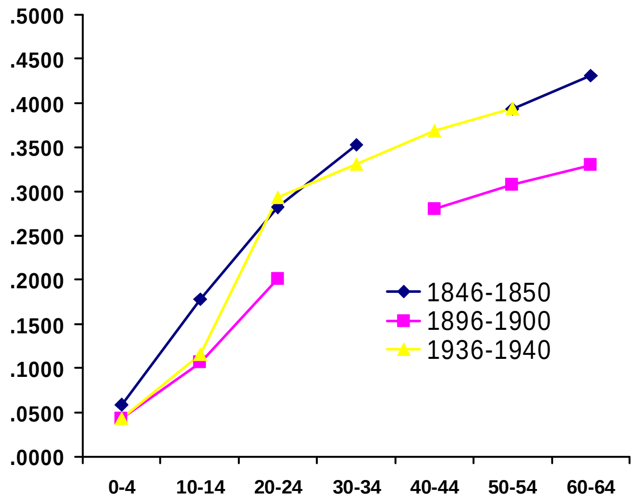
Highlight the same birth group over time

	1850	1860	1870	1880	1900	1910	1920	1940	1950	1960	1970	1980	1990
0-4		.0599	.0582	.0487		.0492	.0554		.0852	.0968	.1077	.1047	.1045
5-9	.1139	.1360	.1139	.0970	.0750	.0860	.0895	.0693	.1221	.1487	.1625	.1826	.1652
10-14	.1669		.1473	.1353	.0991		.1134	.0886		.1653	.1816	.2110	.1981
15-19	.2297	.2277	.2100	.1730	.1305	.1366	.1451	.1183	.1498	.2093	.2182	.2432	.2571
20-24	.2984	.2938		.2405	.1880	.1902		.1751	.2209		.3167	.3044	.3228
25-29	.3461	.3755	.3328	.3100	.2241	.2402	.2372	.2142	.2639	.3014	.3310	.3436	.3574
30-34	.3885	.4040	.3821		.2711	.2728	.2619	.2491	.2732	.3083	.3310	.3711	.3739
35-39	.4209	.4072	.4197	.3704	.3076	.2939	.2852	.2711	.2776	.3179		.3846	.3874
40-44	.4244	.4480	.4410	.4062	.3142	.3161	.3007		.2894	.3145	.3279	.3685	.4033
45-49	.4663	.4525	.4363	.4434	.3564	.3343	.3042	.2901	.3020	.3082	.3312		.4103
50-54	.4896	.4608	.4669	.4629		.3604	.3320	.2994		.3112	.3198	.3585	.3941
55-59	.4987	.4768	.4963	.4735	.4284	.3749	.3381	.3049	.3116	.3180	.3130	.3643	.3859
60-64	.4722	.4866	.4638	.4770	.4638		.3957	.3385	.3277		.3325	.3646	
Total	.2507	.2594	.2528	.2392	.2042	.2074	.2046	.1971	.2260	.2506	.2693	.3075	.3295

Rearrange into birth cohorts

	Year of birth		
	1846-1850	1896-1900	1936-1940
0-4	.0590	.0434	.0434
10-14	.1784	.1068	.1155
20-24	.2818	.2016	.2936
30-34	.3533		.3310
40-44		.2808	.3685
50-54	.3932	.3078	.3941
60-64	.4309	.3299	

Make a nice graph



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Synthetic cohorts

- Similar to cohort analysis, but instead of using successive observations of the same group of people, you treat the age distribution of the population as if it were a cohort passing through time.
- Yields different result from true cohort analysis in periods of rapid change
- Synthetic cohorts are the basis of most commonly used measures of demographic behavior (e.g. life expectancy, total fertility rate, and median age at marriage.

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Synthetic cohorts for internal migration

	1850	1860	1870	1880	1900	1910	1920	1940	1950	1960	1970	1980	1990
0-4		.0599	.0582		.0434		.0554		.0852	.0968		.1047	
5-9		.1360	.1139		.0750		.0895		.1221	.1487		.1826	
10-14		.1784	.1473		.0991		.1134		.1155	.1653		.2110	
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45-49		.4525	.4363		.3564		.3042		.3020	.3082		.3649	
50-54		.4608	.4669		.3932		.3320		.3078	.3112		.3585	
55-59		.4768	.4963		.4284		.3381		.3116	.3180		.3643	
60-64		.4866	.4638		.4638		.3957		.3277	.3299		.3646	
Total		.2594	.2528		.2042		.2046		.2260	.2506		.3075	

