

Revision of the fertility model applied in the national population projection for Belgium

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FEDERAL PLANNING BUREAU (BELGIUM)

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Context

- Federal Planning Bureau (FPB):
 - ✓ Independent public agency.
 - ✓ Draws up studies and projections on economic, social and environmental policy issues
 - ✓ www.plan.be
 - ⇒ Need for demographic projection
- FPB publishes the official demographic projection for Belgium
- Projection up to 2070 – deterministic cohort component model
- Dimensions of the population projection: age, gender, districts (and nationality)



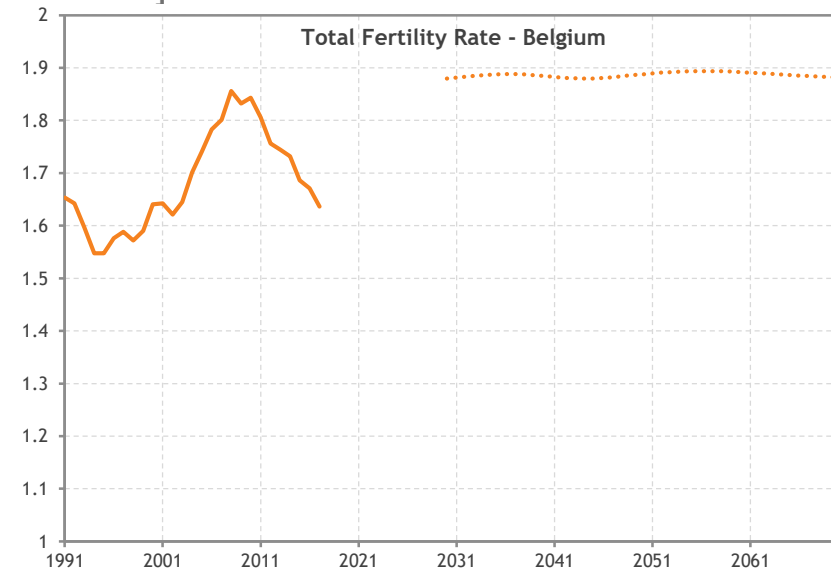
Old methodology

IN A NUTSHELL



Old methodology in a nutshell

- Based on the Age Specific Fertility Rates (ASFR) $\Rightarrow TFR = \sum_x ASFR$
 - Age Specific Fertility Rates 2030-2070
 - Constant
 - Fixed at the average computed on the period 2008-2009
- ⇒ Total fertility rate [2030-2070] ~ Total fertility rate [2008-2009]



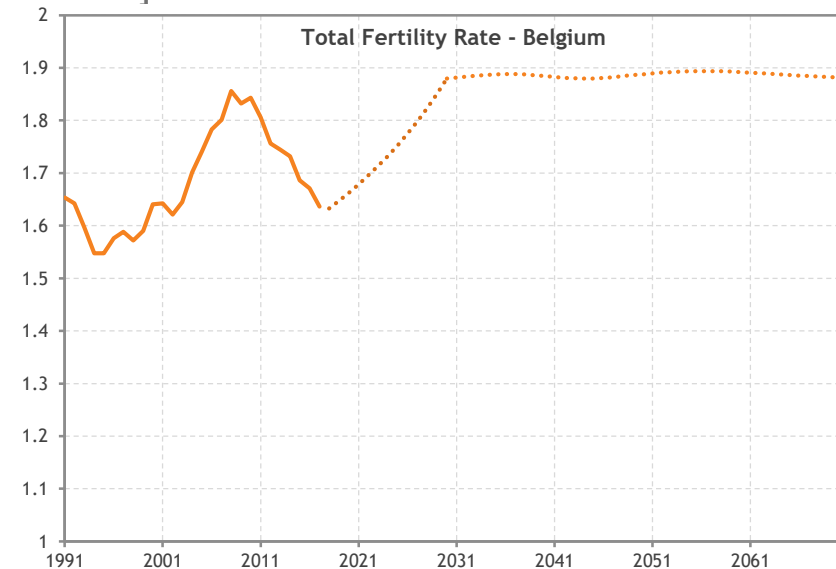
1.88
in 2070



Old methodology in a nutshell

- Based on the Age Specific Fertility Rates (ASFR) => $ICF = \sum_x ASFR$
- Age Specific Fertility Rates **2030-2070**
 - Constant
 - Fixed at the average computed on the period 2008-2009

