Session 2
A Conceptual Framework for Studying Fertility

Social and Economic Aspects of Fertility Decline

Population, Family and Reproductive Health
380.655
AY 2008-2009

Objectives of the lecture

- After listening to this lecture and reading the accompanying references students will be able to:
  - Distinguish between natural and controlled fertility
  - Describe the proximate determinants framework for studying fertility

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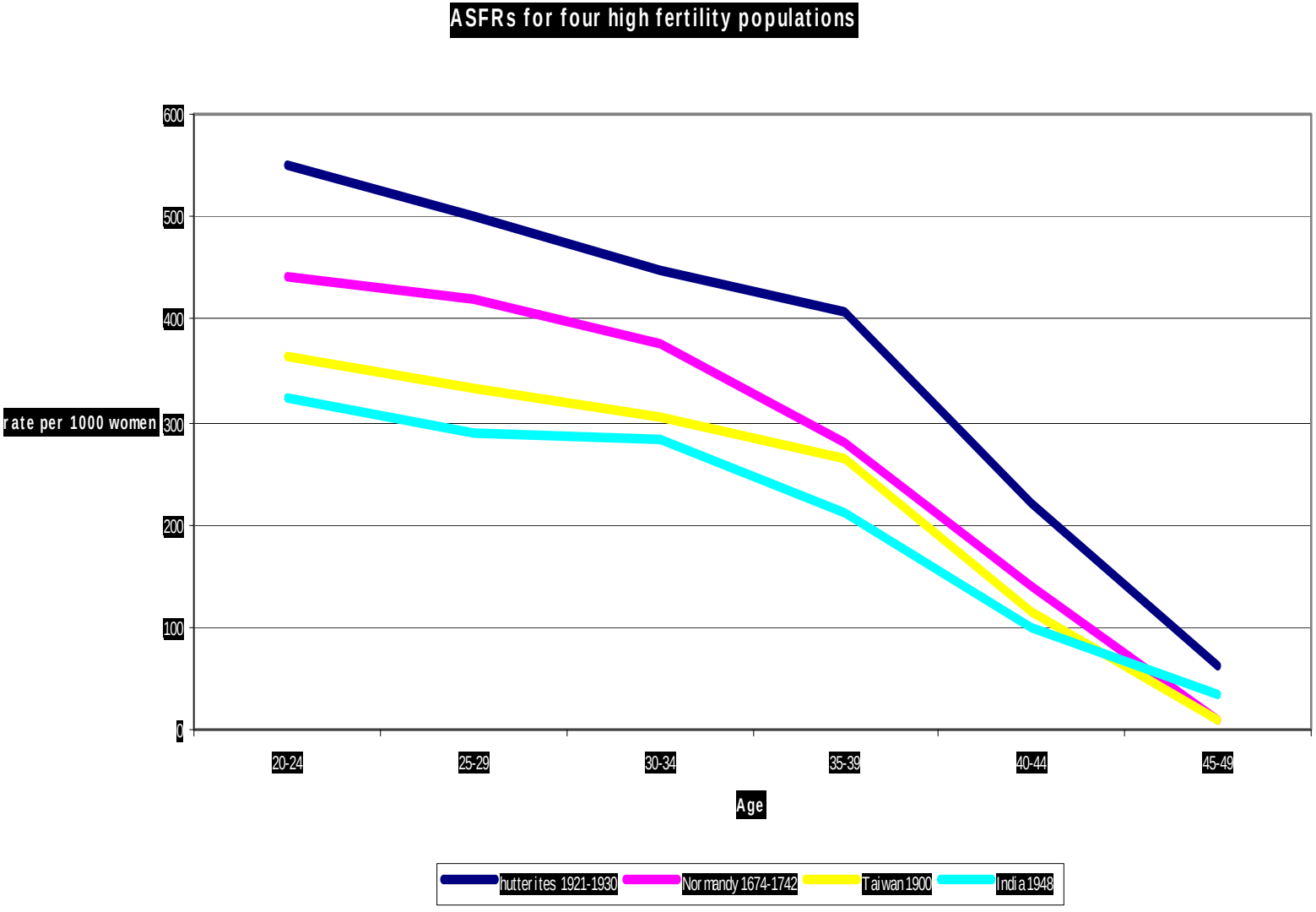
Fertility is always very variable

- On the next slide the ASFRs from several relatively high fertility populations are plotted:
  - Hutterites (1920) TFR~=10.9
  - Normandy (late 17th century) TFR~=8.3
  - Taiwan (1900) TFR ~=7.0
  - India (1945) TFR~= 6.2


ASFRs for four high fertility populations
rate per 1000 women
600
500
400
300
200
100
0
20-24
25-29
30-34
35-39
40-44
45-49
Age
hutterites 1921-1930
Normandy 1674-1742
Taiwan 1900
India 1948

A Useful Distinction to make is between "natural" and "controlled" fertility

- Fertility rates VARY across populations or across time within a population
- This is true of both populations with natural as well as population with controlled fertility
- That is, natural does not mean high and controlled does not mean low, although natural fertility populations tend to be higher on average than controlled fertility populations
  - Point of the distinction is that there is ALWAYS variation across populations and levels are uninformative

