

Bayesian Age-Period-Cohort Modelling

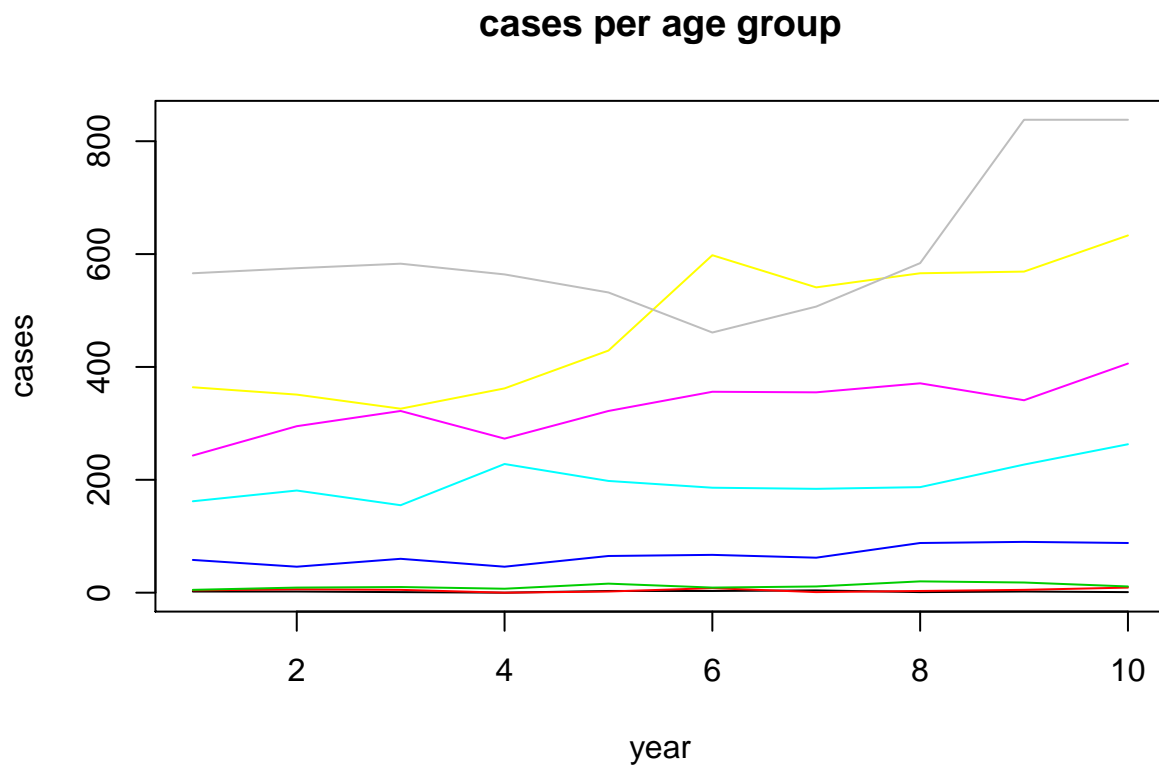
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Data example

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

```
model11 <- 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(model11)
```

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

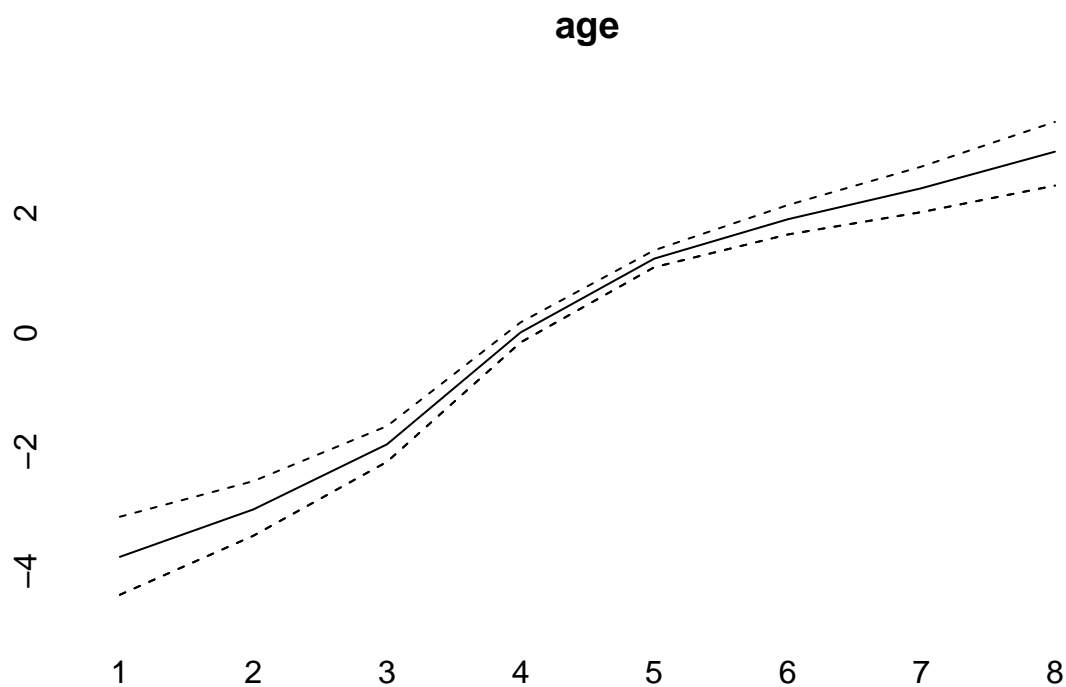
Now we have a look at the model results. This includes estimates of smoothing parameters and deviance and DIC:

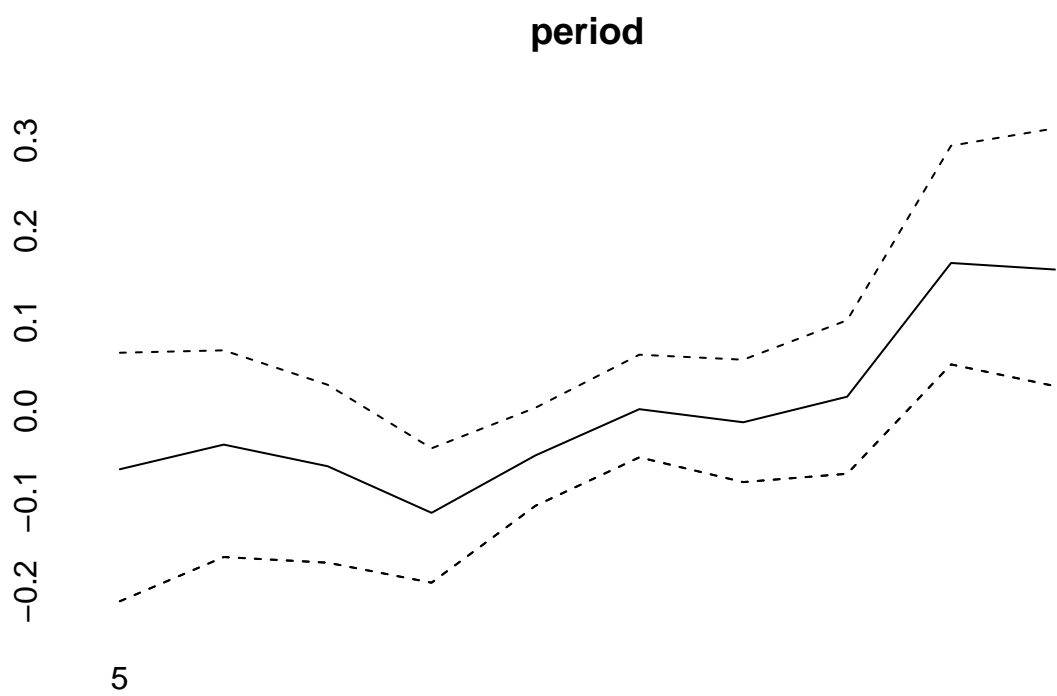
```
print(model1)
```

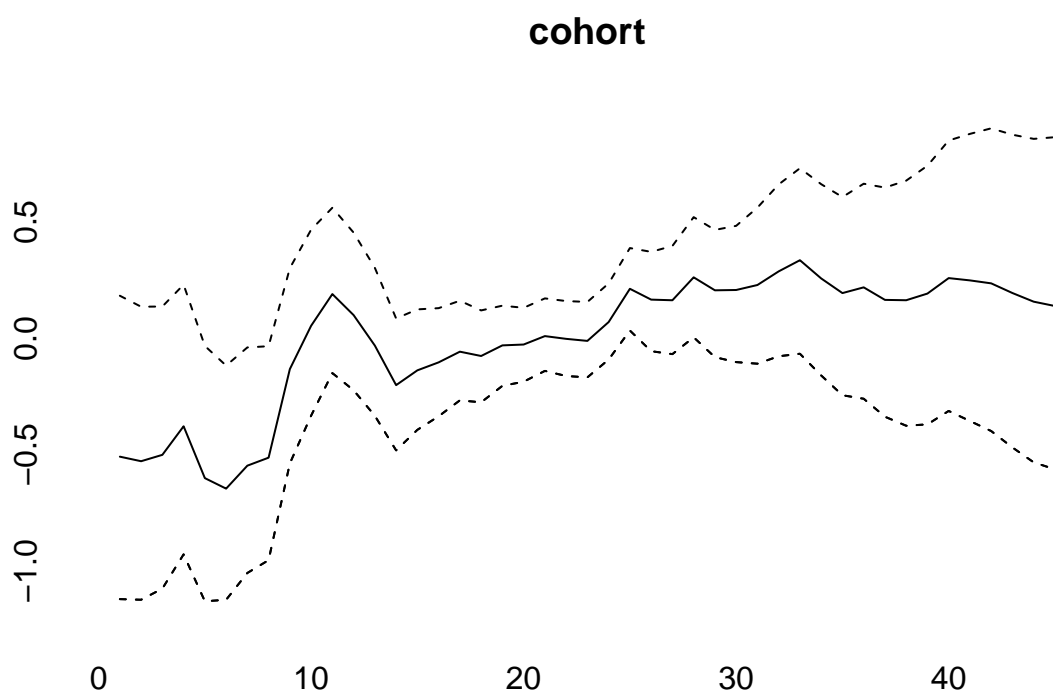
```
##
## Model:
## age (rw1) - period (rw1) - cohort (rw1) model
## Deviance:      231.42
## pD:            37.12
## DIC:           268.54
##
##
## Hyper parameters:           5%           50%           95%
## age                        0.383        1.028        2.167
## period                     67.863       197.536      620.565
## cohort                     34.674        58.569       97.149
```

