Simulating Age-Period-Cohort Data
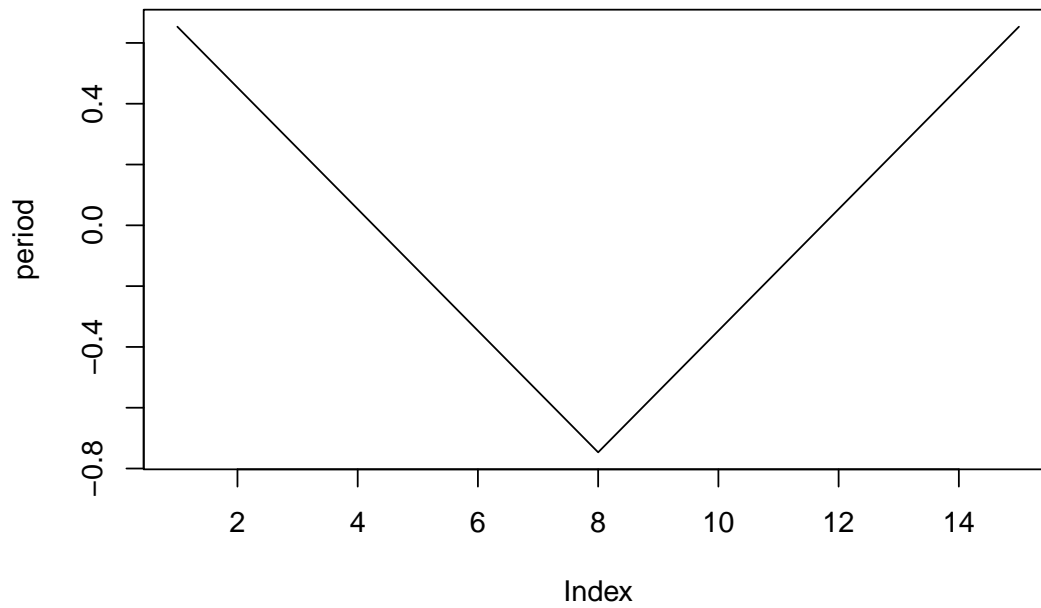
Volker Schmid