Natural Fertility

- The type of marital fertility pattern that emerges when people do not change the behaviors that underlie fertility as a result of how many children they have
- Examples of non-parity specific fertility control:
  - Post-partum abstinence
  - Breastfeeding
  - Taboos about grandmothers having children

Controlled Fertility

- The type of marital fertility pattern that emerges when people do change the behaviors that underlie fertility as a result of how many children they have
- Examples:
  - Have a goal of how many children they want
  - Decide that they have enough children
  - “replace” children who die

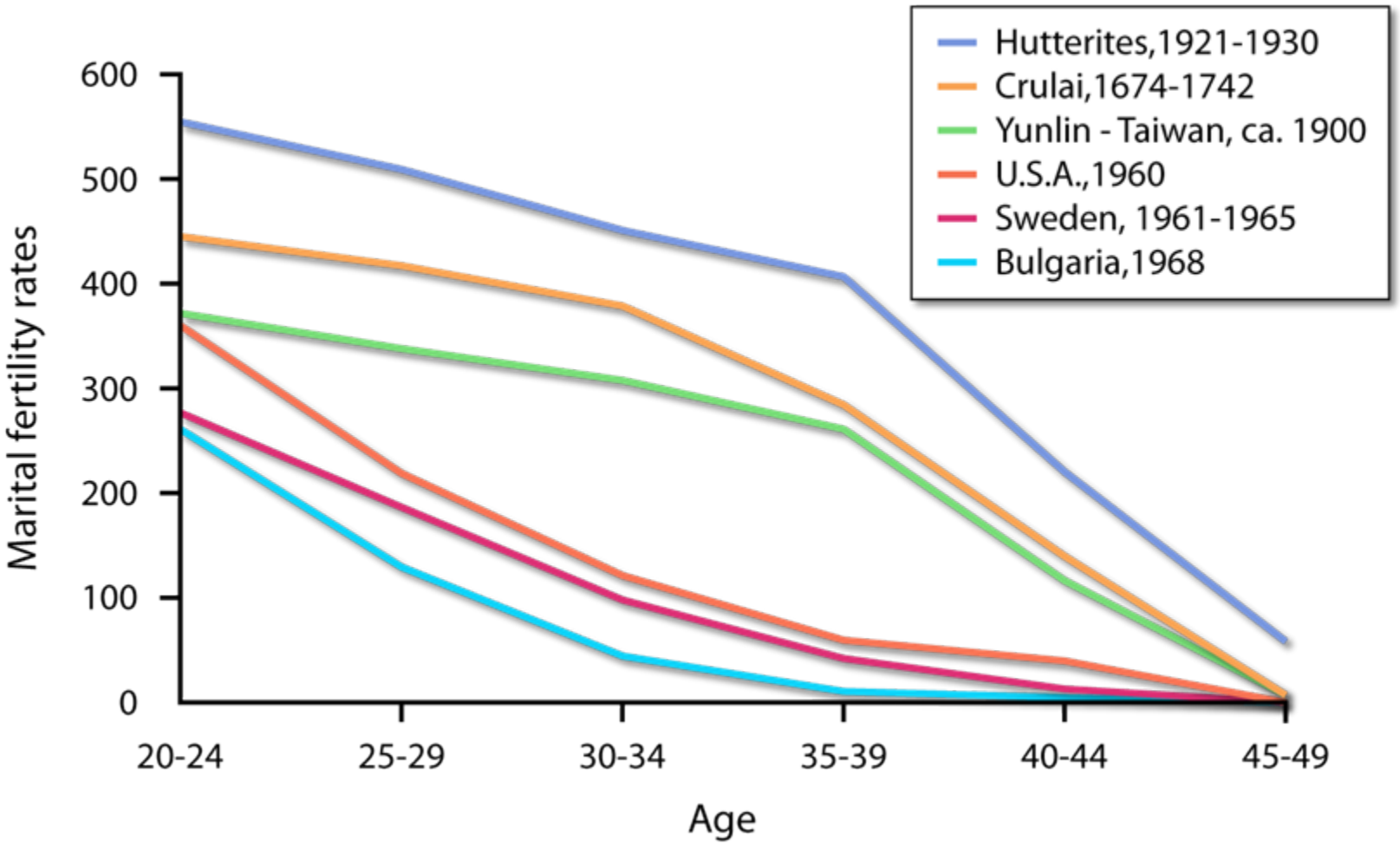
Differences in the shape of the graph when you plot fertility rates by age (ASFRs)

- Under natural fertility, the ASFRs decline as a result of declining funcundity alone: convex shape
- Under controlled fertility, the ASFRs at older ages are lower than younger ages: concave shape

Can tell whether or not a population is using parity specific behavior by shape, not level

- Graph shows three natural and three controlled fertility populations, all of which have different fertility levels

Age Specific Marital Fertility Rates (Births per 1,000 Married Women)