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

```
plot(model1)
```

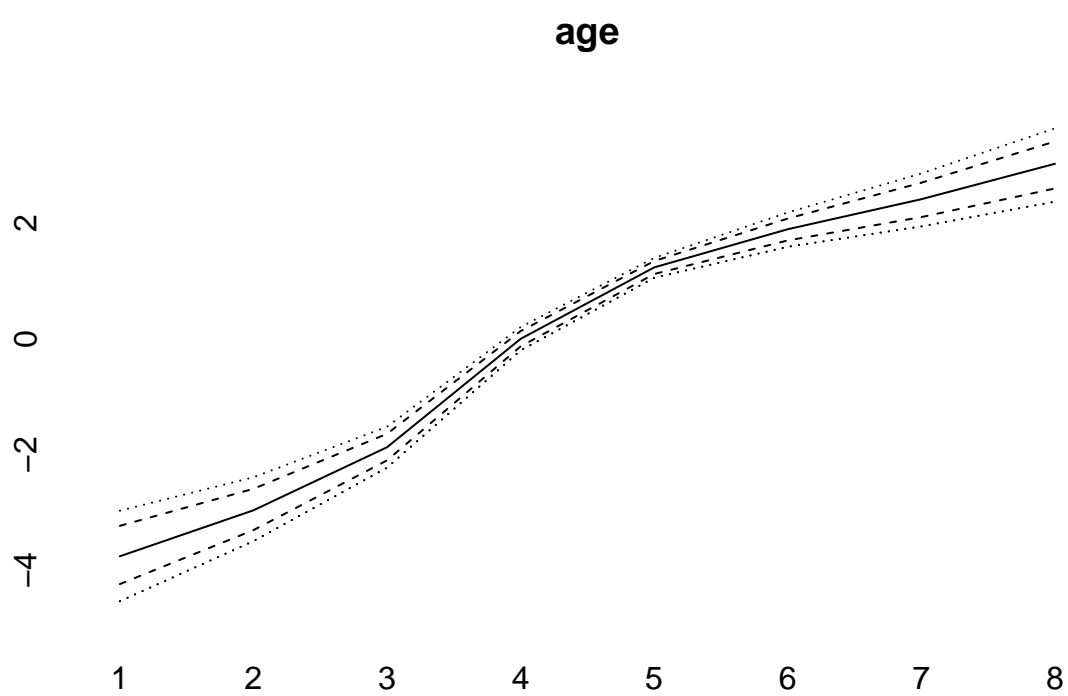


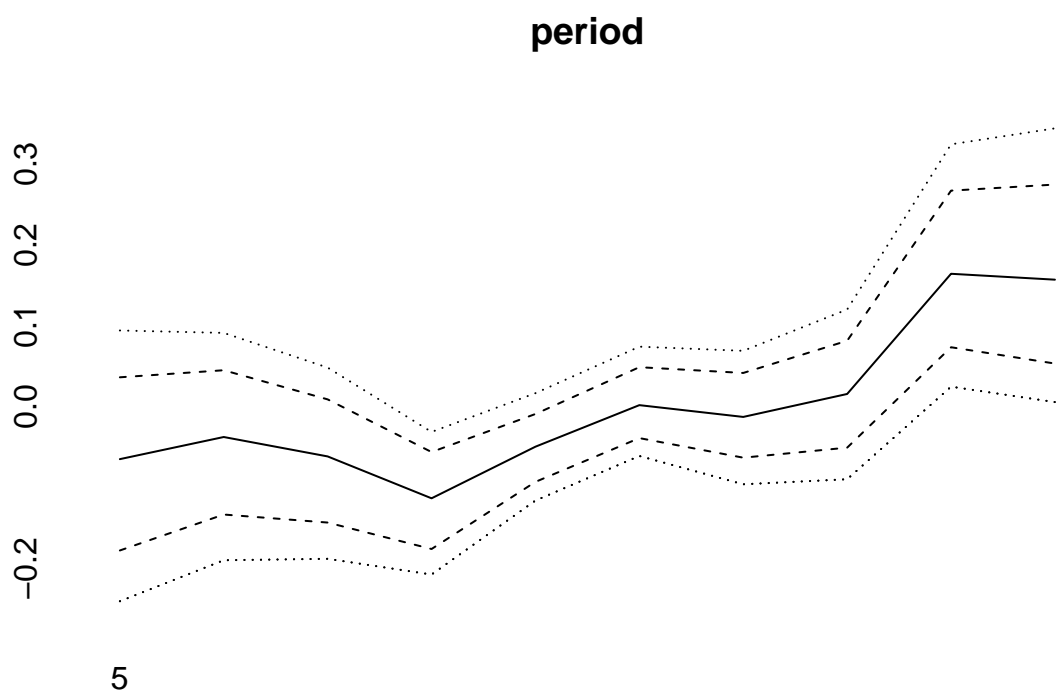


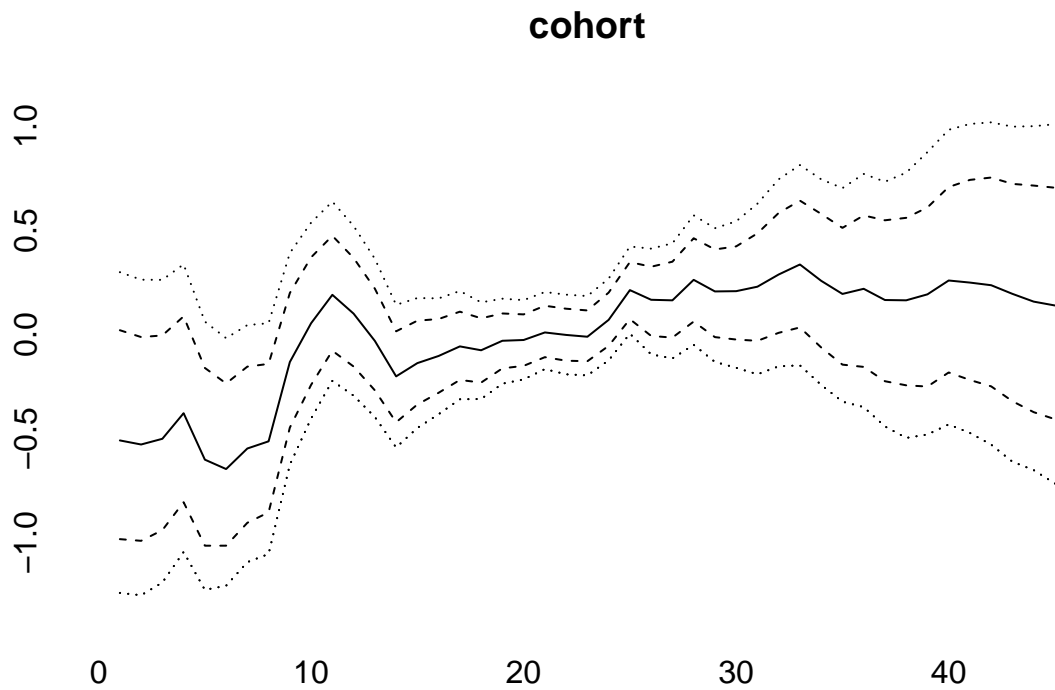


More quantiles are possible:

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







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

```
checkConvergence(model2)
```

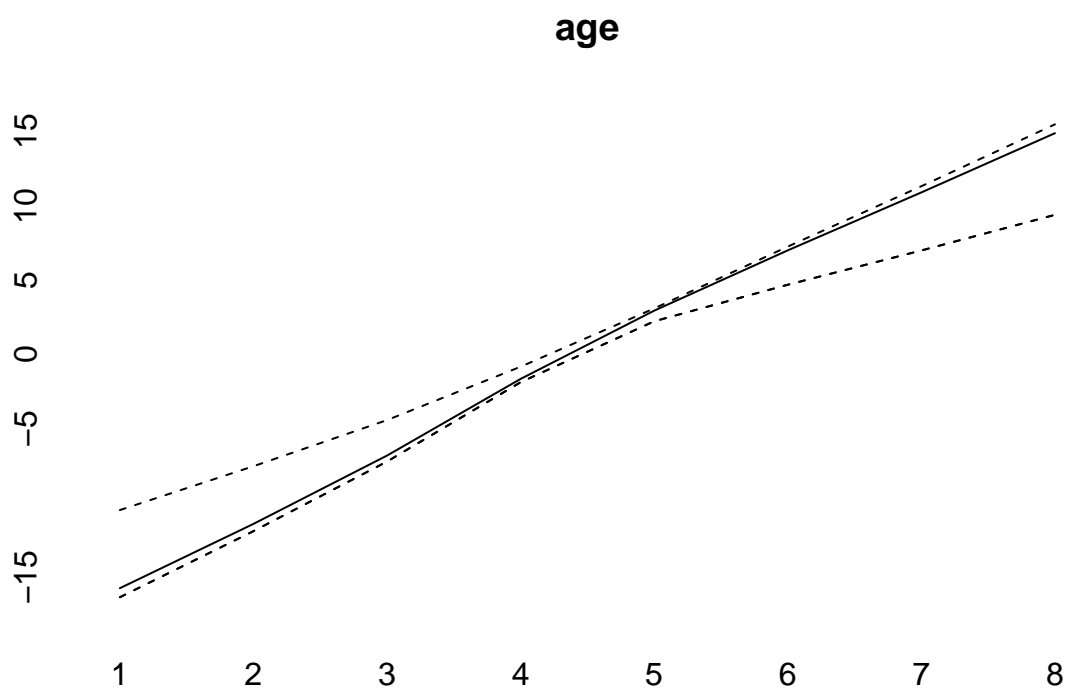
```
## Warning: MCMC chains did not converge!
```