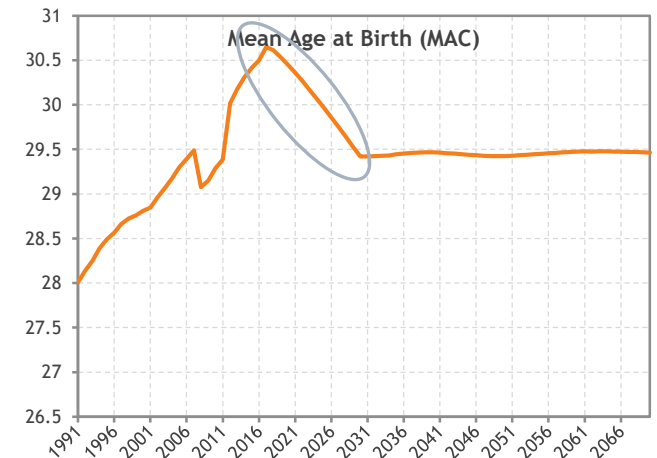
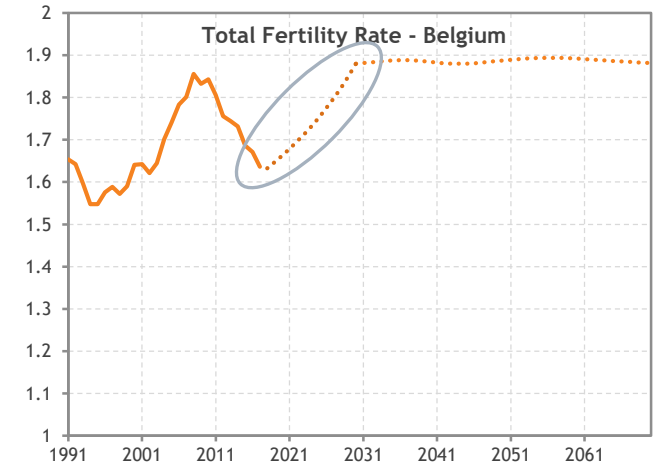
⇒ Total fertility rate [2030-2070] ~ Total fertility rate [2008-2009]
- Age Specific Fertility Rate **up to 2030**
 - Linear interpolation
 - Implicit assumption : recuperation effect



Old methodology in a nutshell

Weaknesses/points to be improved:

1. Total recovery after the sharp decrease of the TFR since 2008
 - Doesn't seem so plausible anymore
 - Mix of structural and conjunctural effects
2. Fertility schedule :
 - Is fixed in the long run : ~ schedule 2008-2009
 - Unlikely trend in the short/medium term



New methodology



New methodology

3 STEPS :

1. Assumption on the global fertility level in Belgium (trend) in the long run (**FER_LT**)
2. Projection of the annual Total fertility Rate (**TFR**)
3. Age Specific Fertility Rate (**ASFR**)



New methodology - STEP 1 / 3

STEP 1 : assumption on the global fertility level in Belgium in the long run (**FEC_LT**)