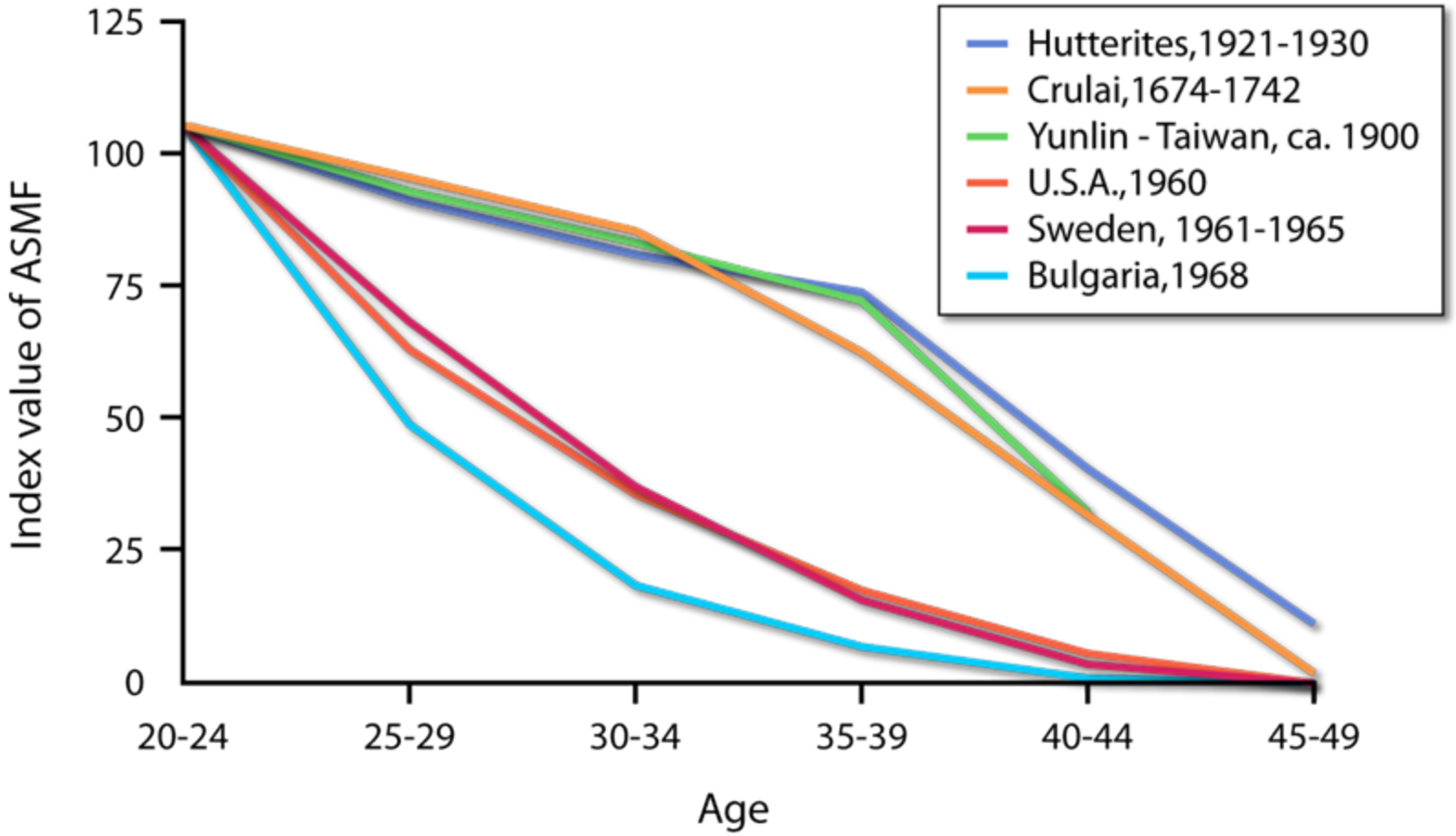
Adapted by CTLT from Knodel, John. 1997. "Family Limitation and the Fertility Transition: Evidence from the Age Patterns of Fertility in Europe and Asia." Population Studies 31(2):219-249

Another way to see this

In the next graph, the ASFRs for the same six populations are plotted again, but this time, the values plotted are the ratio of the ASFR for a given age group with the 20-24 rate for the same population times 100