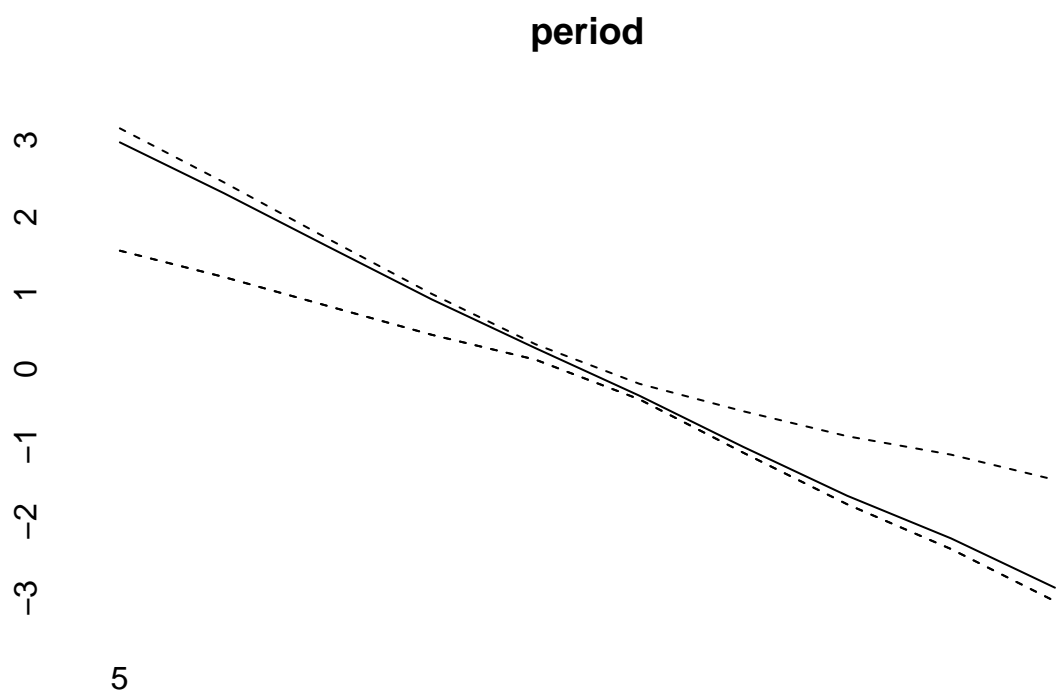
```
## [1] FALSE
```

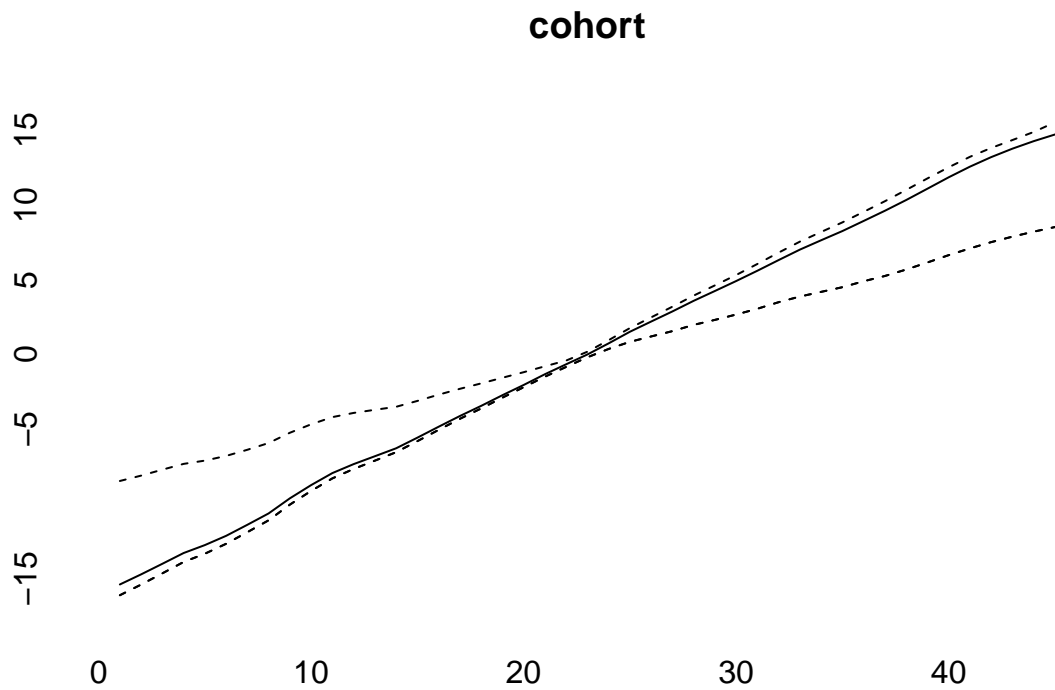
```
print(model2)
```

```
##
## Model:
## age (rw2) - period (rw2) - cohort (rw2) model
## Deviance:      246.23
## pD:            33.82
## DIC:           280.06
##
##
## Hyper parameters:           5%           50%           95%
## age                        2.088        6.309        16.293
## period                     55.066       309.185      2681.709
## cohort                     36.751        74.127       148.093
```

```
plot(model2)
```







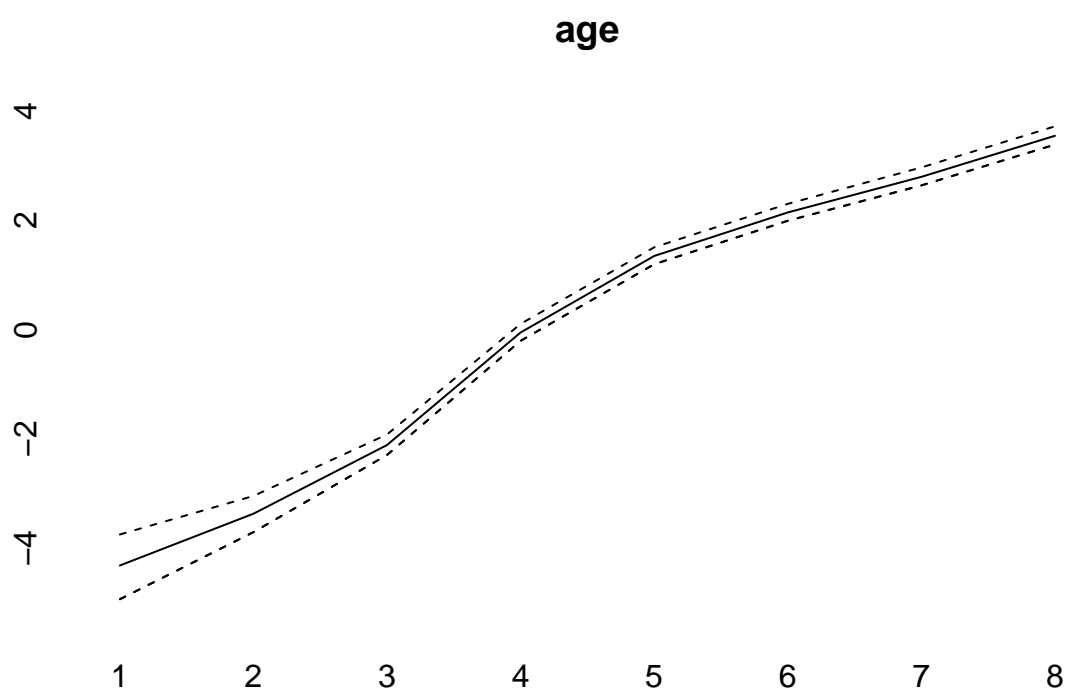
```
model3<-bamp(cases, population, age="rw1", period=" ", cohort="rw2",
             periods_per_agegroup = 5)
checkConvergence(model3)
```

