

Biosocial interactions in modernization

6. Reproductive variation and natalism

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6.1. Evolutionary and ontogenetic background of reproductive behaviour

6.2. Fertility control in modern society

General evolutionary trends with respect to reproduction

Human reproductive specificity lies in the prolongation of a general phylogenetic trend:


- shift from a quantitative to a qualitative reproductive strategy (**r/K evolution**);
- the increasing probability of **fertilisation**;
- the **delayed timing** in the onset of reproduction;
- **expansion** of the infant and juvenile periods of the life span;
- the associated increasing **protection** of the offspring,
 - prenatally through an improvement of the anatomic and physiological organisation of the **reproductive apparatus**
 - postnatally through the progressive development of **social** protection mechanisms

Specific hominid evolutionary trends

Human reproductive physiology is particularly specialised toward the production of **high-quality, large-brained offspring**:

- sexual specificities of men and women (see previous chapter);
- monoparous pregnancy;
- decreased metabolic rates and storage of fat during pregnancy;
- preinsemination mate guarding rather than postinsemination sperm competition;
- raising multiple dependent offspring of different ages;
- caring (feeding) their offspring during the juvenile period of life
- Strong drive towards long-lasting pairbonding;
- extensive paternal investment in offspring;
- stop reproduction at higher age;
- Men and women link their economic and reproductive lives.

Ontogeny of human reproduction

Biological determinants	Reproductive process	Cultural determinants
<p>Genes</p> <p>Nutrition</p> <p>Disease</p>	 <p>Sexual maturation</p> <p>Pair bonding</p> <p>Child bearing motivation</p> <p>Coital frequency</p> <p>Fecundability</p> <p>Pregnancy</p> <p>Delivery/birth</p> <p>Pregnancy result</p> <p>Birth interval</p> <p>Menopause</p> <p>Fecundity</p> <p>Fertility</p> <p>Parenting</p>	<p>Values and norms</p> <p>Social relations</p> <p>Socio-economic factors</p> <p>Technology</p>

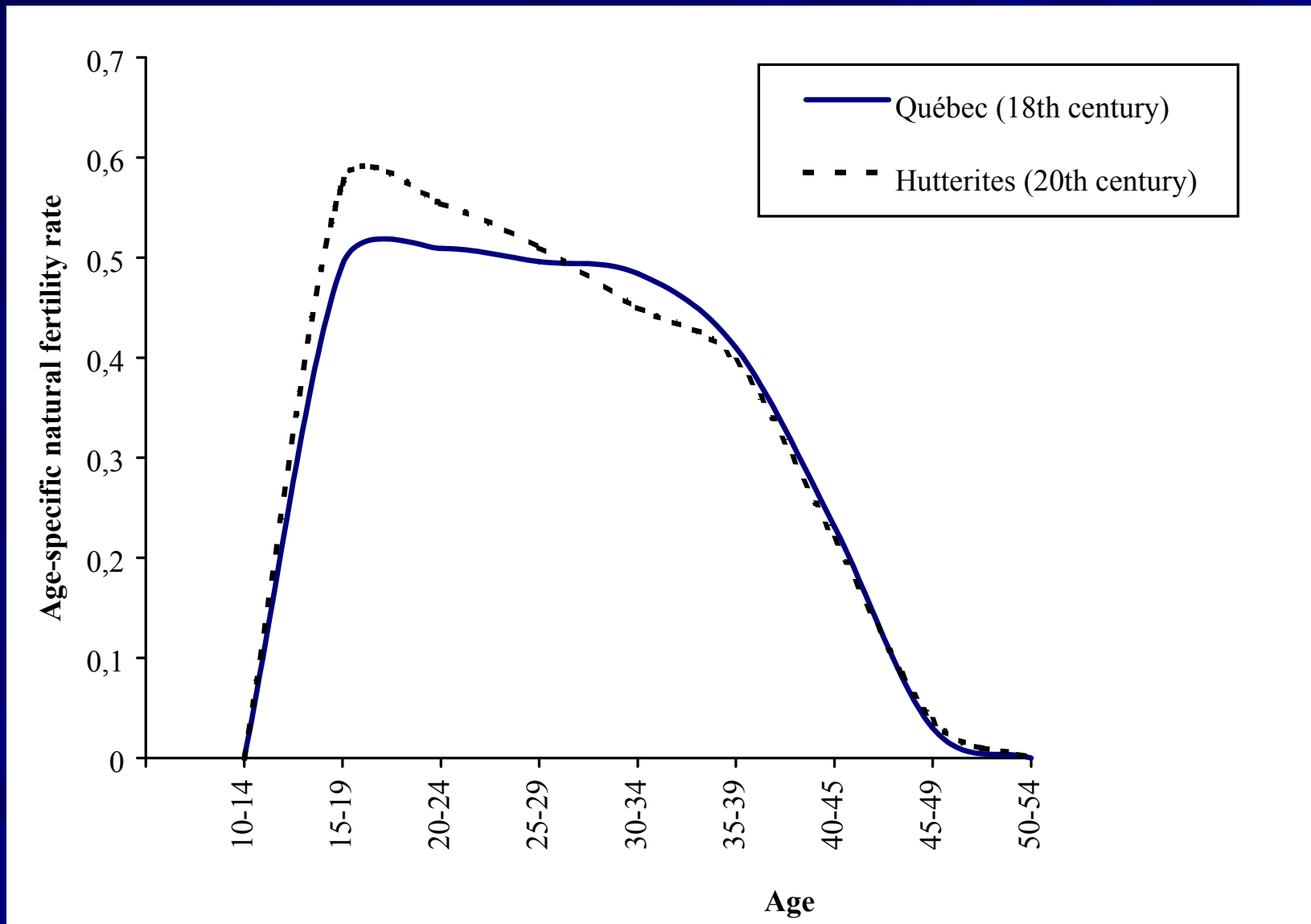
THE ONTOGENETIC SPECIFICITY OF HUMAN REPRODUCTION

- Sexual maturation: late, sexually dimorphic, dissynchronic with fecundity
Pair bonding: strong; long lasting
- Childbearing motivations: childbearing desire - child-number desire -child-timing desire;
- Coital behaviour: frequent; not linked to ovulation;
- Fecundability: average = 0,24; conception waiting time = 6,3 months;
- Pregnancy: only 9 months, resulting in premature neonatus; period of intense selection
- Delivery: difficult; social event;
- Birth interval:
 - Post-partum amenorrhea;
 - Lactation: principal regulator of natural fertility;
- Menopause: 'altriciality-lifespan hypothesis'
- Sterility: primary and secondary;
- Fecundity: average natural fertility = 15.3 live born children, SD : 5.09;
- Fertility: average = strongly variable
- Parenting: long lasting

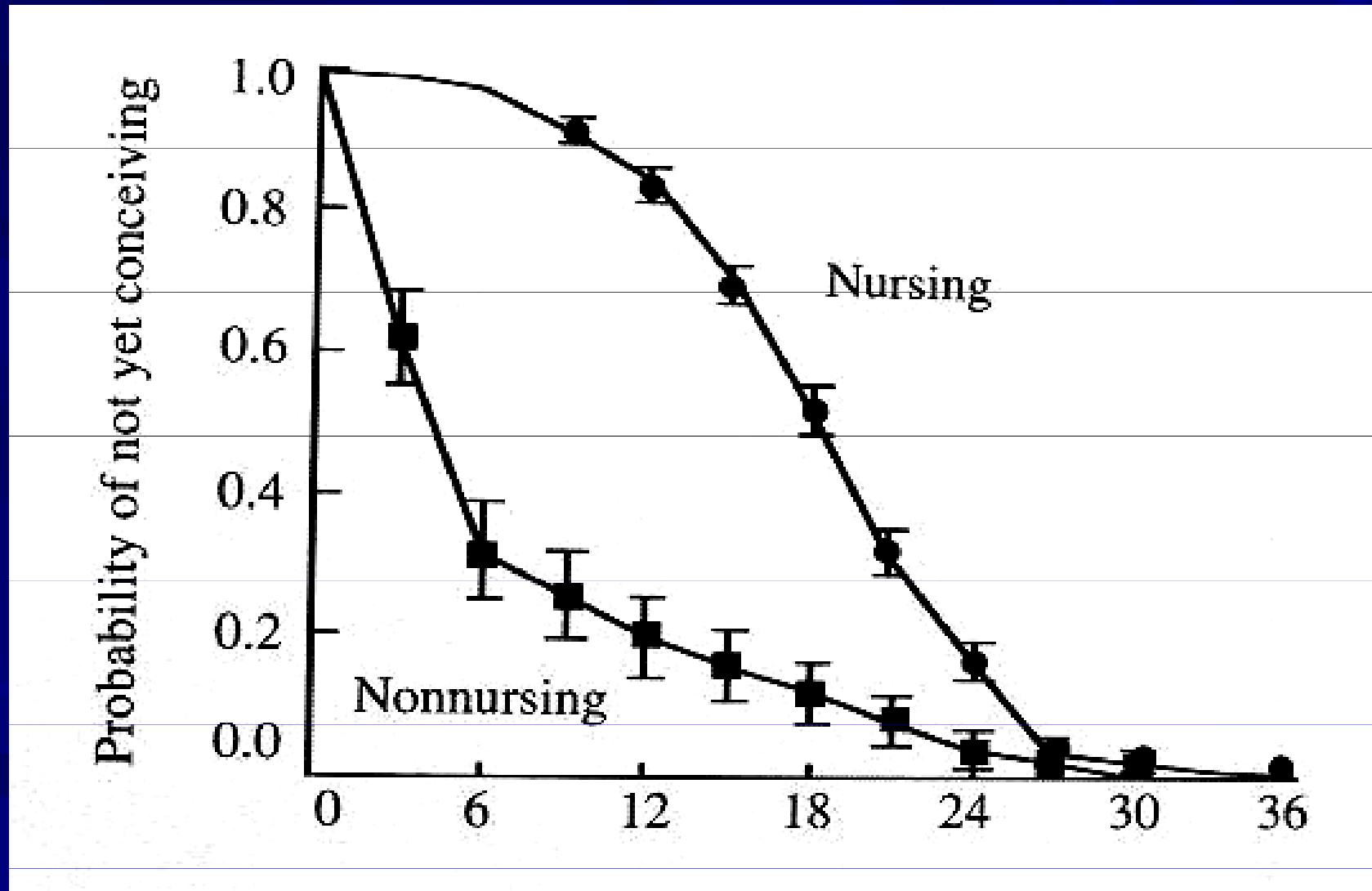
Ontogenetic specificity of human reproductive behaviour

- Strong neuro-endocrinologically based drives directed to **individual preservation** and development
- Strong **sexual drive**
- High **fecundity**
- Weak genetic programming of **parental behaviour**
- Weak biological drive to produce **numerous offspring**

