

# Bayesian Age-Period-Cohort Modeling

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## Data example

BAMP includes a data example.

```
data(apc)
plot(cases[,1],type="l",ylim=range(cases), ylab="cases", xlab="year", main="cases per age group")
for (i in 2:8)lines(cases[,i], col=i)
```

## APC model with random walk first order prior

```
model1 <- bamp(cases, population, age="rw1", period="rw1", cohort="rw1",
              periods_per_agegroup = 5)
```

bamp() automatically performs a check for MCMC convergence using Gelman and Rubin's convergence diagnostic. We can manually check the convergence again:

```
checkConvergence(model1)
```

```
## [1] TRUE
```

Now we have a look at the model results. This includes estimates of smoothing parameters and deviance and DIC:

```
print(model1)
```

```
##
## Model:
## age (rw1) - period (rw1) - cohort (rw1) model
## Deviance:      231.03
## pD:            36.69
## DIC:           267.73
##
##
## Hyper parameters:          5%          50%          95%
## age                       0.404        1.047        2.236
## period                     68.994       200.213     607.918
## cohort                     34.270        59.168      97.495
```

We can plot the main APC effects using point-wise quantiles:

```
plot(model1)
```

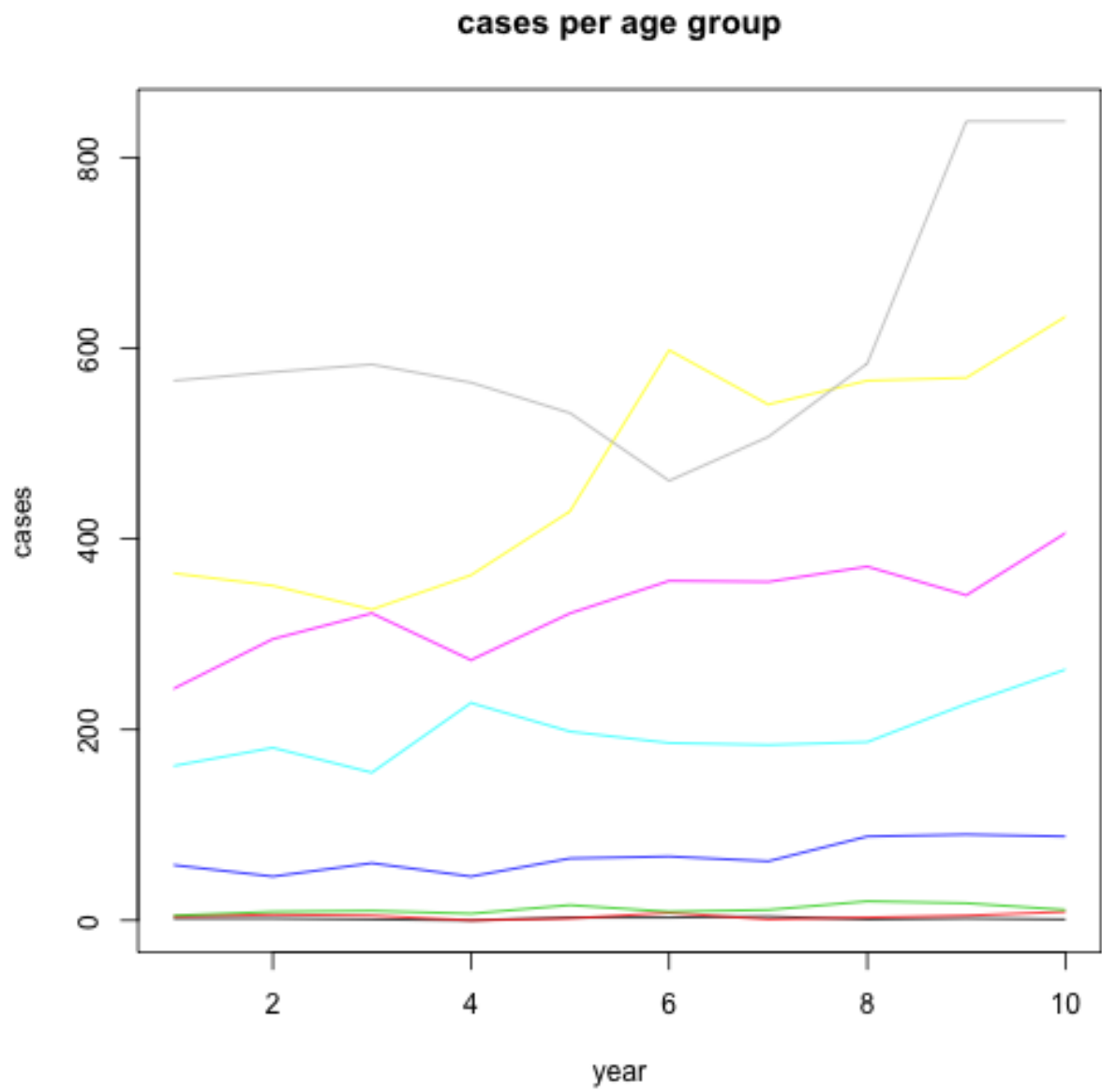
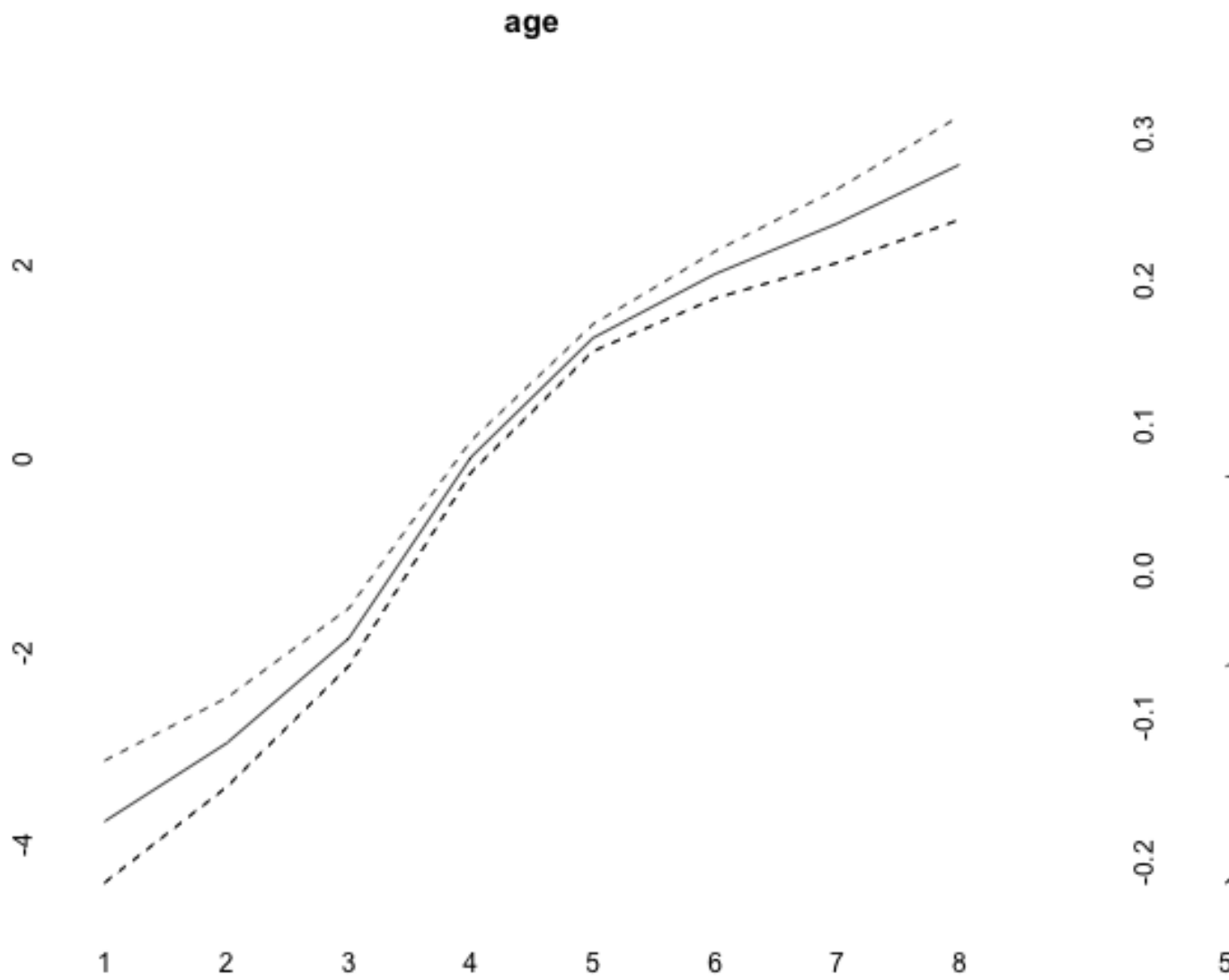
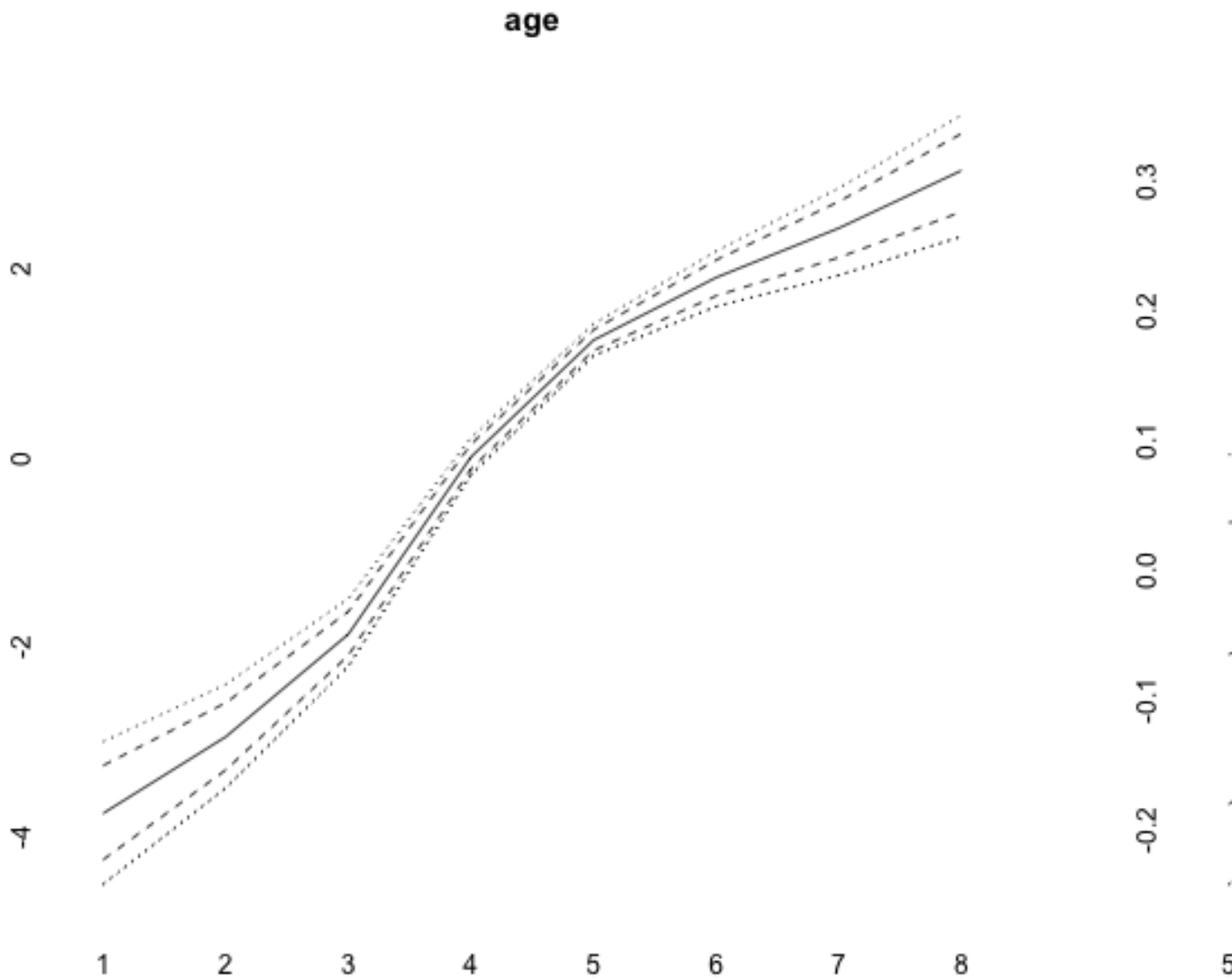