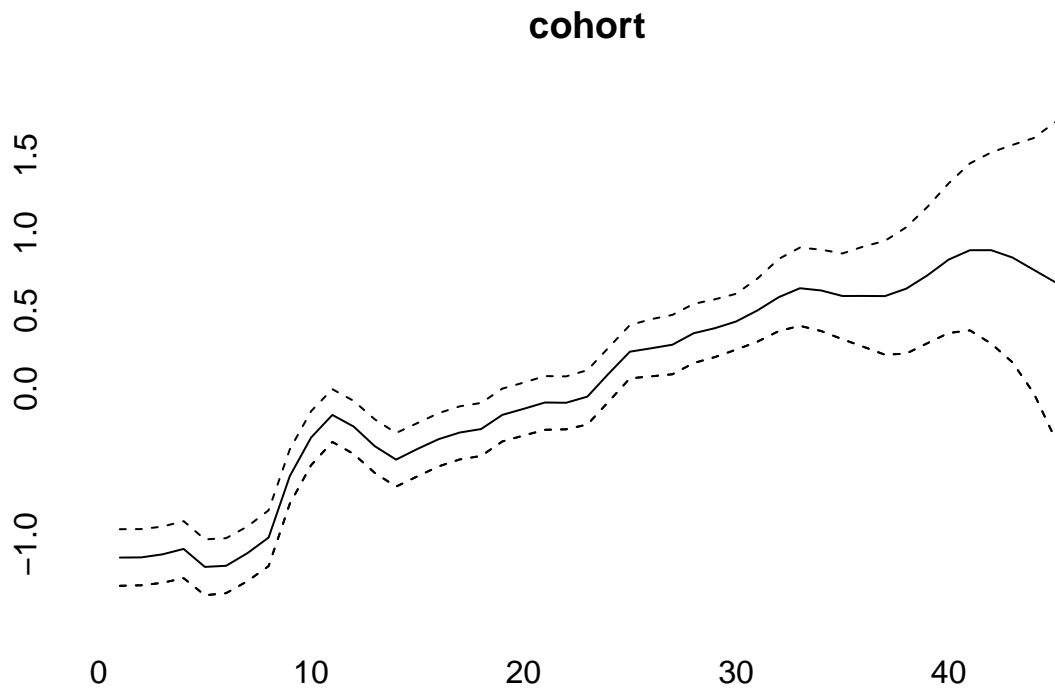
```
## [1] TRUE
```

```
print(model3)
```

```
##
## Model:
## age (rw1) cohort (rw2) model
## Deviance:      276.54
## pD:            30.31
## DIC:           306.84
##
##
## Hyper parameters:           5%           50%           95%
## age                        0.316        0.800        1.637
## cohort                     37.862       73.655       136.414
```

```
plot(model3)
```