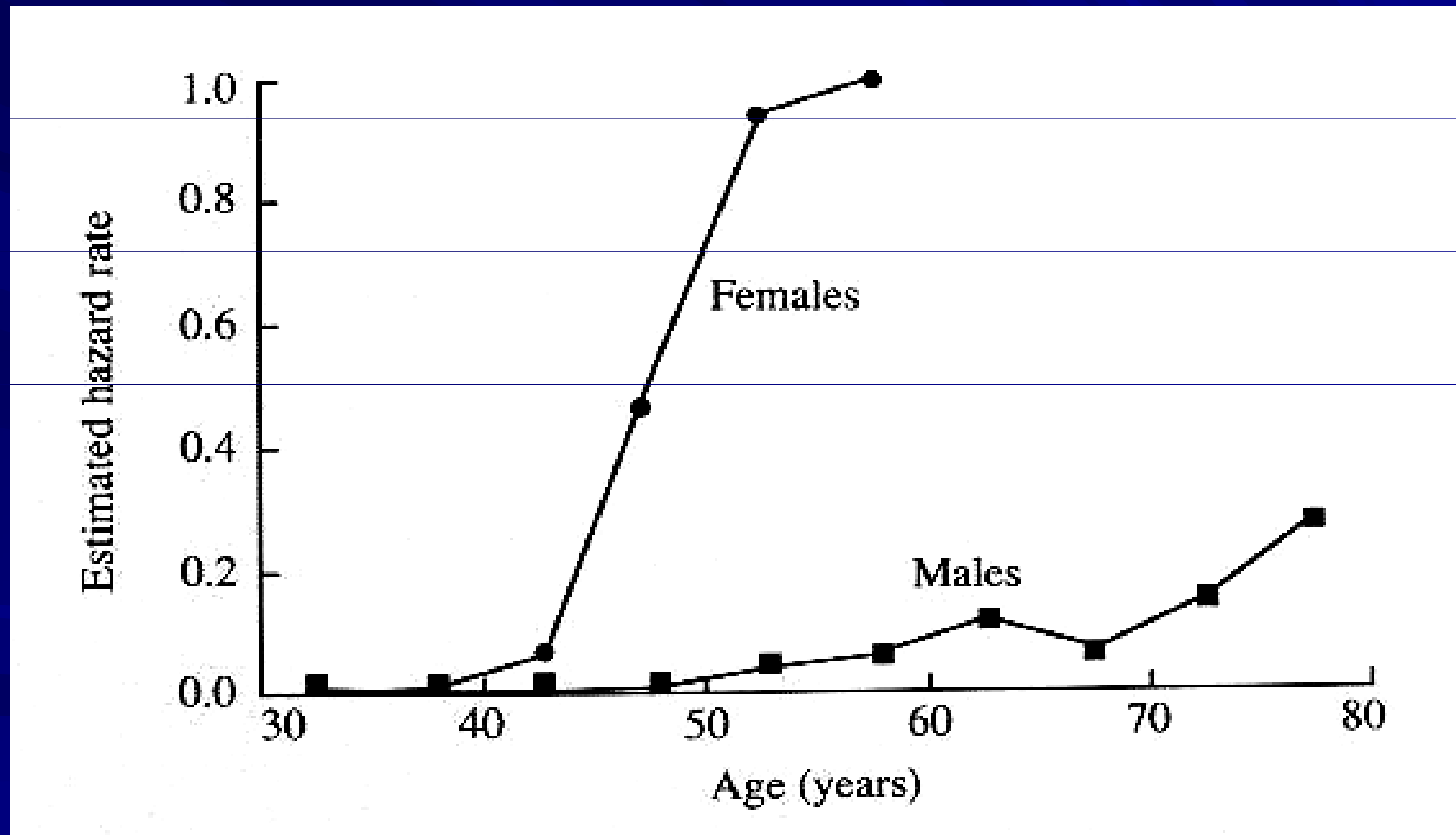
Age-specific natural fertility



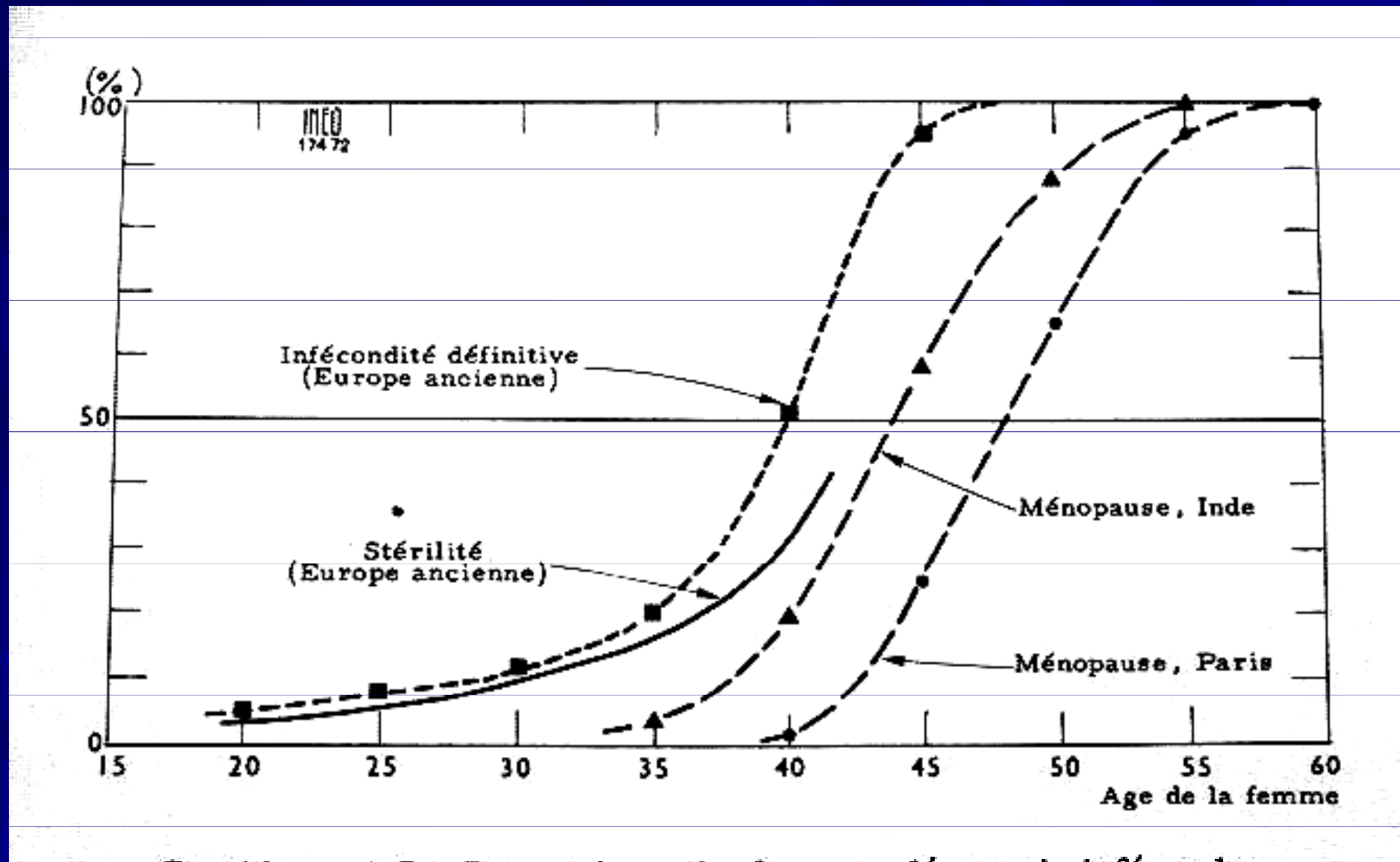
Lactation and fecundability



Probability of ending the reproductive life course, by sex



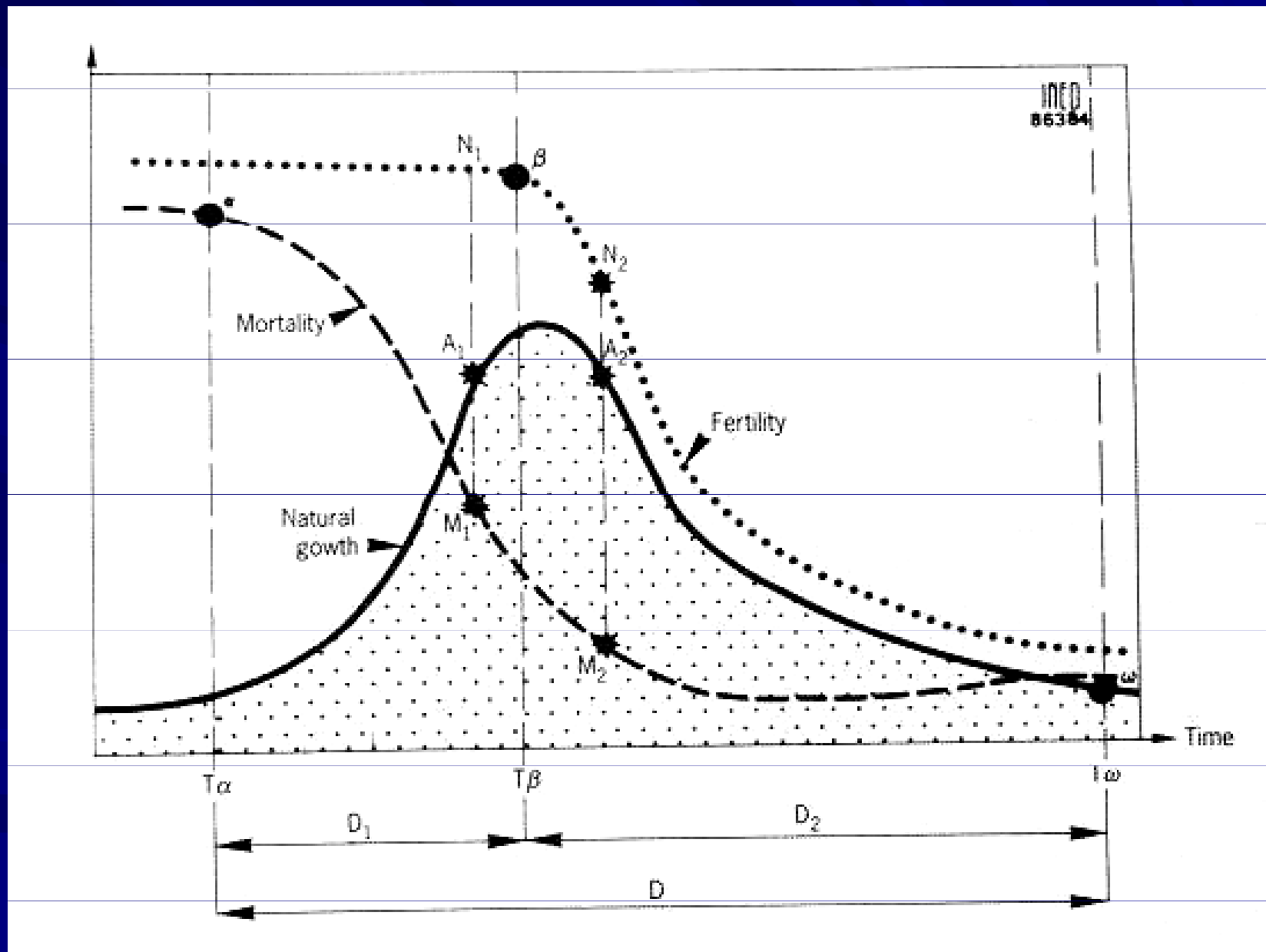
Primary and secondary sterility in the female life course



The **maximization** of inclusive fitness

- = humans, like other organisms, have been designed by natural selection to develop evolved behavioural tendencies to **maximise** their genetic representation in future generations in the context of **constraints** set by the environment and their phylogenetic past:
 - ➔ such optimal reproductive success, through available descendants and nondescendent relatives, results in **evolutionary adaptiveness**;
 - ➔ **trade-offs** between present and future reproduction; quantity and quality of offspring; and mating and parental effort.

Demographic transition



Second demographic transition?

- Lesthaeghe & Van de Kaa, 1986:
 - have labelled the more recent changes in relational and reproductive behaviour, among others leading to a more or less outspoken below-replacement fertility, as the so-called second demographic transition
- Others (e.g. Roussel, 1989; Cliquet, 1990; Coleman, 2003):
 - consider the recent changes merely as an acceleration and generalisation of the changes which started with the industrial revolution.

Below-replacement fertility in an evolutionary perspective

Reproductive fitness: The maximisation-minimisation paradox

- Living organisms are selected to **maximise** their genetic representation in future generations
- In modern culture, people **limit their fertility** below their biological and economic potentials

The paradox between the maximization of inclusive fitness and the demographic transition

- Current knowledge of human behavioural ecology suggests that in traditional and historical populations, people by and large strive to achieve a **maximum** possible personal share of the genetic reproduction of their population, following the biological imperative of fitness maximization;
- Most individuals in modern populations behave very differently by **limiting** their fertility, even to below replacement levels.

Explanations for the paradox

- Maladaptive strategy hypothesis (Hill, 1984)
- Shortage of time hypothesis (Irons?)
- Fertility control hypothesis (Turke, 1989)
- Breakdown-of-kinship-network hypothesis (Turke,1989)
- Evolved two-child family hypothesis (Lopreato & Yu,1988)
- Cultural evolutionary hypothesis (Boyd and Richerson,1985)
- Quality of children hypothesis (Harpenden & Rogers 90)
- Social status/competition hypothesis (Boone & Kessler 1999)
- Economic benefit hypothesis (Volland, 1998)
- Within-population competitiveness (Mace (2000)
- Extrasomatic wealth hypothesis (Kaplan and Lancaster 2000)

Confronting the human reproductive biogram and demographic explanations of the demographic transition

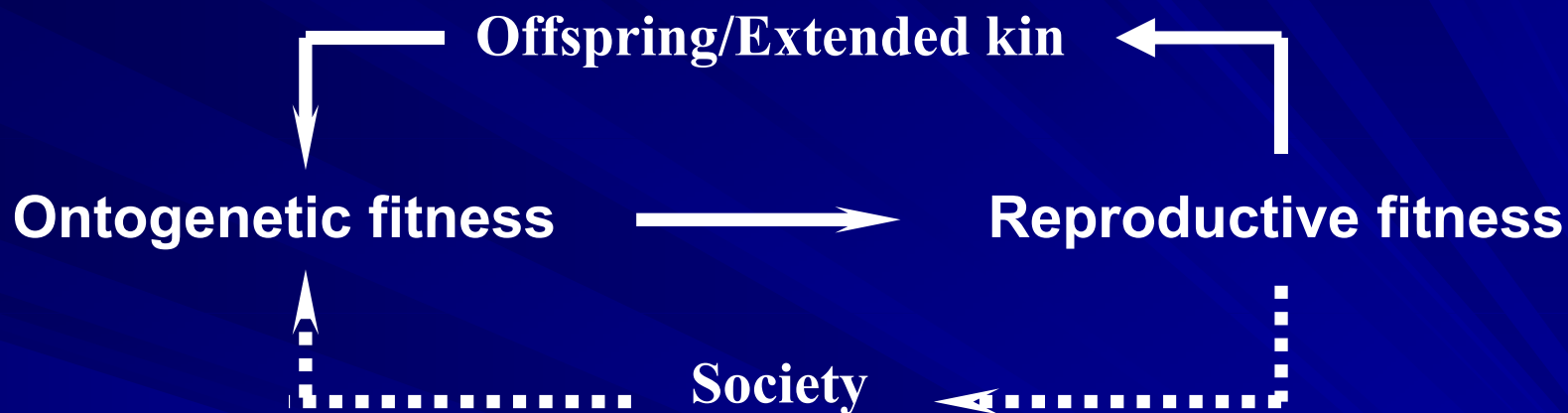
A way to explain the maximization-transition paradox is to consider the changing relations in modern society between **phenotypic fitness and genetic fitness** and to confront the **explanations** of the modern demographic transition in the socio-demographic literature with the **biological ontogenetic determinants** of reproductive behaviour in the human

The determinants of the fertility transition

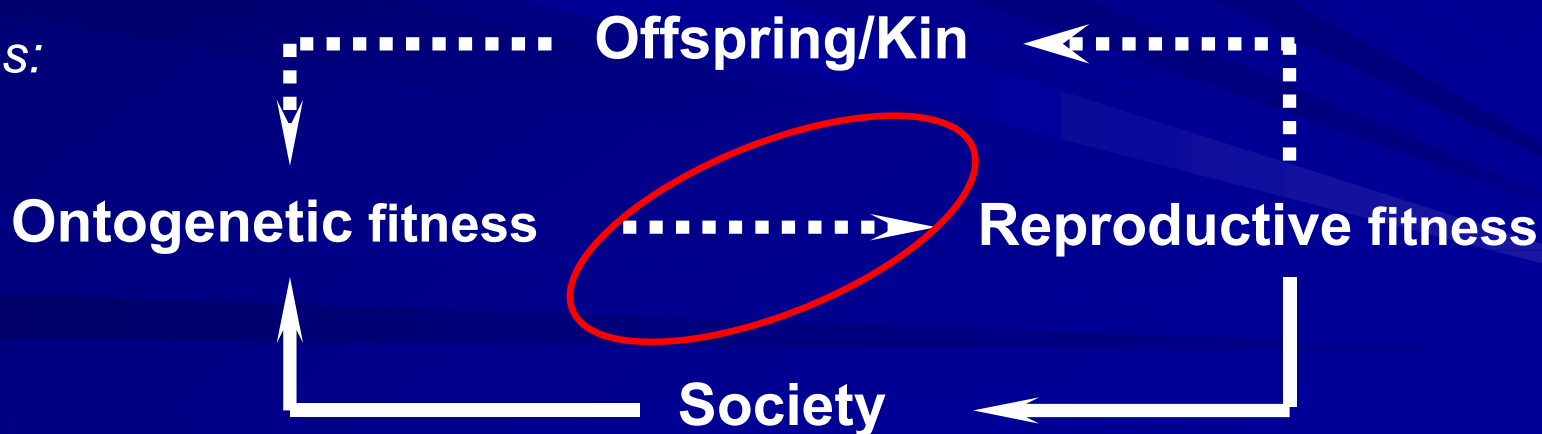
- Changing conditions of life
 - shift from (extended) kin to non-kin dependence;
 - mortality control;
 - enhanced opportunities and exigencies of individual development;
 - birth control;
 - changing gender relations;
- Changing value orientations:
 - secularisation;
 - democratisation;
 - individuation.

Ontogenetic and reproductive fitness in pre-modern and modern societies

Pre-modern societies:



Modern societies:



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Influences of modernization on the biology of reproduction

- Decreasing age at menarche and first ejaculation;
- Increasing age at first birth;
- Dissociation between sex and childbearing;
- Bio-medical interventions on conception, pregnancy, delivery, lactation;
- Birth control

The numerical development of the human species in the course of its evolution

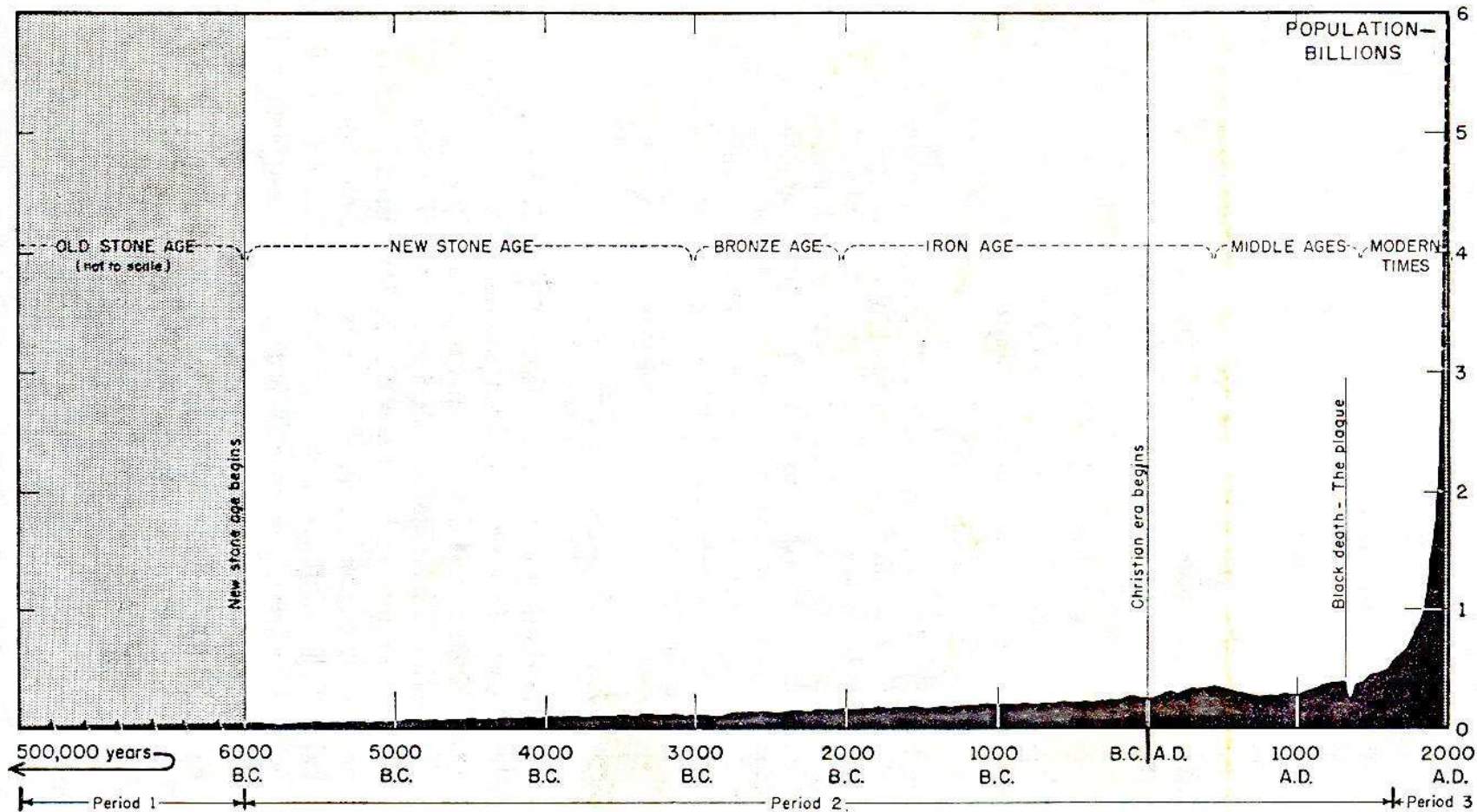


Fig. 1. Growth of Human Numbers. It has taken all the hundreds of thousands of years of man's existence on earth for his numbers to reach three billion. But in only 40 more years population will grow to six billion, if current growth rates remain unchanged. If the Old Stone Age were in scale, its base line would extend 35 feet to the left!

Fertility control

➤ Enhancing fertility

- genetic counselling
- specific technical interventions to facilitate or replace natural **conception** (artificial reproductive technology, ART);
 - donor insemination
 - ovum donation
 - in vitro fertilisation
 - gamete and zygote intrafallopian transfer
 - embryo transplantation
- methods aimed at maintaining the **pregnancy** and induce or facilitate **delivery**
- surrogacy
- adoption

■ Limiting fertility

- Abstinence
- contraception,
- abortion,
- infanticide

Transitions in birth control practices

- Transition from early and universal marriage to the West-European form of late marriage = the so-called **Malthusian** transition;
- The **Neomalthusian** transition, in which fertility was reduced by rank-specific birth control methods.