2022-05-28

```
age=2*sqrt(seq(1,20,length=10))
age<- age-mean(age)
plot(age, type="l")
```
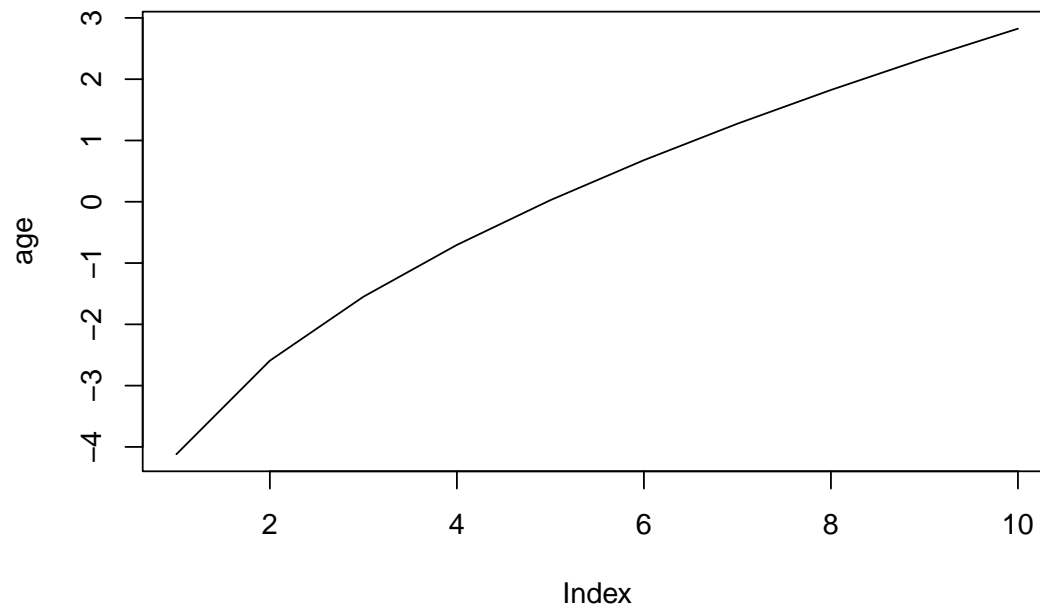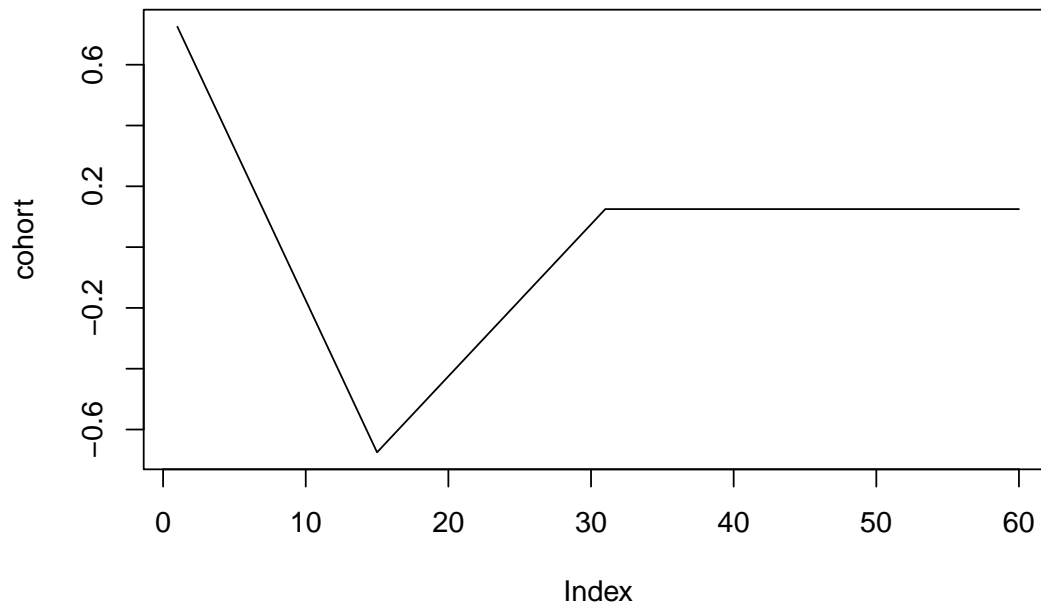


```
period=15:1
period[8:15]<-8:15
period<-period/5
period<-period-mean(period)
plot(period, type="l")
```

```
periods_per_agegroup=5
number_of_cohorts <- periods_per_agegroup*(10-1)+15
cohort<-rep(0,60)
cohort[1:15]<-(14:0)
cohort[16:30]<- (1:15)/2
cohort[31:60]<- 8
cohort<-cohort/10
cohort<-cohort-mean(cohort)
plot(cohort, type="l")
```

```
simdata<-apcSimulate(-10, age, period, cohort, periods_per_agegroup, 1e6)
print(simdata$cases)
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
## [1,]     0    5   22   48   71  128  171  407 1119  3058
## [2,]     1    9   19   34   78   92  160  326  834  2249
## [3,]     1    5   15   29   60   81  127  237  624  1627
## [4,]     0    1   10   25   41   78  105  181  395  1218
## [5,]     1    5   15   27   45   65   90  113  329   915
## [6,]     1    3    6   12   36   55   68  100  279   706
## [7,]     0    0    5   20   21   43   72  102  164   508
## [8,]     0    1    6    8   37   40   52   70  149   363
## [9,]     0    1    4    8   24   59   65  111  147   354
## [10,]    0    1    9   14   34   64   96  131  174   421
## [11,]    1    8    8   17   52   93  106  174  219   515
## [12,]    2    5   11   29   51  114  148  213  294   579
## [13,]    0    8    9   33   72  128  207  306  363   642
## [14,]    1   12   15   38   88  141  254  353  452   661
## [15,]    2    8   18   61   90  184  359  469  577   737
```

```
simmod <- bamp(cases = simdata$cases, population = simdata$population, age = "rw1",
period = "rw1", cohort = "rw1", periods_per_agegroup =periods_per_agegroup)
```

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

```
print(simmod)
```

```
##
## WARNING! Markov Chains have apparently not converged! DO NOT TRUST THIS MODEL!
##
##   Model:
```

```
## age (rw1) - period (rw1) - cohort (rw1) model
## Deviance:      144.76
## pD:             49.19
## DIC:           193.94
##
##
##  Hyper parameters:              5%            50%            95%
## age                          0.509          1.185          2.385
## period                      13.130         25.565         43.880
## cohort                      74.277        119.341        182.323
```

```
checkConvergence(simmod)
```