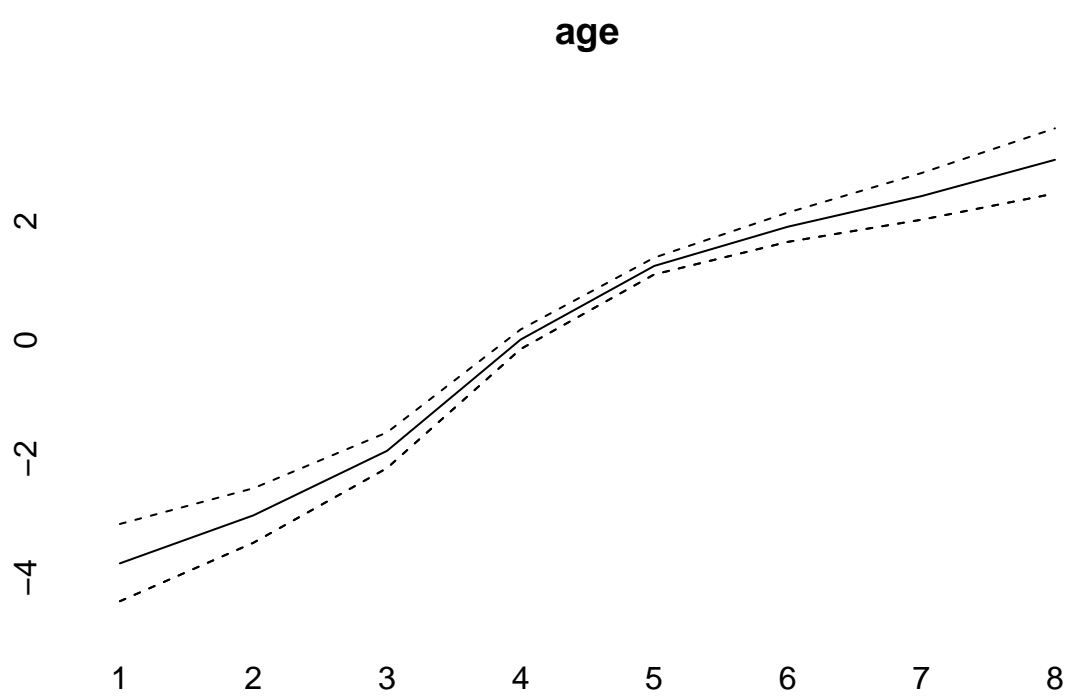


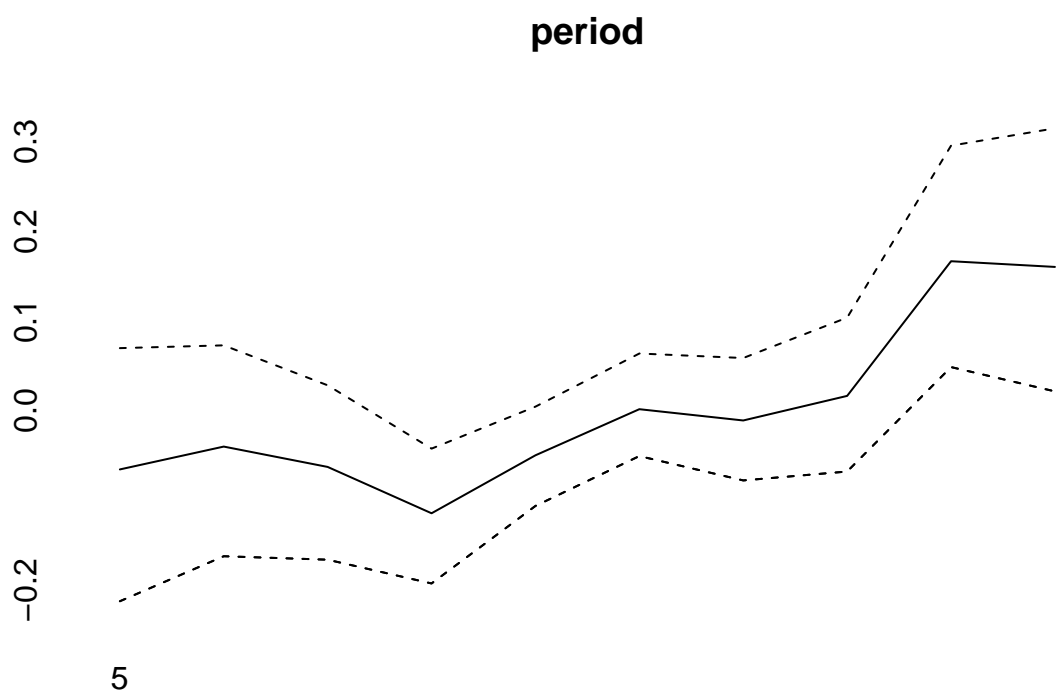


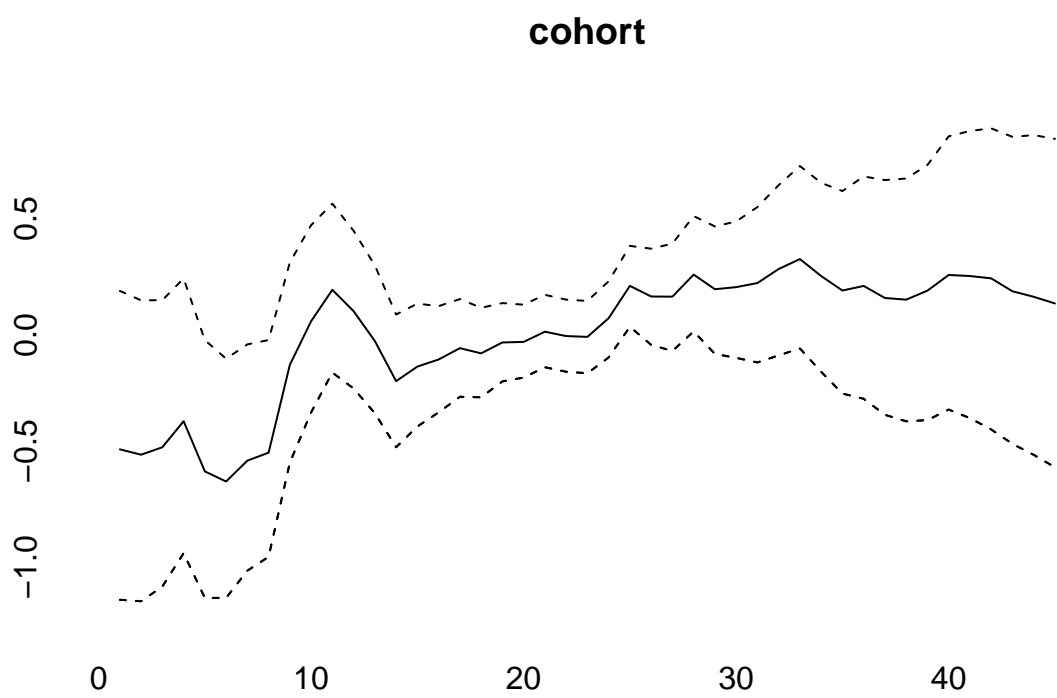
```
(model4<-bamp(cases, population, age="rw1", period="rw1", cohort="rw1",
  cohort_covariate = cov_c, periods_per_agegroup = 5))
```

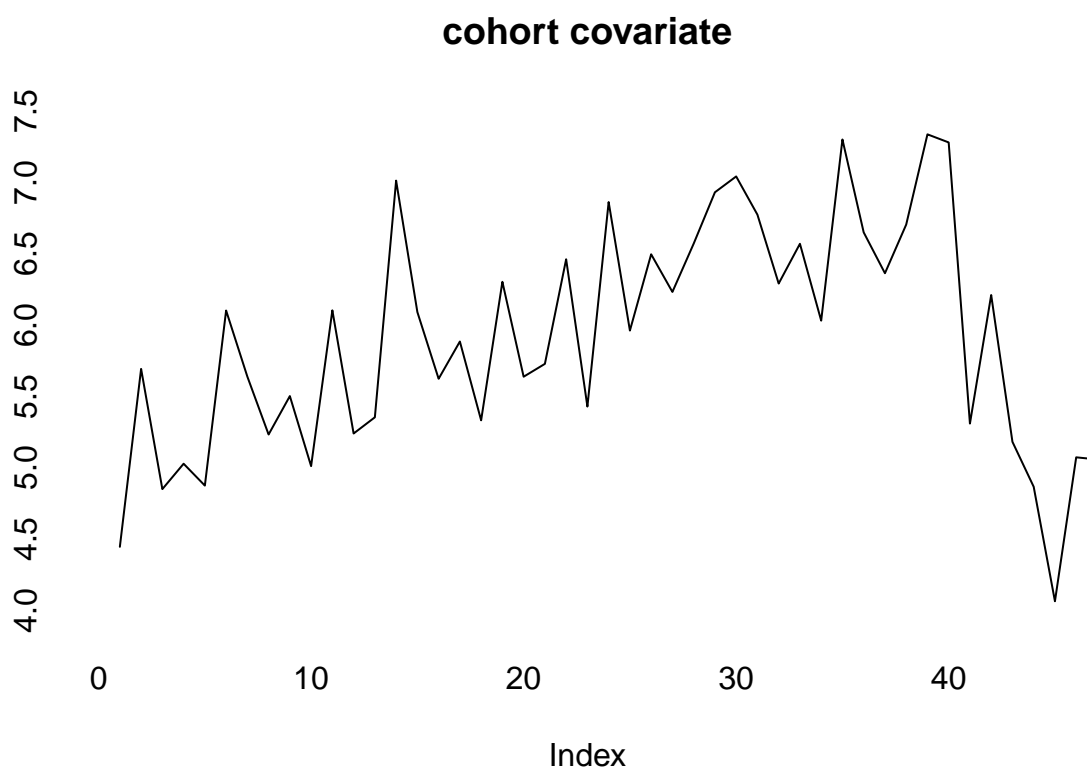
```
##
## Model:
## age (rw1) - period (rw1) - cohort (rw1) model
## Deviance:      231.13
## pD:            36.78
## DIC:           267.91
##
##
## Hyper parameters:
## age            5%      50%      95%
## age            0.409    1.038    2.177
## period         67.593   200.537  596.050
## cohort         34.628    59.030   96.087
```

