

The demographic relevance of assisted reproduction

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INTRODUCTION

Demographic perspective: Low fertility and delayed childbearing

The demographic relevance of assisted reproduction:

More demand for infertility treatment

- Later childbearing = longer time to conception & more infertility
- ? *Rising male factor infertility, declining sperm quality?*

Demographic impact of assisted reproduction & infertility treatment

- Fertility rates
- Births at extreme reproductive ages
- Multiple delivery rates
- Sex ratio at birth (?)

Focus: Mostly Europe, North America

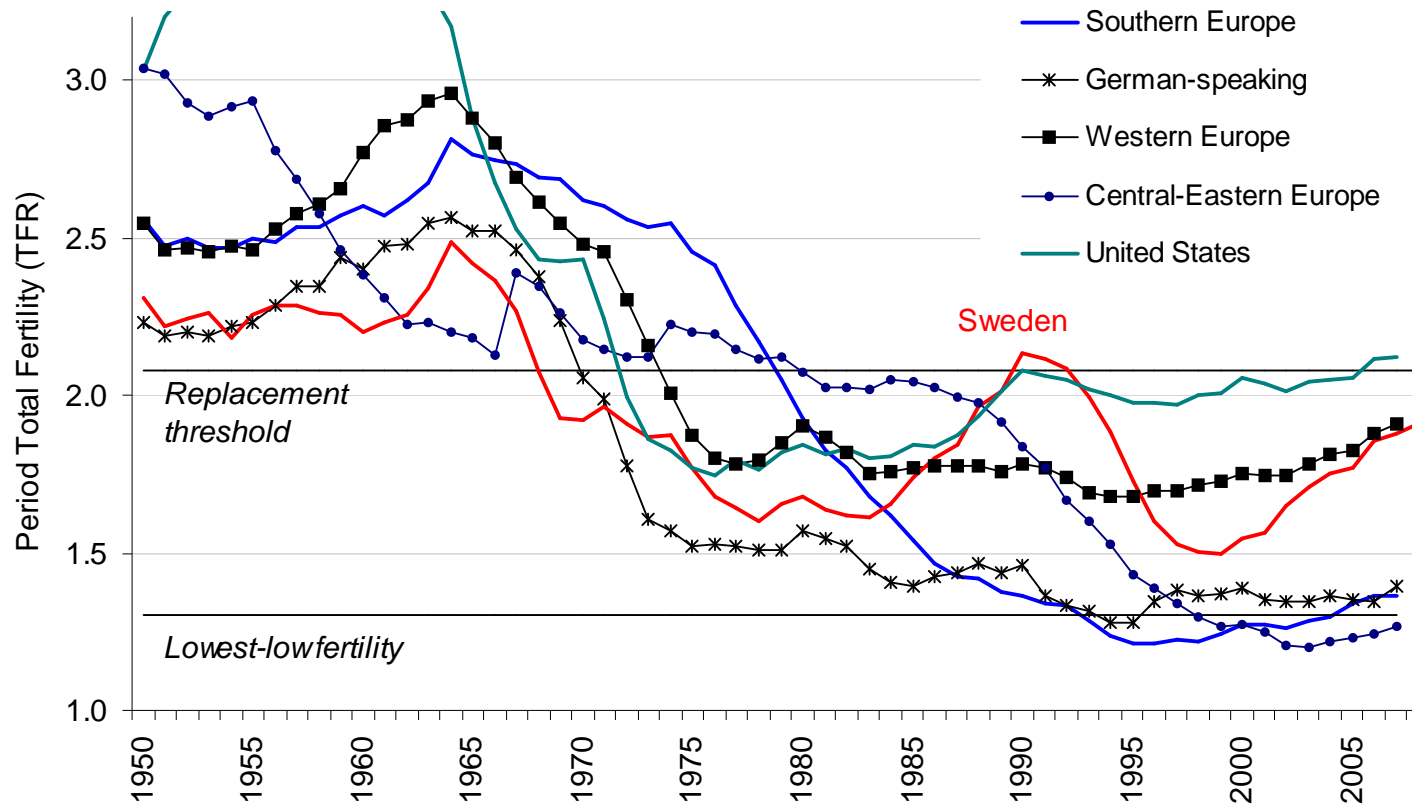
Note: *Fertility, fertility rates* = birth rates; usually computed for women of reproductive ages

Period vs. Cohort approach

TOPICS

- 1) Later parenthood: Trends and consequences
- 2) Demographic relevance of assisted reproduction
- 3) Discussion: Fertility impact of ART
- 4) Future research & Data needs

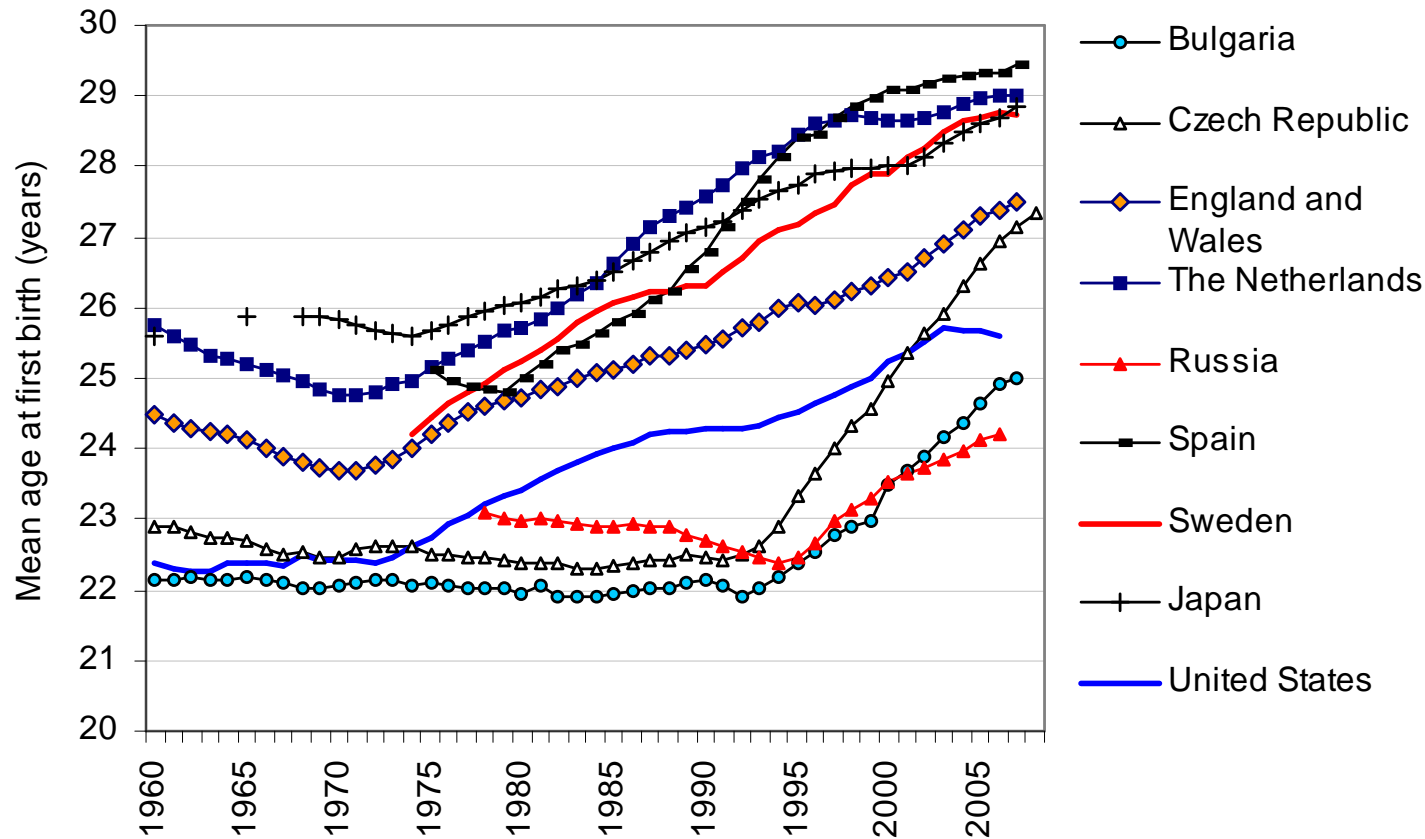
Fertility rates in the developed world: Diverse and mostly below replacement



