An Augmented Variable Dirichlet Process Mixture model for the analysis of dependent lifetimes - Supplementary material

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October 31, 2024

1 Data cleaning operations

The data preparation steps are listed below:

1. Discard observations with same-gender couples, as in Frees et al. (1996) and Deresa et al. (2022);

2. Eliminate records of couples where males and females aged lesser than 40 at the start of the observation period. In this way, the Gompertz model is a reasonable fit for these data;

3. Check of records of couples where both members are alive at the start of the observation period;

4. Elimination of duplicated records.

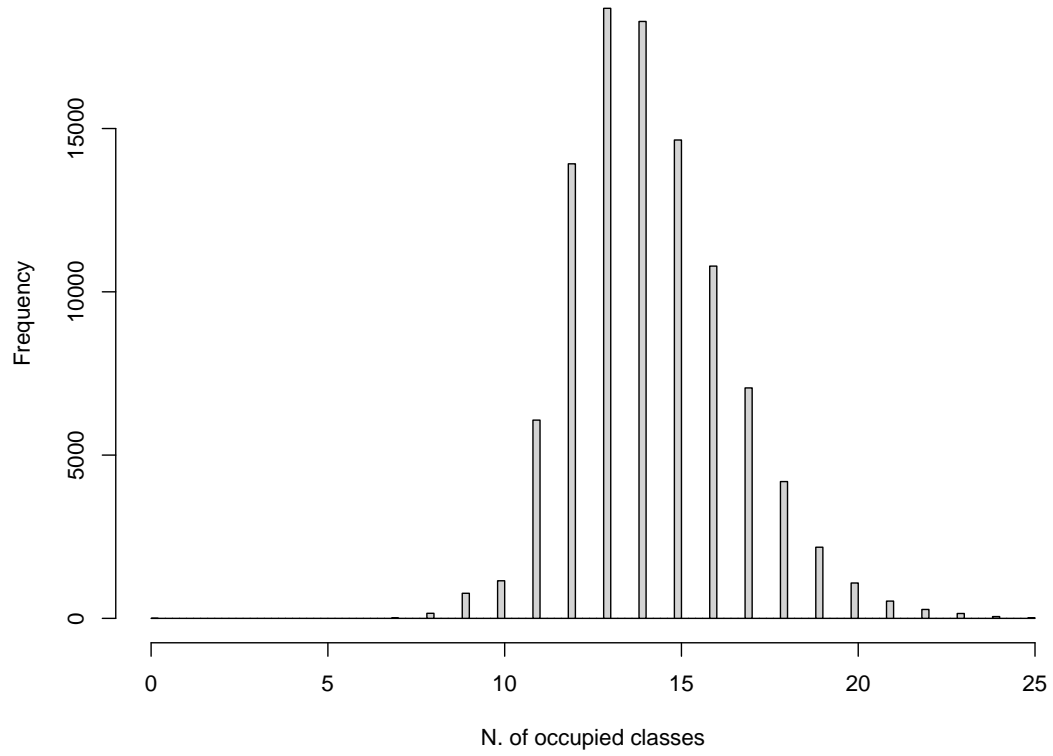# 2 Occupied mixture components throughout the MCMC iterations

Figure 2.1: Histogram of the number of occupied classes throughout the MCMC iterations.

3 Results of the competing models

Table 3.1: Parameter estimates and corresponding standard errors of the Base Gompertz and Proportional hazard models.

