

# **Plastic Age at Childbearing: A Coherent Model for Tempo Differentials in Microdata.**



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# Motivation



## } **Conference on postponement: The importance of getting the tempo right!**

### } **Macrodata:**

- | Relevance of tempo change for tempo adjustment (Bongaarts and Feeney, 1998; Kohler and Ortega, 2002)

- | Possibility of removing distortions caused by confounders adding dimensions to the model (i.e: parity), and using exposure-occurrence rates (Kohler and Ortega, 2002)

### } **Microdata:**

- | Modelling based on rates or probabilities, with a number of covariates.

- | Tempo differentials in childbearing are seldom explicitly modeled

- | These leads to incorrect inferences regarding the impact of the covariates.

# Proposal



**Small methodological note showing:**

**} Why tempo needs to be addressed explicitly in microanalysis.**

**} A (relatively) simple procedure to do so based on linear transformations of the age dimension:  
**A model of plastic age.****

**} Advantages:**

| Tempo differentials appear explicitly,

| The model is very similar to those proposed in the macrodemographic literature, making possible, for instance, tempo-adjustment based on the micro model.

# Application

Small application to the study of **quantum** and **tempo** differentials by **education**.

} **Data: Spanish Fertility Survey 1999 (INE, 1999)**

| 7749 women aged 14-49 in the week of interview (Nov 98- Jan 99)

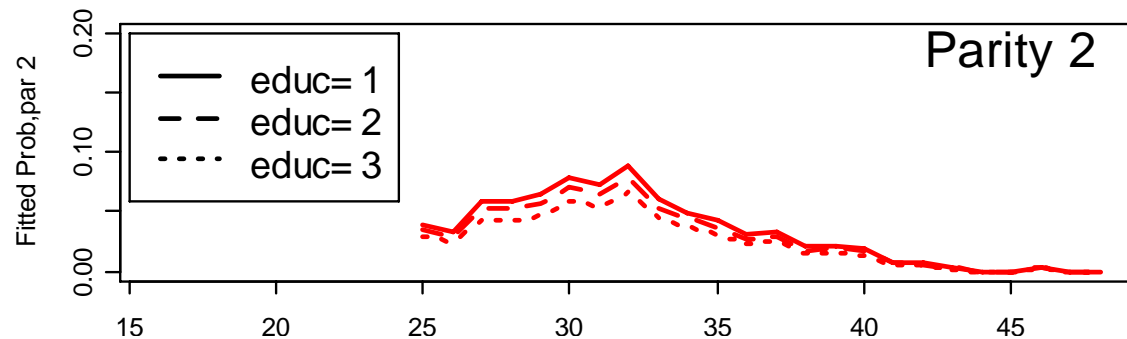
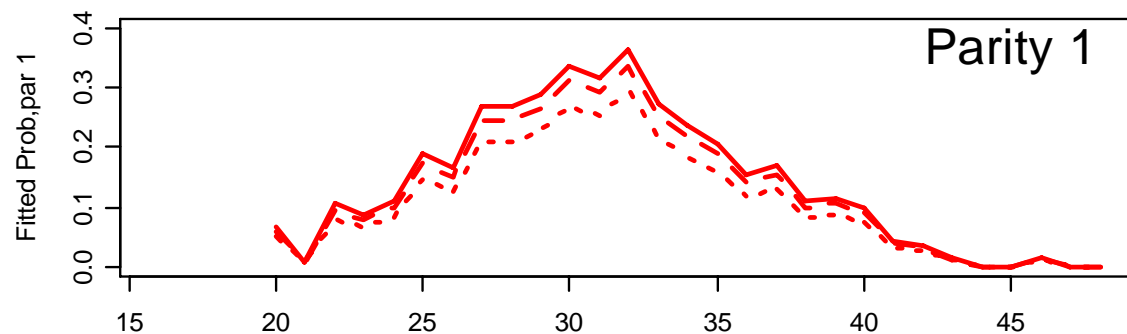
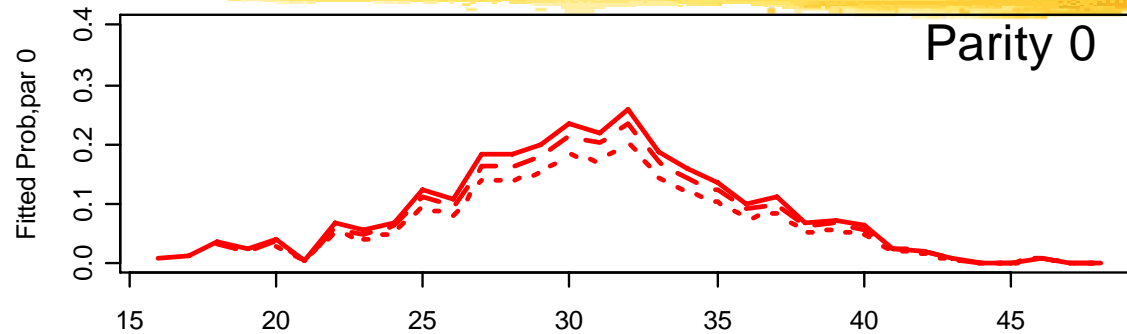
} **Dependent variable: Childbearing probability in 1997**