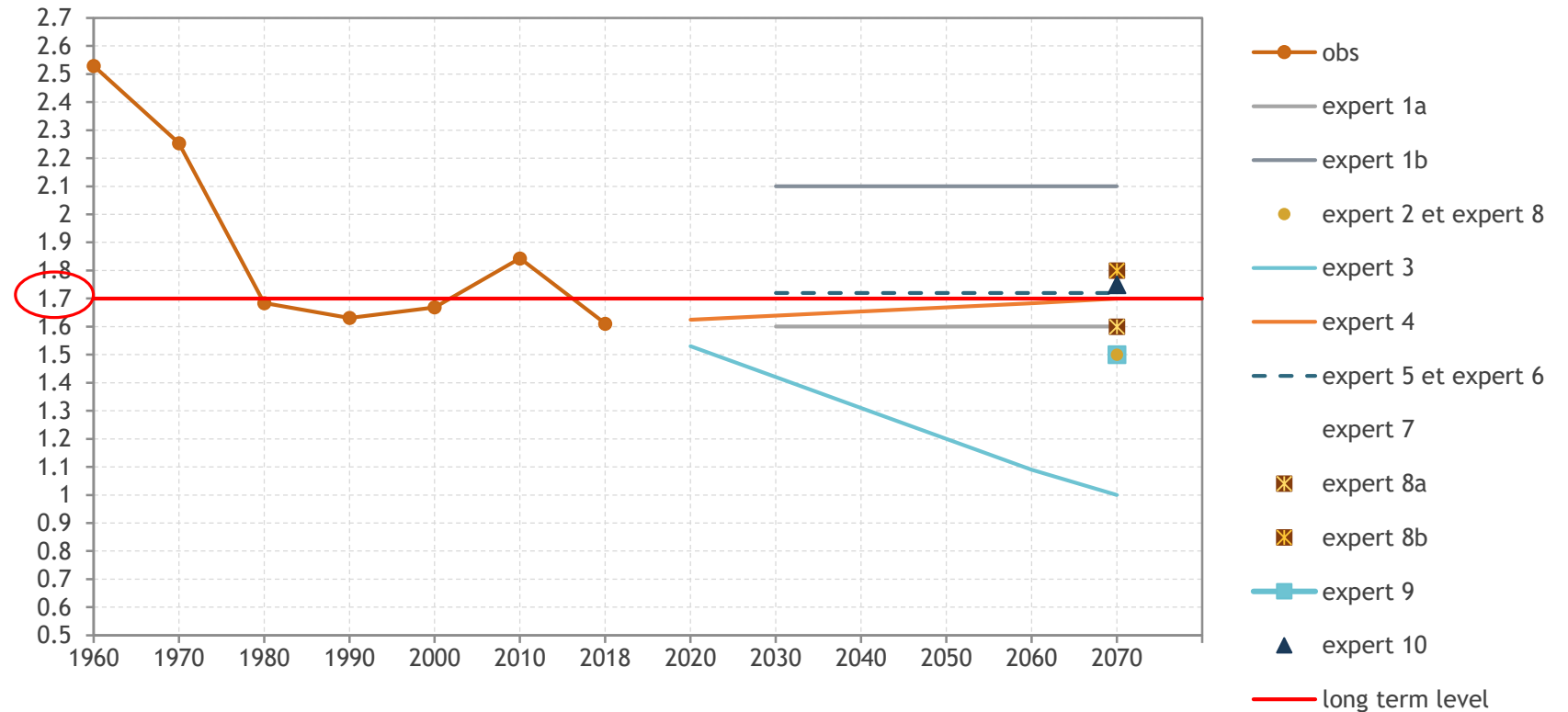
Expert opinions :



New methodology - STEP 1 / 3

STEP 1 : assumption on the global fertility level in Belgium in the long run (**FEC_LT**)

Expert opinions :



