Non-aggregated Intervention Analysis for Patient Satisfaction Scores

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```
library(readxl)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(CausalImpact)
```

```
## Loading required package: bsts
```

```
## Loading required package: BoomSpikeSlab
```

```
## Loading required package: Boom
```

```
## Loading required package: MASS
```

```
##
## Attaching package: 'MASS'
```

```
## The following object is masked from 'package:dplyr':
##
##     select
```

```
##
## Attaching package: 'Boom'
```

```
## The following object is masked from 'package:stats':
##
##     rWishart
```

```
##
## Attaching package: 'BoomSpikeSlab'
```

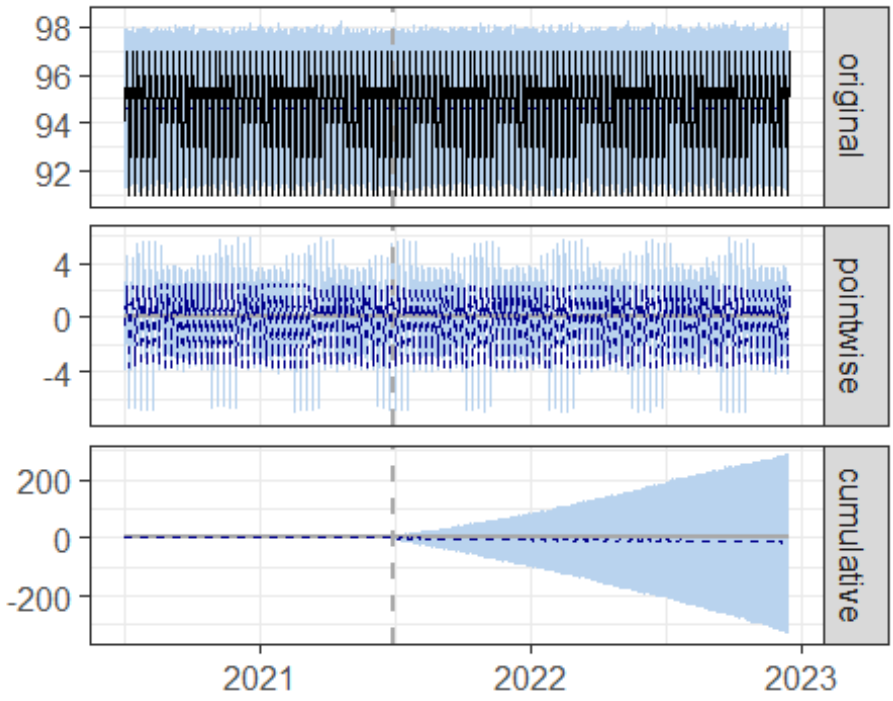
```
## The following object is masked from 'package:stats':
##
##     knots

## Loading required package: zoo

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

## Loading required package: xts

##
## Attaching package: 'xts'

## The following objects are masked from 'package:dplyr':
##
##     first, last

##
## Attaching package: 'bsts'

## The following object is masked from 'package:BoomSpikeSlab':
##
##     SuggestBurn

df<-read_excel("PatientSatisfactionScores.xlsx")
time.points=seq.Date(as.Date("2020-07-01"),by=1,length.out =900 )
prov1<-ts(df$`Provider 1`)
prov2<-ts(df$`Provider 2`)
prov3<-ts(df$`Provider 3`)
prov4<-ts(df$`Provider 4`)
prov5<-ts(df$`Provider 5`)
prov6<-ts(df$`Provider 6`)
prov7<-ts(df$`Provider 7`)
prov8<-ts(df$`Provider 8`)
prov9<-ts(df$`Provider 9`)
prov10<-ts(df$`Provider 10`)
prov11<-ts(df$`Provider 11`)
prov12<-ts(df$`Provider 12`)
prov13<-ts(df$`Provider 13`)
prov14<-ts(df$`Provider 14`)
prov15<-ts(df$`Provider 15`)
prov16<-ts(df$`Provider 16`)
prov17<-ts(df$`Provider 17`)
prov18<-ts(df$`Provider 18`)
prov19<-ts(df$`Provider 19`)
prov20<-ts(df$`Provider 20`)
prov21<-ts(df$`Provider 21`)
```