} **Covariates: Age, Parity and Completed education**

} **GLM and Plastic Age models estimated with and without interactions.**

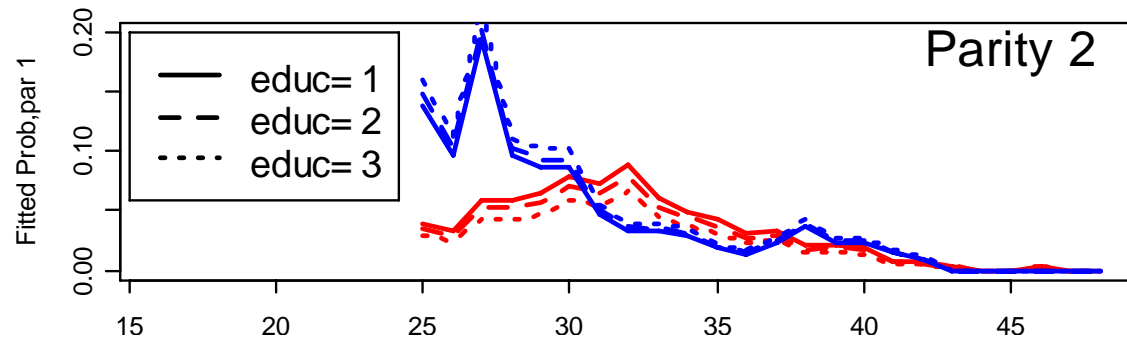
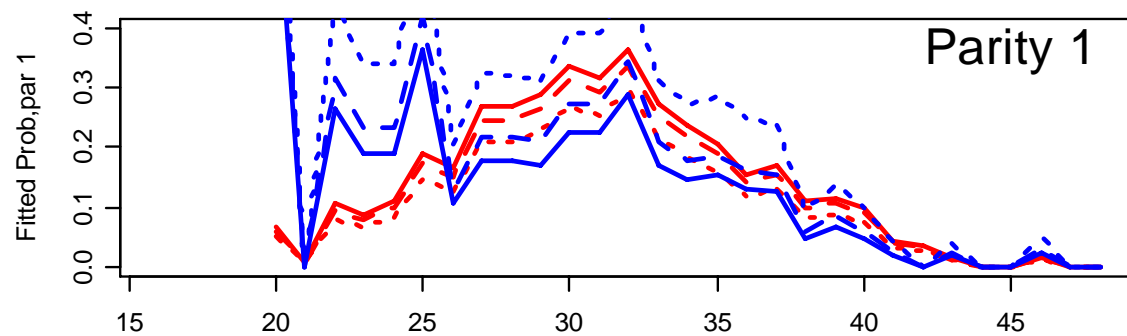
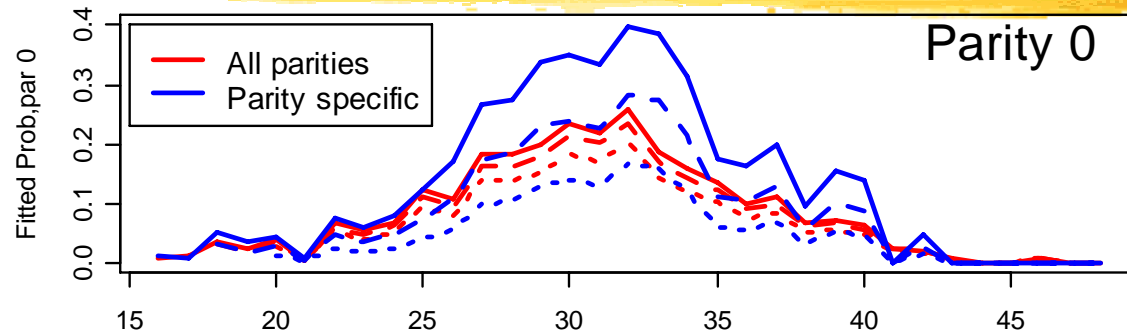
} **Age dimension modelled as categorical variable, and using fixed and data-dependent natural cubic spline basis.**