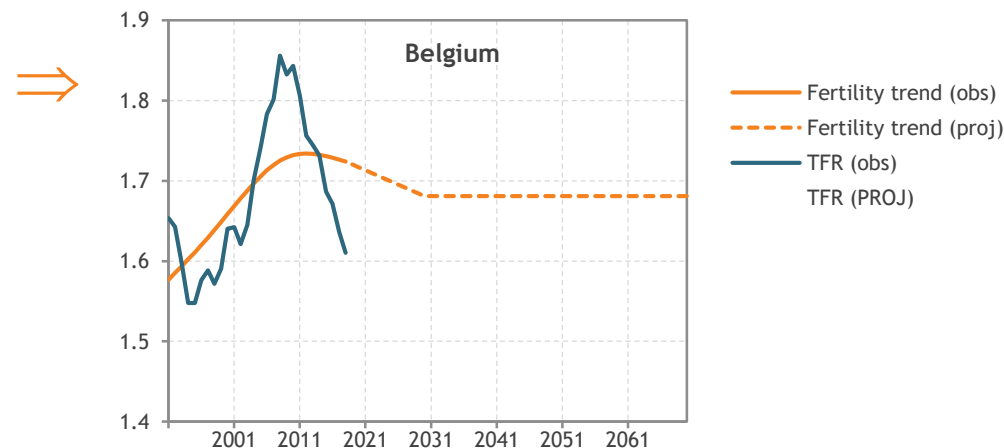
New methodology - STEP 1 / 3

Level (~1.7) based on (implicit) structural determinants of fertility :

1. Number of years spent in education will continue to increase
2. Share of women on the labour market will continue to increase
3. New context : « worldwide » social/political/economic/climate insecurity

This level starts from 2030:

- Most of the experts agree that the current Total Fertility rate is Particularly low
- We should observe a **PARTIAL** recuperation in the coming years.



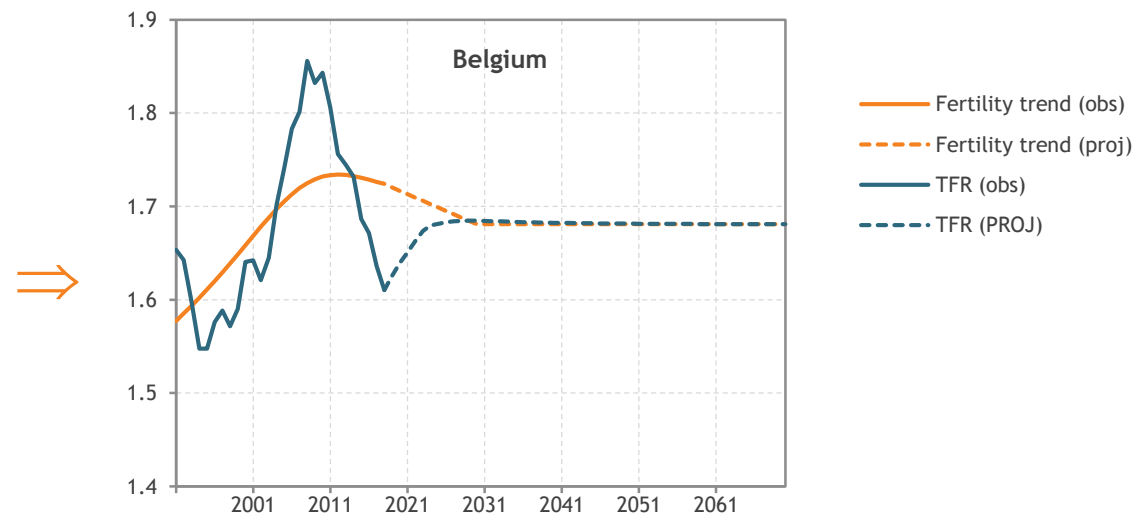
New methodology - STEP 2/3

STEP 2 : Projection of the **TFR** based on a Error Correction Model (ECM)

$$d\ln_t(\text{TFR}) = \beta_1 * d\ln_t(\text{UR}) + \beta_2 * [\ln(\text{TFR}) - \ln(\text{FEC_LT})]_{t-1}$$