Fears of 'birth deficit' and population decline

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

A universal shift to later parenthood: Mean age of mothers at first birth

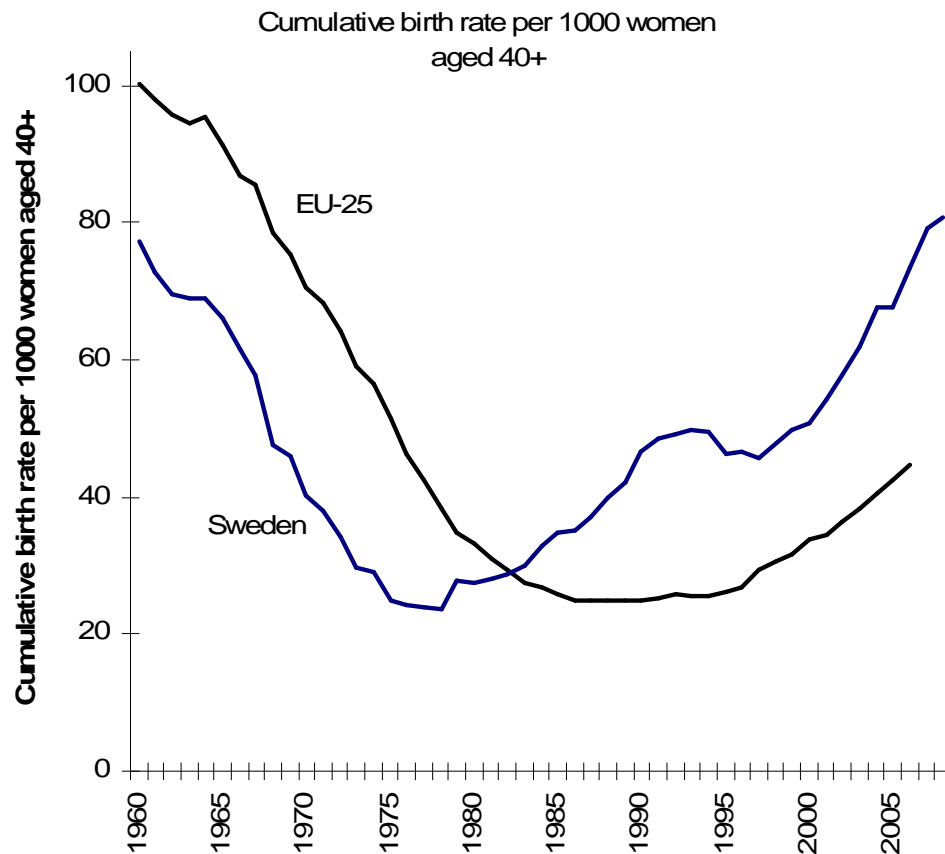


'Postponement transition' (Kohler et al. 2002)

Data sources: Council of Europe (2006), EUROSTAT (2006-9), and national sources

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

Rapid increase in 'late' childbearing, especially first births



Share of births at ages 40+ on total fertility Sweden, in %

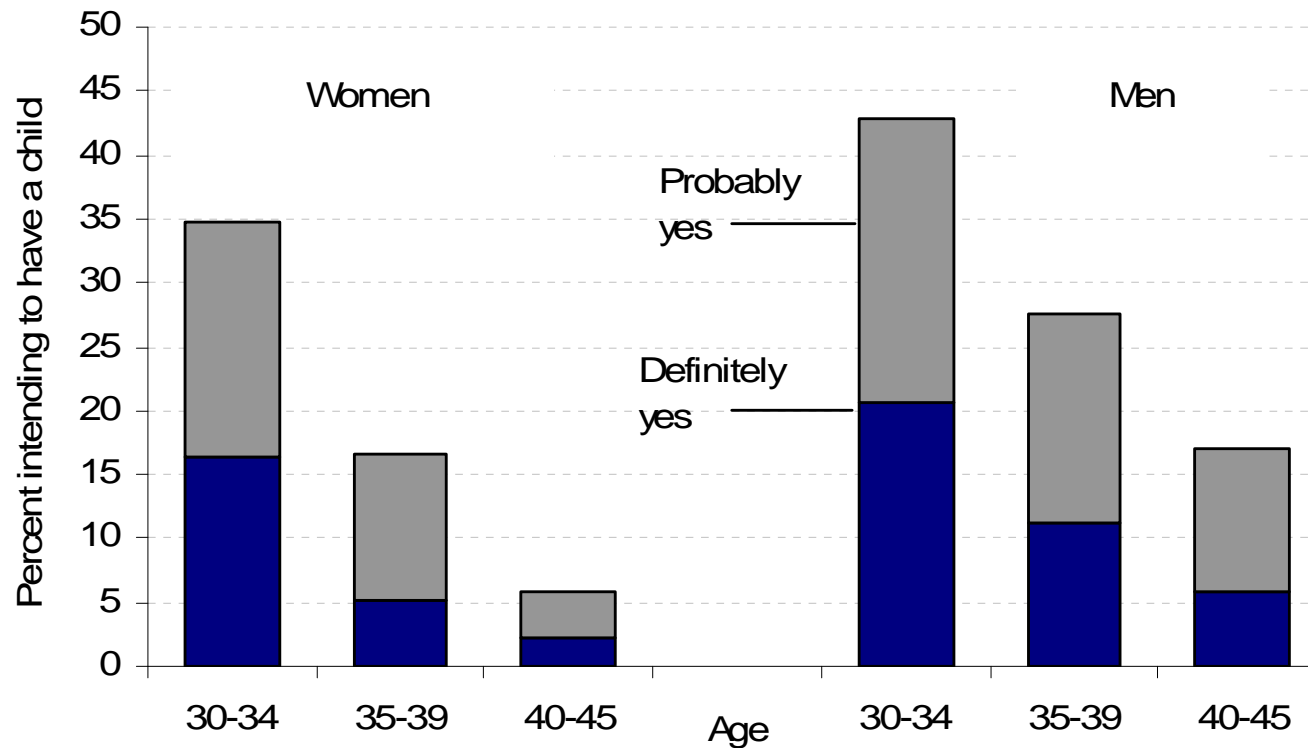
	1986	2006
All births	1.58	3.15
First births	0.57	1.53
Second births	1.01	2.57

Sources: own computations based on Eurostat (2008) and SCB; see Sobotka et al. 2007

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

Many men and women intend to have a child at ages 35+

Austria: Percent men and women intending to have a child within the next three years (2008)