# Logit Models with Education and Parity as Covariates



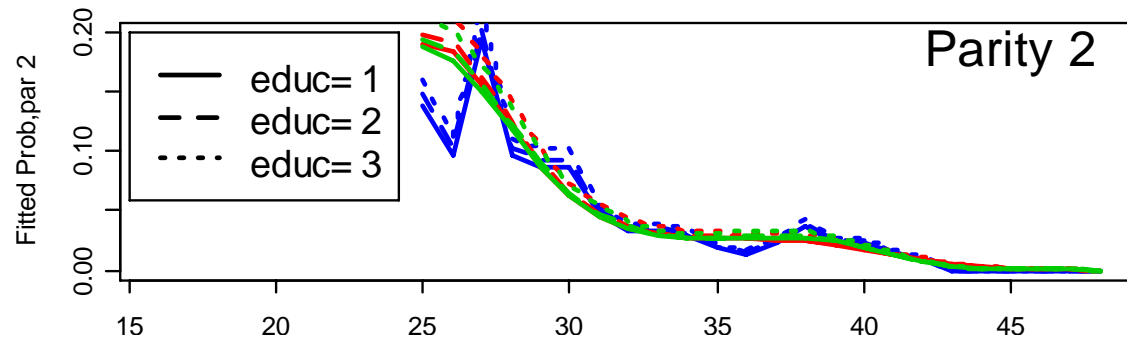
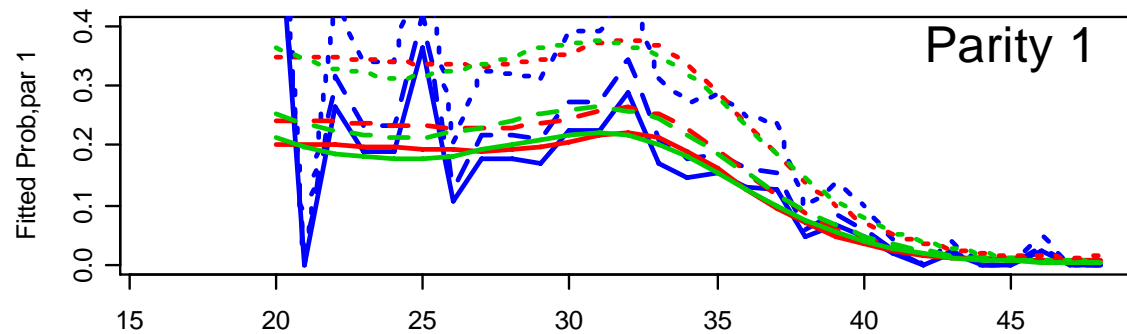
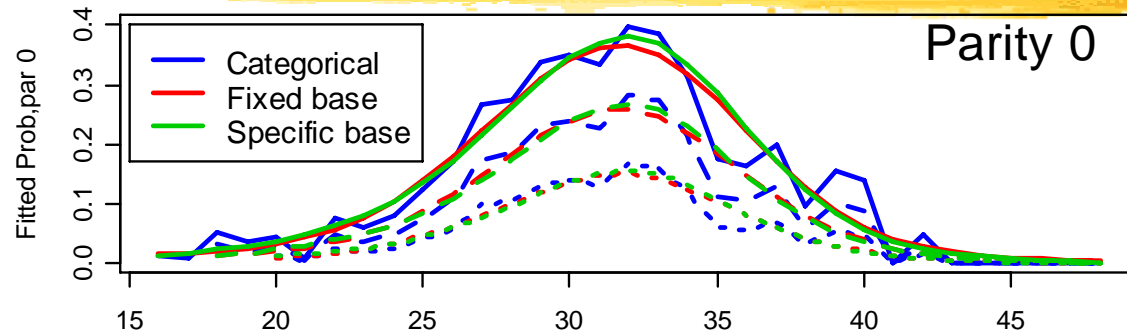
- Models such as this one, are VERY common.
- They impose that the effect of parity and educ is the same irrespective of the other variables.
- They impose that timing is the same at all parities and educational categories.
- This leads to biased parameter estimates, and to unrealistic fitted probabilities