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

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

```
plot(simmod)
```


age
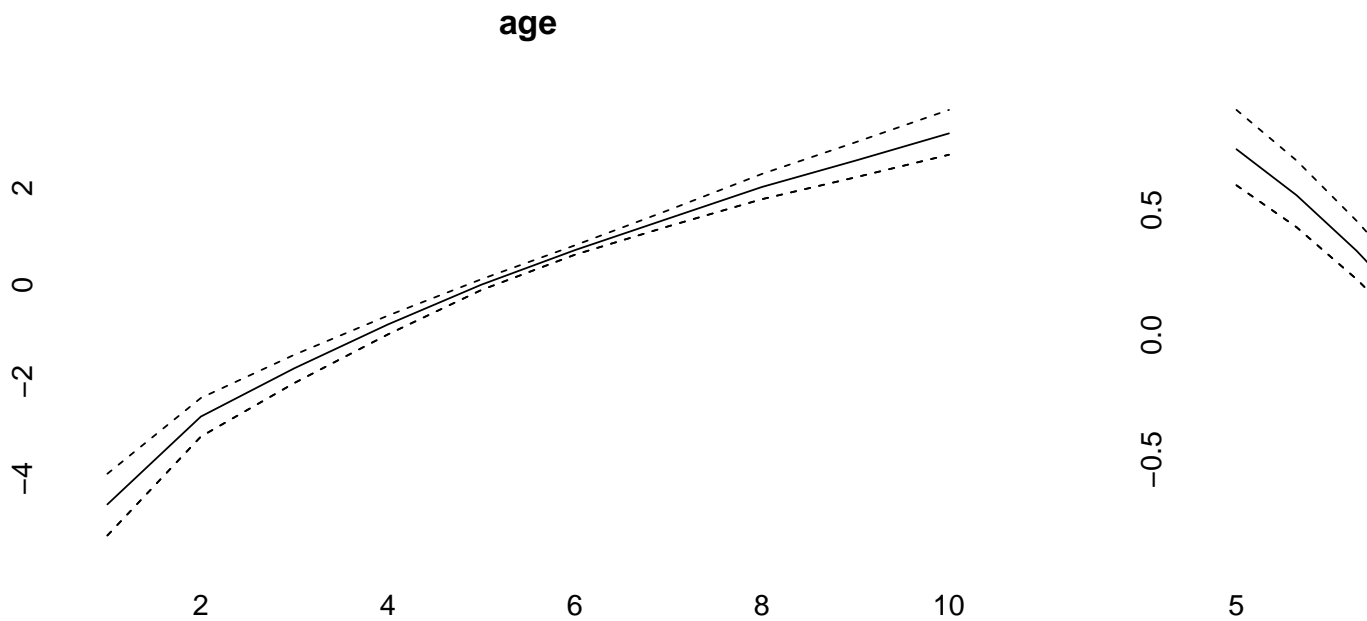
cohort


```
effects<-effects(simmod)
effects2<-effects(simmod, mean=TRUE)
#par(mfrow=c(3,1))
plot(age, type="l")
lines(effects$age, col="blue")