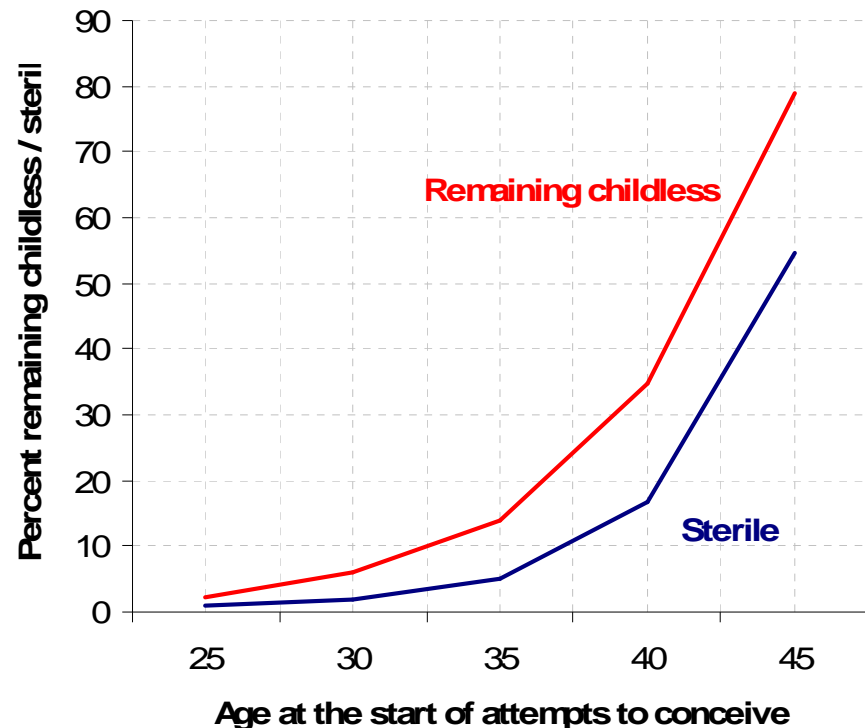
Source: Own computations from the Generations and Gender Programme survey

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

Consequences for individuals and their children

Negative consequences:

- Increase in involuntary childlessness
- Pregnancy complications, miscarriages, foetus malformations
- Infertility linked with substantial long-term distress for childless women (McQuillan et al. 2003)
- Late fatherhood has negative health & neurocognitive outcomes for children



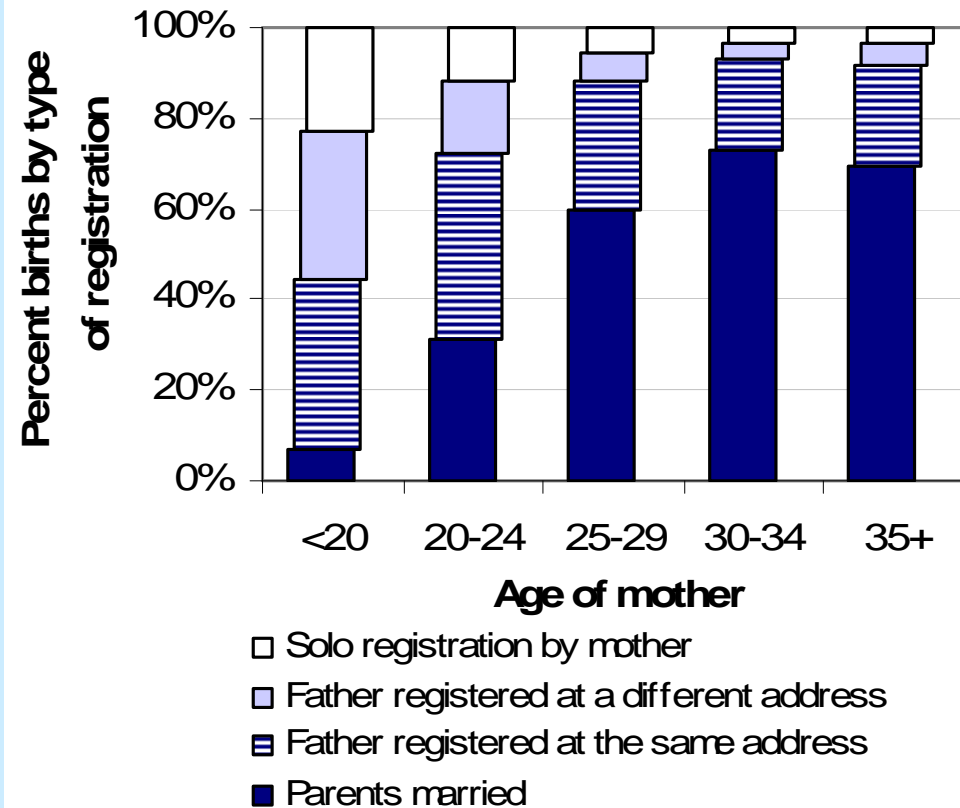
Leridon (2008): Estimates of permanent sterility and permanent childlessness by woman's age at the start of pregnancy attempt

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

Consequences for individuals and their children

Positive consequences:

- Partnership stability, less divorce, better family functioning
 - Fewer single mothers
 - Higher father's involvement
 - Economic security
 - Lower income penalty of childbearing for women, esp. more educated (Joshi 2002, Drolet 2002, Miller 2008)
 - Health (Mirowsky 2005) and longevity advantage? (selection?)
 - Better outcome for adolescent children? (Fergusson & Woodward 1999)
- (see more in Sobotka 2009)*



Source: Office for National Statistics 2007

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

Consequences for the society

POSITIVE: Children with higher human and social capital

NEGATIVE:

Healthcare costs: pregnancy monitoring and care, demand for ART

Potential worsening of infant mortality and health indicators? (Lansac)

Negative effect of delayed childbearing on births & fertility rates

Temporary effect: „Missing births“ during the periods when mean age of mothers increases (*births that occur later*)

Permanent effect: *births that are never realised due to infertility*

Estimated permanent effect of birth postponement on number of children:

Kohler et al. (2002) -1.6% to -5.1% per year of postponement

Leridon & Slama (2008): postponement of 1st pregnancy attempt from 25 to 31 years decreases number of children by 11% (2.0 ► 1.77) ; involuntary childlessness rises by 6% points (10 ► 16%)

BUT: no aggregate-level association of late births & low fertility in Europe

2) DEMOGRAPHIC RELEVANCE OF ART

i. Consequences for numbers of births & birth rates

Minor, but rising impact

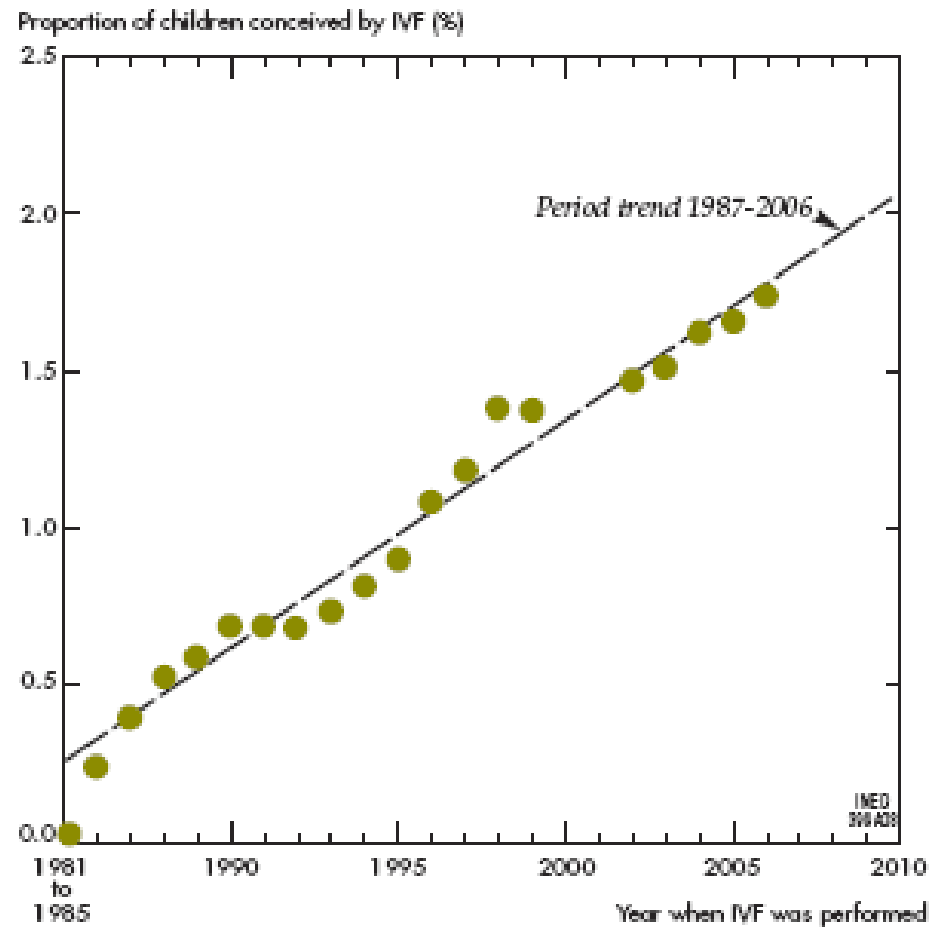
Births after an ART:

- 2-3% in many Western & Northern European c.
- 1.2% in the US (2004)
- Sweden: 2.9 % ART kids in 2005 (Nyboe Andersen et al. 2009)

Births following ART in France

Source: de la Rochebrochard 2008, F. 1

Figure – Increase in the proportion of children conceived by in-vitro fertilization (IVF) in France since 1981

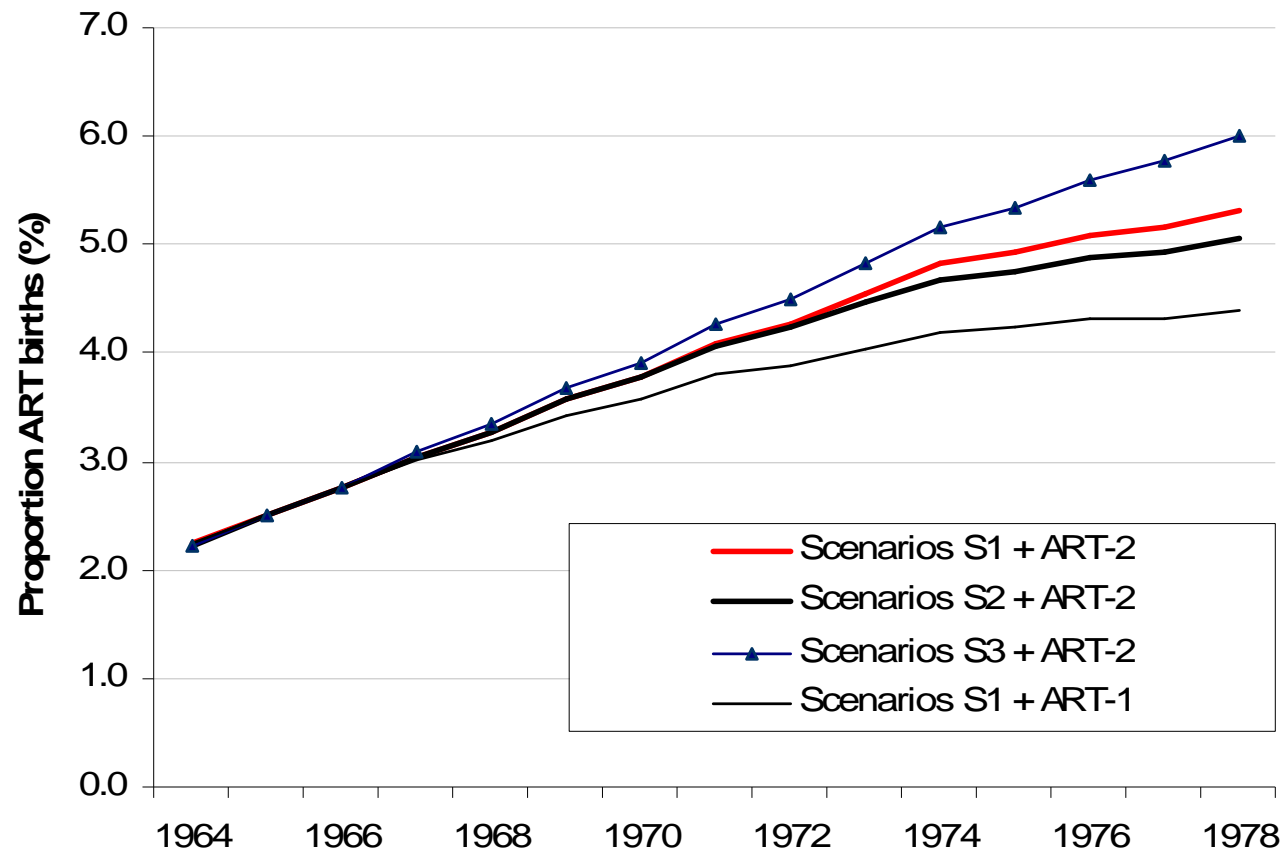


(Elise de La Rochebrochard, *Population & Sociétés*, 451, INED, December 2008)

2) DEMOGRAPHIC RELEVANCE OF ART

i. Consequences for numbers of births & birth rates

DENMARK: Projected proportion of children born after ART treatment, different scenarios



Denmark 2002:
4.2 percent
births after an
ART treatment,
6.0 percent if
intrauterine
insemination
included

Source: Sobotka et al.
2008

2) DEMOGRAPHIC RELEVANCE OF ART

i. Consequences for numbers of births & birth rates

DENMARK: Estimated *crude* and *net* effect of ART on cohort fertility

	Birth cohort		
	1965	1970	1975
Crude effect (summary)			
TFR	1.894	1.902	1.914
Total ART-related TFR (crude effect)	0.043	0.068	0.093
Hypothetical TFR without ART (crude)	1.851	1.834	1.821
Relative ART effect (crude, in %)	2.3	3.7	5.1
Net effect, scenario 1			
Net effect ART	0.037	0.057	0.079
Relative net ART effect (in %)	2.0	3.1	4.3
Net effect, scenario 2			
Net effect ART	0.023	0.036	0.049
Relative net ART effect (in %)	1.2	1.9	2.6