```
prov22<-ts(df$`Provider 22`)
prov23<-ts(df$`Provider 23`)
prov24<-ts(df$`Provider 24`)
prov25<-ts(df$`Provider 25`)
prov26<-ts(df$`Provider 26`)
prov27<-ts(df$`Provider 27`)
prov28<-ts(df$`Provider 28`)
prov29<-ts(df$`Provider 29`)
prov30<-ts(df$`Provider 30`)
prov31<-ts(df$`Provider 31`)
prov32<-ts(df$`Provider 32`)
prov33<-ts(df$`Provider 33`)
prov34<-ts(df$`Provider 34`)
prov35<-ts(df$`Provider 35`)
```

Non-aggregated intervention analysis (all 35 graphs and individual

reports)

```
data1 <- zoo(prov1, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data1, pre.period, post.period)
plot(impact)
```




```
summary(impact)
```

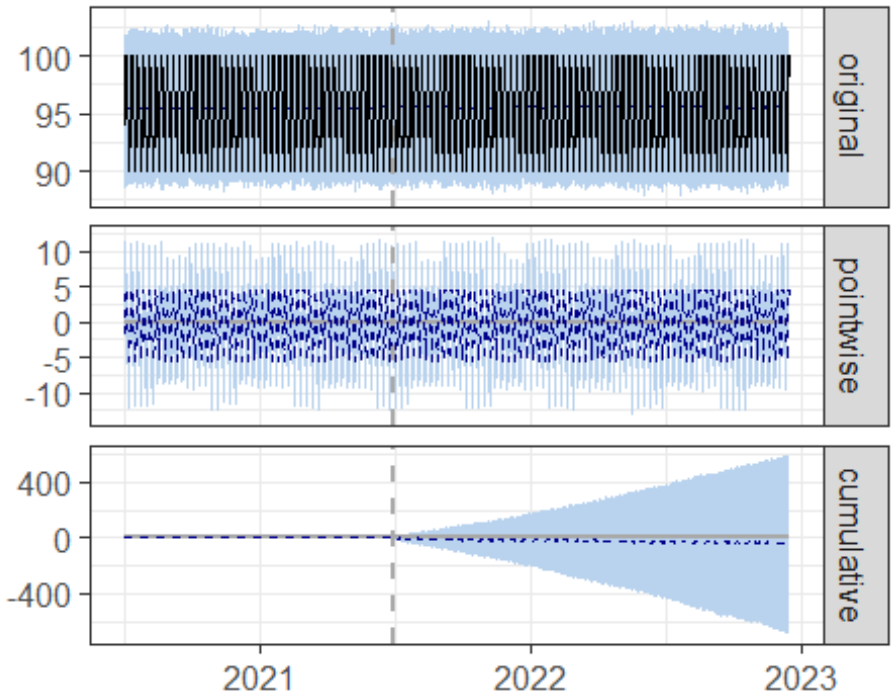
```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   95               50623
## Prediction (s.d.)        95 (0.3)         50635 (161.0)
## 95% CI                   [94, 95]         [50335, 50955]
##
## Absolute effect (s.d.)   -0.022 (0.3)     -11.838 (161.0)
## 95% CI                   [-0.62, 0.54]    [-331.57, 288.23]
##
## Relative effect (s.d.)   -0.023% (0.32%)  -0.023% (0.32%)
## 95% CI                   [-0.65%, 0.57%]  [-0.65%, 0.57%]
##
## Posterior tail-area probability p:   0.485
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 94.62. In the absence of an intervention, we would have
expected an average response of 94.64. The 95% interval of this
counterfactual prediction is [94.08, 95.24]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.022 with a 95%
interval of [-0.62, 0.54]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 50.62K. Had the intervention not taken place, we
would have expected a sum of 50.63K. The 95% interval of this prediction is
[50.33K, 50.95K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
```

```
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.485. This
means the effect may be spurious and would generally not be considered
statistically significant.
```

```
data2 <- zoo(prov2, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data2, pre.period, post.period)
plot(impact)
```