lines(effects2$age, col="green")
```

```
plot(period, type="l")
lines(effects$period, col="blue")
lines(effects2$period, col="green")
```

```
plot(cohort, type="l")
lines(effects$cohort, col="blue")
lines(effects2$cohort, col="green")
```



```
prediction<-predict_apc(simmod, periods=5, population=array(1e6,c(20,10)))
```
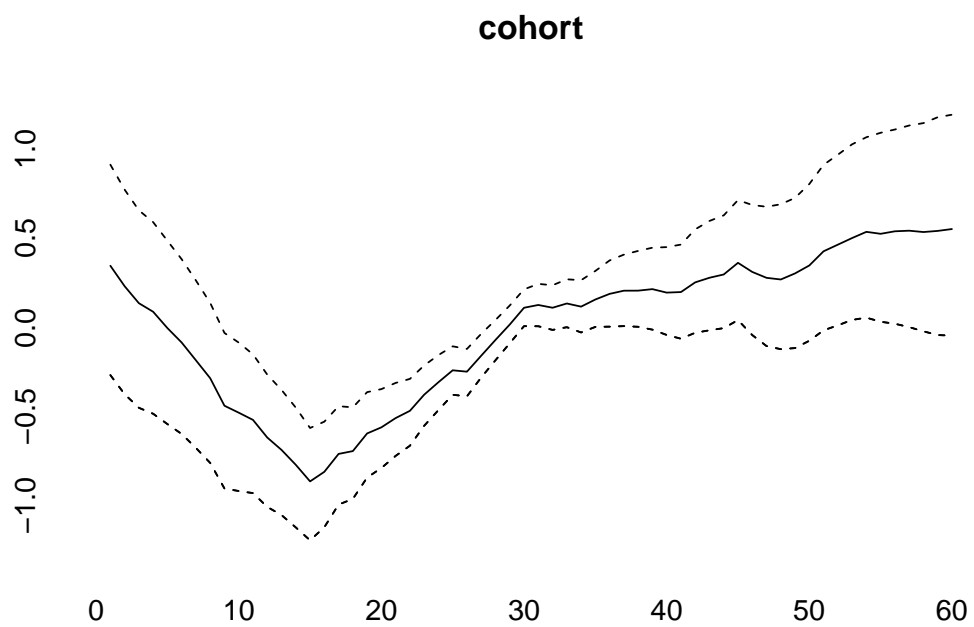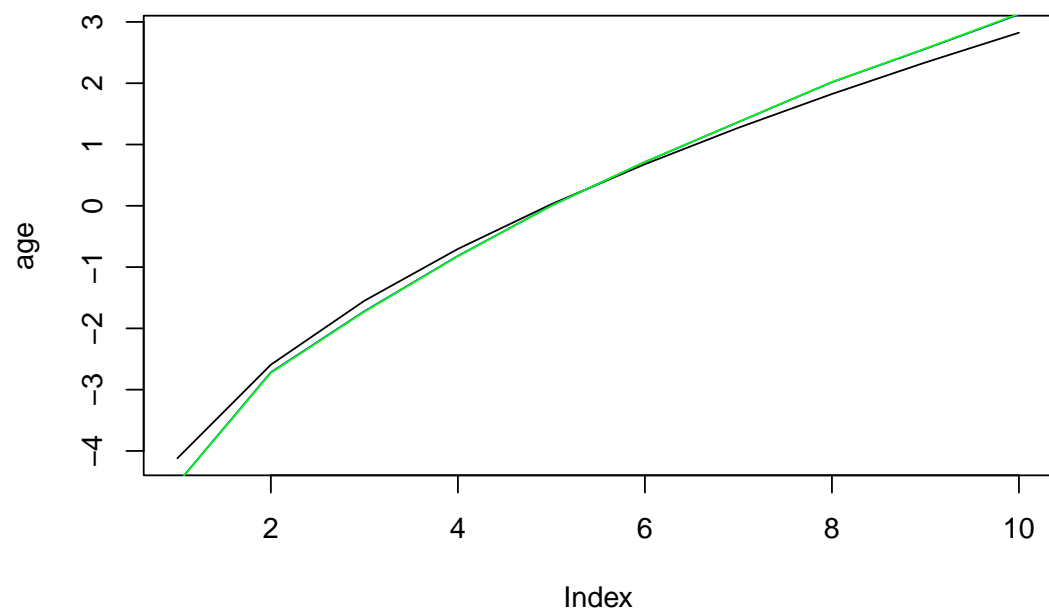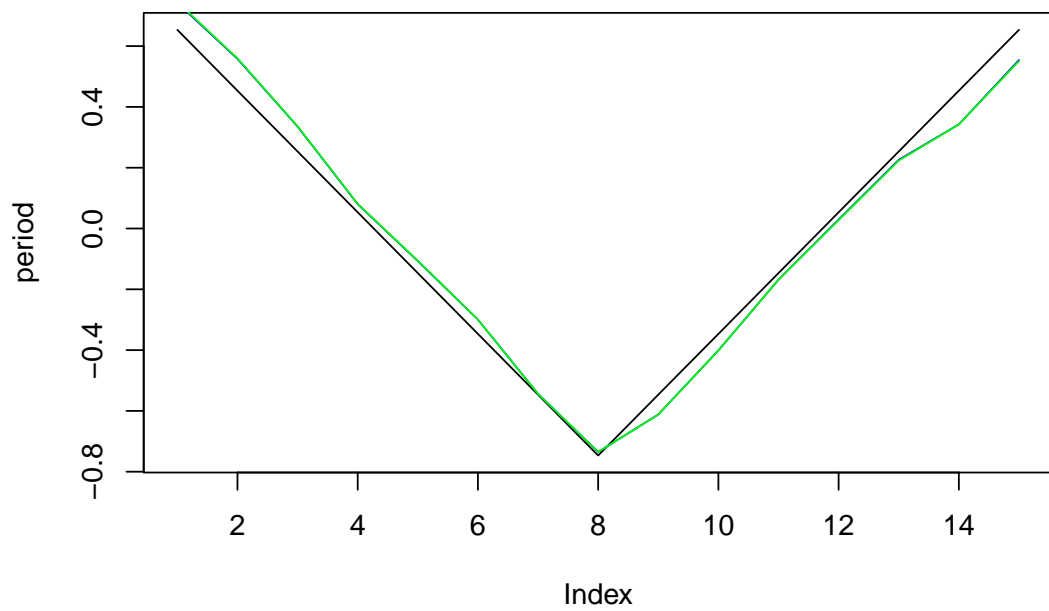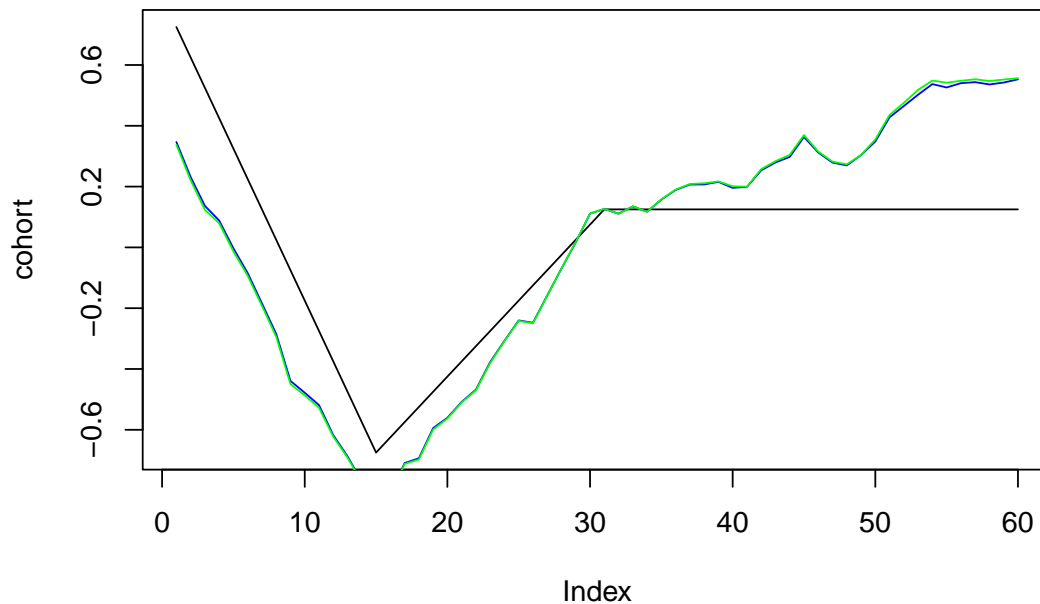
```
plot(prediction$cases_period[2,], ylim=range(prediction$cases_period),ylab="",pch=19)
points(prediction$cases_period[1,],pch="-",cex=2)
```