Contraceptive transitions and relation to demographic transition

■ Malthusian methods

- Abstinence
- Celibacy
- Late marriage

■ Use of 'traditional' methods

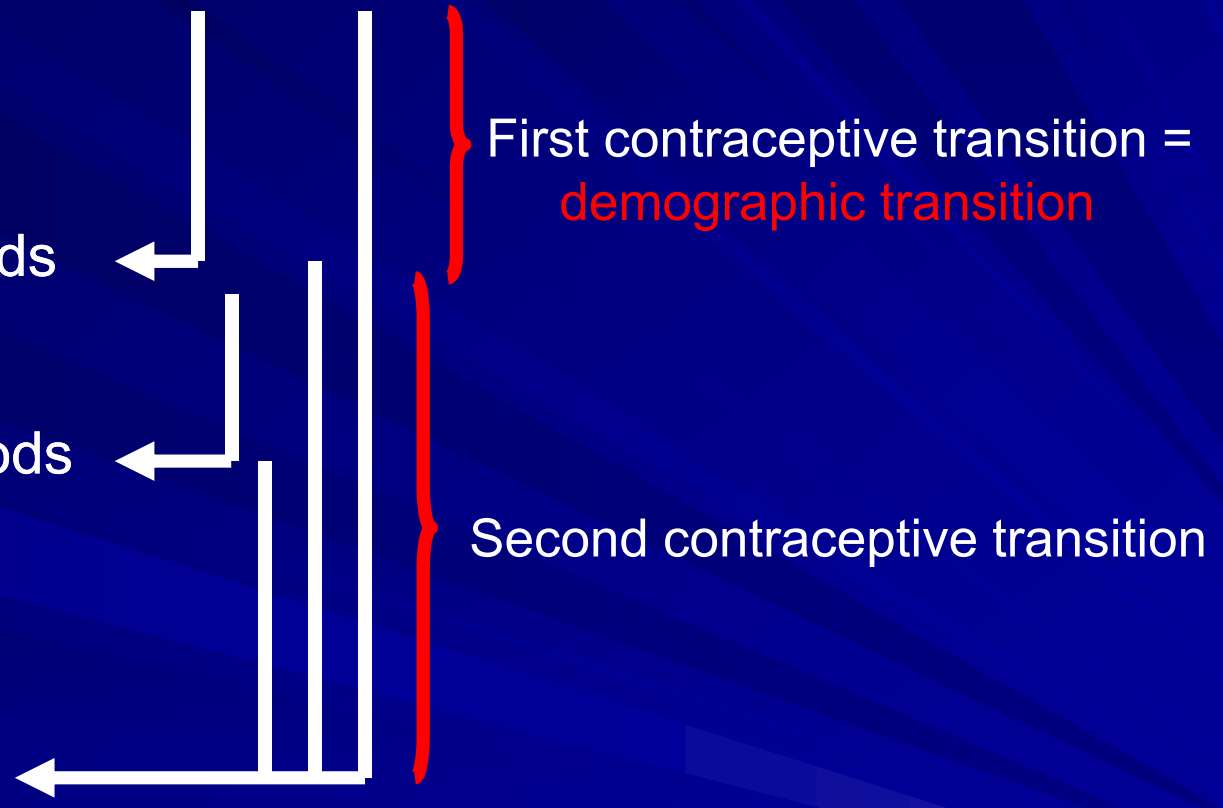
- (Periodic) abstinence
- **Coitus interruptus**

■ Mechanical barrier methods

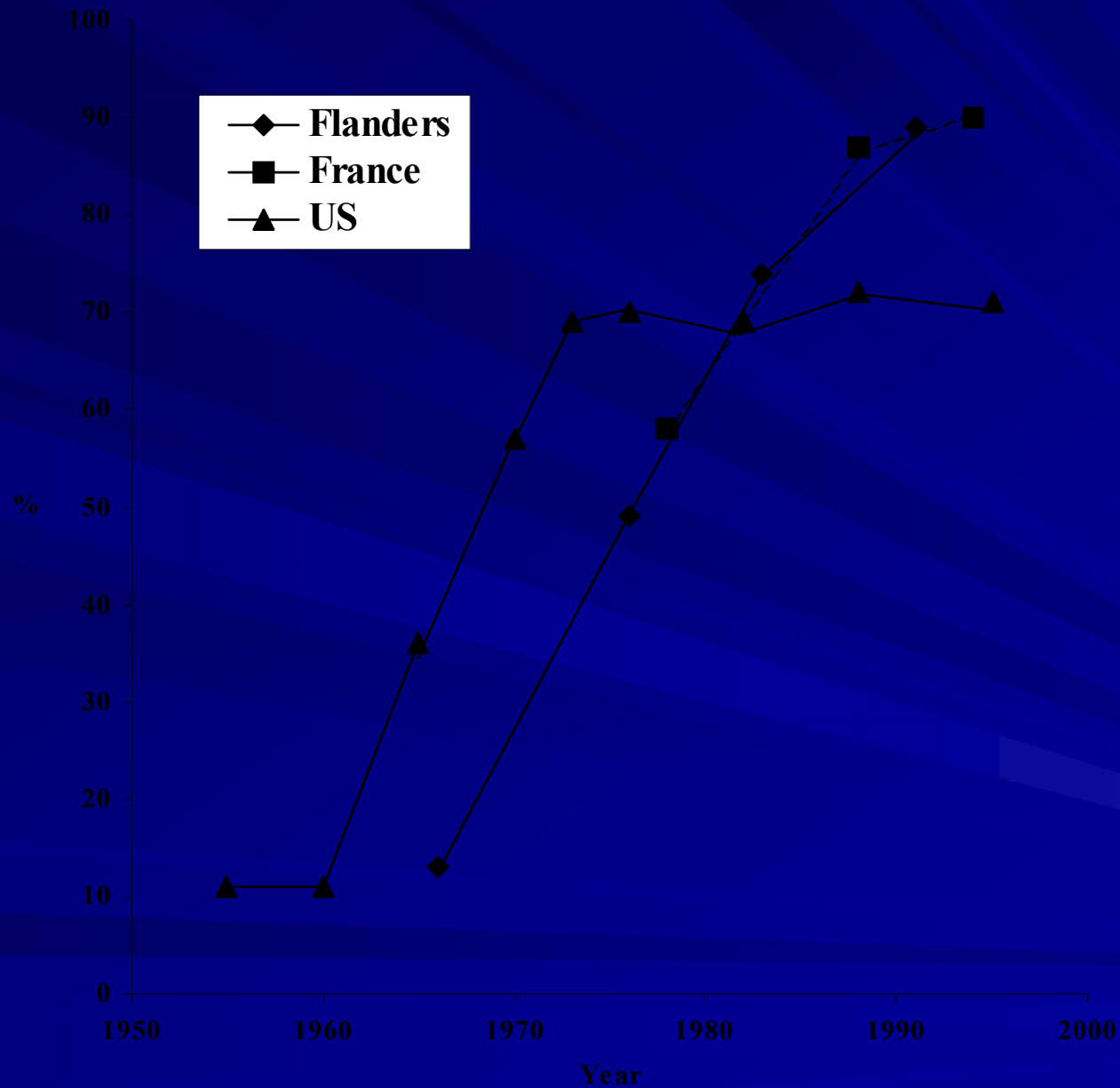
- Douche
- Condom
- Diaphragm
- Spermicides

■ Highly effective methods

- **Pill**
- IUD
- Sterilization



The modernization of contraception



Sexual revolutions, contraceptive transitions and demographic transitions

Period	Sexual behaviour	Birth control	Demography
Late 18 th , early 19th century	First sexual revolution	Transition from Malthusian to Neo-Malthusian birth control	First demographic transition
1960s	Second sexual revolution	Modern contraceptive transition	Second demographic transition

Sexual revolutions (Shorter, 1975)

- First revolution (late 18th, early 19th century):
“shift in the determinants of partner choice, going from outward considerations such as property and parental wishes, to **inner feelings**”.
- Second revolution (1960s):
“people of all ages, but adolescents in particular, began to strip away the sentimental layers from the romantic experience to get at its hard sexual core, thinking **eroticism** most precious in what human relationships have to offer us and impatient with the delays that feeling once imposed”.

Effects of the modern contraceptive transition

■ Fertility:

- Increase in contraceptive effectiveness
- reduction of excess fertility
- Population growth: below-replacement level
- How low can fertility go?
- Differential fertility
- indirect attitudinal effect: conscious parenthood

■ Sexual life and family dynamics:

- less interference with intercourse
- sexual revolution?
- premarital sex, consensual unions, extra-marital relations and the formation of new partnering
- no sexual promiscuity

■ Gender relations:

- boosts self-confidence and independence of women
- change in gender power relations

■ Health:

- freed women (and men) from fear for unexpected and unwanted pregnancies
- method specific effects: IUD; Pill; sterilization
- larger number of menstrual periods

■ Genetic effects:

- Decreased gene-spreading effect of male promiscuous behaviour
- Changes in gene pool composition on basis of genetic differentials in fertility

$$e = 1 - \frac{f_r}{f_n}$$

Contraceptive effectiveness (Flanders, 1991)

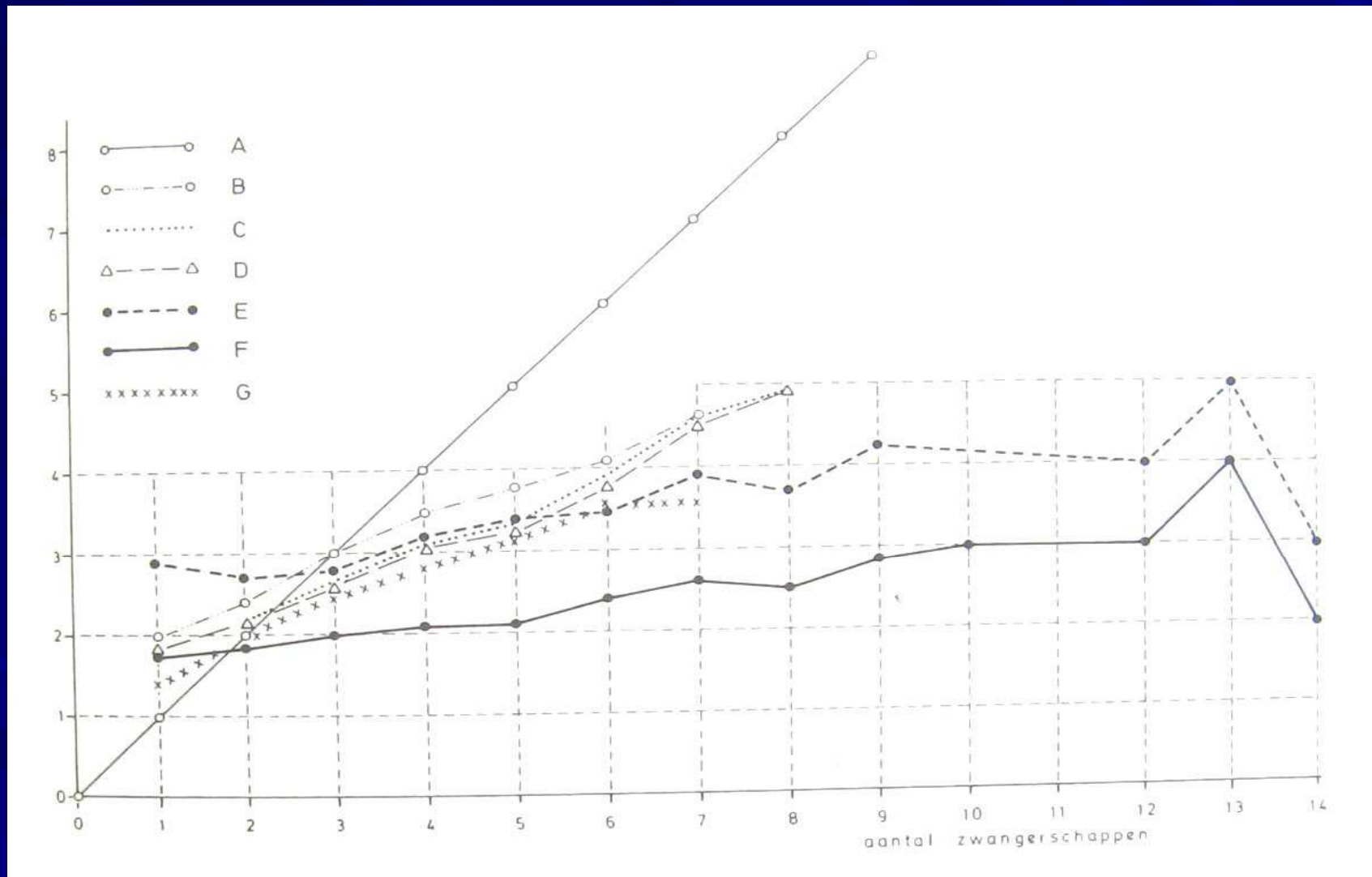
- User effectiveness: $e = 1 - F_r/F_n$
- Calculation by means of life table technique

Contraceptive method	Cumulative conception coefficient after one year	Average effectiveness
CI/PA	13,05	0,92
Condom	4,14	0,97
IUD	3,71	0,98
Pill	1,42	0,99
Sterilization	0,00	1,00

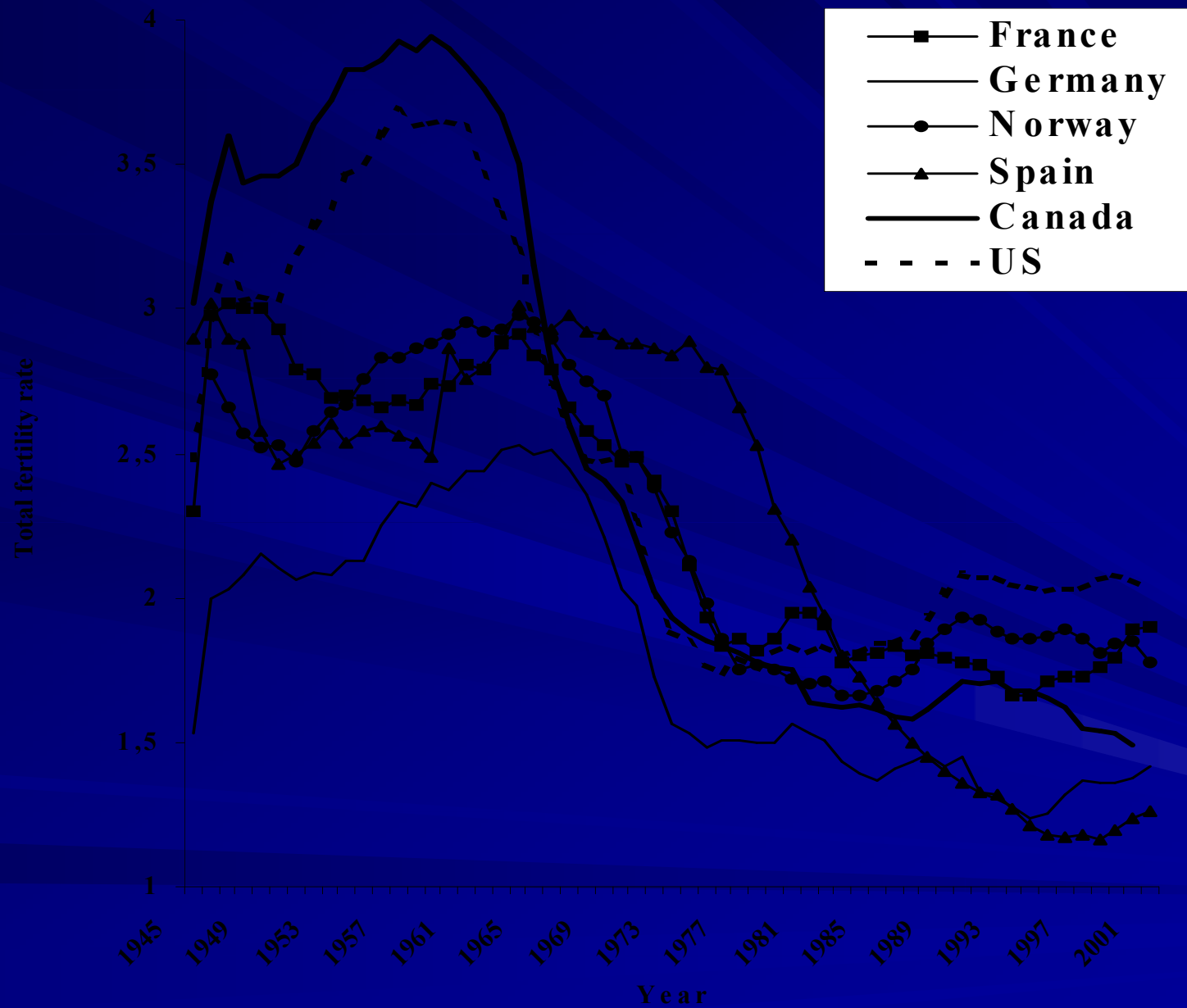
Excess fertility among married couples in Flanders

Year	% unwanted	% unwanted after correction for abortion
± 1970	13	25
± 1980	7	15
1992	6	?

Wanted and realized number of children according to number of pregnancies



Below-replacement fertility




How low fertility can get ?