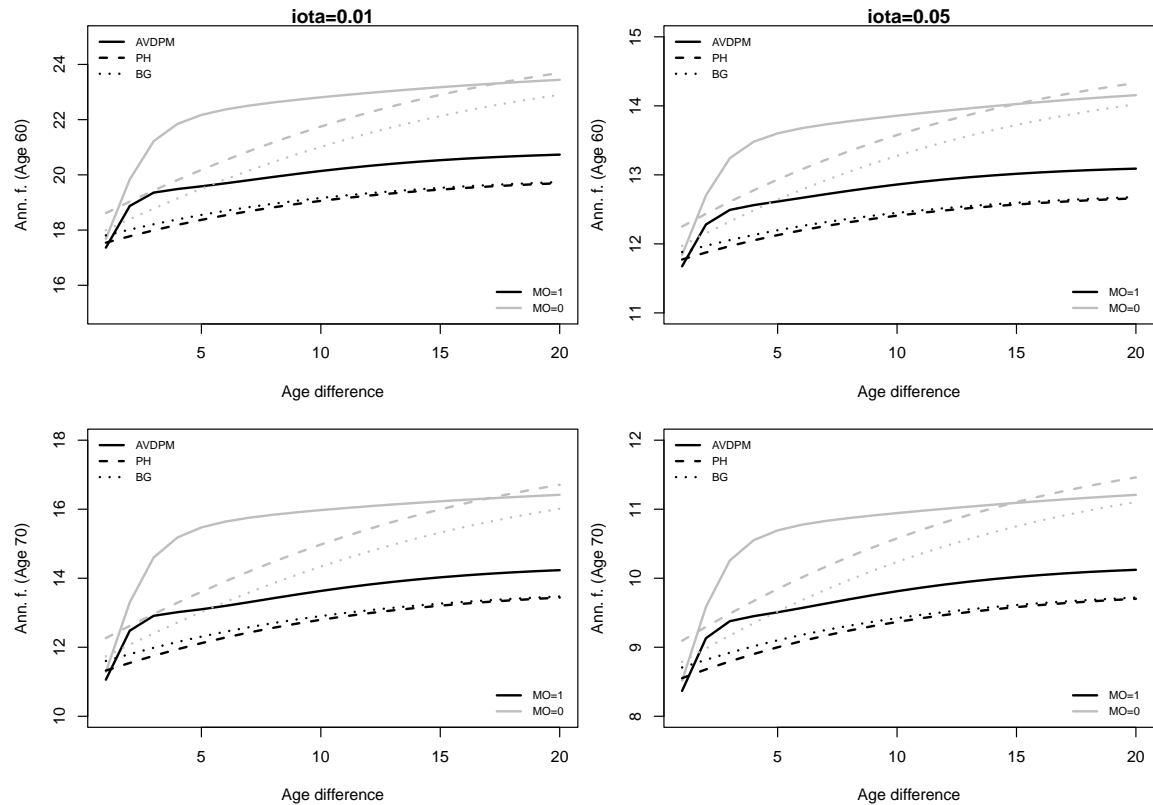| Parameter	Base Gompertz		Proportional hazard	
	Estimate	St. err.	Estimate	St. err.
α_1	-3.92	0.0367	-3.97	0.0715
β_1	0.0991	0.0046	0.0987	0.0046
$\delta_{1,1}$	$-$	$-$	-0.0035	0.0279
$\delta_{1,2}$	$-$	$-$	0.0697	0.0827
α_2	-4.85	0.0581	-5.10	0.1143
β_2	0.1243	0.0074	0.1309	0.0077
$\delta_{2,1}$	$-$	$-$	0.0053	0.0448
$\delta_{2,2}$	$-$	$-$	0.3234	0.1208

4 Joint life annuity factor

Figure 4.1: Joint life annuity factor calculated using the AVDPM model (solid line), the PH model (dashed line) and the BG model (dotted line) for different values of age difference ($\exp\left(Z^A\right)$, x-axis) and Z^M when the oldest member is aged 60 (top panel) and 70 (bottom panel), for $\iota = 1\%$ (left panel) and $\iota = 5\%$ (right panel).

References

Deresa, N., Van Keilegom, I. & Antonio, K. (2022), 'Copula-based inference for bivariate survival data with left truncation and dependent censoring', *Insurance: Mathematics and Economics* **107**, 1–21.
  URL: *https://www.sciencedirect.com/science/article/pii/S0167668722000841*

Frees, E. W., Carriere, J. & Valdez, E. (1996), 'Annuity valuation with dependent mortality', *The Journal of Risk and Insurance* **63**(2), 229–261.
  URL: *http://www.jstor.org/stable/253744*