So the value for 20-24 will always be 100

Index Values of Age Specific Marital Fertility Rates with 20-24 Rate = 100



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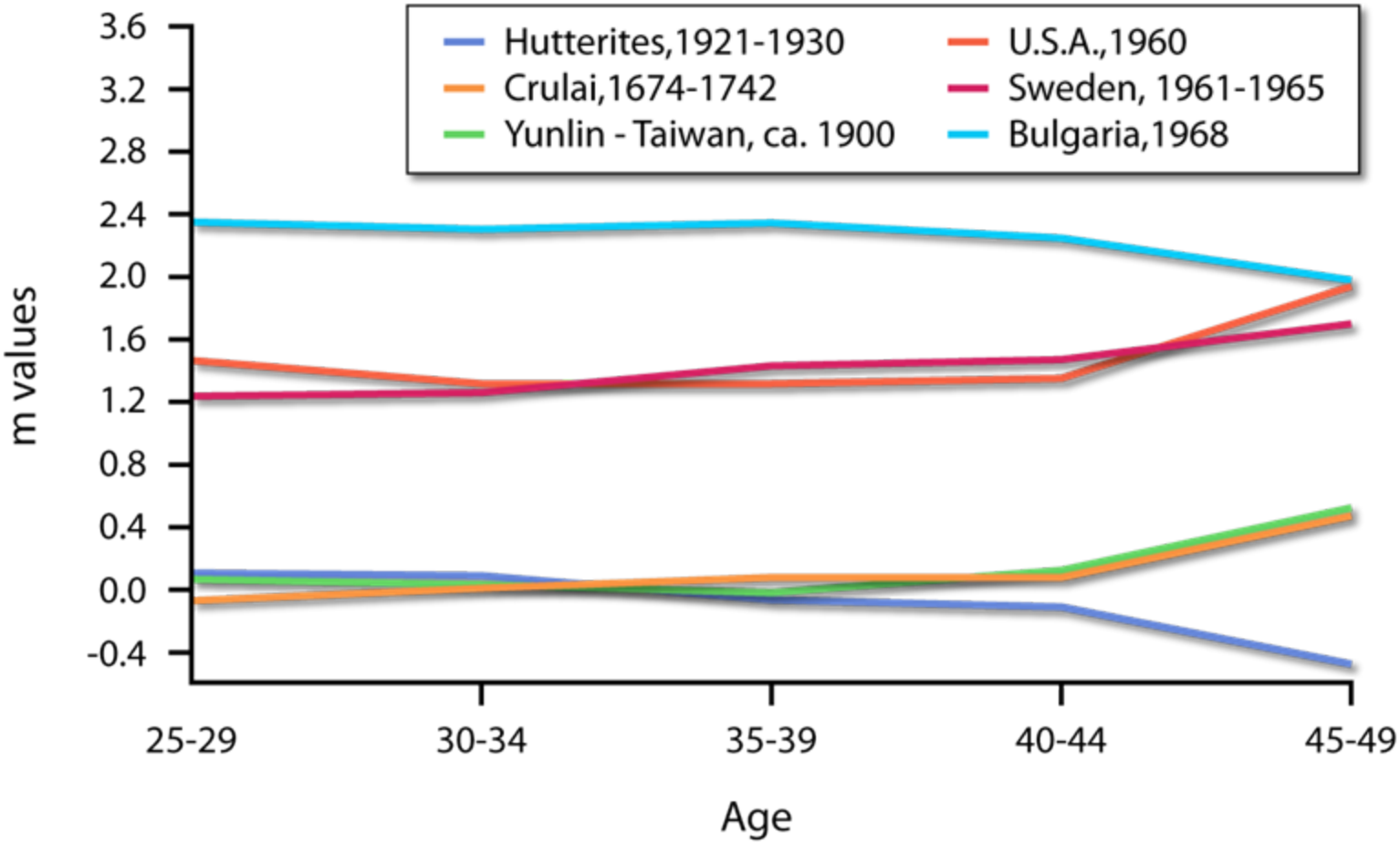
Coale's measure of m

- Calculated the deviation of ASFRs from the 20-24 ASFR for 43 controlled fertility populations
- Took the average
- If a population's ASFRs deviate in exactly the same way as this average, then m=1
- If a population follows a natural fertility pattern, m=0
- If m is very large, then the fall-off in fertility is very great (i.e. larger than the average of the 43 countries)

Values of m, the Index of Fertility Control



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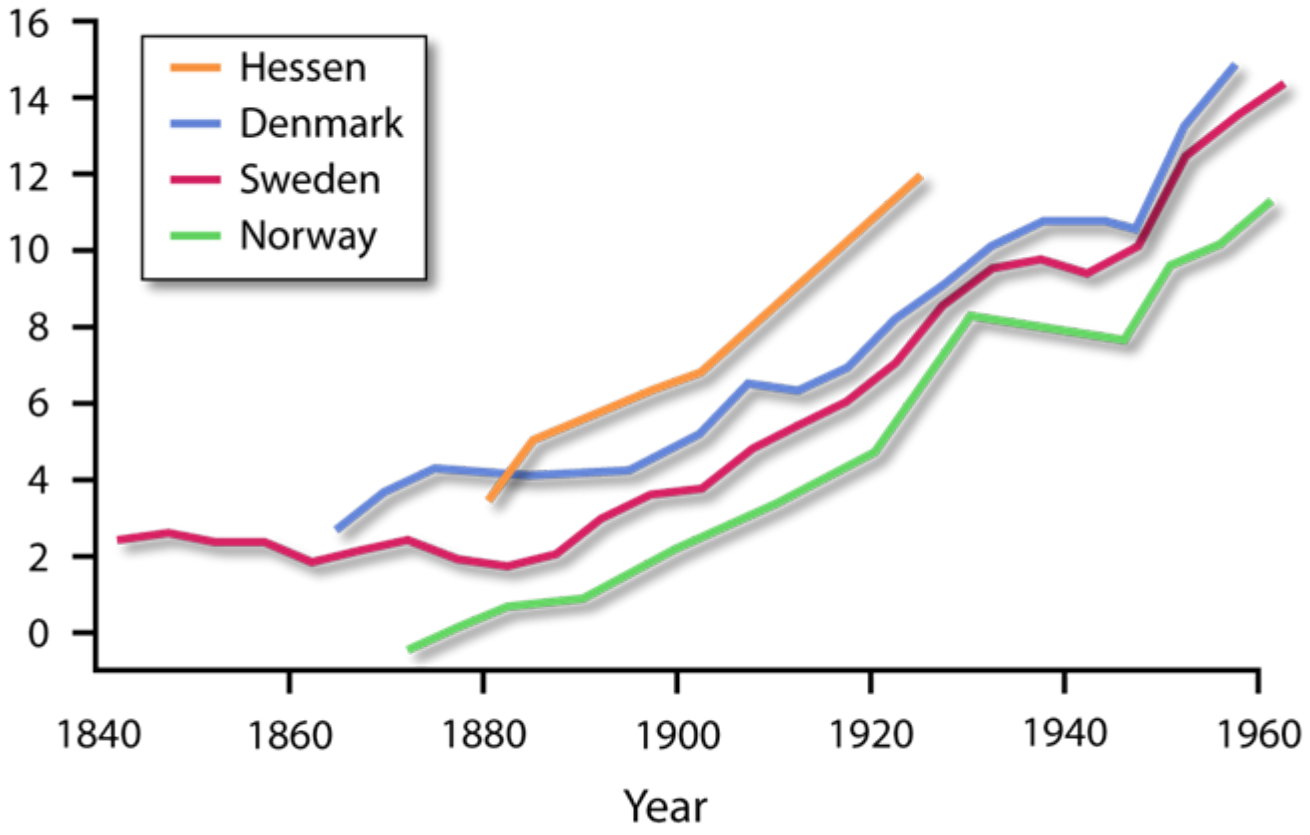
m goes up when populations make the transition from natural to controlled fertility