- Decline gradually towards zero?
- Foster (2000):
 - evolved biological predisposition lies in **inherited nurturing behaviour** rather than in having children per se
 - a conscious motivation for bearing at least **one child**
 - **Variation** due to environmental conditions

Social differentials in contraceptive transition

- First transition (from Malthusian to Neo-Malthusian birth control):
 - strong SES/educational differentials
 - Second transition (shift to modern contraceptives):
 - Initially among **higher** educational groups and ideologically **secularized** groups;
 - Later: generalised shift;
 - **Unmet needs**: adolescents, people with weak emotional or cognitive abilities, insufficiently integrated migrants from developing countries
- socially differential fertility
- socially differential fertility

From accidental to conscious parenthood

- Pillenknick?
- Considerable misunderstanding about the supposed **causative relationship** between the spreading of efficient contraceptives and the recent resumption of the fertility decline;
- Desired family size appeared and still appears to be partially **independent** of the realized number of children (see figure)
- Efficient birth-control methods do have an **instrumental** effect on fertility (avoid excess fertility);
- **Availability** of modern contraceptives: 
from accidental parenthood to conscious parenthood

Effects on sexual life:

- Undoubtedly **less interference** with intercourse, but difficult to demonstrate
 - (users of modern methods are more exigent in sexual matters);
- **Sexual revolution?**
 - difficult to evaluate, but probably overestimated;
 - Antibiotic drugs may have had a more important influence.
- **Partnership**: increase in premarital sex, consensual unions, extra-marital relations and the formation of new partnering
- Not associated with a considerable increase of **sexual promiscuity**