```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   95               51079
## Prediction (s.d.)        96 (0.63)        51112 (337.76)
## 95% CI                   [94, 97]         [50480, 51760]
##
## Absolute effect (s.d.)   -0.062 (0.63)    -33.293 (337.76)
## 95% CI                   [-1.3, 1.1]      [-681.1, 598.2]
##
## Relative effect (s.d.)   -0.065% (0.66%)  -0.065% (0.66%)
```

```
## 95% CI                   [-1.3%, 1.2%]     [-1.3%, 1.2%]
##
## Posterior tail-area probability p:   0.472
## Posterior prob. of a causal effect:  53%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

Analysis report {CausalImpact}

During the post-intervention period, the response variable had an average value of approx. 95.47. In the absence of an intervention, we would have expected an average response of 95.54. The 95% interval of this counterfactual prediction is [94.36, 96.75]. Subtracting this prediction from the observed response yields an estimate of the causal effect the intervention had on the response variable. This effect is -0.062 with a 95% interval of [-1.27, 1.12]. For a discussion of the significance of this effect, see below.

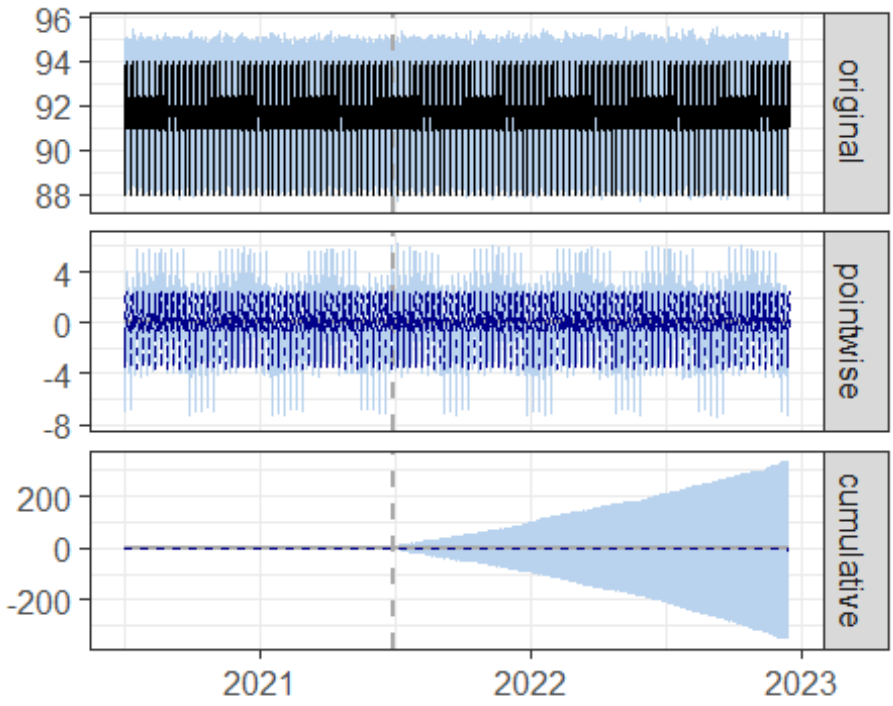
Summing up the individual data points during the post-intervention period (which can only sometimes be meaningfully interpreted), the response variable had an overall value of 51.08K. Had the intervention not taken place, we would have expected a sum of 51.11K. The 95% interval of this prediction is [50.48K, 51.76K].

The above results are given in terms of absolute numbers. In relative terms, the response variable showed a decrease of -0%. The 95% interval of this percentage is [-1%, +1%].

This means that, although it may look as though the intervention has exerted a negative effect on the response variable when considering the intervention period as a whole, this effect is not statistically significant, and so cannot be meaningfully interpreted. The apparent effect could be the result of random fluctuations that are unrelated to the intervention. This is often the case when the intervention period is very long and includes much of the time when the effect has already worn off. It can also be the case when the intervention period is too short to distinguish the signal from the noise. Finally, failing to find a significant effect can happen when there are not enough control variables or when these variables do not correlate well with the response variable during the learning period.