# Parity-specific Logit Models with Education as Covariate



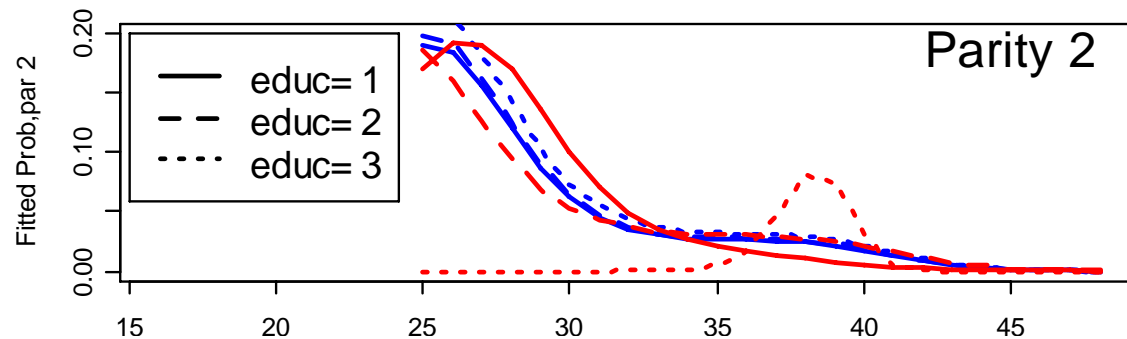
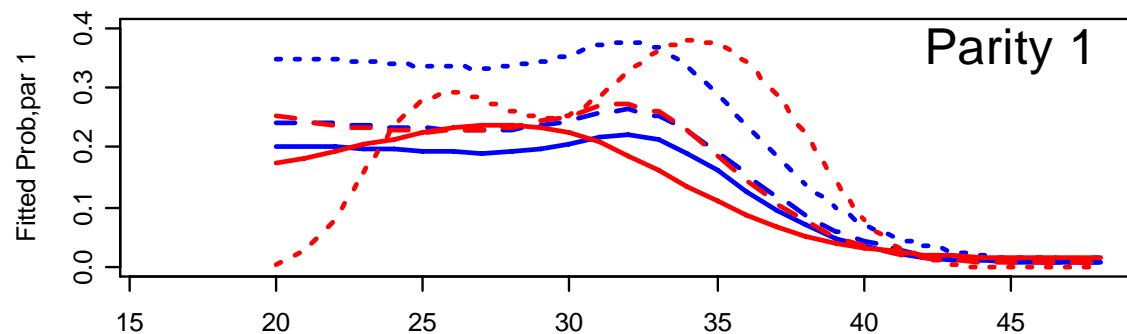
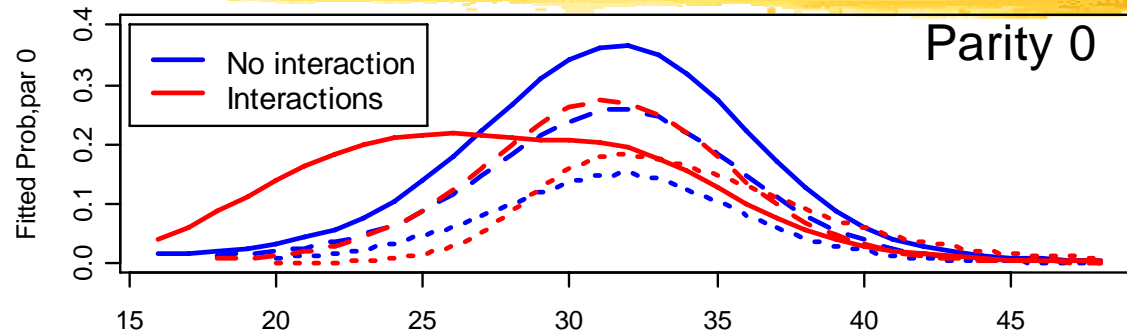
- Parity specific models show that the effects of education is very different for different parities.
- That the age-schedule is very different at different parities.
- But continue to impose the same timing for different education levels
- And are too heavily parameterized, leading to age instability.