Effects on gender relations

- Freed women (and men) from unexpected and unwanted **pregnancies**;
 - Husbands and lovers lost a substantial means of **control** of their women
 - Boosts self-confidence and independence of **women**
 - change in gender **power relations**
-
- ```
graph TD; A["➤ Freed women (and men) from unexpected and unwanted pregnancies;"] --- B["➤ Husbands and lovers lost a substantial means of control of their women"]; B --- C["➤ Boosts self-confidence and independence of women"]; C --- D["➤ change in gender power relations"];
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# Effects on health issues

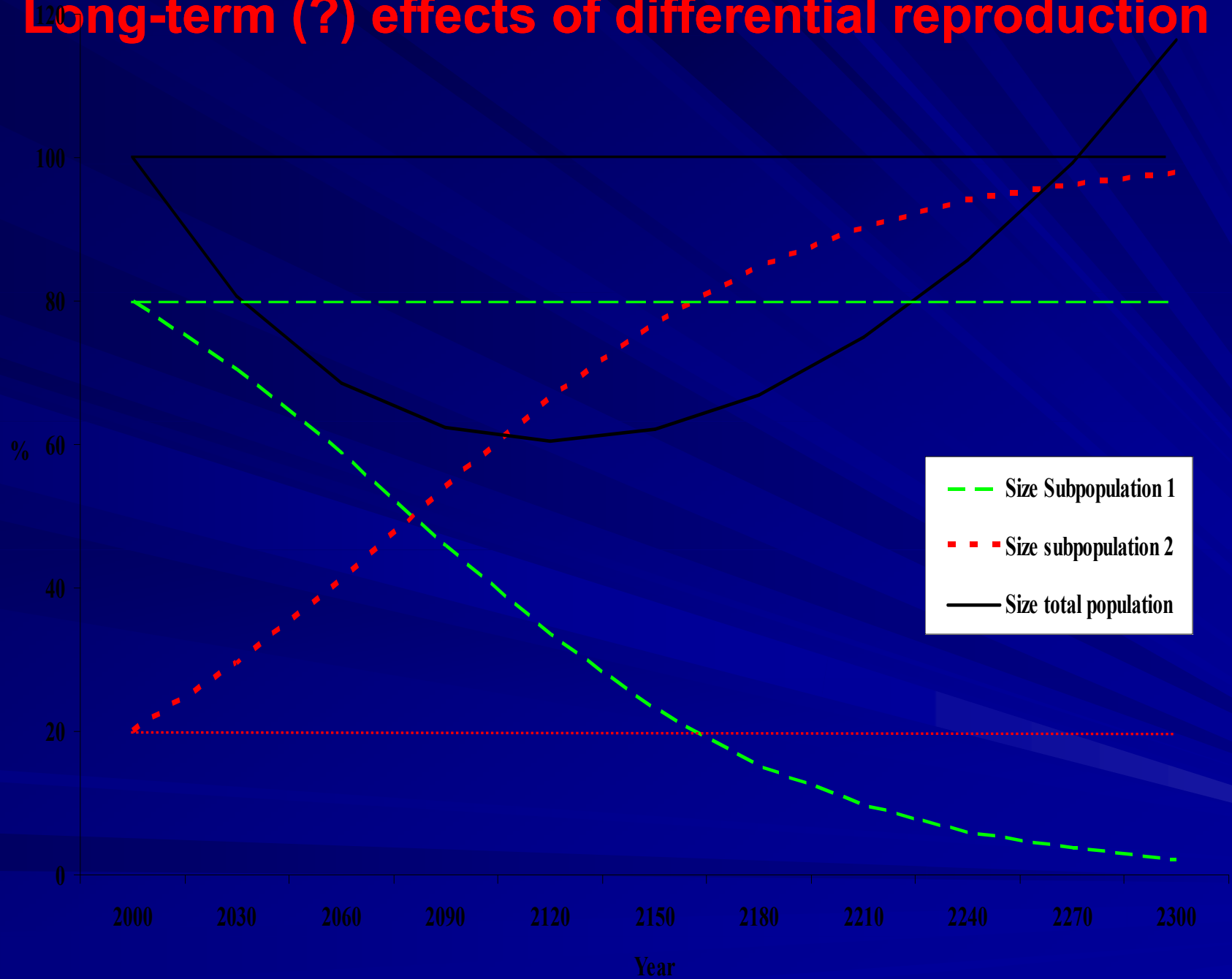
- Reduced **fear and stress** about unexpected and unwanted pregnancies;
- **Method** specific effects:
  - IUD: increased risk of tubal pregnancy;
  - Pill: increased risk of subfecundity; Reductions in overall risk of cancer and in risk of main gynaecologic cancers
  - Sterilization: risk of **regret** (among younger age groups)
- Larger number of **menstrual periods**; can be reduced through oral contraception.



# Genetic effects

- Decreased gene-spreading effect of **male promiscuous behaviour**
- Possible influence on **fecundity**
- Changes in gene pool composition on basis of **genetic differentials** in fertility

# Long-term (?) effects of differential reproduction



# Induced abortion

- **Ideological** question
- **Irreconcilable** standpoints:
  - Sanctity of life vs quality of life
  - Maternal (parental) rights vs foetal rights
  - Individual rights vs societal norms
- Possible **solutions**:
  - In principle: **consequentialistic** approach, taking into account a holistic view of human life, including intra- as well as intergenerational aspects;
  - Pragmatic: '**educational**' approach
    - informing women (couples) of advantages, risks, and consequences of I.A.,
    - leaving the decision to the women;
    - Providing an appropriate follow-up (mainly contraceptive advice).

## Major aspects of induced abortion

- Prevailing **views** on induced abortion;
- **Legislation** on induced abortion;
- **Methodology** of induced abortion:
  - Abortus provocatus criminalis
  - Abortus arte provocatus (medical abortion)
- Unwanted pregnancy, **contraception** and abortion;
- Sexual and reproductive **education**;
- The **female** and induced abortion
- The **foetus** and induced abortion
- **Demographic** effects of induced abortion

## Major findings on the prevalence of abortion

- Prevalence is dependent upon the attitudinal, legal, medical infrastructural, educational, and contraceptive **background**.
- Legalized abortion, in presence of good contraceptive policy, **minimizes** the abortion frequency;
- Legal prohibition of abortion, in combination with bad contraceptive policy, **maximizes** abortion and perpetuates the use of **non-medical abortion**.

# Indications for induced abortion

- Social indications: most prevalent
  - Economic situation
  - Marital status (unmarried, divorced)
  - Age (too young, too old)
  - Family size (excess fertility)
- Medical indications: least prevalent
  - Maternal indications: very rare phenomenon
  - Foetal indications:
    - Selective abortion avoids congenital impairments;
    - Prevents infertility: it allows couples to build up a normal family with healthy children