Where

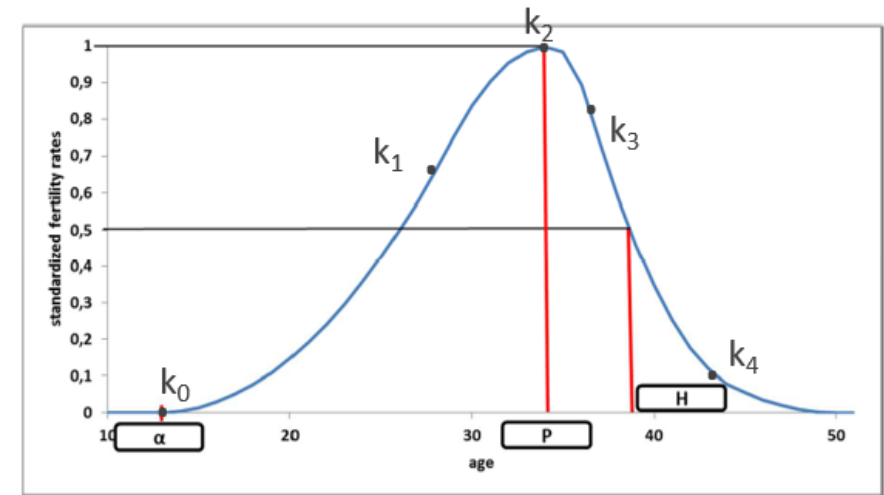
- **UR** = Unemployment rate (conjuncturel effect)
- **TFR_LT** = Fertility trend (from STEP1) (structural effect)



New methodology - STEP 3/3

STEP 3 : From the TFR to the Age Specific Fertility Rate (ASFR)

- Method -> Shmertmann (2003)
- Based on 3 demographic parameters (TFR, P and H), the ASFR can be estimated with a quadratic splines function

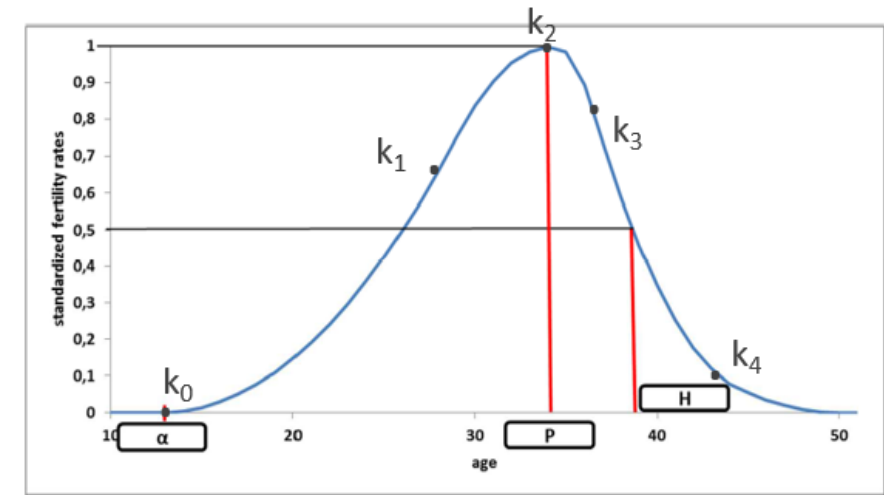
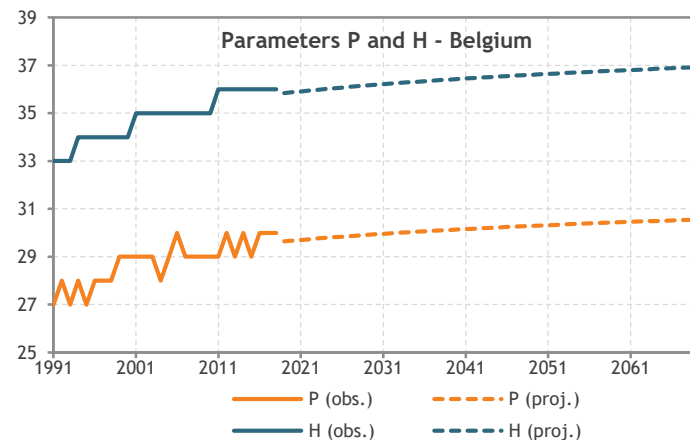


New methodology - STEP 3/3

From the TFR to the Age Specific Fertility Rate (ASFR)