The probability of obtaining this effect by chance is p = 0.472. This means the effect may be spurious and would generally not be considered statistically significant.

```
data3 <- zoo(prov3, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data3, pre.period, post.period)
plot(impact)
```



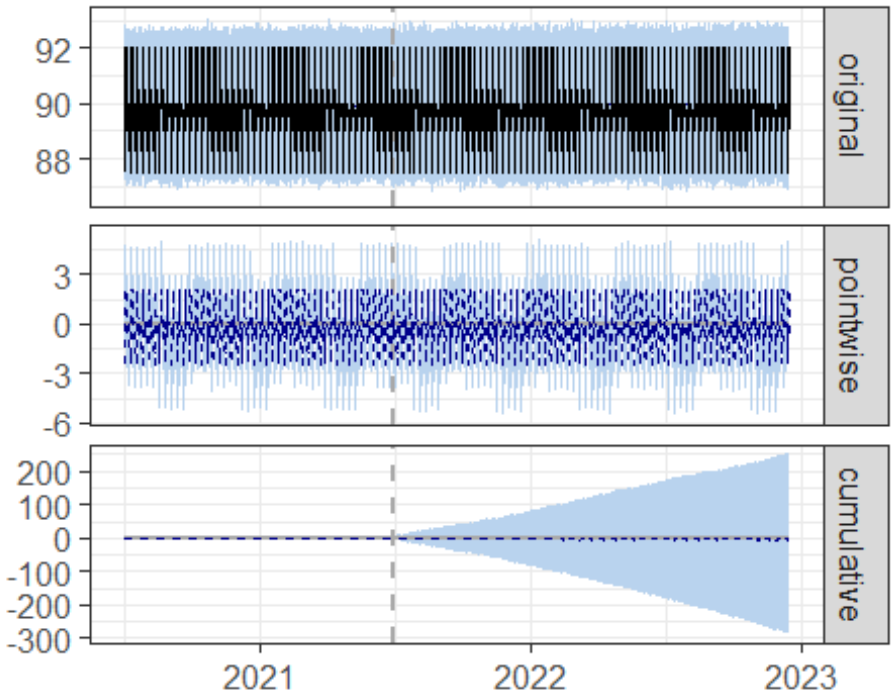

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   92                 49006
## Prediction (s.d.)        92 (0.33)          49009 (174.73)
## 95% CI                   [91, 92]           [48664, 49355]
##
## Absolute effect (s.d.)   -0.0068 (0.33)     -3.6359 (174.73)
## 95% CI                   [-0.65, 0.64]      [-349.63, 341.65]
##
## Relative effect (s.d.)   -0.0074% (0.36%)   -0.0074% (0.36%)
## 95% CI                   [-0.71%, 0.7%]     [-0.71%, 0.7%]
##
## Posterior tail-area probability p:   0.499
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 91.60. In the absence of an intervention, we would have
```

```
expected an average response of 91.61. The 95% interval of this
counterfactual prediction is [90.96, 92.25]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0068 with a 95%
interval of [-0.65, 0.64]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.01K. Had the intervention not taken place, we
would have expected a sum of 49.01K. The 95% interval of this prediction is
[48.66K, 49.36K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.499. This
means the effect may be spurious and would generally not be considered
statistically significant.