Values of the Fertility Control (*m*) for Selected Countries: Average Values of *m*



Adapted by CTLT from Knodel, John. 1977. "Family Limitation and the Fertility Transition: Evidence from the Age Patterns of Fertility in Europe and Asia." Population Studies 31(2):219-249.

Another measure is M

- The ratio of the population of interest's ASFR for 20 to 24 to the natural fertility population that was used as a reference
- This is a level factor

Table on the following page

- Presents data on m and M measures for a variety of populations
  - Sri Lanka in 1953 has one of the highest m's (0.44)
    - M=0.86
  - Bulgaria has one of the lowest m's(0.02)
    - M=0.83

TABLE 1. *Index of fertility control,* m, *and associated statistics for selected European and Asian populations*

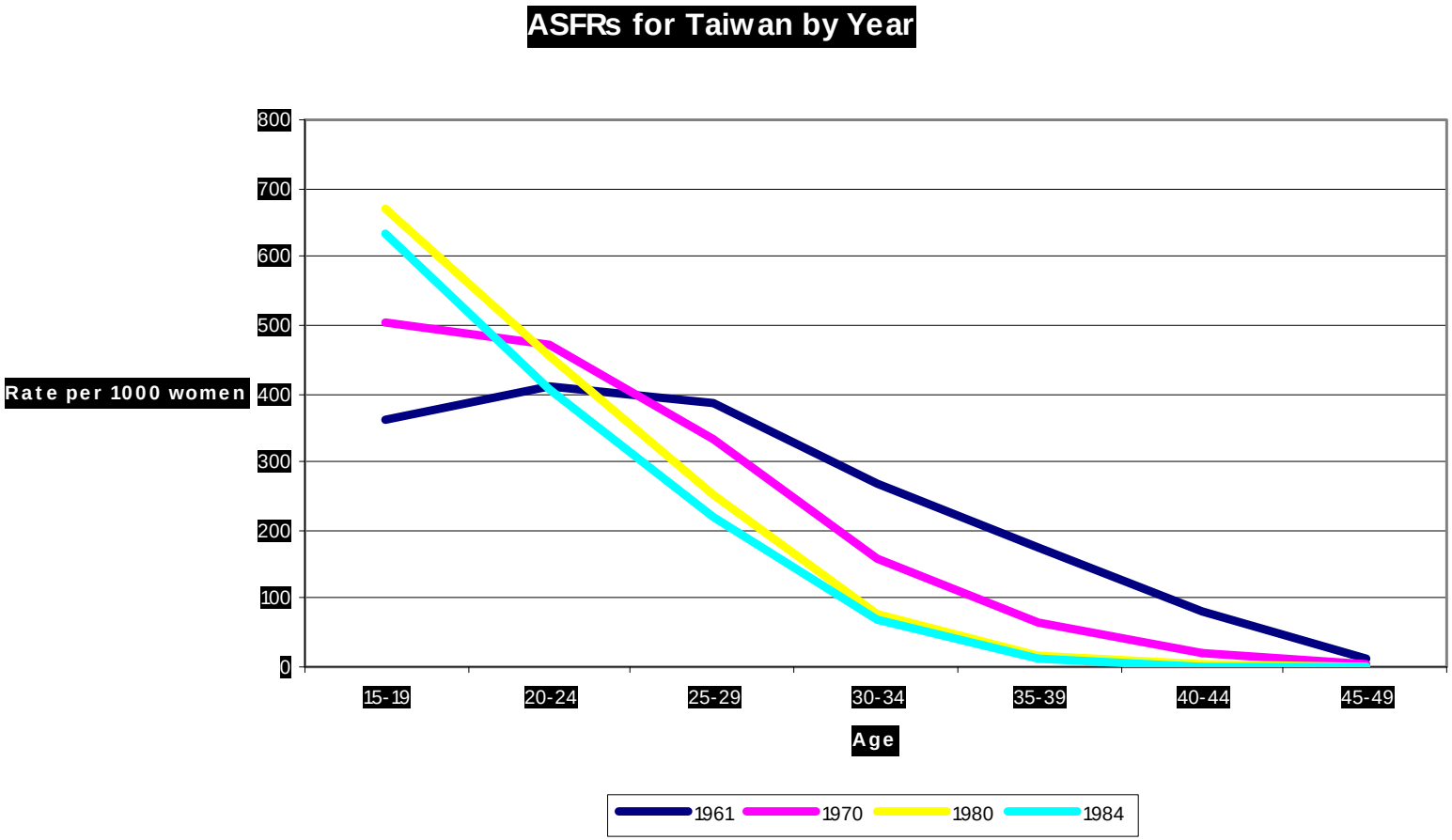
	Date	Source	*M* (Index of fertility level)	*m* (Index of fertility control)		*m* for individual age groups				
				Mean	Standard deviation	25–29	30–34	35–39	40–44	45–49
European populations										
Reconstitution studies										
7 south and central French villages	17–18th Century	A	0·94	0·02	0·08	−0·11	0·05	0·07	0·07	n.a.
6 north French villages	17–18th Century	A	1·15	0·00	0·08	−0·09	−0·05	0·01	0·12	n.a.
14 NW French villages	17–18th Century	A	1·06	0·03	0·04	−0·03	0·04	0·06	0·06	n.a.
8 German villages	17–18th Century	A	0·97	−0·00	0·04	−0·06	0·01	0·02	0·03	n.a.
Quebec	17th Century	B	1·11	−0·06	0·08	−0·00	−0·13	−0·14	−0·11	0·06
Alskog (Swedish village)	1745–1820	S	0·79	0·13	0·10	−0·04	0·22	0·19	0·20	0·09
National statistics										
Bulgaria	1901–05	C	0·83	0·02	0·34	0·36	0·05	0·24	0·09	−0·63
Denmark	*ca* 1865*	D	0·97	0·26	0·05	0·26	0·33	0·30	0·19	0·23
Finland	1871–80	E	0·98	0·24	0·13	0·43	0·28	0·19	0·07	n.a.
