Contribution of increasing education, delayed union formation and adverse economic conditions to variation in Belgian period fertility, 1960-2000

Karel Neels
• Reasons for postponement and decline of period fertility (Mills, Rindfuss, McDonald & te Velde 2011; Blossfeld, Mills & Klijzing 2005; McDonald 2006; Lesthaeghe & Neels 2002):
  - introduction and diffusion of contraceptive technology
  - rising enrollment and educational attainment
  - increasing labour force participation (including incompatibility between caring for children and labour force participation, expected increase in earnings and wage penalties, loss of training opportunities and depreciation of job-specific human capital)
  - shift to an ‘individualistic family model’; the changing role and position of children (child becoming locus of emotional and financial investment)
  - rising gender equity in education and labour market under institutional constraints (e.g. lack of childcare and supporting policies; low benefit levels and/or rigid labour markets)
  - variation in economic context and housing markets
  - changing partnership patterns (incl. higher separation/divorce, lack of suitable partners as a result of hypogamy/hypergamy and increasing education)
  - declining real wages

• Little quantitative evidence on the contribution of these potential causes to macro-level trends in fertility tempo (Ni Bhrolchain & Beaujouan 2012)
• **Reverse causation**: early childbearing impeding education (Cohen, Kravdal & Keilman 2011)

• **Negative selection on (un)observable factors** jointly affecting education and timing of first birth (family background, career preferences, genetic factors,…)
  (Braakmann 2011, Tropf 2015, Rijken & Liefbroer 2009, Grönqvist & Hall 2013)

  - Incarceration effect
  - Incompatibility student-parent roles
  - Increase in permanent income versus substitution effect and quality-quantity trade-off
  - Increasing bargaining power for women in households
  - Multiplier effect on household income through positive assortative mating
  - Knowledge of contraception and reproductive health
  - Reduction in reproductive life span after education
Education & Fertility: Mechanisms, Causal Pathways, Aggravating Circumstances


  - **consistent findings regarding fertility tempo**: postponement of first births away from teenage motherhood; increasing fertility rates between ages 20-30 and 35-40, suggesting that education shifts sequence of transitions in early adulthood into older ages
  - **inconsistent findings regarding fertility quantum**: effect ranges from negative over neutral to positive between countries periods considered, suggesting contextual factors are important

• **Recession induced postponement and recuperation** (Sobotka, Skirbekk & Philipov 2011, Neels, Theunynck & Wood 2013; Vikat 2004; Verick 2009; Aassve, Cottini & Vitali 2013)

  - prolonged enrolment in education
  - **increasing unemployment, deteriorating job conditions and overeducation** (entailing relative income deprivation and delayed entry into established labour market positions and intended career trajectories, particularly among higher educated)
  - reduced public expenditure (unemployment and parental leave benefits, childcare,...)
  - procyclical effect largely limited to younger age-groups and higher educated

- education associated with rising individualism/postmaterialist values
- postmaterialism not directly associated with lower fertility intentions
- indirect effect through changes in living arrangements/ frequent spells of single living: may affect family formation indirectly
- variation in economic conditions may induce changes in living arrangements

Research Question
Contribution of educational expansion, economic conditions and changes in living arrangements to macro-level change in synthetic parity progression ratio to first births and mean age at first birth?
Data & Methods

- 2001 Belgian Census (N=3.500.000 women) (Deboosere & Willaert, 2004)

- Individual-level effects:
  - age baseline (centered age 15, cubic effect)
  - enrolment (time-varying)  (Blossfeld et al. 2001, Black et al.)
  - educational level  (Becker 1960)
  - duration since graduation (quadratic effect)  (Skirbekk et al. 2004, Ni Bhrolchain et al. 2012)
  - education*baseline interaction
  - partnership status (ever in co-residential union, time varying)
  - duration since first union (quadratic effect)

- Macro-level effects:
  - exogenous variation in annual unemployment rate  (OECD, Sobotka et al. 2011, Singer & Willet 2003)
  - lags of 1 year (recession induced postponement) and 10 years (compensation)
  - cross-level interaction age*unemployment lag 1
  - cross-level interaction education*unemployment lag 10
Methodology

- Discrete-time hazard model (logit) of first birth hazards:

\[
\ln \left( \frac{\hat{h}_i^t}{1 - \hat{h}_i^t} \right) = a + \sum bX \\
\hat{h}_i^t = \frac{e^{a+\sum bX}}{1 + e^{a+\sum bX}}
\]

- Simulated SPPR1 and MAC1-series based on fitted hazards by age/year:

\[
SPPR_1^t = 1 - \prod_{i=0}^{35} (1 - \hat{h}_i^t) \\
MAC_1^t = 14.5 + \sum_{i=0}^{35} \frac{(\hat{S}_{i+1}^t - \hat{S}_i^t)}{SPPR_1^t} \frac{i + (i + 1)}{2}
\]

- Assessing fit between observed and simulated time-series:

- \( r \) zero-order correlation
- \( r_{\text{dif}} \) correlation between first-order differenced time-series
- \( |e| \) mean absolute deviation

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SPPR1 and MAC1: Observed and Simulated Time-series

Model 1: Centred age (cubic specification)
Education (time-varying enrolment, level & duration since leaving quadratic)