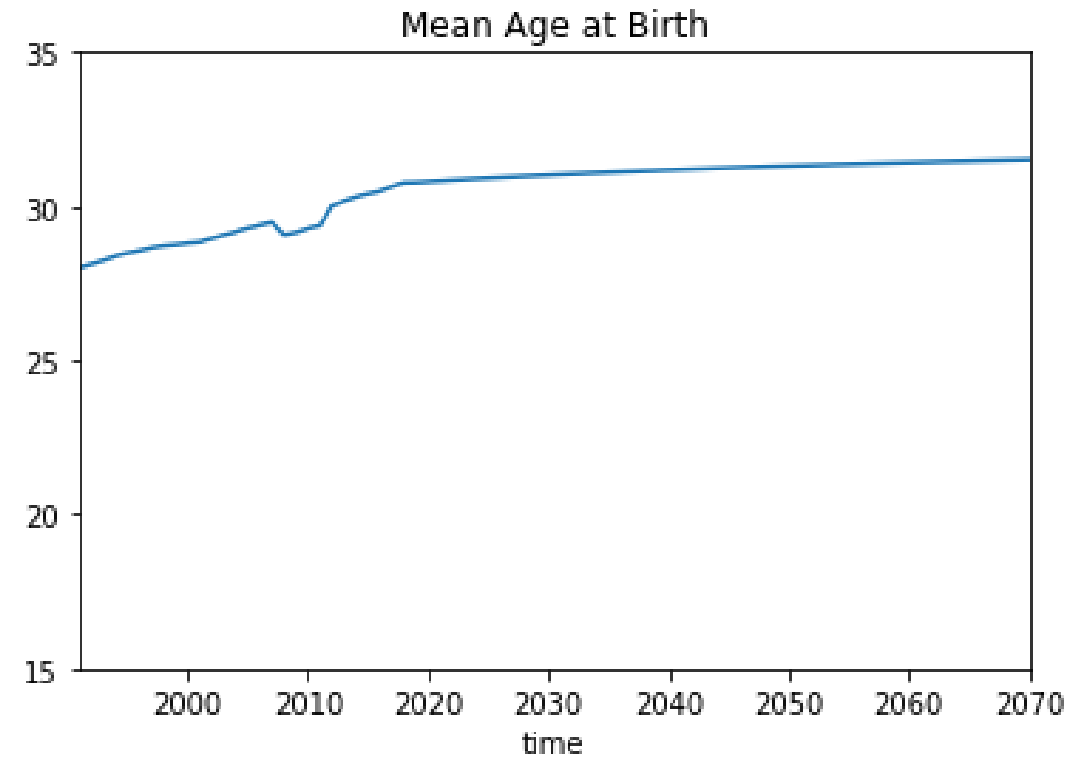
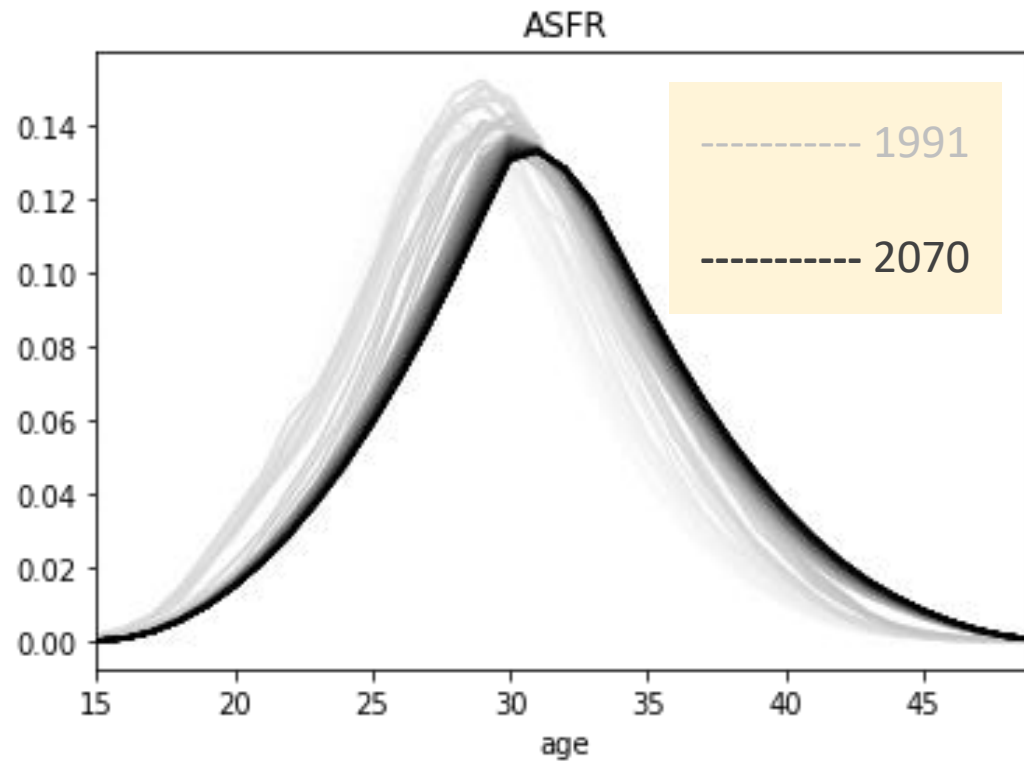
- Méthode de Shmertmann (2003) :
- Based on 3 parameters (TFR, P and H), the ASFR can be computed with a quadratic splines function