data4 <- zoo(prov4, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data4, pre.period, post.period)
plot(impact)
```



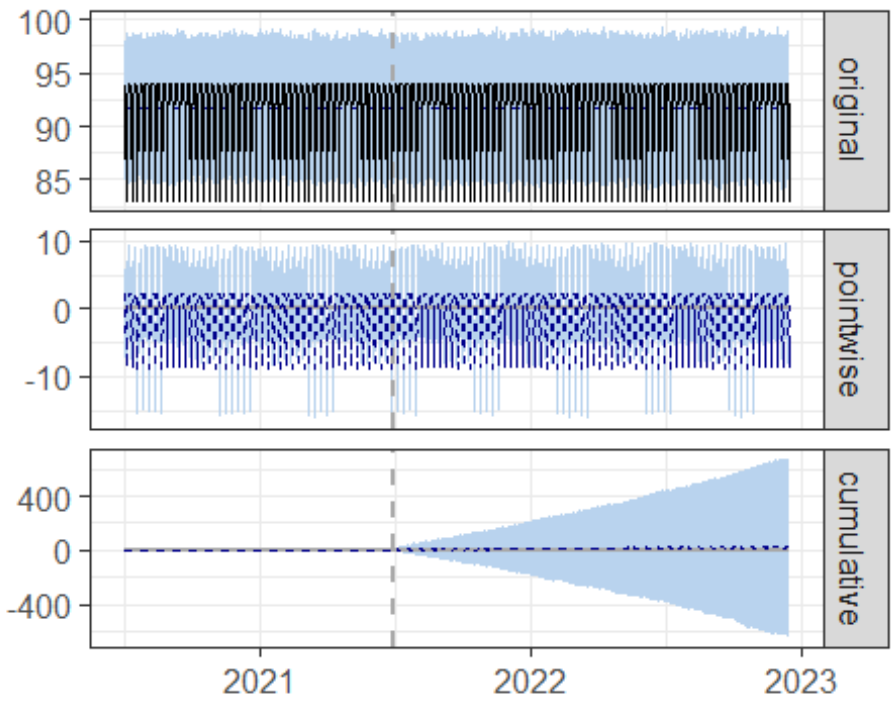

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   90                 48117
## Prediction (s.d.)        90 (0.27)          48120 (142.12)
## 95% CI                   [89, 90]           [47864, 48401]
##
## Absolute effect (s.d.)   -0.0069 (0.27)     -3.6831 (142.12)
## 95% CI                   [-0.53, 0.47]      [-284.26, 252.81]
##
## Relative effect (s.d.)   -0.0077% (0.3%)    -0.0077% (0.3%)
## 95% CI                   [-0.59%, 0.53%]    [-0.59%, 0.53%]
##
## Posterior tail-area probability p:   0.491
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 89.94. In the absence of an intervention, we would have
```

```
expected an average response of 89.94. The 95% interval of this
counterfactual prediction is [89.46, 90.47]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0069 with a 95%
interval of [-0.53, 0.47]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.12K. Had the intervention not taken place, we
would have expected a sum of 48.12K. The 95% interval of this prediction is
[47.86K, 48.40K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.491. This
means the effect may be spurious and would generally not be considered
statistically significant.

data5 <- zoo(prov5, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data5, pre.period, post.period)
plot(impact)
```




```
summary(impact)
```

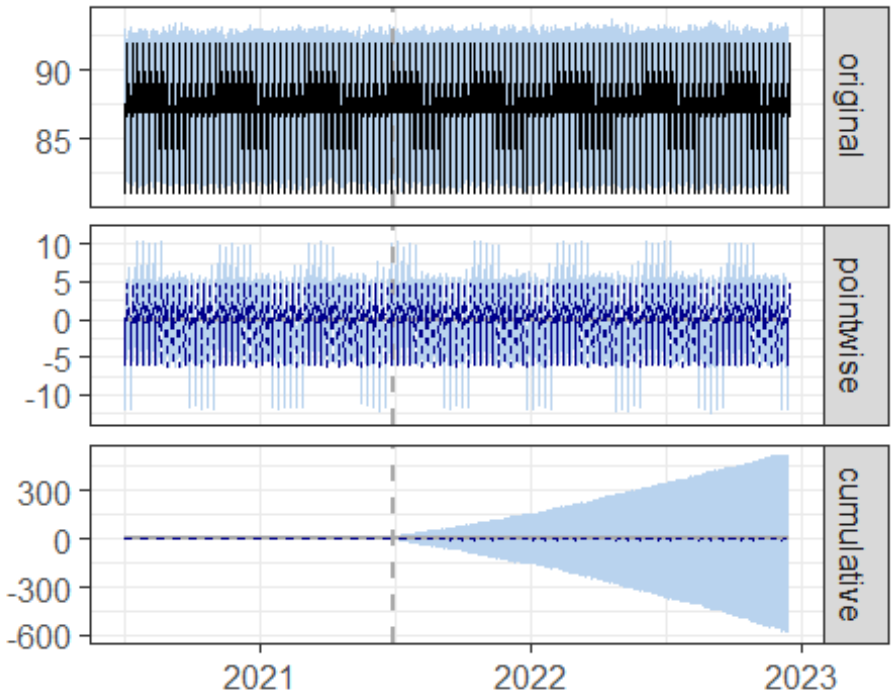
```
## Posterior inference {CausalImpact}
##
##                          Average         Cumulative
## Actual                   92              49073
## Prediction (s.d.)        92 (0.64)       49054 (344.75)
## 95% CI                   [90, 93]        [48398, 49721]
##
## Absolute effect (s.d.)   0.034 (0.64)    18.412 (344.75)
## 95% CI                   [-1.2, 1.3]     [-648.6, 674.5]
##
## Relative effect (s.d.)   0.038% (0.7%)   0.038% (0.7%)
## 95% CI                   [-1.3%, 1.4%]   [-1.3%, 1.4%]
##
## Posterior tail-area probability p:   0.479
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 91.72. In the absence of an intervention, we would have
```

```
expected an average response of 91.69. The 95% interval of this
counterfactual prediction is [90.46, 92.94]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.034 with a 95%
interval of [-1.21, 1.26]. For a discussion of the significance of this
effect, see below.


Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.07K. Had the intervention not taken place, we
would have expected a sum of 49.05K. The 95% interval of this prediction is
[48.40K, 49.72K].


The above results are given in terms of absolute numbers. In relative terms,
the response variable showed an increase of +0%. The 95% interval of this
percentage is [-1%, +1%].


This means that, although the intervention appears to have caused a positive
effect, this effect is not statistically significant when considering the
entire post-intervention period as a whole. Individual days or shorter
stretches within the intervention period may of course still have had a
significant effect, as indicated whenever the lower limit of the impact time
series (lower plot) was above zero. The apparent effect could be the result
of random fluctuations that are unrelated to the intervention. This is often
the case when the intervention period is very long and includes much of the
time when the effect has already worn off. It can also be the case when the
intervention period is too short to distinguish the signal from the noise.
Finally, failing to find a significant effect can happen when there are not
enough control variables or when these variables do not correlate well with
the response variable during the learning period.


The probability of obtaining this effect by chance is p = 0.479. This means
the effect may be spurious and would generally not be considered
statistically significant.
```

```r
data6 <- zoo(prov6, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data6, pre.period, post.period)
plot(impact)
```