Source: Sobotka et al.
2008

2) DEMOGRAPHIC RELEVANCE OF ART

ii. Births at extreme late reproductive ages

Pushing the age limits of childbearing

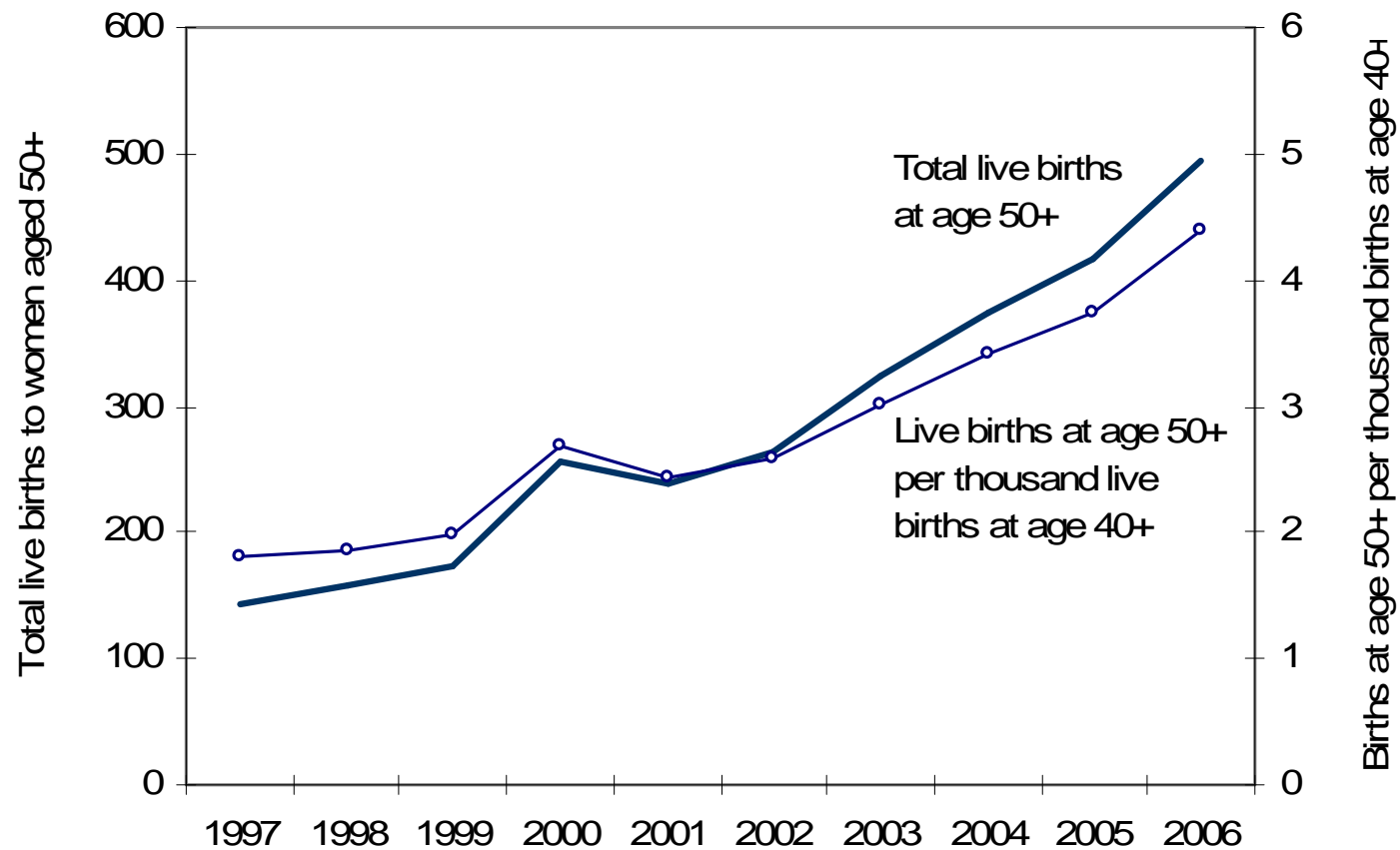


January 2007: a single woman from Spain named Carmela Bousada gave birth to healthy twins one week before her 67th birthday (and 18 years after reaching menopause)

2) DEMOGRAPHIC RELEVANCE OF ART

ii. Births at extreme late reproductive ages

US: Live births to mothers aged 50+, 1997-2006

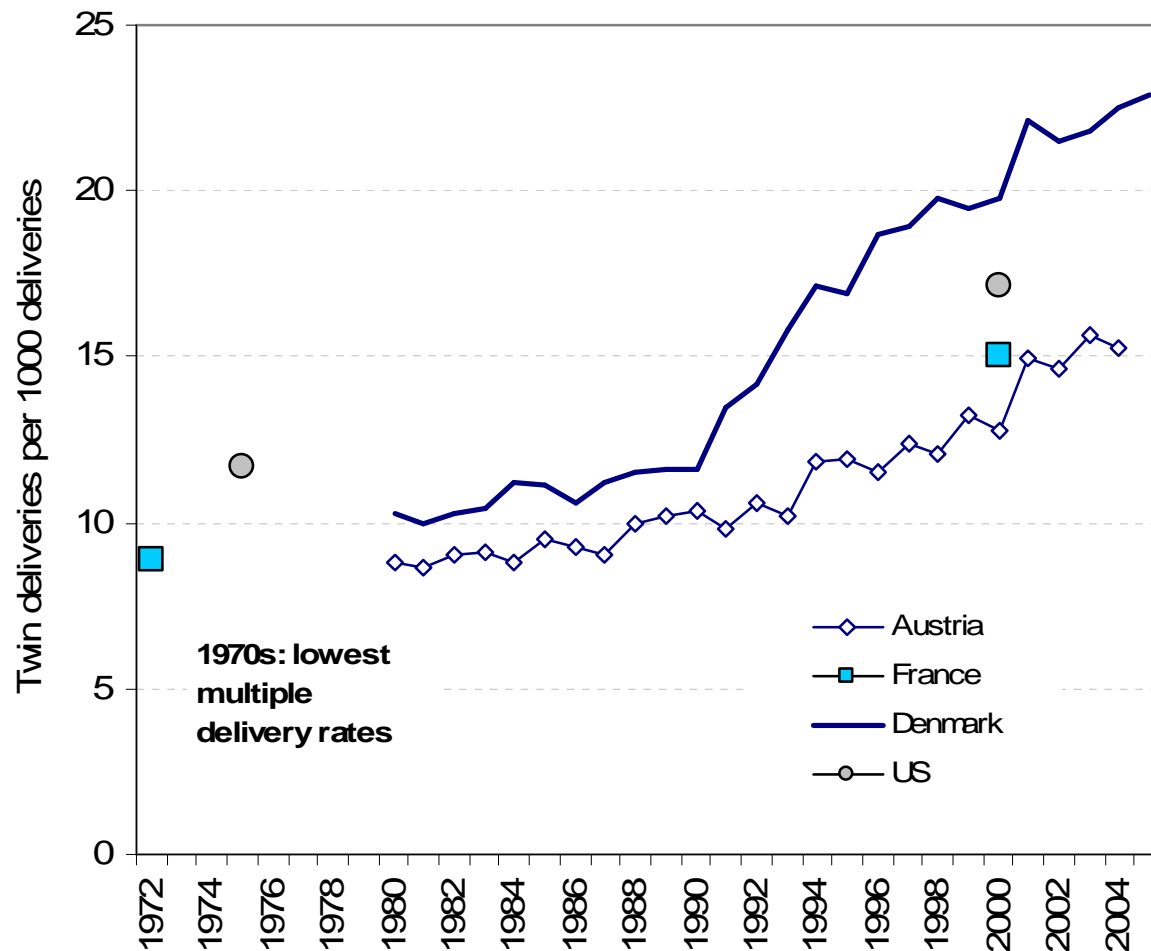


Source: Sobotka et al. 2008, computed from NCHS data

2) DEMOGRAPHIC RELEVANCE OF ART

iii. Multiple delivery rates

Huge increase in multiple deliveries (twins & triplets) across developed countries since the 1980s:



Sources: Statistics Denmark 2008, Pison and Couvert (2004), birth data from Statistics Austria and Smulian et al. (2004)

2) DEMOGRAPHIC RELEVANCE OF ART

iii. Multiple delivery rates

- White populations, 1975: twinning rate of ca. 10-12 per 1000 deliveries (1% deliveries, 2% children born as multiples)
- ART: multiple-embryo transfers; ca 25% (range 12-35%) deliveries & 40% ART children twins or triplets (ESHRE 2008)