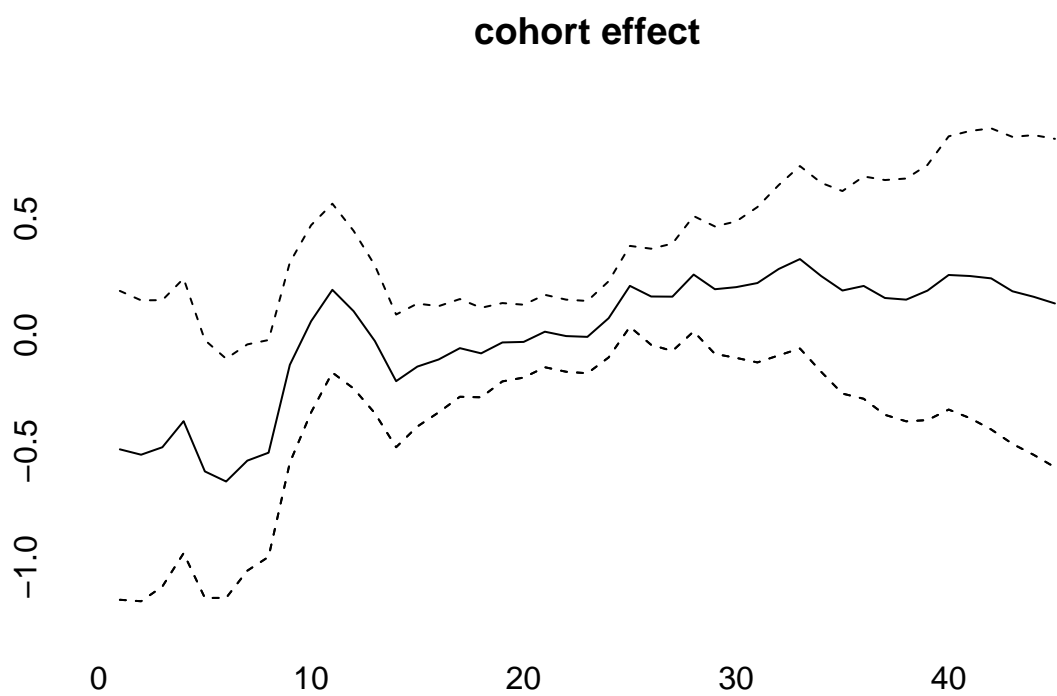
```
plot(model4)
```



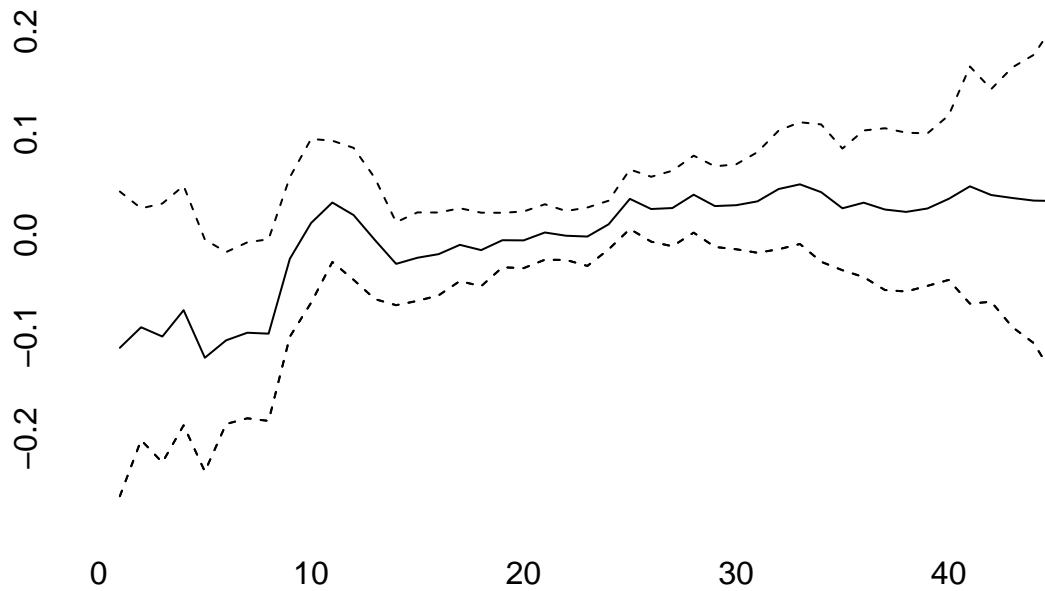








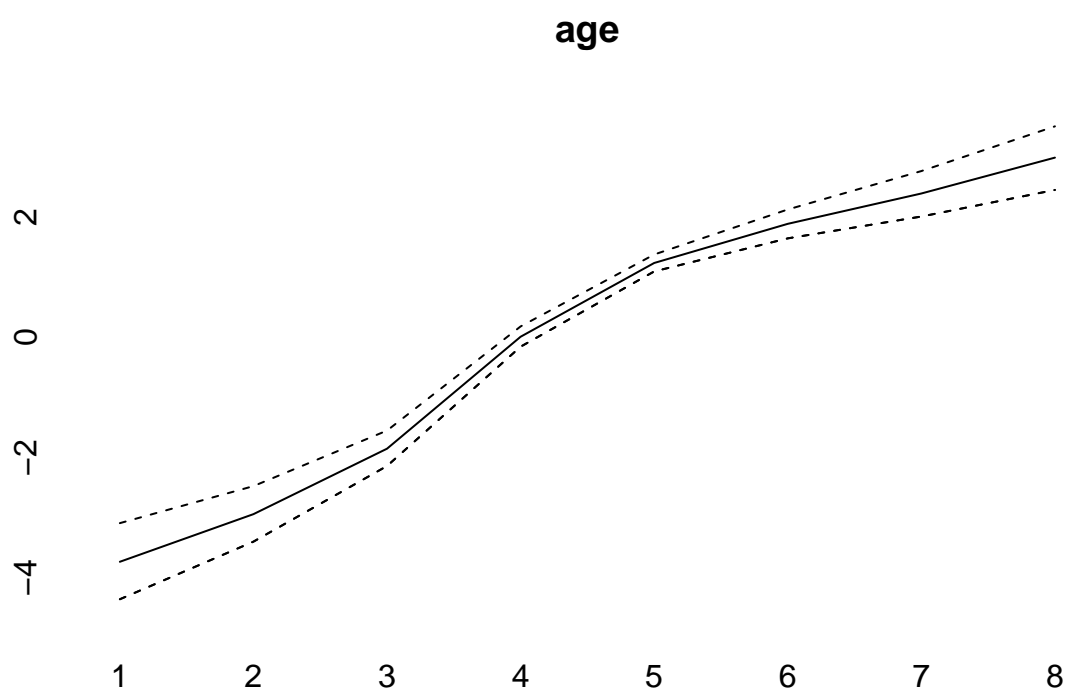
raw effect of cohort covariate

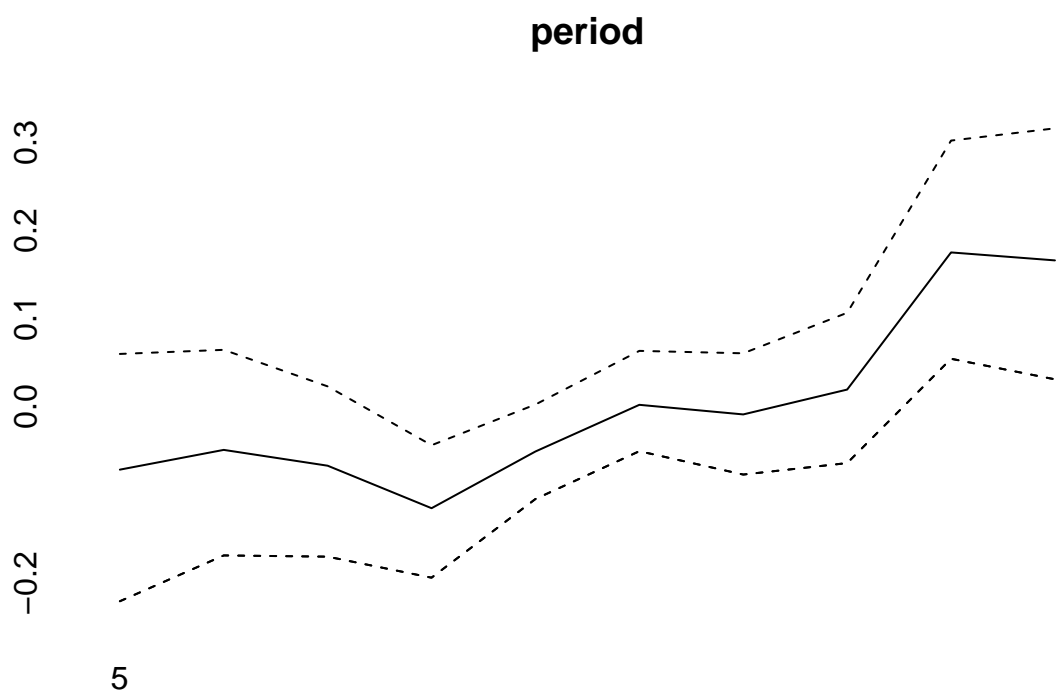


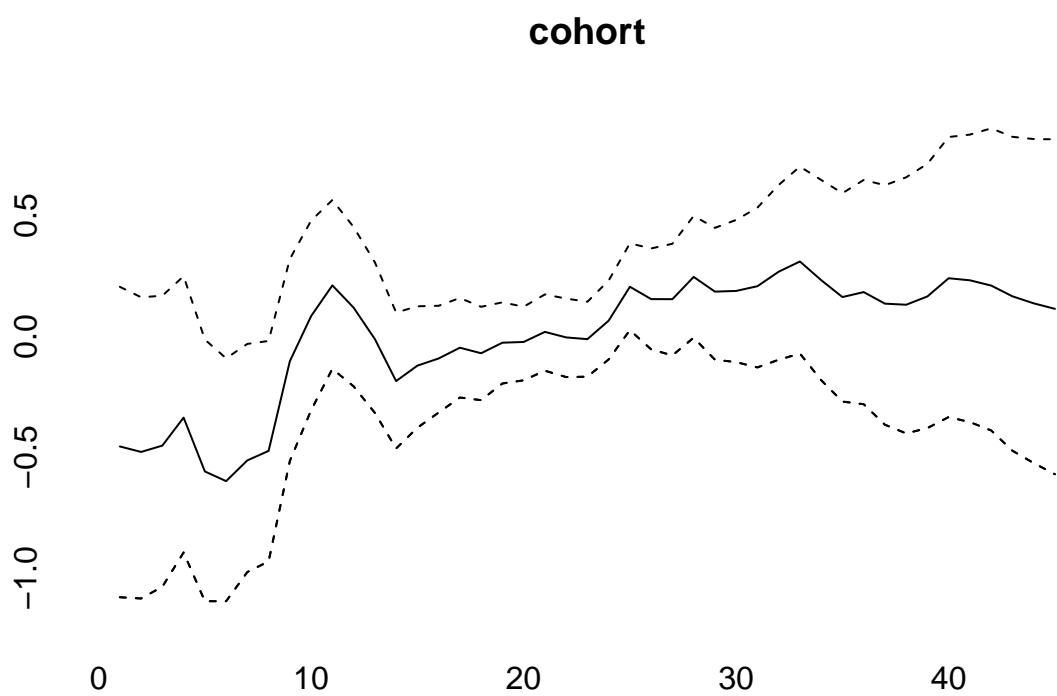
```
(model5<-bamp(cases, population, age="rw1", period="rw1", cohort="rw1",
  period_covariate = cov_p, periods_per_agegroup = 5))
```

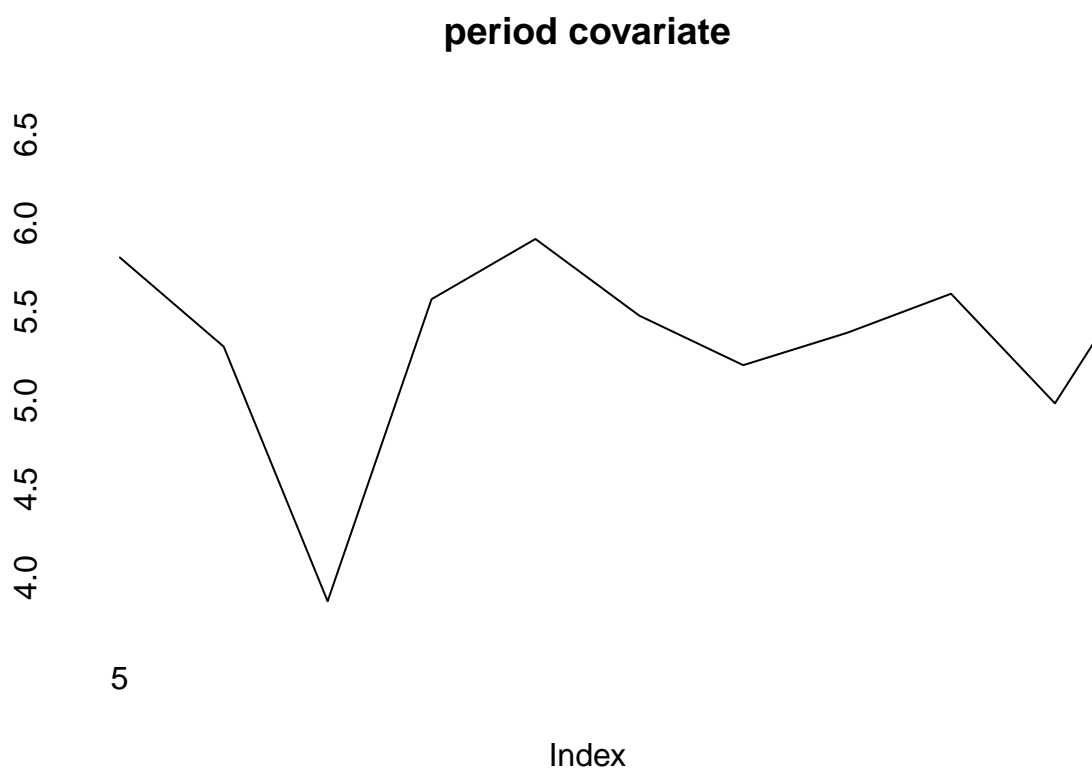
```