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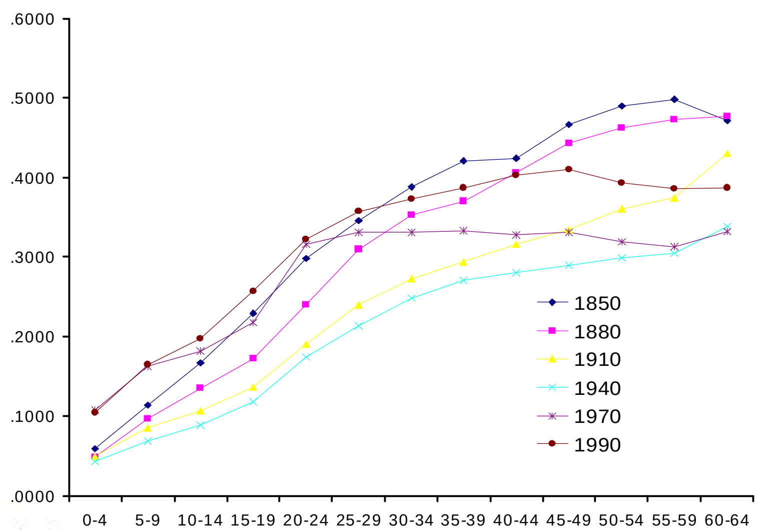
. . . And make a nice graph



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Period change vs. cohort change vs. life course change

- Period change refers to changes that occur from one year to the next
- Cohort change is change occuring between successive birth cohorts
- Often the two are different (example of fertility in the depression)
- Life course change is change that occurs within a cohort as they age.

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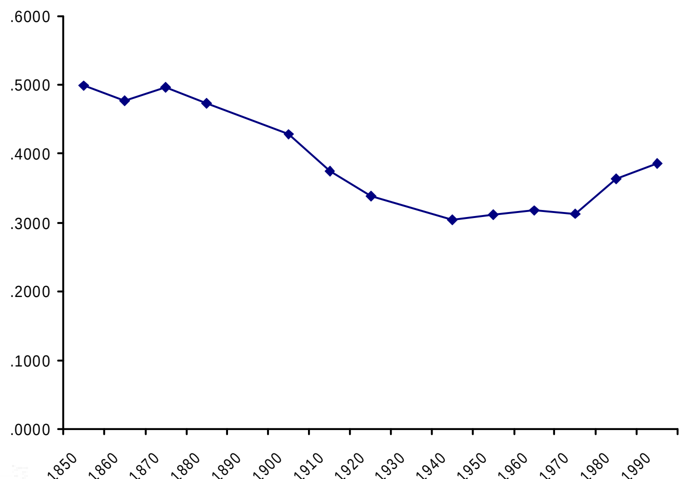
Period change: percent migrant among persons aged 55-59



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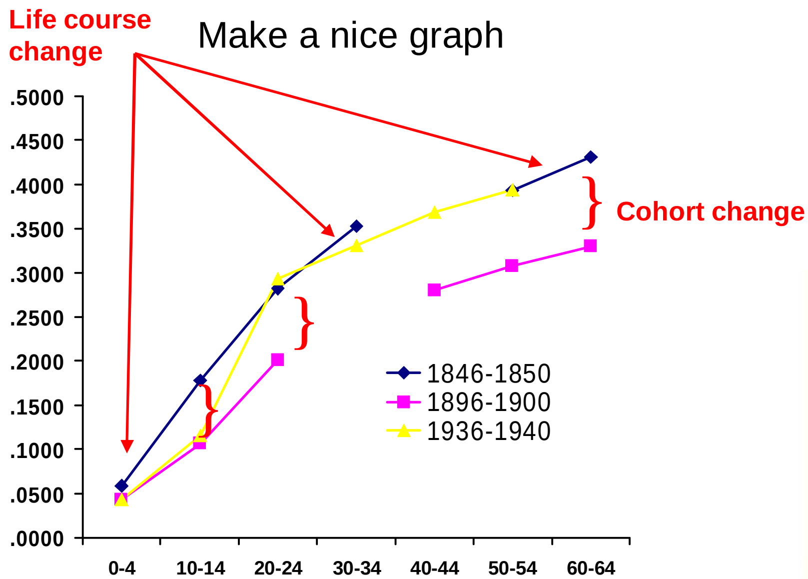
Make a nice graph



Demographic synthetic cohort measures

- Life expectancy: derives from life table; 2000 represents the number of years that would be lived by a synthetic cohort that experienced the same age-specific death rates as the population as a whole in 2000
  - Does not mean how long a baby born in 2000 can expect to live
  - Cohort life tables are possible, but only for cohorts that are extinct.
- Total Fertility Rate, Net Reproduction Rate: number of children a synthetic cohort of women would have.