# Parity-specific Logit Models with Education as covariate and age splines



- Spline models capture with very few parameters (four in this case) the age-schedule.
- They provide a lot of flexibility.
- It does not really matter if the same base is used for all parities.
- But, still continue to impose the same timing for different education levels

# Parity-specific Logit Models with education and age-spline interaction



- There are very large differential in timing across educational categories: women with primary education very different.

- Models that force common timing lead to a biased impression of quantum by education.

- For higher parities, the model with interactions is too parameterised.

# Plastic Age Model: A simple proposal which makes demographic sense

} Macrodemographic models (i.e: Kohler and Ortega, 2002), are often based in assumptions that changes in the age-schedule of fertility overtime are limited to **linear transformations of age**.

} This idea can also be imposed on microdemographic models to advantage.

$$a_e = \frac{a_0 - \mu_e}{\omega_e}$$

} We take as reference age, age for primary educated women.

} Four unknown parameters:  $\mu_2, \omega_2, \mu_3, \omega_3$

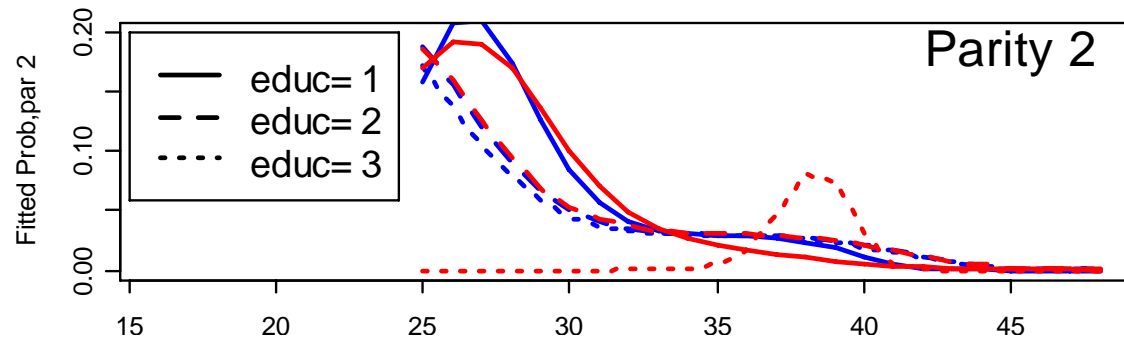
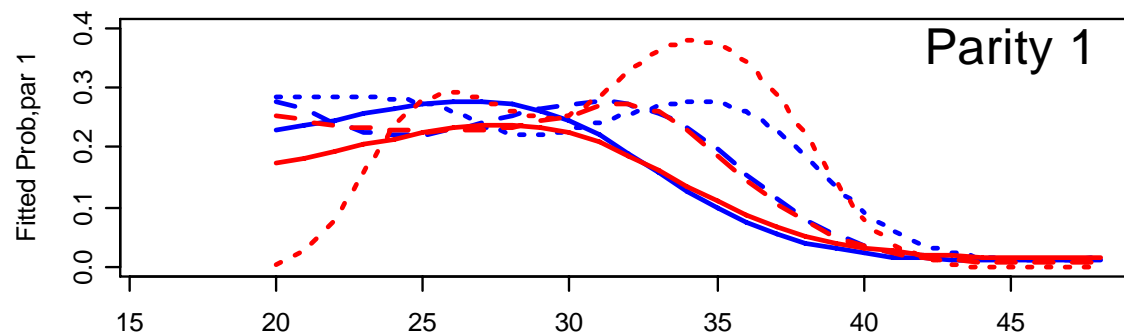
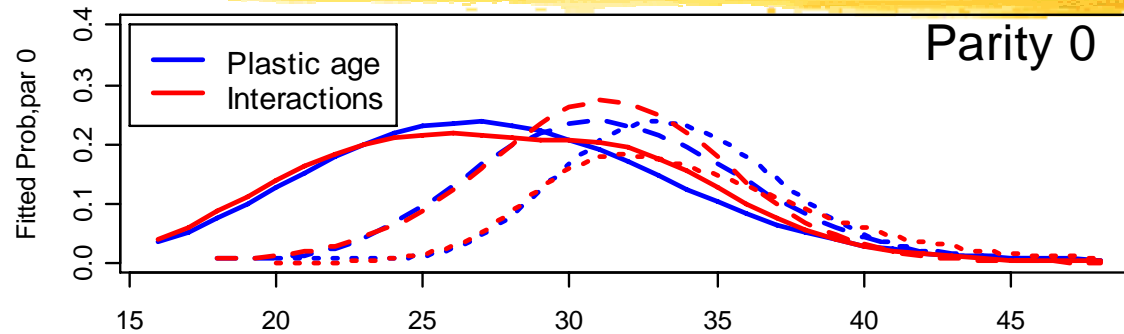
} For given values of the **plastic age** parameters, the predictor function is linear (i.e: education and age-spline can be put as regular covariates within the model)

# Plastic Age Model: Estimation

**Estimation of the model: Concentrated maximum-likelihood:**

- } For a given value of the **plastic age** parameters, estimate the GLM associated (with standard procedure)
- } Get the likelihood.
- } Iterate to obtain the ML estimates of the **plastic age** parameters and of the rest of covariates.
- } In order to do inference: Correct for degrees of freedom (four more estimated parameters) in any **LR** test, or model selection criteria ( **AIC**, **BIC**, ...)
- } **This application:**
  - | BFGS maximization algorithm for the **plastic age** parameters
  - | *glm* function in R for the rest of parameters
  - | Problems if non-constant splines are used!