Norway	1871–75†	F	0·93	−0·05	0·21	0·06	0·14	0·06	−0·05	−0·46
Sweden	1751–1800	G	1·00	0·23	0·20	0·45	0·28	0·33	0·22	0·14
Asian populations										
China – rural	1930	H	0·57	0·06	0·09	−0·05	0·08	0·15	0·13	−0·04
Comilla (Bangladesh)	1963–64	I	0·71	0·13	0·06	0·09	0·06	0·22	0·15	n.a.
Hong Kong	1961	J	1·02	0·61	0·11	0·55	0·68	0·32	0·66	0·42
Mysore (India)‡		K	0·68	0·24	0·22	−0·10	0·42	0·21	0·44	n.a.
Indonesia – rural§	1965–70	L	0·77	0·17	0·06	0·17	0·23	0·25	0·13	0·08
4 Japanese villages	17–19th Century	M	0·84	0·18	0·19	0·44	0·27	0·23	0·12	−0·14
Japan	1925	N	0·74	0·21	0·03	0·25	0·21	0·19	0·24	0·18
Korea	1961	O	0·81	0·03	0·08	−0·10	0·09	0·12	0·07	−0·05
Malaysia	1957	P	0·96	0·25	0·23	0·31	0·41	0·40	0·34	−0·20
Pakistan	1963–65	Q	0·64	−0·24	0·41	−0·07	−0·06	0·03	−0·04	−1·06
Philippines	1963–67	R	0·94	0·19	0·08	0·17	0·25	0·24	0·26	0·04
Singapore	1957	P	1·00	0·30	0·06	0·26	0·32	0·36	0·35	0·19
Sri Lanka	1953	P	0·86	0·44	0·20	0·20	0·28	0·45	0·78	0·47
Taiwan	1956	P	0·82	−0·02	0·13	−0·08	0·05	0·09	0·07	−0·25
Thailand	1960	P	1·02	0·11	0·23	0·31	0·29	0·15	0·12	−0·34

Interest in explaining why populations have different levels of fertility has driven a lot of research

- In particular, scholars and policy makers have been interested in why fertility declines
- In light of the variability in fertility, they needed a simple way to distinguish contracepting pops from non-contracepting pops

Next Slide shows a case where these ideas really were illuminating

- Taiwan from 1961 through 1984
  - 1961 is natural
  - After that is controlled
  - Note that early fertility actually goes up


ASFRs for Taiwan by Year
Rate per 1000 women
800
700
600
500
400
300
200
100
0
15-19
20-24
25-29
30-34
35-39
40-44
45-49
Age
1961
1970
1980
1984