Figure 1: plot of chunk loadplot



More quantiles are possible:

```
plot(model1, quantiles = c(0.025,0.1,0.5,0.9,0.975))
```



```
model2 <- bamb(cases, population, age="rw2", period="rw2", cohort="rw2",
              periods_per_agegroup = 5)
```

```
checkConvergence(model2)
```

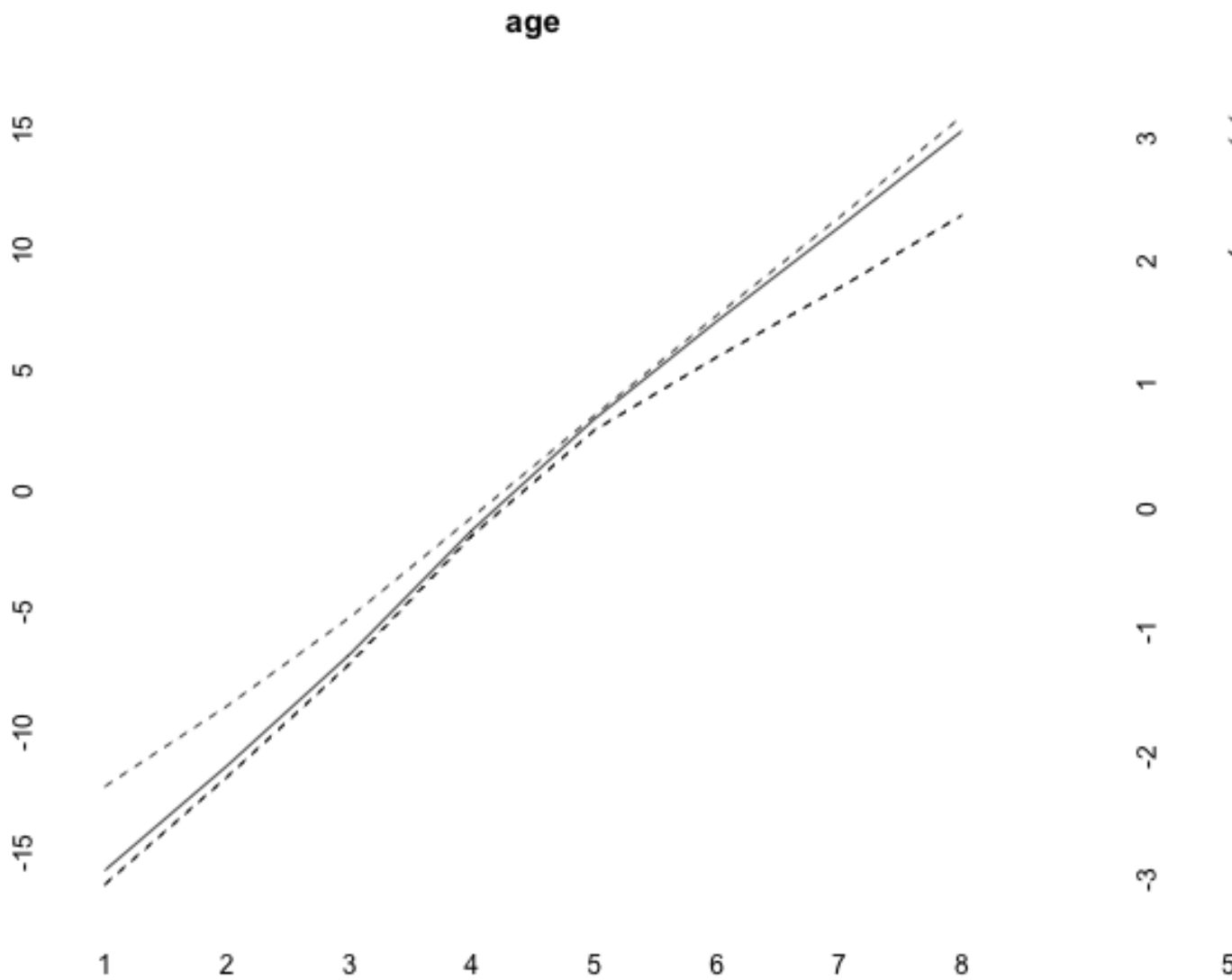
```
## [1] TRUE
```

```
print(model2)
```

```
##
## Model:
## age (rw2) - period (rw2) - cohort (rw2) model
## Deviance:      246.32
## pD:            33.69
## DIC:           280.01
```

```
##
##
## Hyper parameters:          5%          50%          95%
## age                        2.014        6.246        16.696
## period                     55.490       307.804      2827.581
## cohort                     37.044       74.924       146.403
```

```
plot(model2)
```