# Plastic Age model: Results

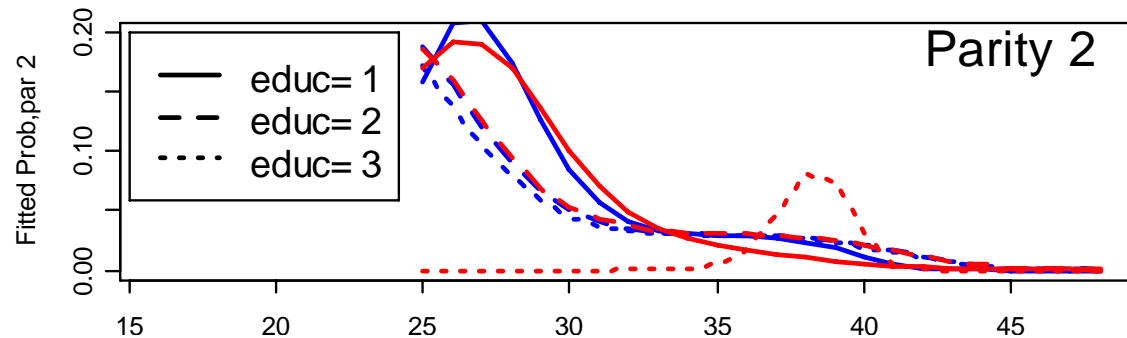
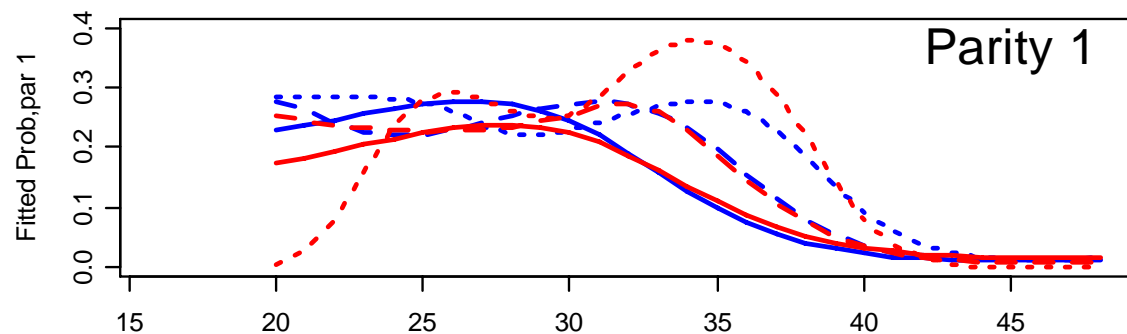
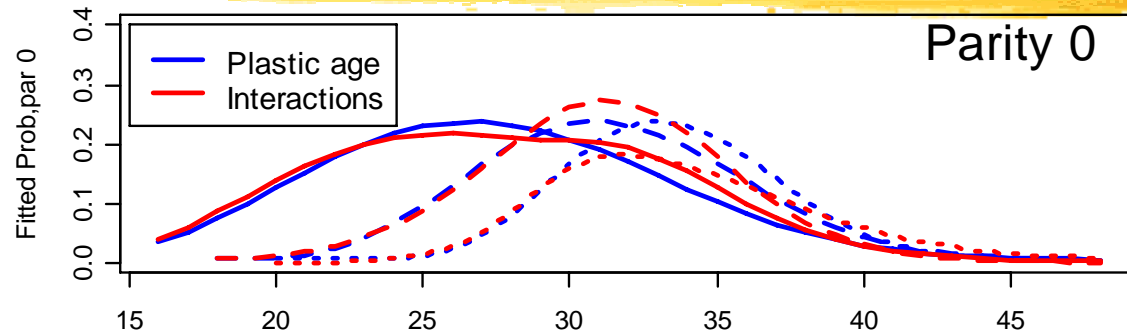


- The results are very similar for parity 0 with a more parsimonious model (four parameters less)

- Problems connected to overfitting at higher parities, are sharply reduced.

- The parameter estimates (not shown) make demographic sense.

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# Conclusions



## WHAT TO DO:

} The **plastic age** model provides a relatively simple way to admit tempo differentials in microdemographic analysis of fertility.

It has the following advantages:

- } Demographic coherence,
- } Relatively simple to estimate,
- } Possibility to combine with macrodemographic analysis: fertility tables, tempo adjustment, ...

## WHAT TO AVOID:

- } Models where parity is just a covariate
- } Models with a covariate which is known to be associated with different fertility timing: Use **plastic age**