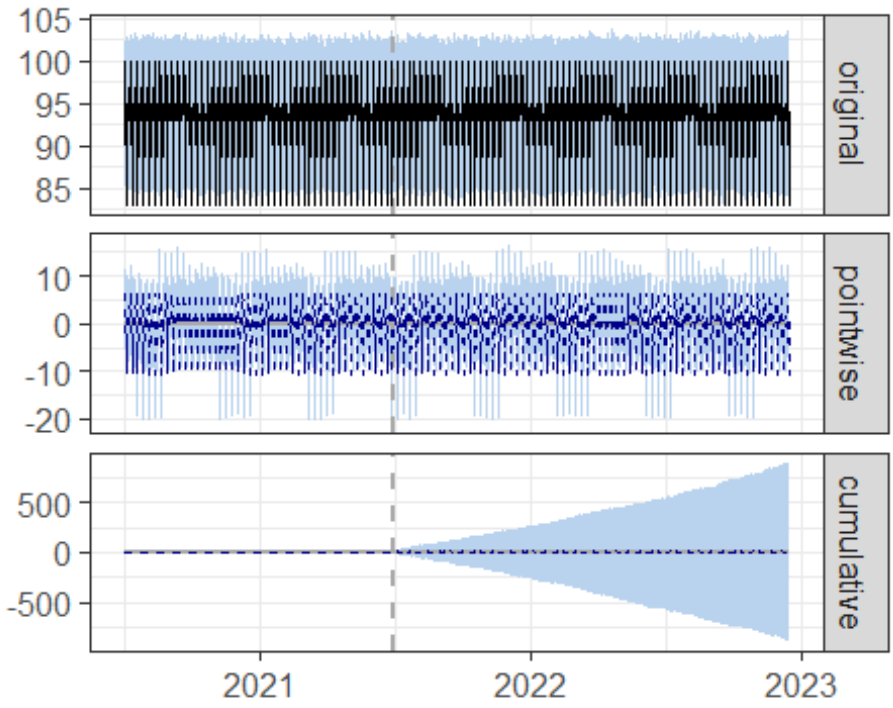

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   87                 46713
## Prediction (s.d.)        87 (0.53)          46717 (284.58)
## 95% CI                   [86, 88]           [46185, 47300]
##
## Absolute effect (s.d.)   -0.0081 (0.53)     -4.3217 (284.58)
## 95% CI                   [-1.1, 0.99]       [-587.8, 527.69]
##
## Relative effect (s.d.)   -0.0093% (0.61%)   -0.0093% (0.61%)
## 95% CI                   [-1.3%, 1.1%]      [-1.3%, 1.1%]
##
## Posterior tail-area probability p:   0.491
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 87.31. In the absence of an intervention, we would have
```