##
## Model:
## age (rw1) - period (rw1) - cohort (rw1) model
## Deviance:      231.25
## pD:            36.84
## DIC:           268.09
##
##
## Hyper parameters:
## age              5%          50%          95%
## age              0.410        1.047        2.274
## period           64.966       192.937       589.622
## cohort           34.844        60.224        99.953
```

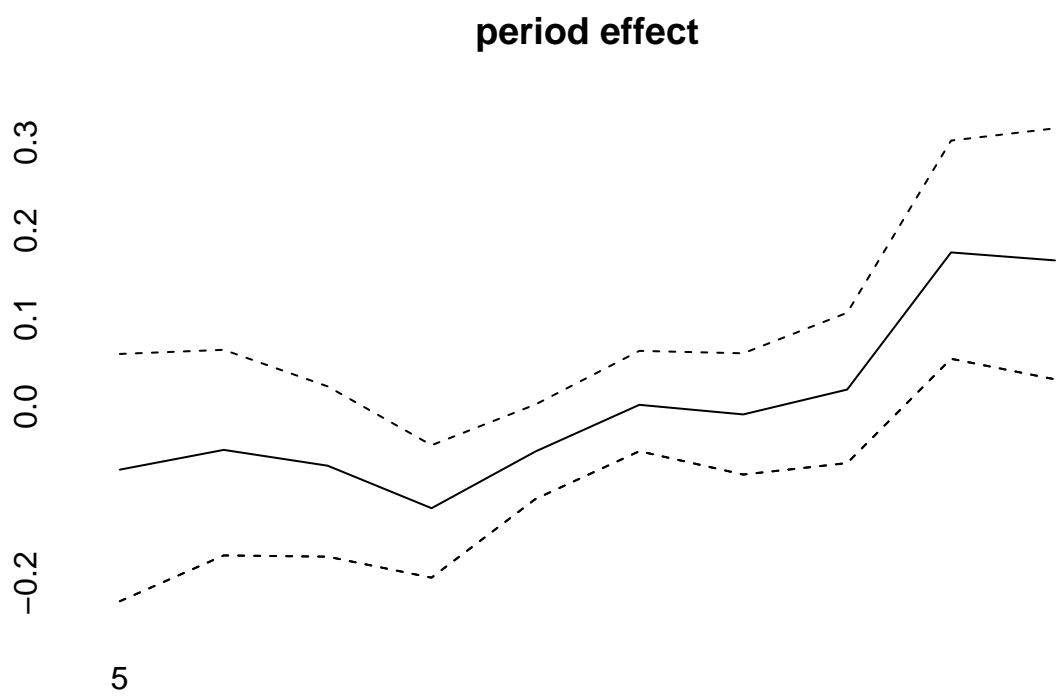
```
plot(model5)
```











raw period covariate effect