⇒ P and H still to be projected : logarithmic trend



New methodology - STEP 3/3

Illustration - Belgium



Conclusion



Conclusions

The model :

- Takes into account **expert opinions** to determine the long run fertility trend (structural component) (**FEC_LT**)
- Includes some **conjunctural determinants** of fertility (unemployment rate) to project the **TFR**
- Models **also the fertility schedule (ASFR)** -> Schmertmann model applied in projection
- Is applicable at the **district level** (not shown in this presentation)
- Is **transparent....**



Conclusions

Room for improvement:

- Long run fertility trend:
 - Take into account birth order?
 - Migration background?
- Conjunctural determinants:
 - Is unemployment rate relevant enough? (precarity on the labour market, uncertainty...=> but need a projection)
 - Should we make age groups ? Determinants of fertility depend on age of the mother...
- ...



Thank you for your attention

Questions? Suggestions?

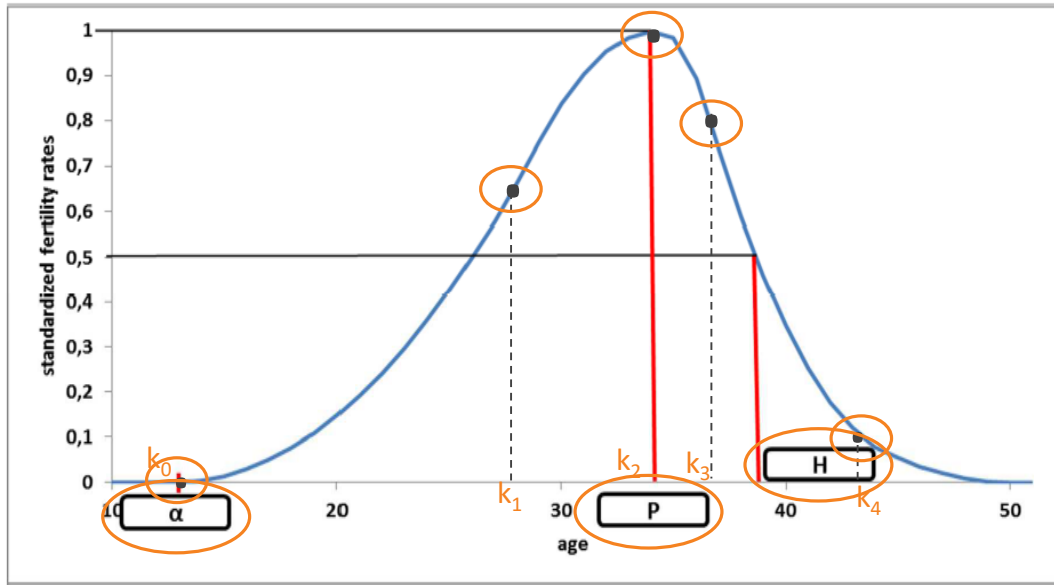
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MODELE DE SCHMERTMANN (2003)