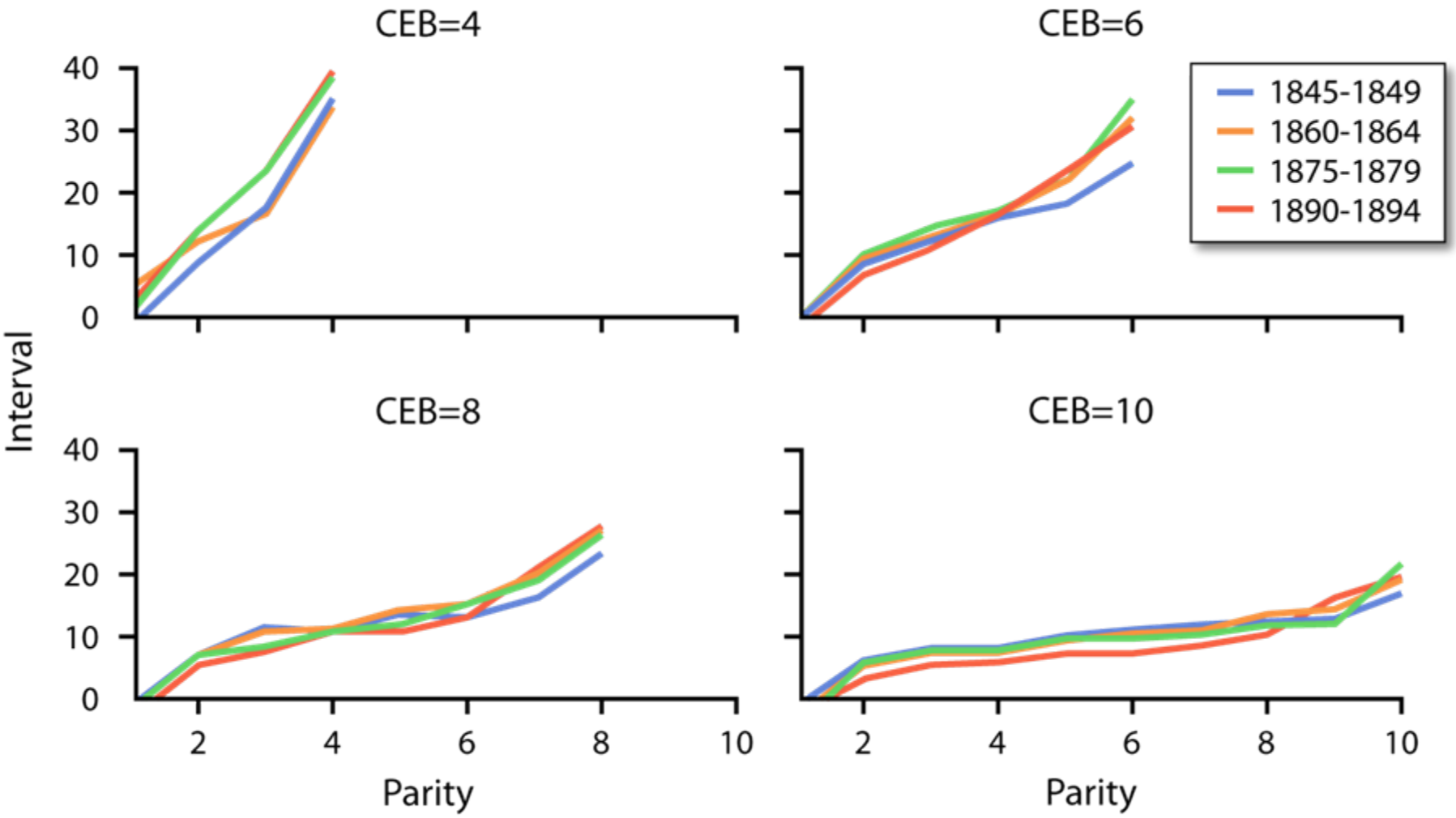
Criticism of the natural vs. controlled distinction

- Regards variation within these two categories as uninteresting
  - Assume the nature of the transition is the same for those whose natural pattern had a TFR of 4 as those whose natural pattern had a TFR of 7
- If people practiced parity specific fertility control by spacing, the m index will not detect it

For example, in 19th century USA

- Anderton and Bean compared four cohorts that span the transition from high to low fertility
- They find evidence that Americans in the 1800s reduced family size through spacing

Mean Birth Interval (-17.5 Months) by Women's Birth Cohorts and Parity



Adapted by CTLT from Anderton, Douglas L. and Lee L. Bean. 1985. "Birth Spacing and Fertility Limitation: A Behavioral Analysis of a Nineteenth Century Frontier Population." Demography 22(2):169-183.