## Demographic impact of legalization of induced abortion

➤ Apparent initial increase;



Illegal abortions become visible;

➤ No real increase, except in absence of efficient contraceptive policy

# Realized fertility

- **Realised fertility at the family level**
  - Trends
  - Effects
- **Realized fertility at the population level**
  - Trends
  - Effects
    - Demographic effects
    - Genetic effects



# Realised fertility at the family level

## ■ Trends:

- Reversal of relation between wanted number of children and realized number:  $< \longrightarrow >$
- Considerable decrease of family size variance
- Disappearance of large family
- In some countries: substantial resumption of childlessness

## ■ Effects

- Ontogenetic
- Genetic

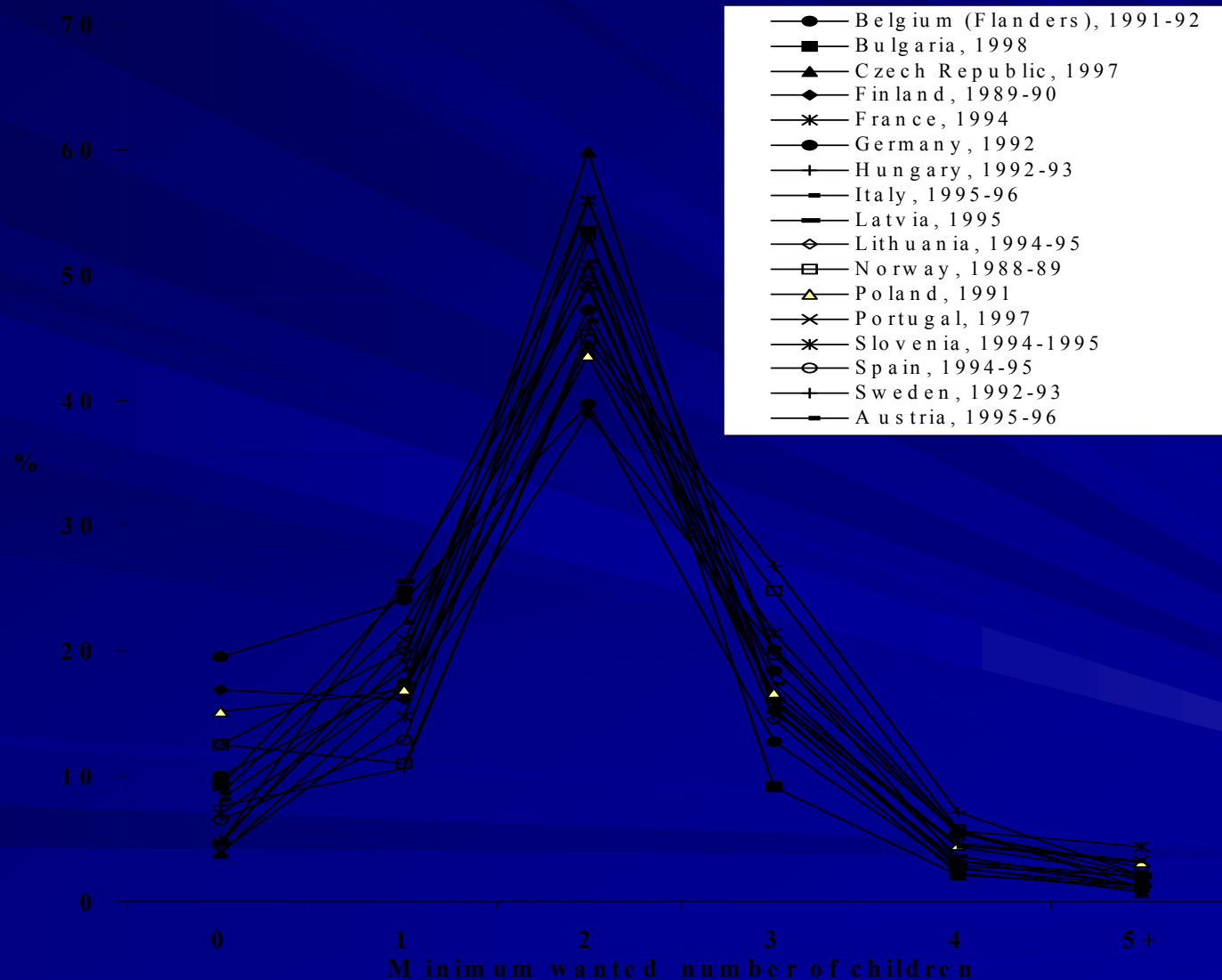
# Number of wanted children

- A few decades ago women:
  - Desired number of children  $<$  realised number (excess fertility);
- Currently:
  - Desired number  $>$  realised number (deficit fertility).

**Deficit fertility: wanted fertility > realised fertility**  
(married couples in Flanders, 1992)

- Deficit fertility: 12%
- Reasons of deficit fertility (100%):
  - Socio-biological 46
  - Relational 22
  - Socio-economic 20
  - Other 12

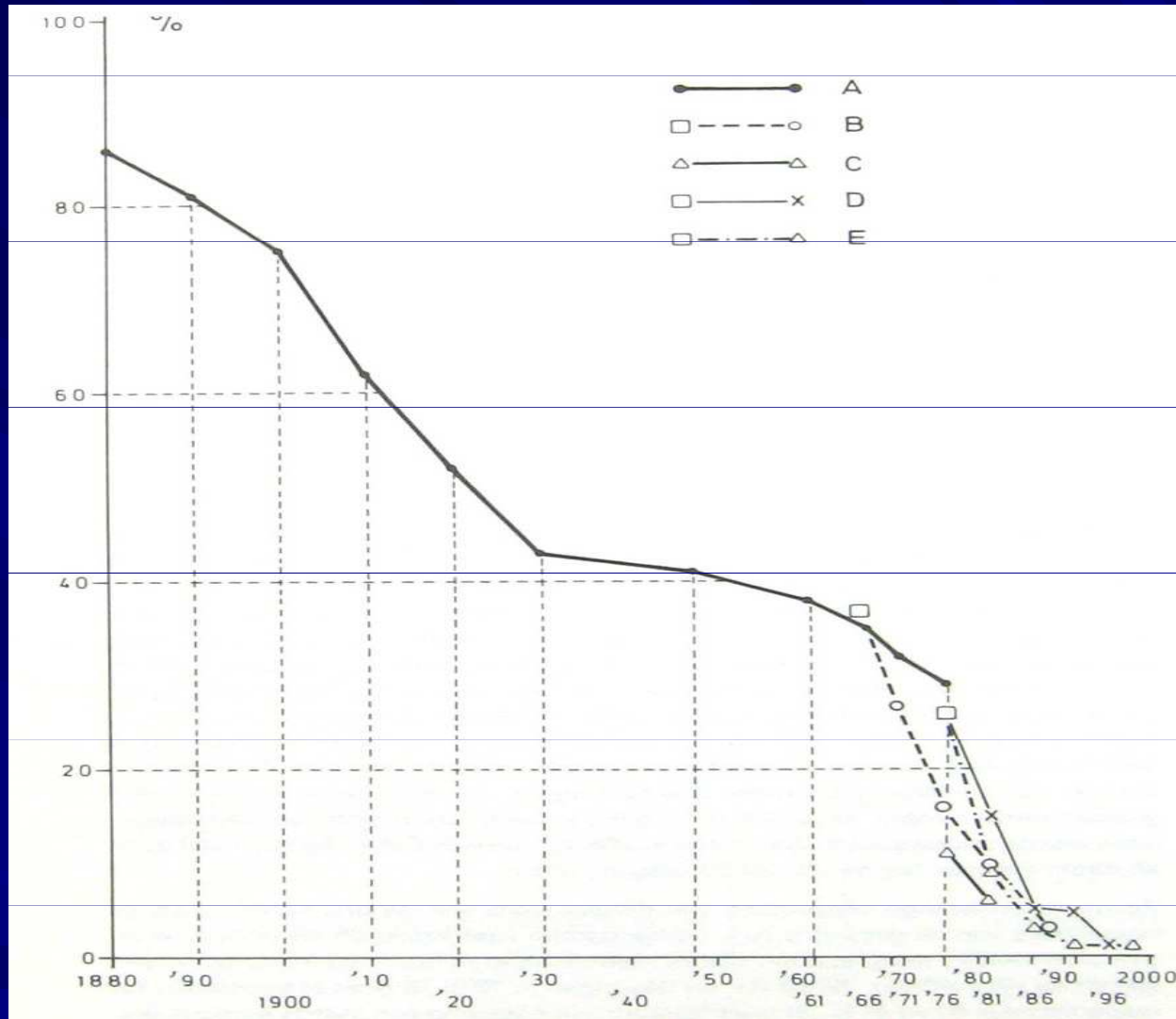
# Frequency distribution of minimum wanted number of children in selected European countries (1988 -1997)



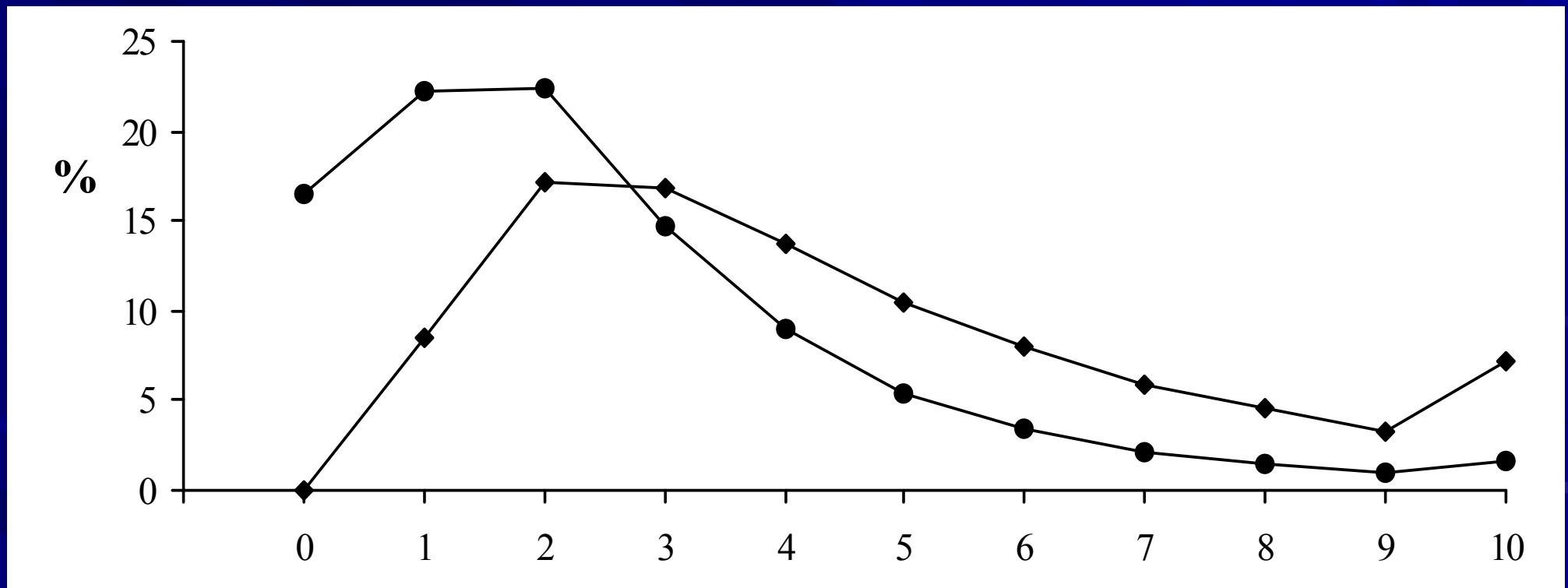
## The disappearance of the large family

- Demographic effects: **below-replacement** fertility
- Ontogenetic effects: favourable **phenotypic** consequences
- Genetic effects: variable
  - Potentiality for high **fecundity** might decrease
  - Genetic **heterogeneity** increases
  - Depending on type of association between fertility and genetic features, **dysgenic or eugenic** effects.

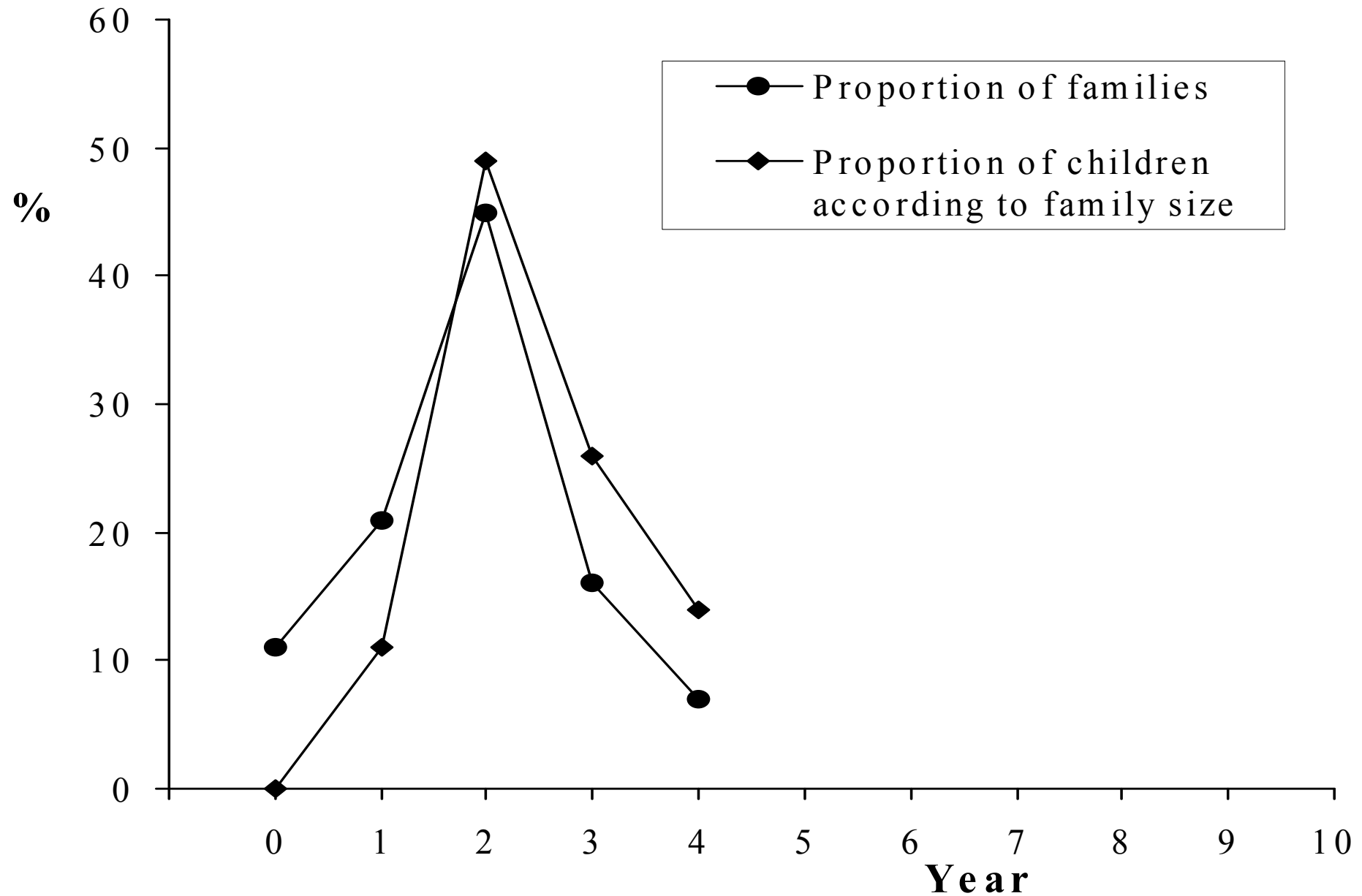
# The disappearance of the large family



# Family size and offspring number distribution in pre-transitional regime



# Family size and offspring number distribution in post-transitional regime





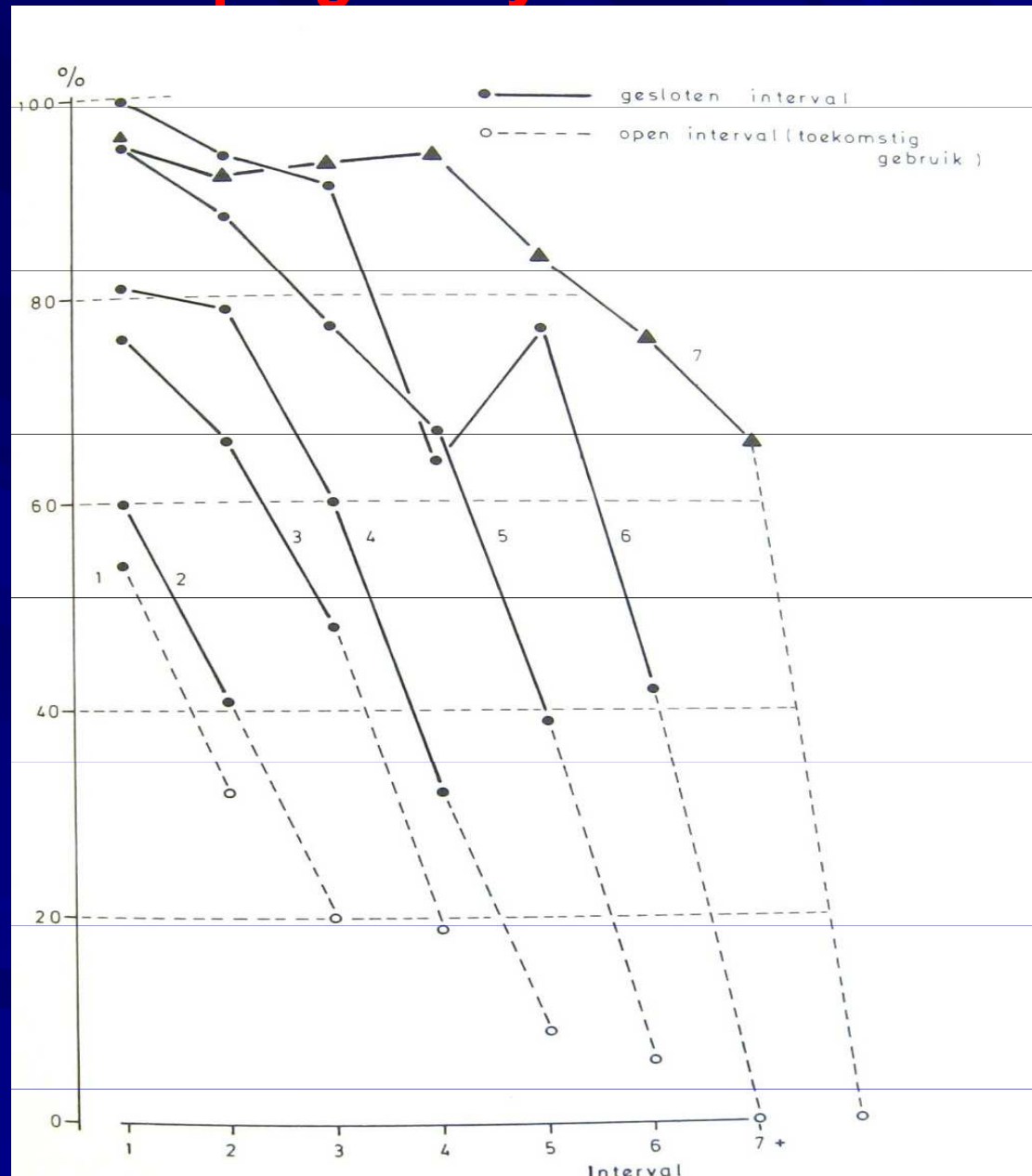
# Characteristics of parents and offspring in large families

- Less educated;
- Less upward social mobility;
- Lower standard of living
- Lower intelligence
- Weaker emotional personality characteristics
- More health problems
- Less harmonious partnership
- Authoritarian behavioural pattern
- Better socialization
- Absent or failing birth control pattern

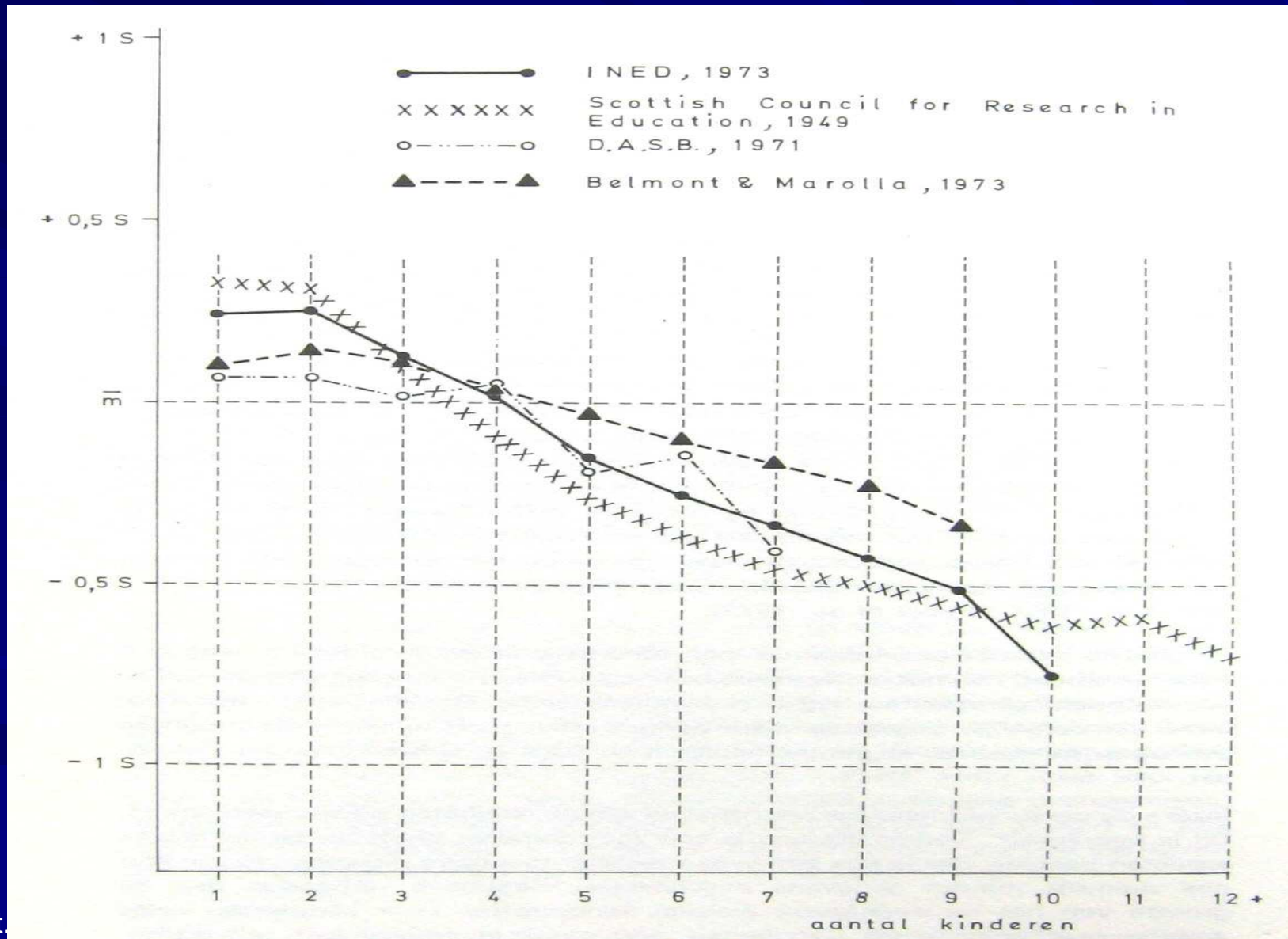
# Causes of large family syndrome

- Influences of **family size** itself
  - Less resources to be shared
  - Heavier physical load and psychic stress
- Purely **statistical** correlations
  - Covariance with **birth order**, birth interval, parents' age
- **Sorting** effects
  - Parents of large families differ from other parents

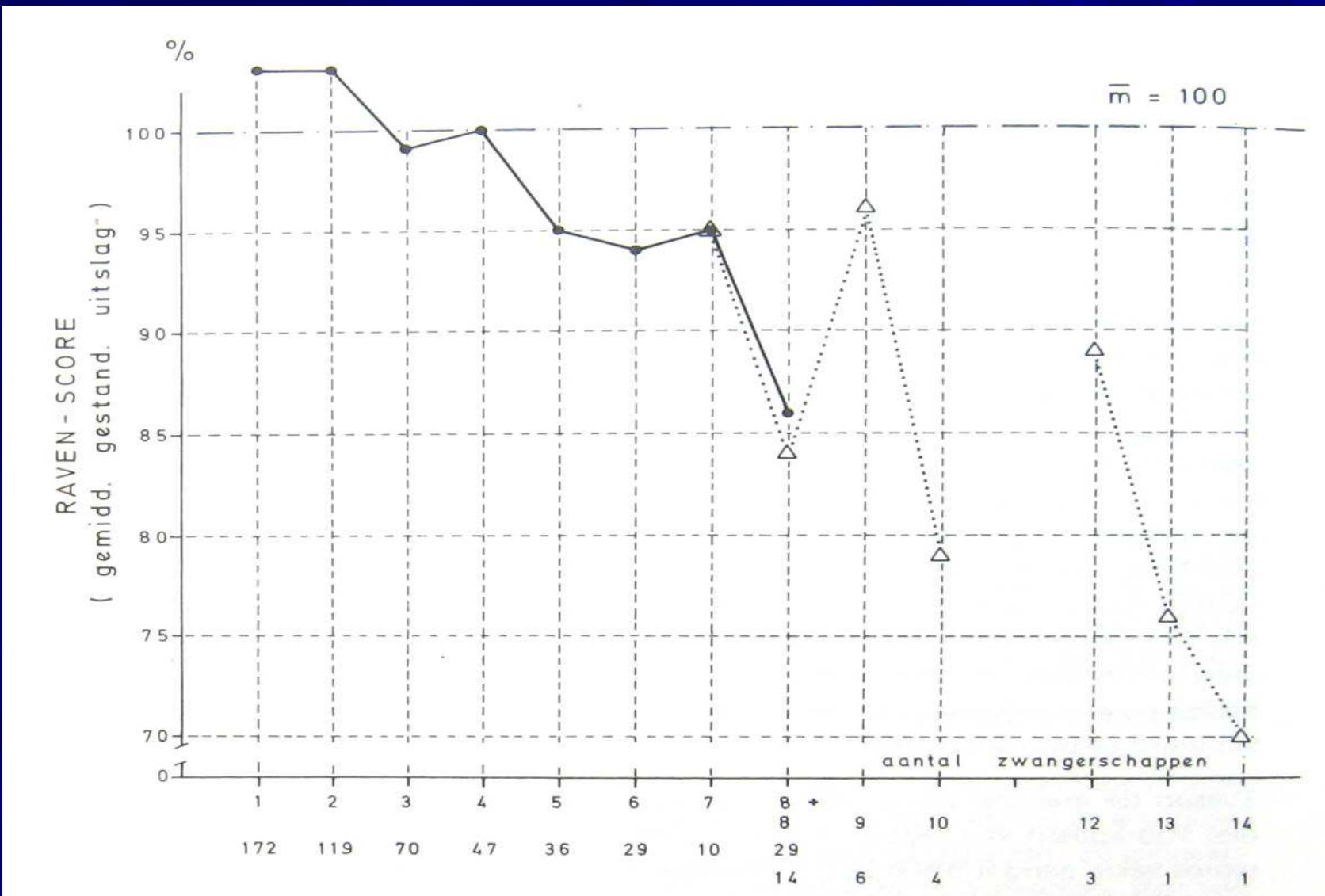
# Use of coitus interruptus by birth interval and pregnancy number



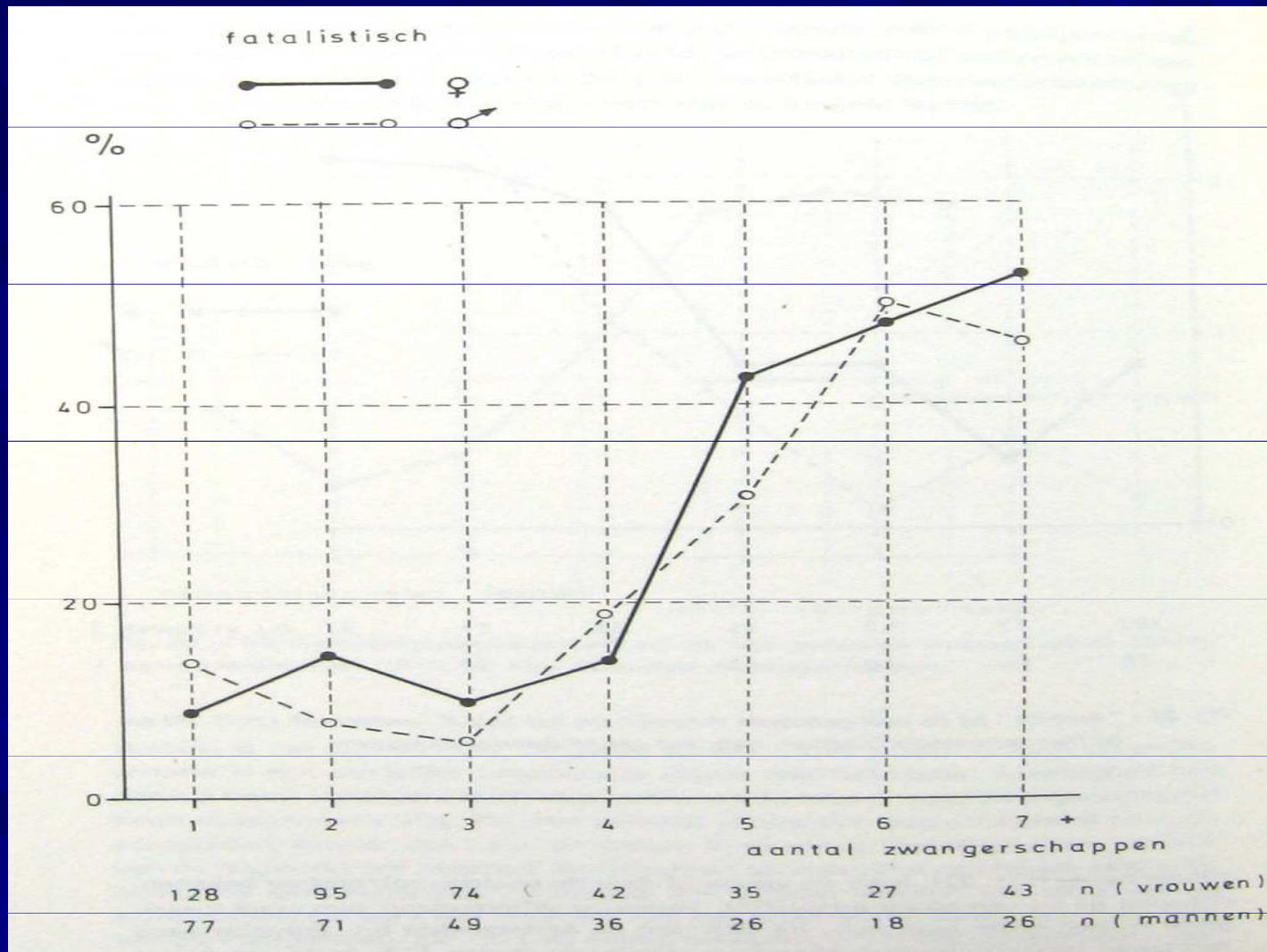
# Intelligence level according to number of pregnancies



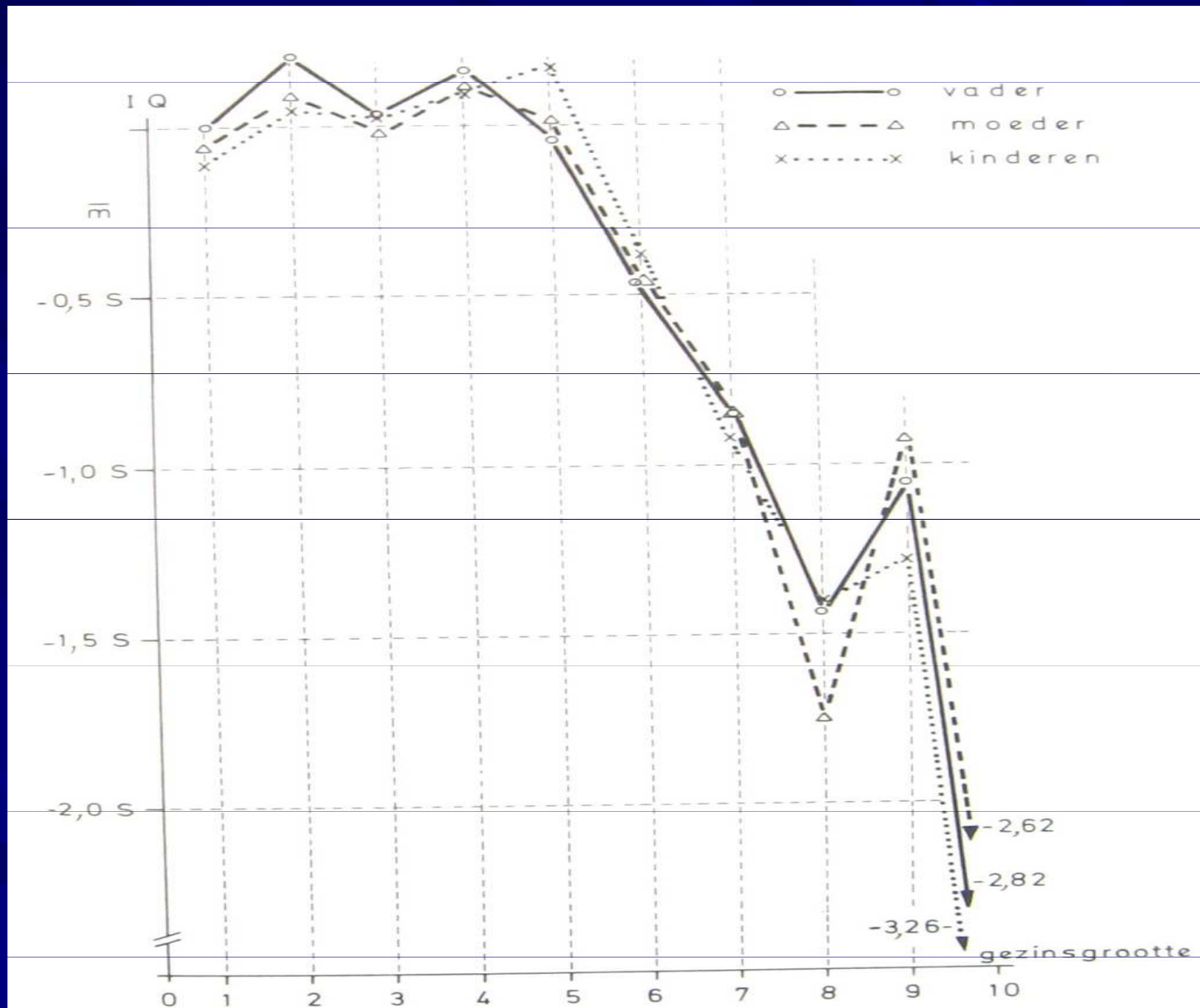
# Intelligence level according to number of pregnancies



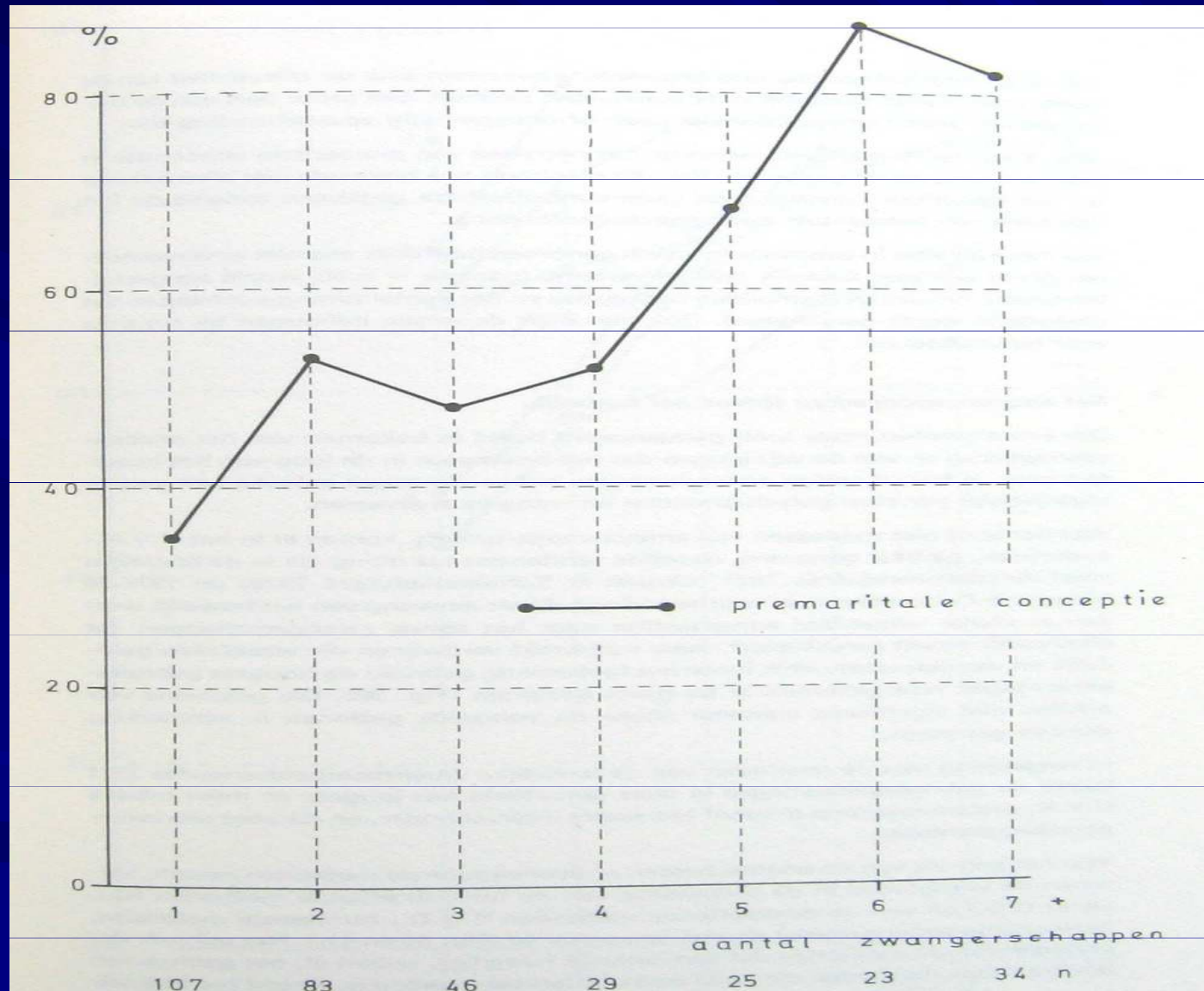
# Fatalism according to the number of pregnancies



# Intelligence of parents and children



# Example of sorting effect: premarital conceptions by number of pregnancies

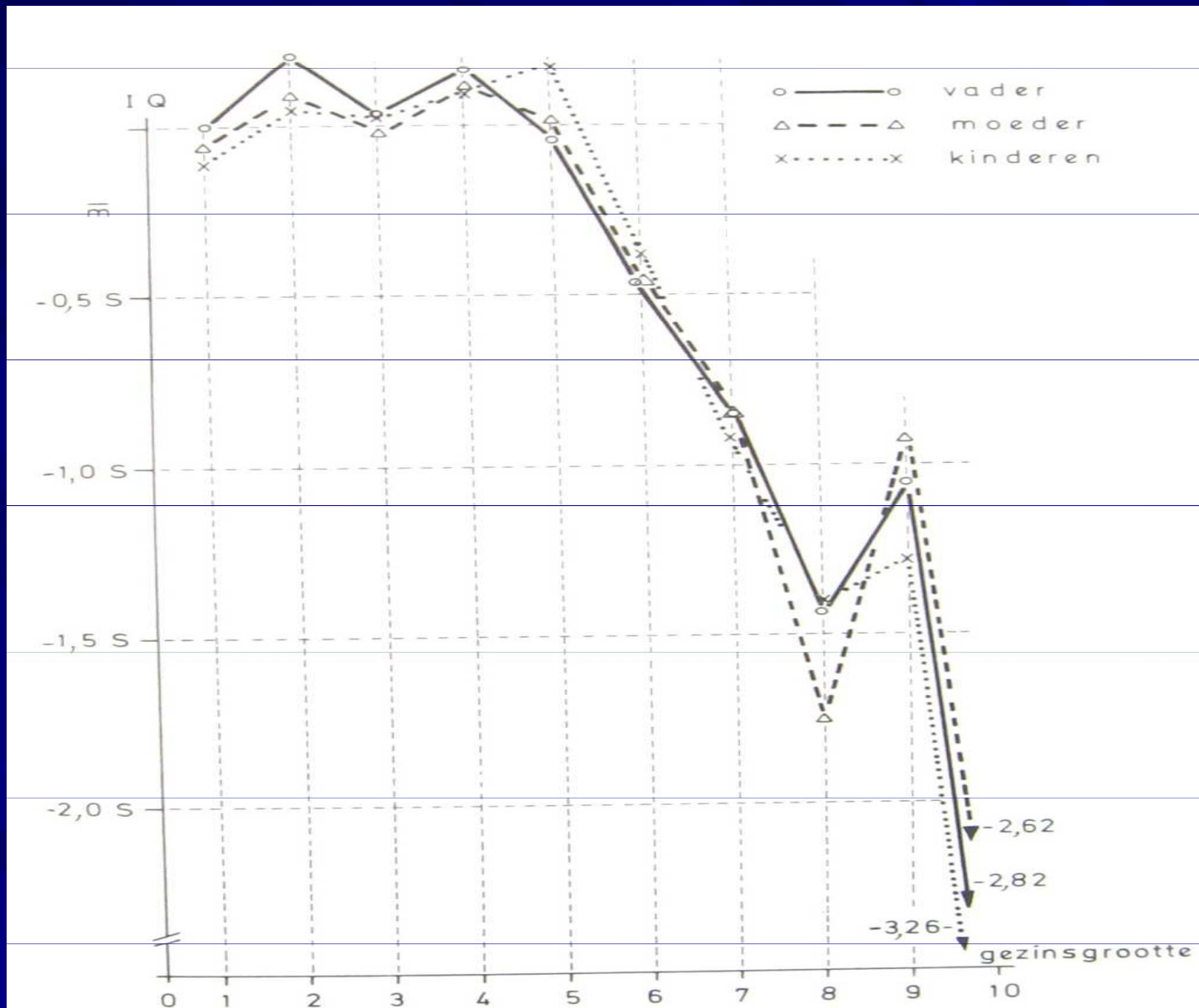