US 2006: 30.7% multiple deliveries (28.8% twins) (CDC 2008)

- 2000s: trend towards limitations to single embryo transfer

Denmark: 24.7% deliveries in 2000 multiple (20.3% in 2005)

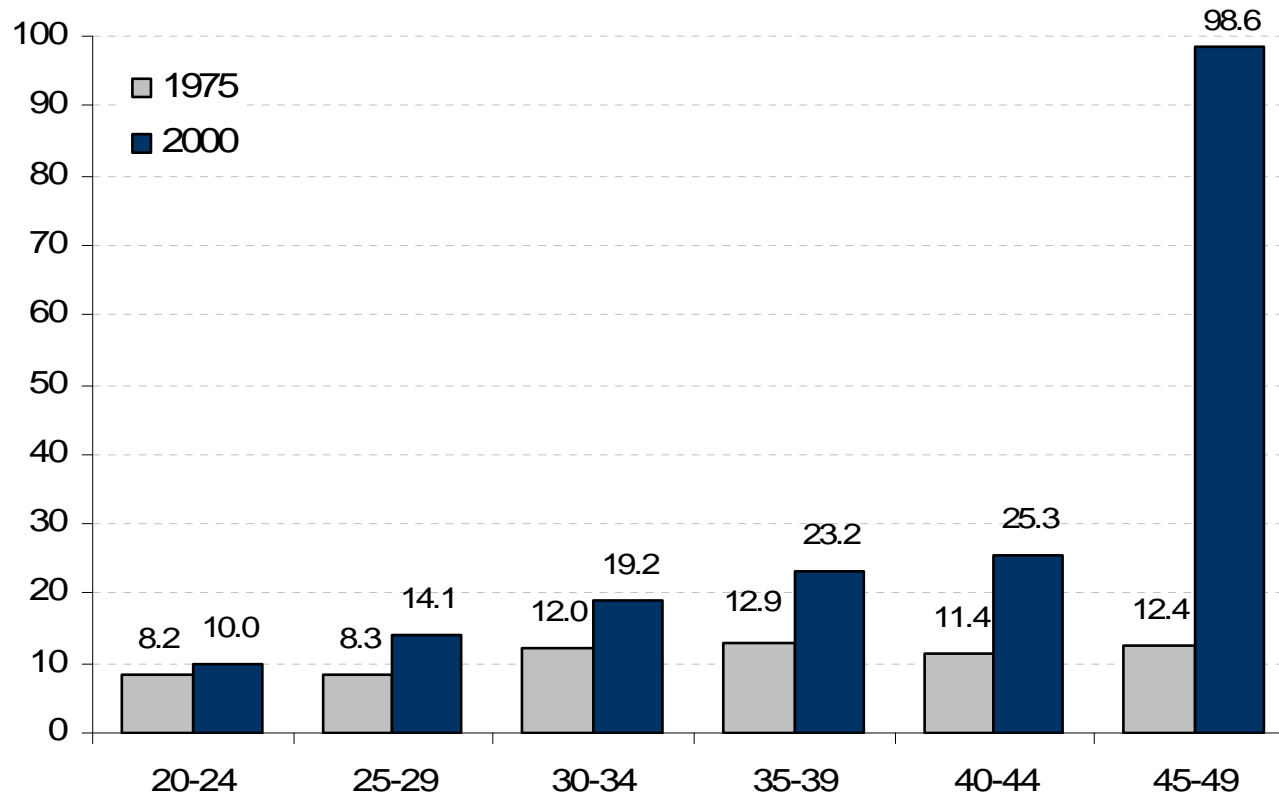
SWE: 24.5% multiple deliveries in 1999, only 11.8% in 2003

- Rising ART use may counterbalance the decline in twinning
- Ethical debate: undesirable twin births??
 - *Negative health & economic effects vs. parental wishes (Wely et al. 2006)*

2) DEMOGRAPHIC RELEVANCE OF ART

iii. Multiple delivery rates

Strong effects by age: twin delivery surge at higher ages



Source: adopted from Smulian et al. (2004, *Obstetrics & Gyn.*), T. 2, p. 281

Twin delivery rates by age of mother, US 1975 and 2000

2) DEMOGRAPHIC RELEVANCE OF ART

iv. Sex ratio at birth (SRB)

Asia: Korea, China, northern India: skewed sex ratios at birth, 'missing girls'

- Usual sex ratio 105-106 boys per 100 girls
- China 2000: 119.2 in 2000 (Yi 2007)
- Consequences for future generation size (59 vs. 63 F per 100 mothers in the next generation), male surplus, many men never able to marry (10% if policy unchanged, Yi 2007)

Other developed world, incl. Japan

- No evidence of skewed SRB (exception: Indians in the UK: Dubuc & Coleman 2007)
- Parental gender 'indifference,' 2 kids, F+M most popular combination

2) DEMOGRAPHIC RELEVANCE OF ART

iv. Sex ratio at birth (SRB)

ART not to be blamed (yet)

- Skewed SRB mostly achieved through sex-selective abortion following ultrasound screening
- Some role of ‘sperm sorting‘

ART: minor role, but some potential

- Spread of sex selection through preimplantation genetic diagnosis (PGD) in India (possibly also China, Korea?)
- Offered by some ART centers (Malpani et al. 2002: reproductive choice, „family balancing“)
- Ethically problematic (Hansotia 2004)
- Europe: sex selection in PGD usually allowed only for avoidance of inherited sex-linked disorders

3) DISCUSSION

i. ART ill suited for offsetting rising infertility due to delayed childbearing

Nature, 4 November 2004: *“Age is no barrier”*

- Leridon 2004: ART makes up for one half of births lost by postponing childbearing from age 30 to 35, but is as ineffective as spontaneous conceptions for women aged 42
- Technology advances fuel a false perception of reproductive control - an illusion of control over the timing of conception

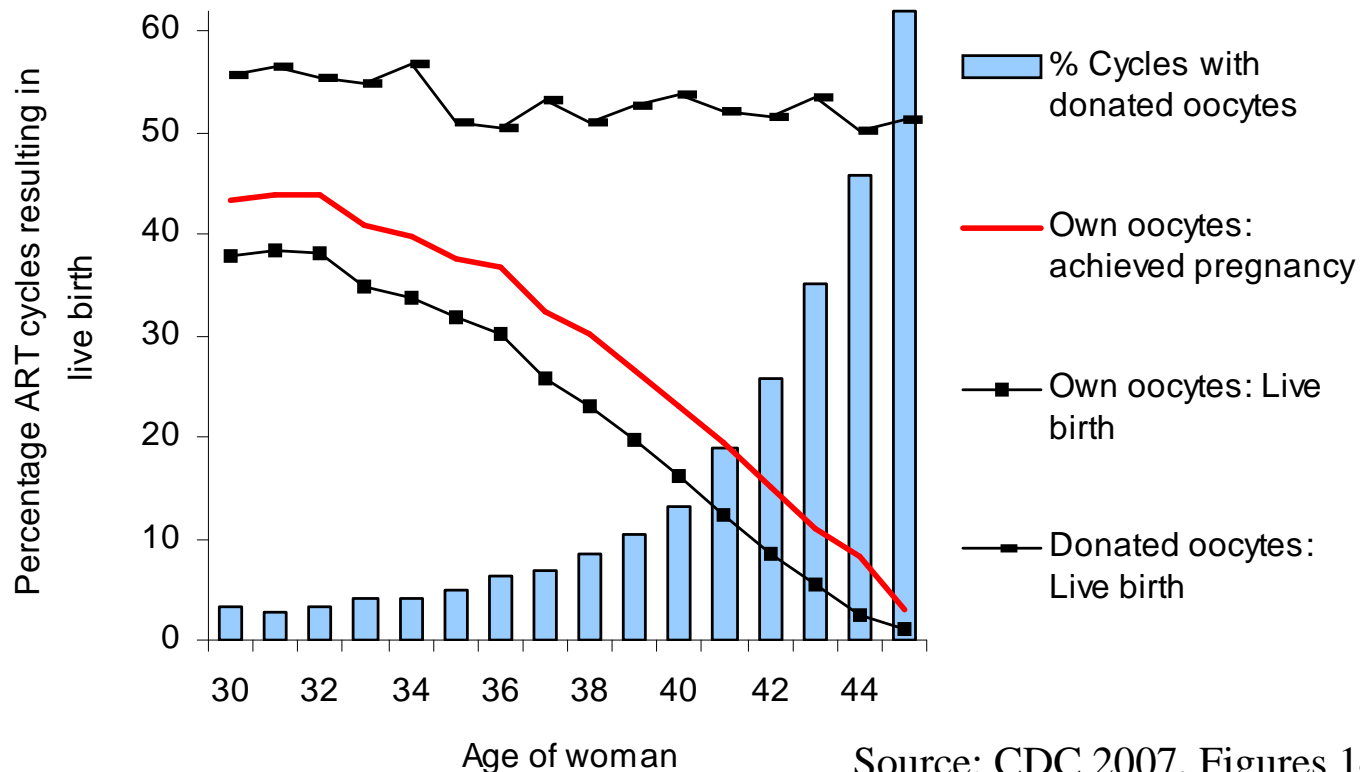
Low success rates & high costs of ART child:

- **Australia:** live births per fresh cycle ART only 3.9% at age 42;
- Cost per live birth using fresh embryo cycles:
30,700 AUS \$ at age 30-34 vs. 307,600 \$ at age 42

3) DISCUSSION

i. ART ill suited for offsetting rising infertility due to delayed childbearing

United States 2005: % ART cycles resulting in pregnancy and live birth by age of woman



Source: CDC 2007, Figures 14, 44, and 45

3) DISCUSSION

ii. Limited importance of ART for birth rates

OPTIMISTIC VIEWS:

- Grant et al. 2007, Ziebe et al. 2008: ART has a potential as a population policy with pronatalist effects
- Grant et al. 2007: UK total fertility rate could increase by 0.04 if Danish provision applied (+2.4%); “maximum potential“ +0.20 (!!!)
- Thaele and Uszkoreit (2007): “...*fertility treatment is more than a medical need: fertility treatment plays a major role in battling negative population growth*”
- Ziebe et al. 2008: „ART can play an important role in increasing fertility rates in Europe“
- “Full access” after 3 years (unrealistic!) can boost Dutch TFR by 0.07-0.08 (+4%, Habbema et al. 2009)

3) DISCUSSION

ii. Limited importance of ART for birth rates

SKEPTICISM APPEARS MORE WARRANTED:

- More rigorous and realistic assessments including spontaneous conceptions, involuntary twin births, limited recourse to ART
- Unnecessary ‚rush‘ may falsely suggest better performance (Habbema et al. 2009)
- Wider spread may lead to further birth postponement and may be contraproductive for fertility rates (Rainer et al. 2008)
- The ‚net effect‘ of ART on fertility rates up to 1-3% at present
- Leridon and Slama (2008): 50% ART use would offset only one fifth of the negative impact of birth postponement on fertility rates

4) FUTURE RESEARCH & DATA NEEDS

- ✓ Can ART achieve higher success rates among older (40+) women? Any future role for oocyte cryopreservation?
- ✓ Monitoring and researching fertility intentions of ,older‘ (35+) men and women, their attempts and involuntary infertility
- ✓ Rising male factor infertility? Need for continuous fecundity monitoring (te Velde et al. 2009)
- ✓ Spontaneous conceptions of ,infertile‘ couples: how high compared to ART?
- ✓ More realistic models of ART use and the net impact of ART on birth rates

Questions?

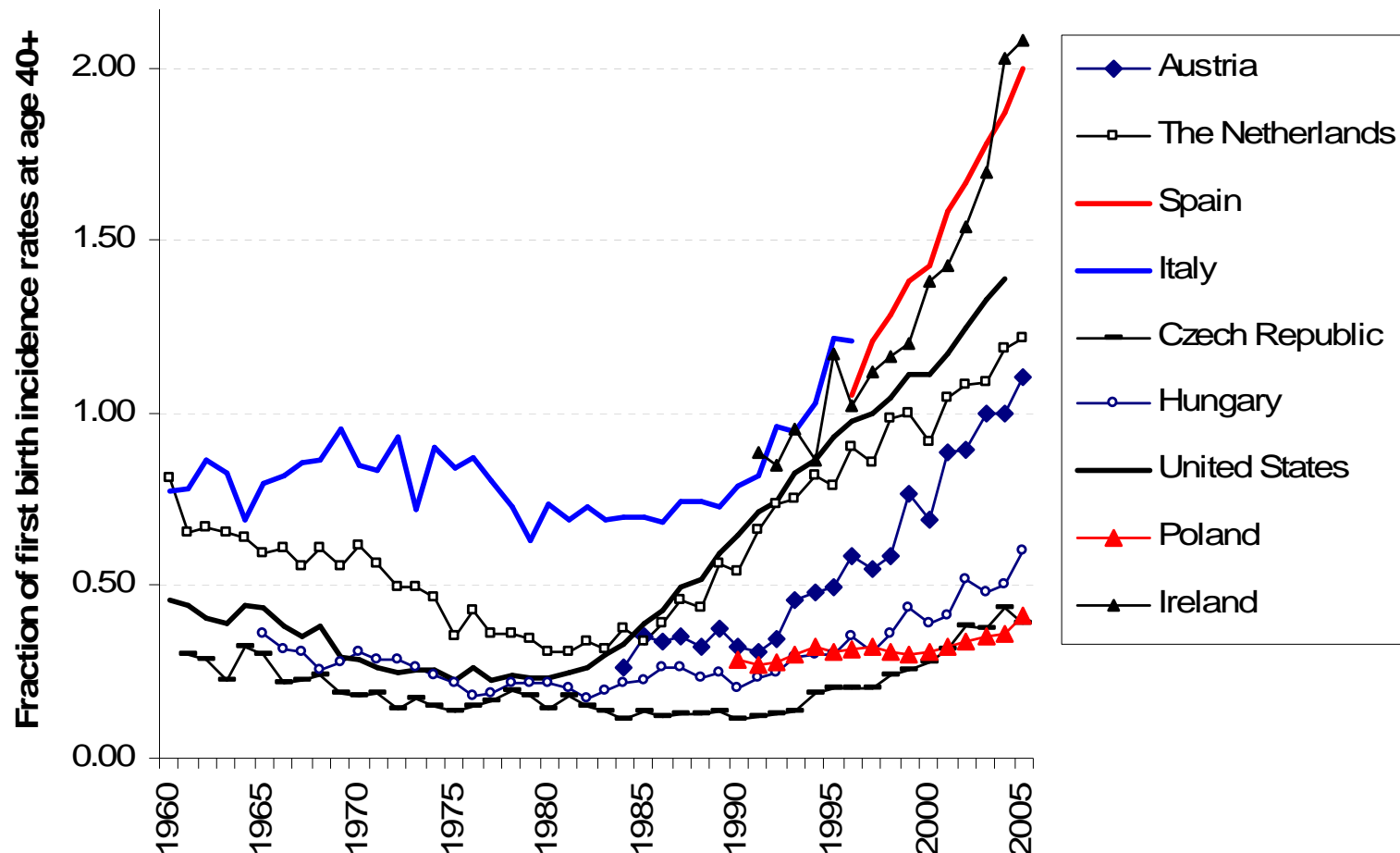
Comments?