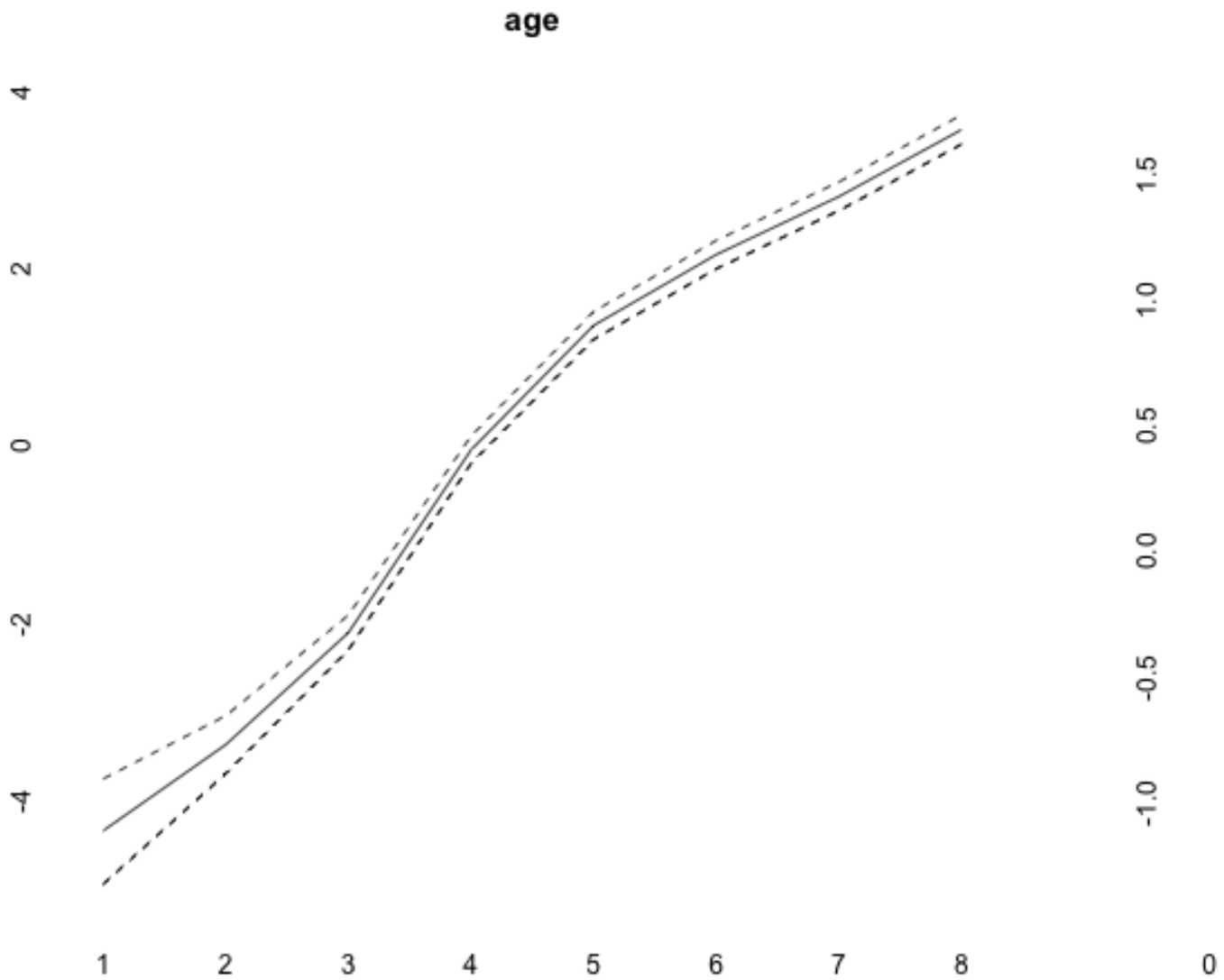
```
model3<-bamp(cases, population, age="rw1", period=" ", cohort="rw2",
             periods_per_agegroup = 5)
checkConvergence(model3)
```

```
## [1] TRUE
```

```
print(model3)
```

```
##  
## Model:  
## age (rw1) cohort (rw2) model  
## Deviance:      276.60  
## pD:            29.99  
## DIC:           306.59  
##  
##  
## Hyper parameters:      5%      50%      95%  
## age                    0.301   0.797   1.644  
## cohort                 38.018  74.193  139.638
```

```
plot(model3)
```