## Optimal limits of family-size variation

- Three types of relations between specific characteristics and family size:
  - **Linear** relationship;
  - **Threshold** from a higher number on ( $\sim 5$ );
  - Sometimes separate position of **one-child** family.
- Optimal limits of family-size variation lie between **2 and 4** children.

# Example of phenotypic threshold according to family size



# Realized fertility at the population level

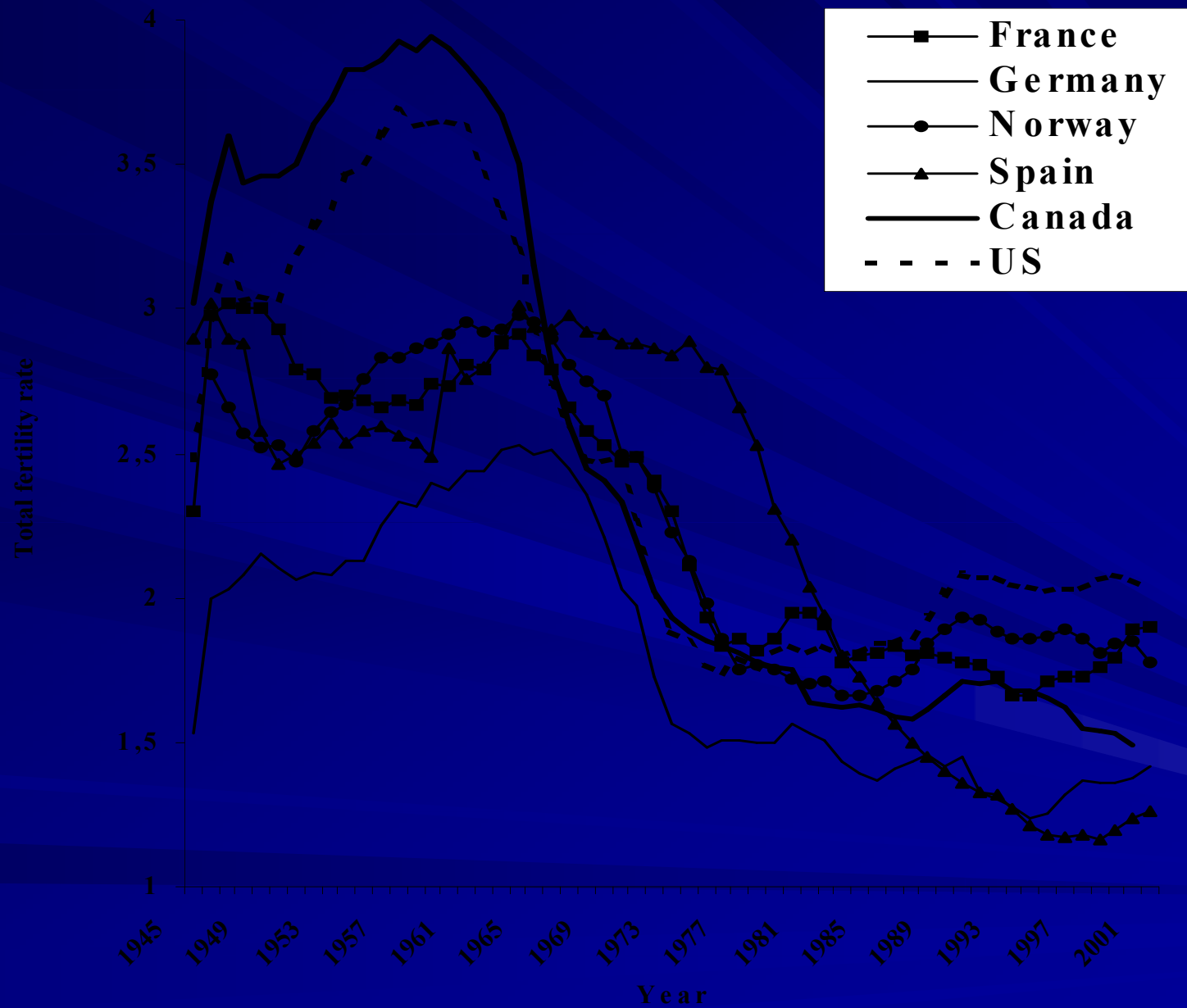
## ■ Trends

- Below-replacement fertility
- Increase of definitive childlessness
- Postponement of maternal age
- Insufficient fertility recuperation at higher age

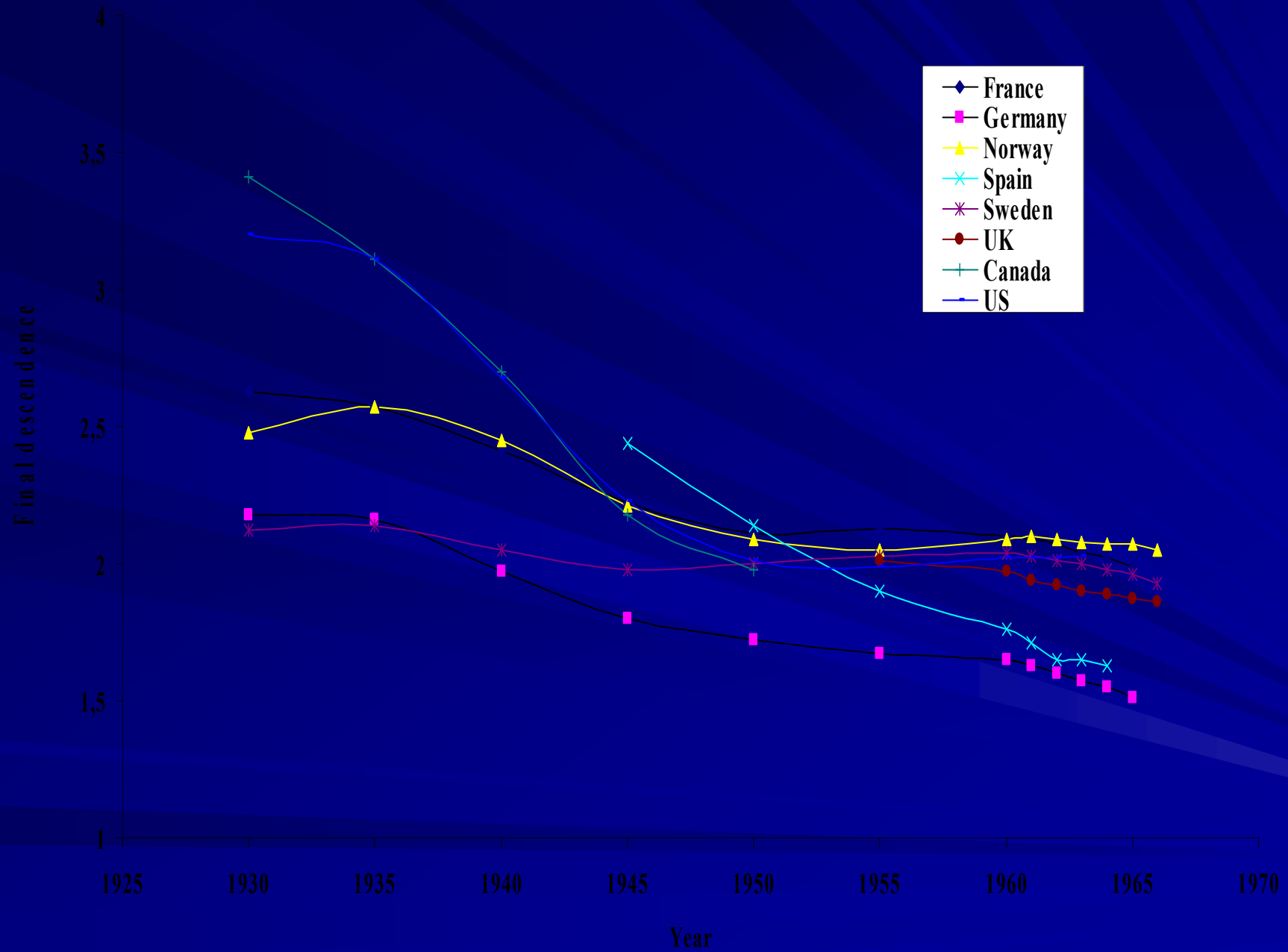
## ■ Effects

- Societal effects
  - Population decrease
  - Population dejuvenation and ageing
- Genetic effects

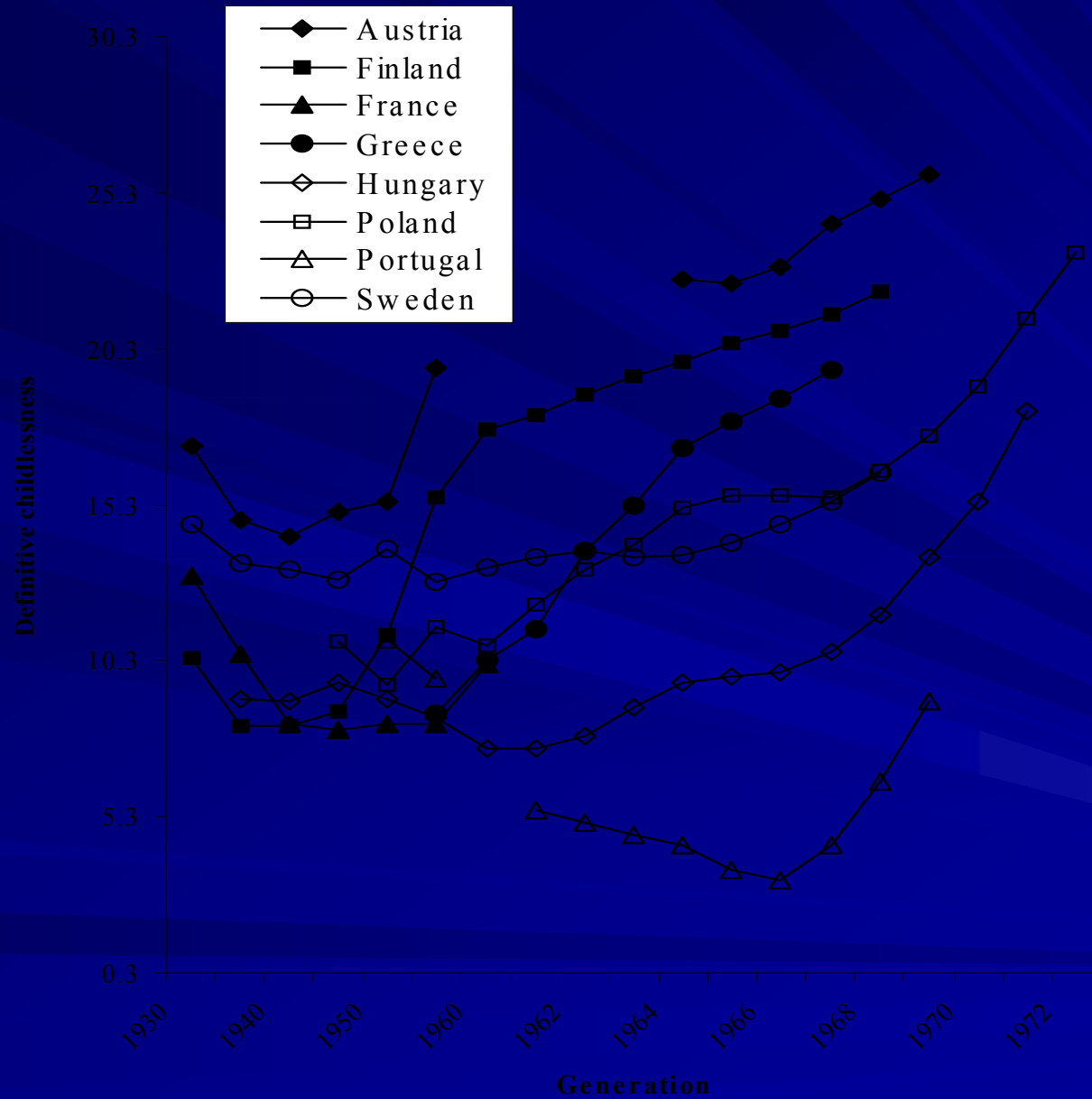
# Below-replacement fertility



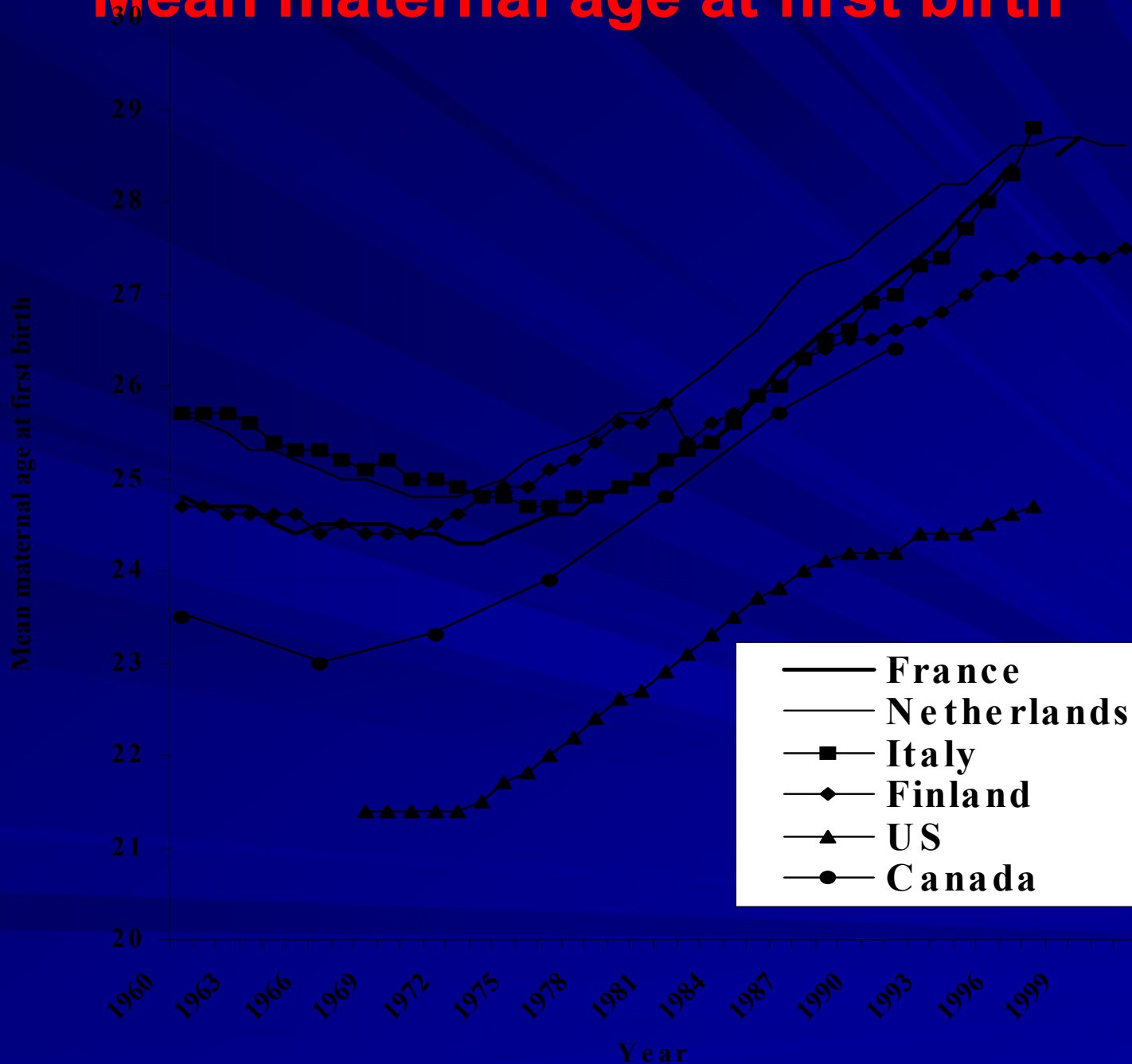
# Final descendance



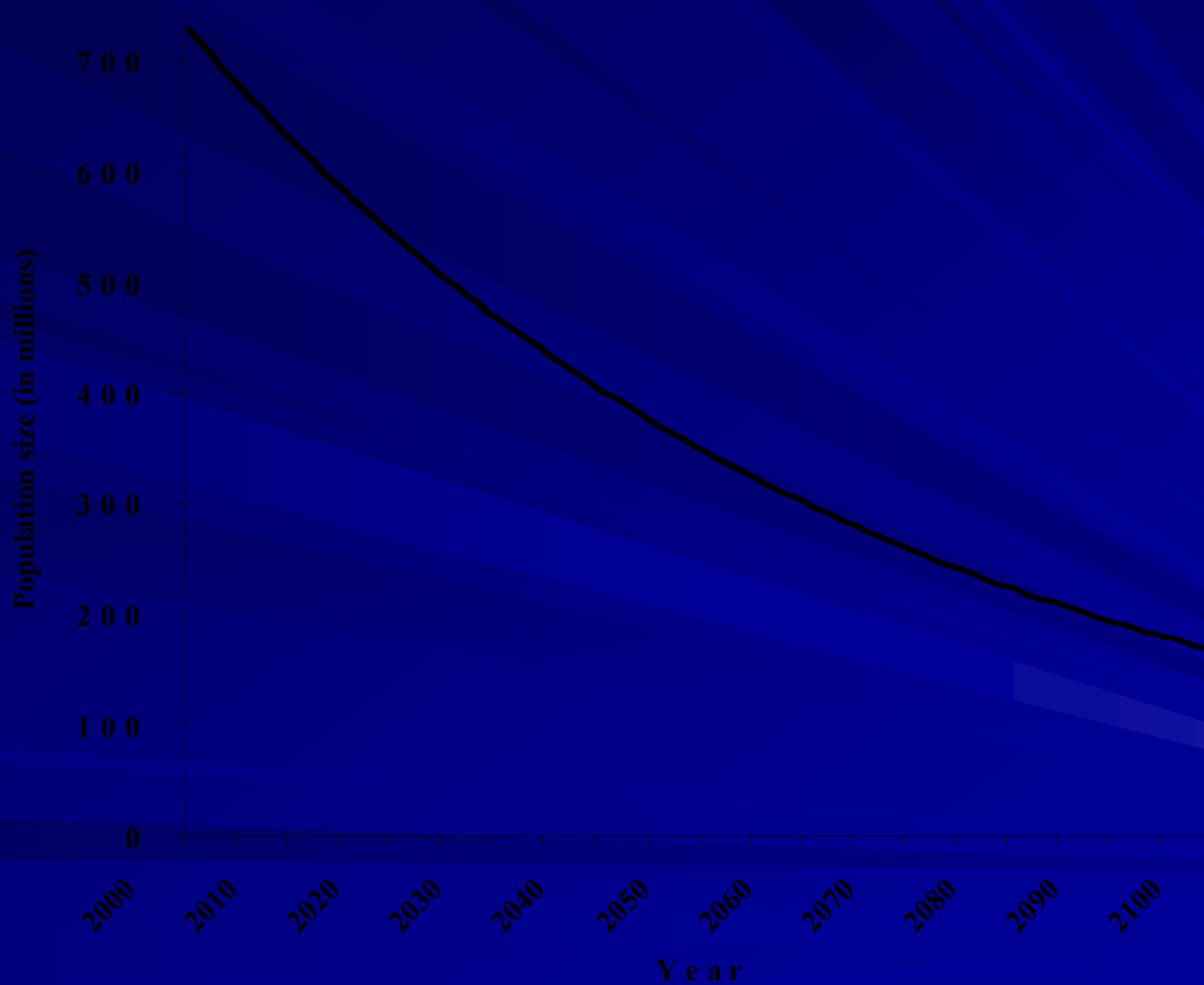
# Definitive childlessness of female generations



# Mean maternal age at first birth

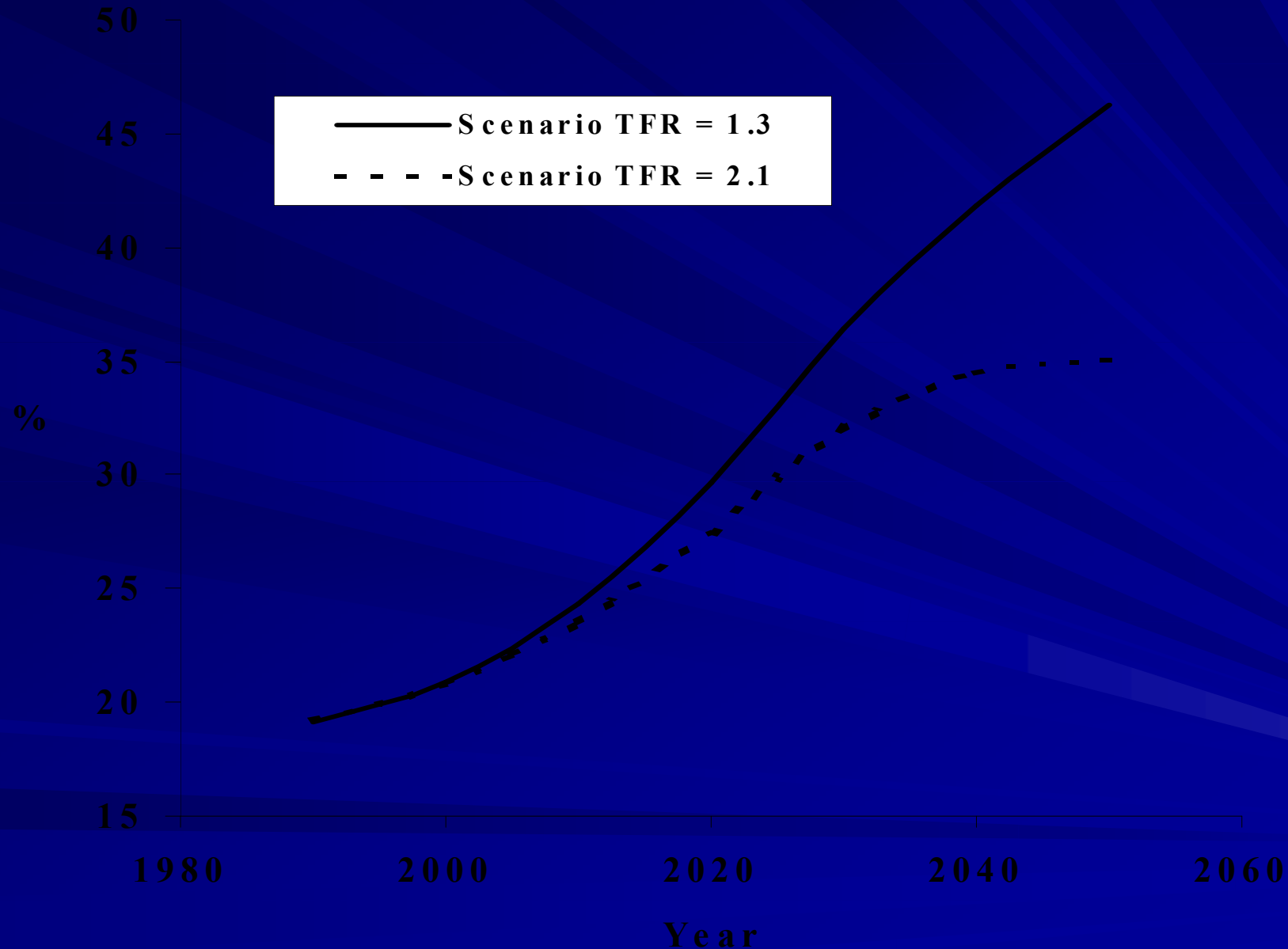


# Population decrease in Europe





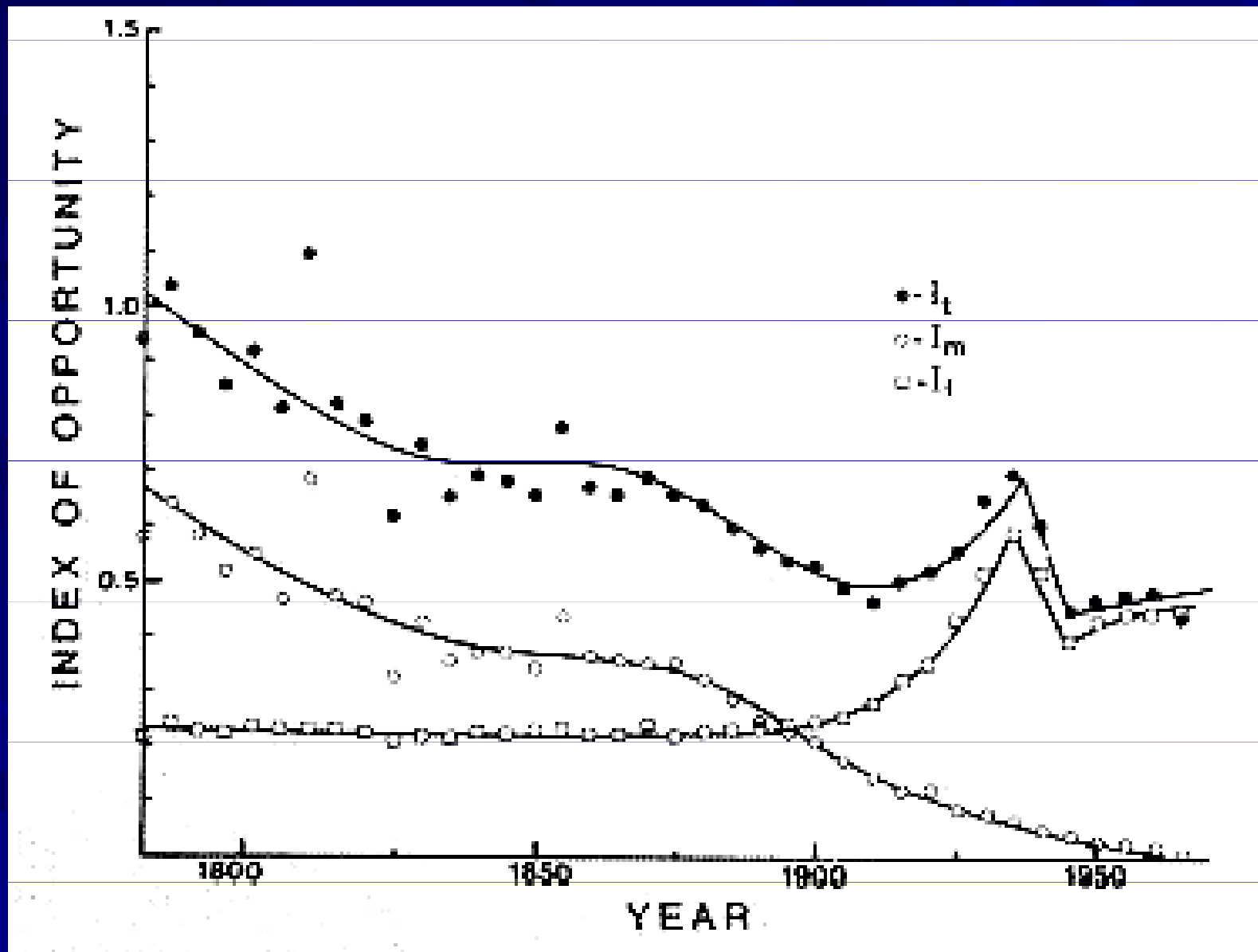
# Future population ageing scenarios based on very low fertility and replacement fertility levels



# Qualitative effects of demographic trends

- Decreasing variance in family size:
  - Changes in opportunities for selection?
  - Decreasing unfavourable ontogenetic and genetic effects;
  - Depending on the biological features of remaining parents of large families: (un)favourable;
- Increasing maternal age:
  - increasing phenotypic complications;
  - Increasing genetic impairments.
- Selection relaxation
- Changed selection of childbearing motivation
  - In the long run, below-replacement fertility individuals/couples would be outselected.

# The changes of the fertility index of opportunity of selection ( $I_f$ )



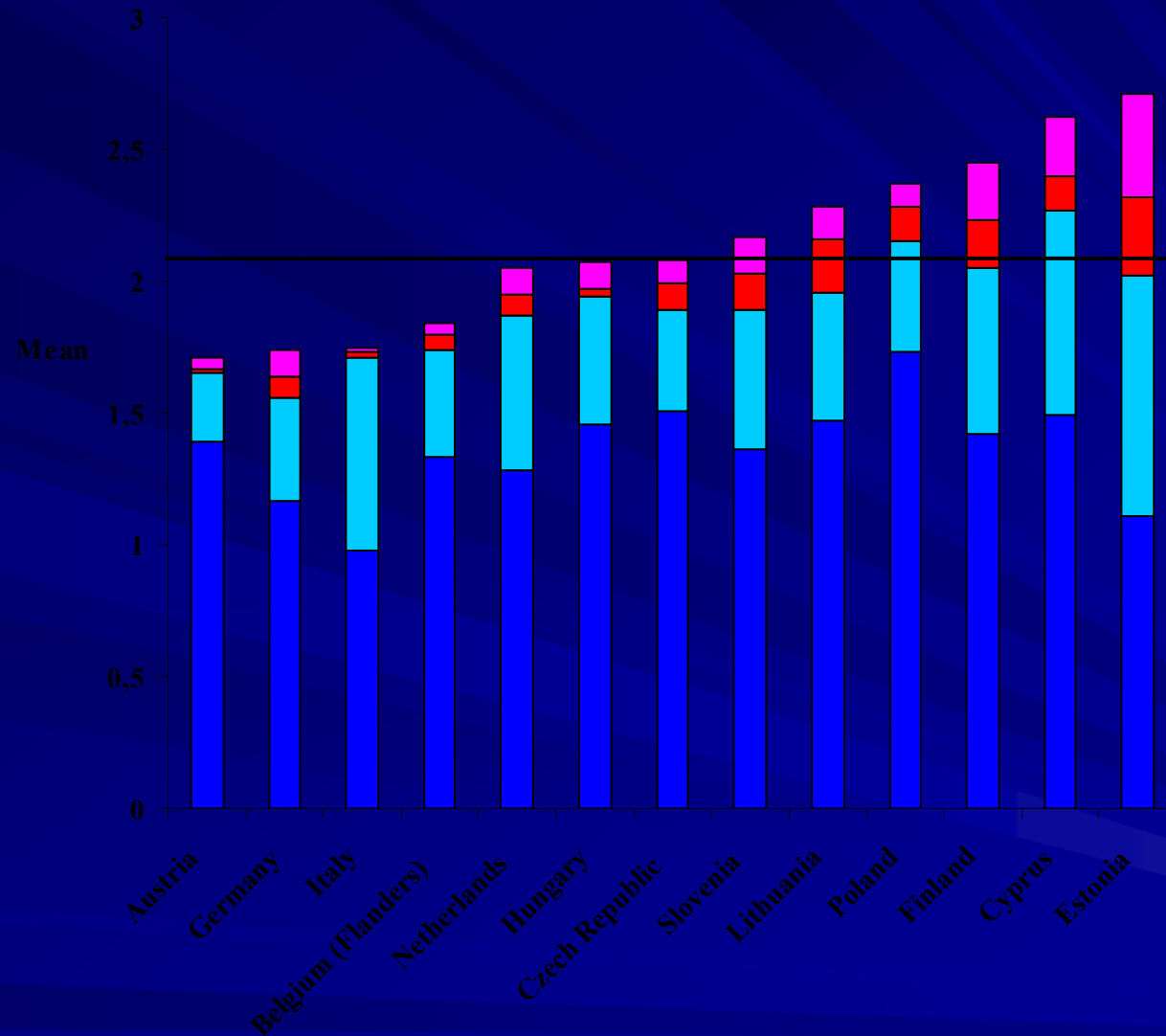
# Policy implications

- Reproductive behaviour is a phenomenon that has been and partially still is a domain of heavy **ideological and political debate and controversy** in modern culture, e.g.
  - United Nations world population conference, **Bucharest**, 1974:
    - *“all couples and individuals have the basic human right to decide freely and responsibly the number and spacing of their children and to have the information, education and means to do so”*
  - United Nations International Conference on Population and Development, **Cairo** 1994:
    - *“The population and development objectives and actions of the present Programme of action will collectively address the critical challenges and interrelationships between population and sustained economic growth in the context of sustainable development”...*

# Why replacement fertility?

- Avoid excessive population ageing due to dejuvenation
- Avoid sustained population decline
- Avoid ingroup-outgroup conflict due to strong immigration flows

# Intentions and possible effect of desired policies, taking into account probable life-course obstacles, by country (IPPAS database)



- Additional number of children respondents might have if desired policy measures are implemented
- Number of children respondents might have if desired policy measures are implemented