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points(prediction$cases_period[3,],pch="-",cex=2)
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```
## Warning in plot.xy(xy.coords(x, y), type = type, ...): conversion failure on '-' in 'mbcsToSbcs': do
## substituted for <80>
```

```
## Warning in plot.xy(xy.coords(x, y), type = type, ...): conversion failure on '-' in 'mbcsToSbcs': do
## substituted for <93>
```

```
## Warning in plot.xy(xy.coords(x, y), type = type, ...): font metrics unknown for Unicode character U+
```

```r
for (i in 1:20)lines(rep(i,3),prediction$cases_period[,i])
```
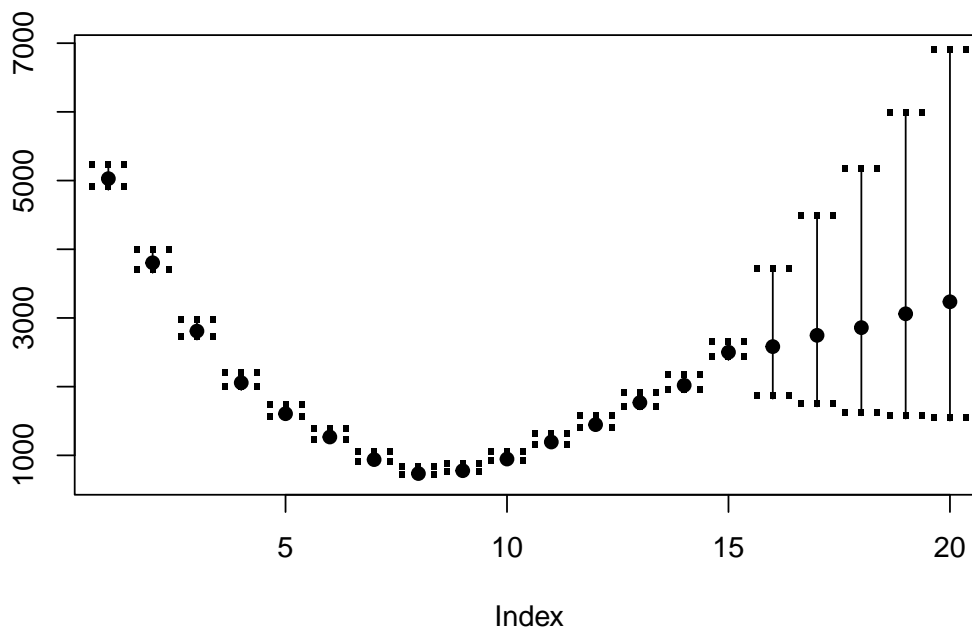


```r
plot(prediction$period[2,])
```

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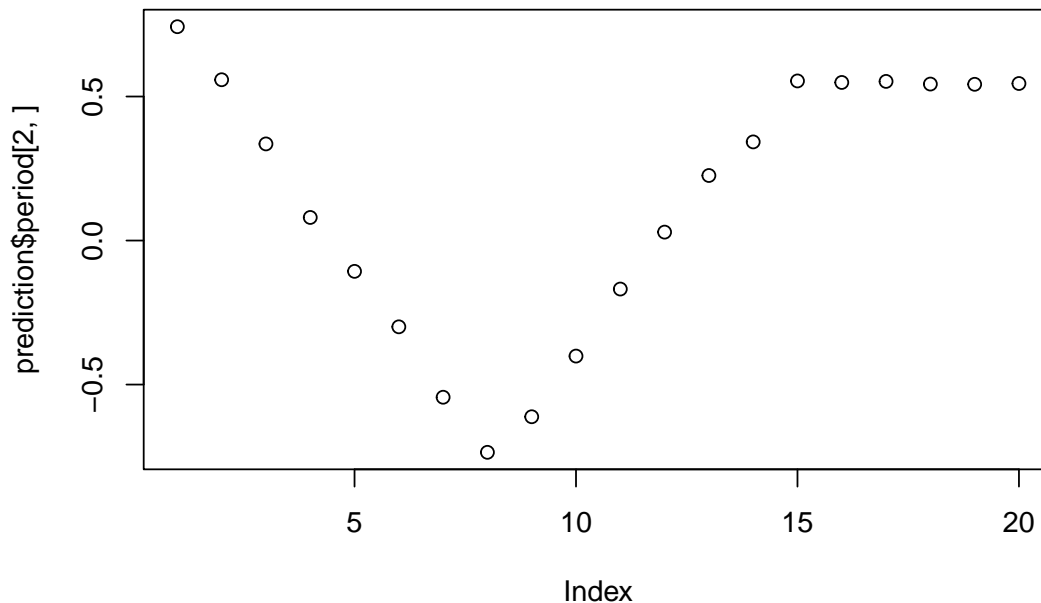
```r
cov_p<-rnorm(15,period,.1)
```

```r
simmod2 <- bamp(cases = simdata$cases, population = simdata$population, age = "rw1",
period = "rw1", cohort = "rw1", periods_per_agegroup =periods_per_agegroup,
period_covariate = cov_p)
```

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

```r
print(simmod2)
```

```
##
## WARNING! Markov Chains have apparently not converged! DO NOT TRUST THIS MODEL!
##
##   Model:
## age (rw1)  - period (rw1)  - cohort (rw1) model
## Deviance:     144.95
## pD:            49.58
## DIC:          194.53
##
##
##   Hyper parameters:                 5%           50%           95%
## age                            0.505         1.153         2.346
## period                        13.299        25.521        44.353
## cohort                        72.863       117.161       178.724
```

```r
checkConvergence(simmod2)
```

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

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

```
plot(simmod2)
```


age

cohort

period effect

5

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