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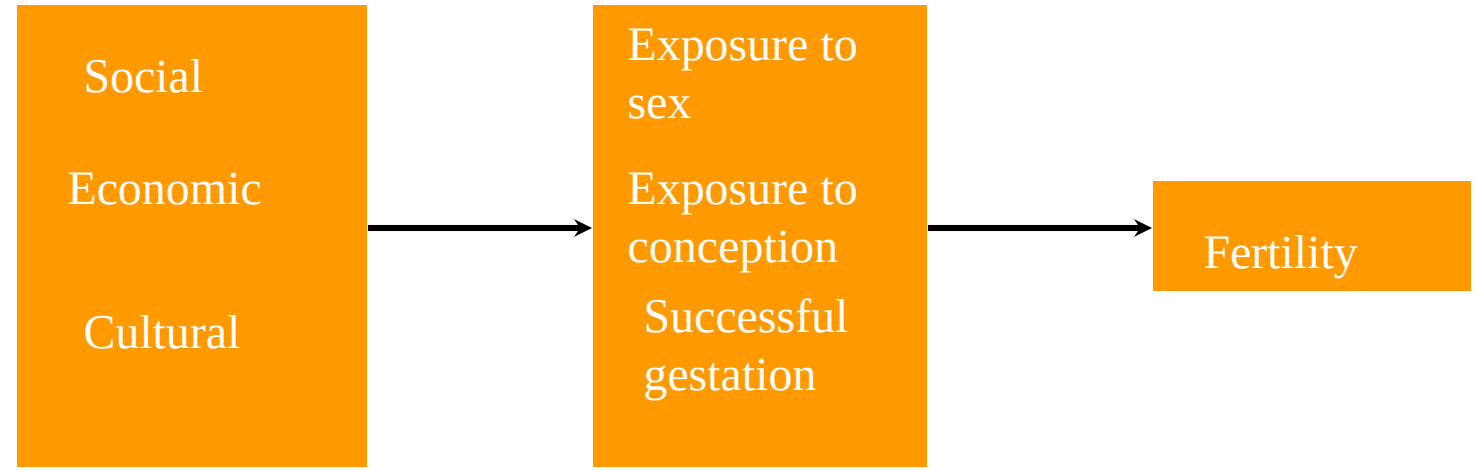
The Proximate Determinants Framework for Studying Fertility

- People began studying fertility in the 1950s
- Before concern about population growth
- Part of Modernization Theory
  - A set of social science ideas developed as former colonial societies began to be of interest to European scholars

Kingsley Davis and Judith Blake

- 1950s
- The “intermediate variables” approach
- First formal statement that the broad and sweeping social phenomena that people were attempting to link to fertility change could not affect fertility directly
- For example, many have linked economic development with low fertility
  - When the GNP changes, women don’t magically become less able to conceive by osmosis



Big Sweeping Factors

Intermediate Factors

Outcome

Factors Affecting Exposure to Sex

- Formation and Dissolution of Sexual Unions
  - Age at entry into Sexual Union
  - Permanent Celibacy
  - Time Spent between or after Unions
- Exposure to Coitus within Unions
  - Voluntary abstinence
  - Involuntary abstinence
  - Coital Frequency

Factors Affecting Exposure to Conception

- Involuntary Infecundity
- Use of Contraception
- Voluntary Infecundity (sterilization)

Factors Affecting Gestation

- Involuntary fetal mortality (miscarriage)
- Voluntary fetal mortality (abortion and infanticide)

Social and Economic Institutions

- Davis and Blake argued that pre-industrial populations evolved social and economic institutions to produce sufficient fertility to overcome high mortality
- This does not always mean social and economic institutions that promote the highest possible fertility
  - Polygyny and post-partum abstinence (insured that children were not closely spaced, probably lowered infant mortality)
  - European marriage patterns (insured that children were born to the most prosperous people)

How did John Bongaarts improve on Davis and Blake's model?

- D&B missed breastfeeding entirely
- Bongaarts attempted to quantify the intermediate variables, which he re-named proximate determinants, by proposing specific measures and using them (the measures) to predict the TFR, using real data
  - Flaws in the data and the project should not take away from the importance of the attempt

Bongaarts Proximate Determinants Model

A. *Exposure to intercourse*

1. Proportions of women married by age

B. *Exposure to conception*

2. Contraceptive use and effectiveness
3. Duration of post-partum infecundability
4. frequency of intercourse
5. Permanent sterility

C. *Successful gestation and parturition*

6. Spontaneous intrauterine mortality
7. Induced intrauterine mortality

Bongaarts criteria for evaluating the importance of the proximate determinants

- Sensitivity
  - How big an impact does the factor have?
- Variability
  - How much variability does the factor explain

Results

- Proportion married and contraception score high on both sensitivity and variability
- Post-partum infecundability and abortion score moderately on sensitivity and very high on variability
- Other three (intrauterine mortality, sterility and coital frequency) are, at best, moderate on one

Results

- Bongaarts focused on proportion married, contraception, post-partum infecundability and abortion
- Developed a mathematical model where one calculates the TFR by multiplying maximum fertility (15.3*) by indices of these four factors that range in value from 0 to 1

The four indexes are defined as follows:

C_m = index of marriage (equals 1 if all women of reproductive age are married and 0 in the absence of marriage)

C_e = index of contraception (equals 1 in the absence of contraception and 0 if all fecund women use 100% effective contraception)

C_a = index of induced abortion (equals 1 in the absence of induced abortion and 0 if all pregnancies are aborted)

C_i = index of postpartum infecundability (equals 1 in the absence of lactation and postpartum abstinence and 0 if the duration of infecundability is infinite)

$$TFR = C_m * C_c * C_a * C_i * TF$$

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