Estimation of the density function



Alpha The youngest age at which fertility rises above zero

P The age at which fertility reaches its peak level

H The youngest age above P at which fertility falls to half of its peak level

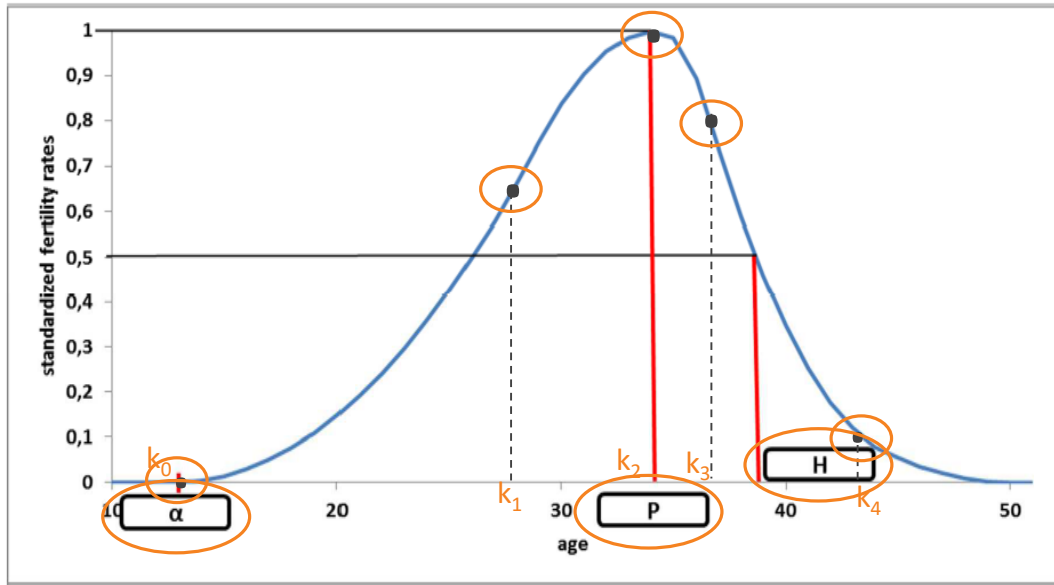
⇒ Density function is defined by 5 intervals joined at knot values k_0 to k_4 .

⇒ k_x are computed with α , P et H



MODELE DE SCHMERTMANN (2003) - principes

Estimation of the density function



- ⇒ Density function is defined by 5 intervals joined at knot values k_0 to k_4 .
- ⇒ k_x are computed with α , P et H

quadratic SPLINES function:

$$f(x) = R * \Phi(x) = \sum_{k=0}^4 \Theta_k (x - k_k)^2$$

- $k_0 : \alpha$
- $k_1 : (1-W) * \alpha + W * P$
où $W = \min [0.75, 0.25 + 0.025(P - \alpha)]$
(plus P est tardif, plus k_1 est proche de P)
- $k_2 : P$
- $k_3 : (P+H) / 2$
- $k_4 : (H+50) / 2$
- $f(x)$ « normalized » ⇒ $TFR = R * \Phi(x)$ (R fixes the level of fertility)
- slope at ages P and $50 = 0$.

Adaptation : k_1 is estimated



New methodology - STEP 3/3

From the Total Fertility Rate (TFR) to the Age Specific Fertility Rate (ASFR)

- Méthode de Shmertmann (2003) :
 - Based on 3 parameters (TFR, P and H), the ASFR can be computed (quadratic splines function)
 - P and H are projected with a logarithmic trend
 - In Shmertmann (2003) k_1 is computed
 - Adaptation : k_1 is estimated
 - Allows a better fit, in particular when fertility is concentrated