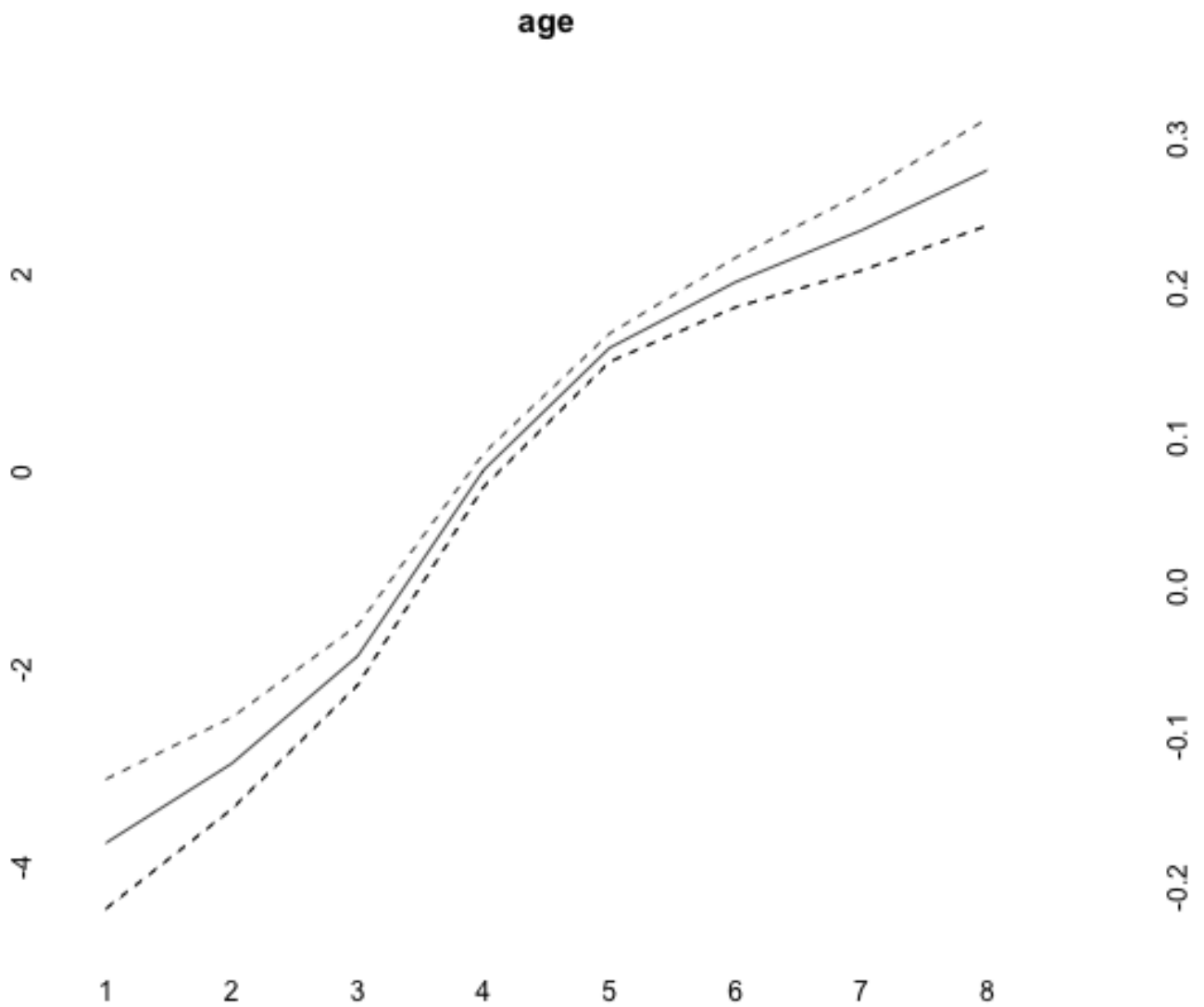


```
(model4<-bamp(cases, population, age="rw1", period="rw1", cohort="rw1",
              cohort_covariate = cov_c, periods_per_agegroup = 5))
```

```
##
## Model:
## age (rw1) - period (rw1) - cohort (rw1) model
## Deviance:      231.32
## pD:            36.92
## DIC:           268.25
##
##
## Hyper parameters:
## age            5%          50%          95%
##               0.406      1.040      2.252
## period         65.700     196.123    626.652
```

```
## cohort          34.013      59.356      97.958
```

```
plot(model4)
```



```
(model5<-bamp(cases, population, age="rw1", period="rw1", cohort="rw1",  
              period_covariate = cov_p, periods_per_agegroup = 5))
```

```
##  
## Model:  
## age (rw1) - period (rw1) - cohort (rw1) model  
## Deviance:      231.22  
## pD:            36.81  
## DIC:           268.04  
##  
##
```



```
## Hyper parameters:          5%          50%          95%
## age                        0.394        1.039        2.197
## period                     66.652       195.959      625.782
## cohort                     34.518        59.524       98.195
```

```
plot(model15)
```