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First-time motherhood at late ages

- First birth rates among women aged 40+ and their share on the first-order TFR increasing more rapidly than the overall late fertility rates
- Frequency of late first births at the record-high level in many countries

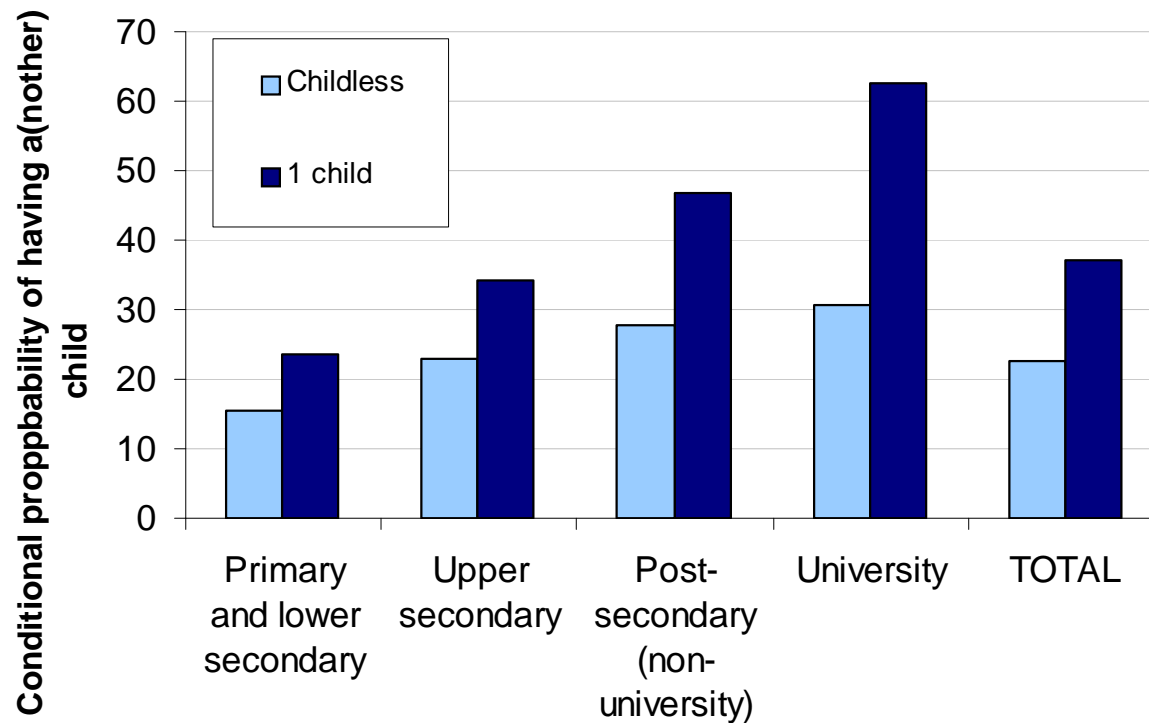


Data sources: computations based on Eurostat (2006), CBS Statline, Statistics Austria and NCHS (2006)

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

The late parenthood shift led by the highly educated

Denmark: Conditional probabilities of ever having a child after age 35 for childless women and mothers with one child
Cohort 1960, per 100 women



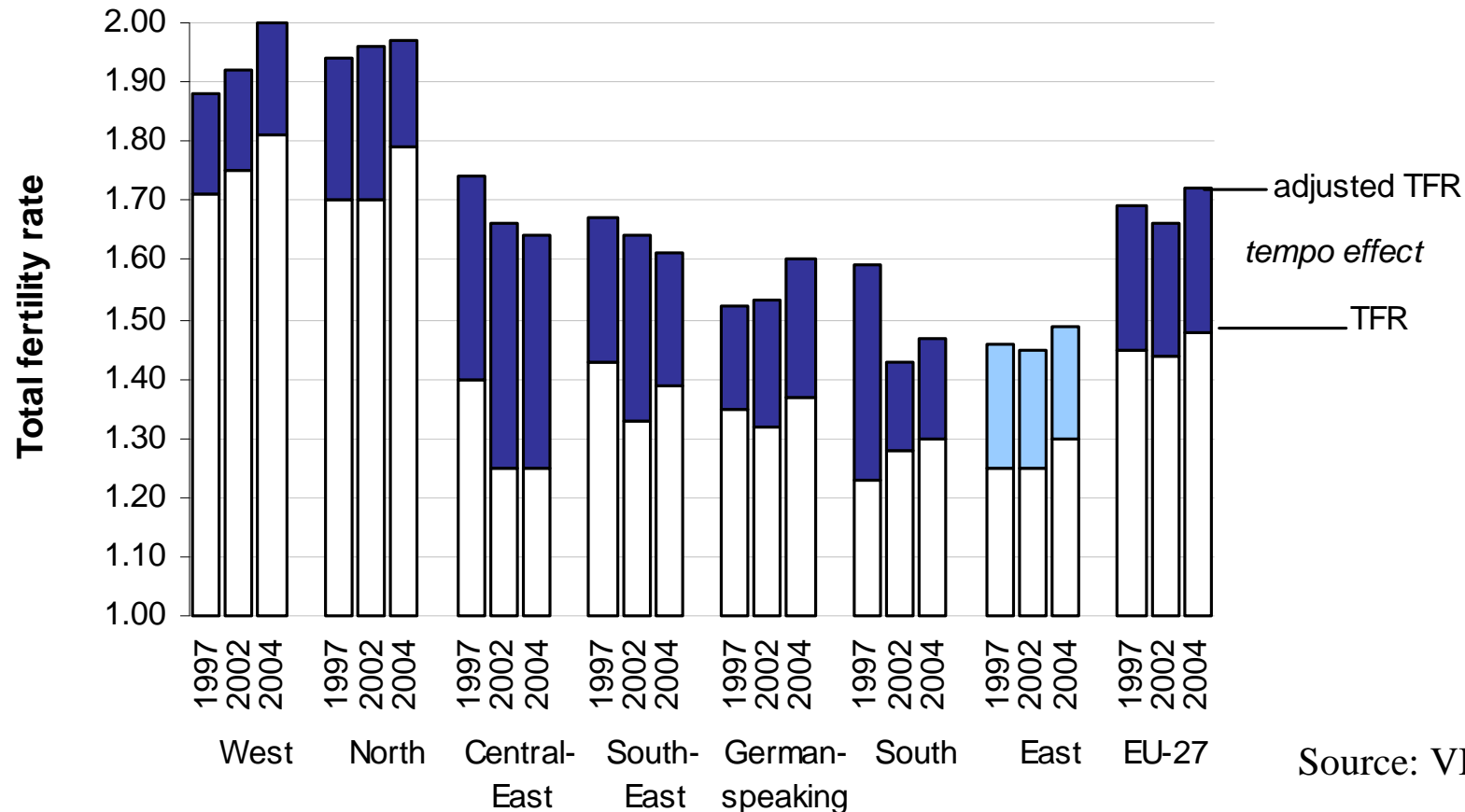
Source: Own computations from Danish Birth registry data

1) LATER PARENTHOOD: TRENDS & CONSEQUENCES

Consequences for the society

Temporary effect of delayed childbearing on fertility rates in Europe:

Total Fertility Rate (TFR), observed and estimated in the absence of



Source: VID 2008