Observed & Simulated SPPR1

- $R = 0.8694$
- $R^2 = 0.7559$
- $R_{dif} = 0.1039$
- $|e| = 0.0211$ (0.0380 under Constant Schedule)

Observed & Simulated MAC1

- $R = 0.9567$
- $R^2 = 0.9152$
- $R_{dif} = 0.3094$
- $|e| = 0.5013$ (1.1247 under Constant Schedule)
SPPR1 and MAC1:
Observed and Simulated Time-series

Model 3:  
Centred age (cubic specification)
Partnership (ever co-residential union, duration since first partnership quadratic)

\[ R = 0.7777 \]
\[ R^2 = 0.6048 \]
\[ \text{Rdif} = 0.1483 \]
\[ |e| = 0.0229 \]

\[ R = 0.9251 \]
\[ R^2 = 0.8559 \]
\[ \text{Rdif} = 0.4172 \]
\[ |e| = 0.8537 \]
SPPR1 and MAC1: Observed and Simulated Time-series

Model 5: Centred age (cubic specification)
Unemployment Rate (lagged 1 year)

Observed & Simulated SPPR1

Observed & Simulated MAC1

\[ R = 0.9561 \]
\[ R^2 = 0.9251 \]
\[ R_{\text{dif}} = 0.3843 \]
\[ |e| = 0.0266 \]

\[ R = 0.8644 \]
\[ R^2 = 0.7471 \]
\[ R_{\text{dif}} = 0.3689 \]
\[ |e| = 0.7457 \]
Model 6: Centred age (cubic specification)
Unemployment Rate (lagged 1 year, Age*Unemployment Rate)

R = 0.9618
R² = 0.9142
Rdif = 0.3961
|e| = 0.0095

R = 0.8638
R² = 0.7462
Rdif = 0.3698
|e| = 0.5090
Model 10: Centred age (cubic specification)
Education (time-varying enrolment, level & duration since leaving)
Partnership (ever partnered, duration since first partnership)
Unemployment Rate (lagged 1 year, Age*Unemployment Rate)

Observed & Simulated SPPR1

\[ R = 0.9329 \]
\[ R^2 = 0.8703 \]
\[ R_{dif} = 0.4009 \]
\[ |e| = 0.0125 \]

Observed & Simulated MAC1

\[ R = 0.9515 \]
\[ R^2 = 0.9053 \]
\[ R_{dif} = 0.4260 \]
\[ |e| = 0.3422 \]
SPPR1 and MAC1: Observed and Simulated Time-series

Model 11:  
- Centred age (cubic specification)
- Education (time-varying enrolment, level & duration since leaving)
- Partnership (ever partnered, duration since first partnership)
- Unemployment Rate (lagged 1 & 10 years + Age*Unemployment Rate)

R = 0.9586
R² = 0.9189
Rdif = 0.4715
|e| = 0.0095

Observed & Simulated SPPR1

R = 0.9712
R² = 0.9432
Rdif = 0.4449
|e| = 0.2832

Observed & Simulated MAC1
Decline of SPPR1 and fertility postponement: Educational Expansion under Adverse Economic Conditions

Educational expansion:
• requires joint consideration of:
  - time-varying enrolment (Blossfeld & Huinink 1991; Black et al. 2008)
  - attainment (Becker 1960)
  - duration since leaving (quadratic) or ‘social age’ (Skirbekk et al. 2004, Ní Bhrolchain & Beaujouan 2012)
• educational expansion correctly captures long-term trend in SPPR1 & MAC1: relevant dimension for long-term projection
• cannot account for temporal acceleration/deceleration in SPPR1/MAC1 trends:
  - high fertility in 1960s
  - low fertility in 1975-1990 and mid 1990s

Economic Context
• procyclical among women < 30 years affecting period fertility (Neels et al. 2013, Aassve et al. 2013)
• compensation among women >30 years reducing effect on cohort fertility (Sobotka et al. 2011)
• economic conditions accounts for period acceleration/deceleration in SPPR1/MAC1:
  - mean absolute deviation/year in SPPR1: < 1 percentage point
  - mean absolute deviation/year in MAC1: < 0,30 years

Delayed Union Formation: limited impact on SPPR1 and particularly MAC1-trends
Thank you for your attention!

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## Appendix A  Model Fit Statistics SPPR1

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### Individual-level covariates
- Centered age (cubic specification)
- In education (time-varying)
- Educational level
- Duration since graduation (quadratic)
- Education level*baseline hazard function
- Partnership status (time-varying)
- Duration since 1st partnership (quadratic)

### Macro-level covariates
- Unemployment (lagged 1 year)
- Unemployment (lagged 1 year)*Age-group
  - urlag1*age1519
  - urlag1*age2024
  - urlag1*age2529
  - urlag1*age3034
  - urlag1*age3539
  - urlag1*age4044
  - urlag1*age4549
- Unemployment (lagged 1 year)*Age-group*Education
- Unemployment (lagged 10 years)*Age-group
  - urlag10*age3034
  - urlag10*age3539
  - urlag10*age4044
  - urlag10*age4549

### Correlation between fitted and observed SPPR1

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## Appendix B  Model Fit Statistics MAC1

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