- Number of children respondents intend to have
- Number of children respondents already have

## Background of ideological controversy

- Sociobiologically, not surprising that reproductive issues are a sensitive domain in ideological and political quarters:
  - At the **individual** level:
    - Proximately: having children, safeguarding one's old days, or guaranteeing one's immortality;
    - Ultimately: transmission of one's **genes** in future generations.
  - At the **population** level:
    - intergenerational balances;
    - territorial integrity and national identity = intergroup **balance of power** dynamics.

# Policy implications include:

## ➤ Fertility control

- contraception
- abortion
- medically assisted fertility

## ➤ Fertility

- Advocating low fertility
- Promoting population growth
- Advocating redressing fertility at/around **replacement level**
  - Avoid excessive population dejuvenation
  - Avoid excessive population decrease
  - Avoid excessive immigration



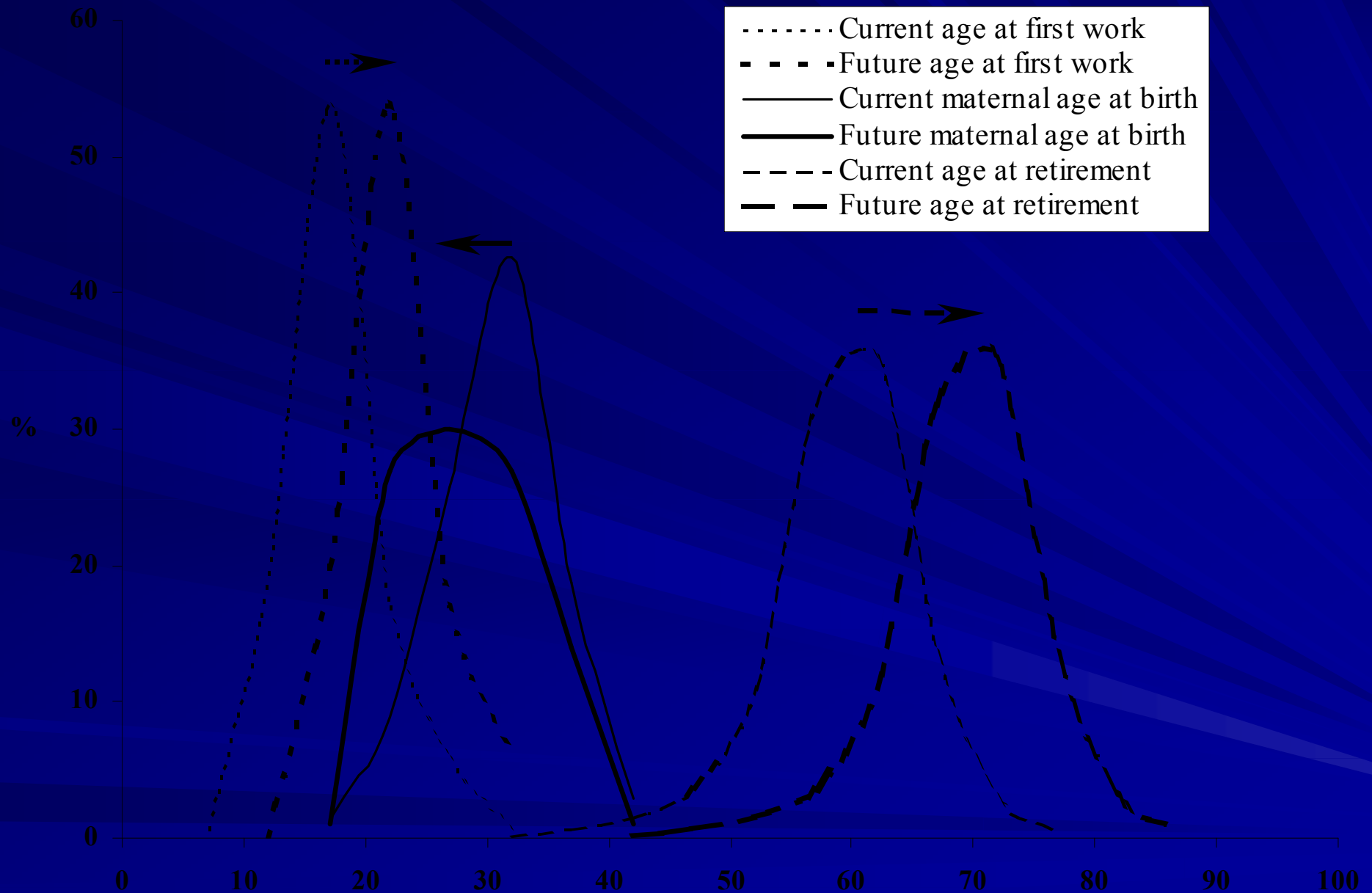
# Fertility variation necessary to maintain long-term generational replacement

|                     | Alternative models |         |
|---------------------|--------------------|---------|
| Number of children  | % women            | % women |
| 0                   | 10                 | 15      |
| 1                   | 10                 | 20      |
| 2                   | 45                 | 10      |
| 3                   | 30                 | 50      |
| 4                   | 5                  | 5       |
| <i>Average: 2,1</i> | 100                | 100     |

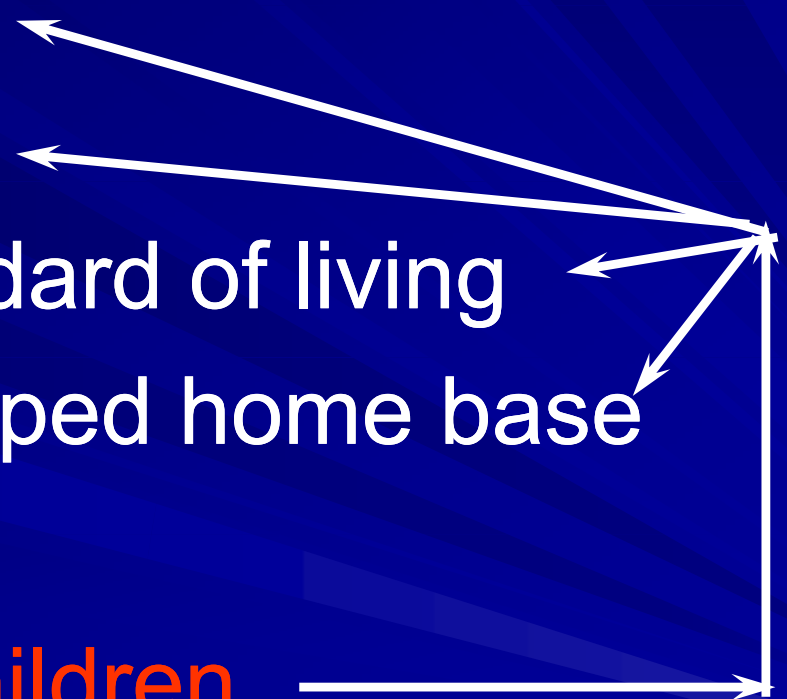
## Feasibility of fertility policy

- **Gender** equity and equality: reconciling work patterns and family life
- Societal coverage of financial **costs** of children
- Creation of a more child-friendly **environment**
- Rebalancing **individual and societal values** with respect to intergenerational continuity
- Rethinking the entire **life course** perspective regarding education, employment and retirement

# Rethinking the entire life course



# Reshuffling creative, recreative and procreative goals in the life course

- Prolonged schooling
  - Build out a career
  - Acquire a decent standard of living
  - Construct a well-equipped home base
  - Enjoy life
  - Get and raise a few children
  - Retirement → postpone to higher  
ages
- 
- A diagram consisting of a central point on the right side of the slide. From this point, several white arrows point leftwards towards the list items. One arrow points to 'Prolonged schooling', another to 'Build out a career', and a third to 'Acquire a decent standard of living'. A fourth arrow points down and then left towards 'Construct a well-equipped home base'. A fifth arrow points down and then left towards 'Get and raise a few children'. A sixth arrow points down and then left towards 'Retirement'. The arrows suggest a process of re-evaluating or reshuffling these goals.

# IPPAS conclusions

- The **family policy measures** considered in PPAS may have a slight positive effect on completed fertility;
- A substantial and long-lasting effect, however, can only be expected from a rather considerable re-organisation of the economy of time and the re-allocation of societal resources over the **entire life course**.