```
expected an average response of 87.32. The 95% interval of this
counterfactual prediction is [86.33, 88.41]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0081 with a 95%
interval of [-1.10, 0.99]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 46.71K. Had the intervention not taken place, we
would have expected a sum of 46.72K. The 95% interval of this prediction is
[46.18K, 47.30K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.491. This
means the effect may be spurious and would generally not be considered
statistically significant.

data7 <- zoo(prov7, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data7, pre.period, post.period)
plot(impact)
```



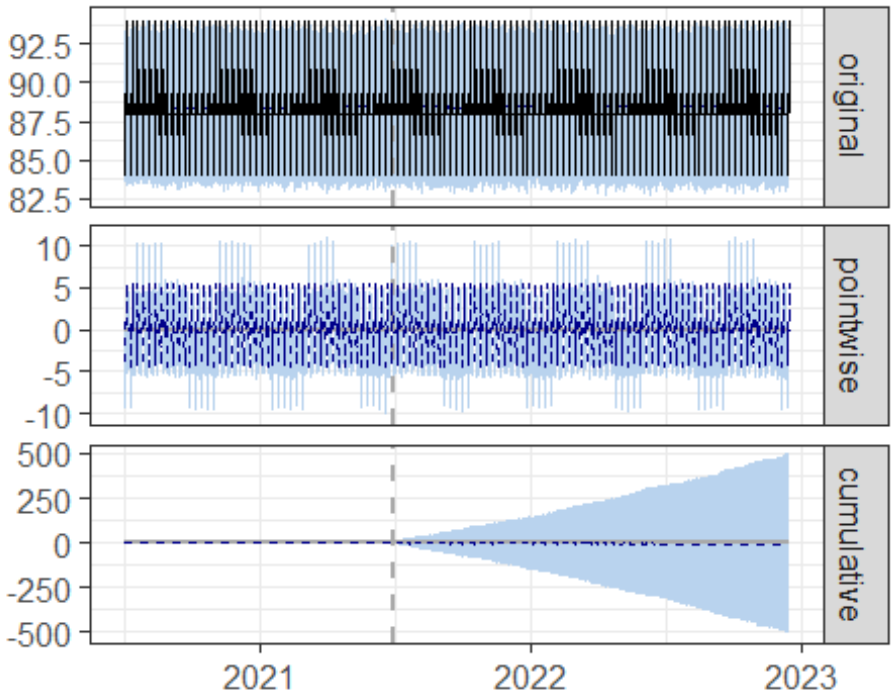

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   94                 50088
## Prediction (s.d.)        94 (0.85)          50089 (457.41)
## 95% CI                   [92, 95]           [49190, 50983]
##
## Absolute effect (s.d.)   -0.0017 (0.85)     -0.9076 (457.41)
## 95% CI                   [-1.7, 1.7]        [-894.9, 898.0]
##
## Relative effect (s.d.)   -0.0018% (0.91%)   -0.0018% (0.91%)
## 95% CI                   [-1.8%, 1.8%]      [-1.8%, 1.8%]
##
## Posterior tail-area probability p:   0.486
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 93.62. In the absence of an intervention, we would have
```

```
expected an average response of 93.62. The 95% interval of this
counterfactual prediction is [91.94, 95.30]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0017 with a 95%
interval of [-1.67, 1.68]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 50.09K. Had the intervention not taken place, we
would have expected a sum of 50.09K. The 95% interval of this prediction is
[49.19K, 50.98K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-2%, +2%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.486. This
means the effect may be spurious and would generally not be considered
statistically significant.

data8 <- zoo(prov8, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data8, pre.period, post.period)
plot(impact)
```



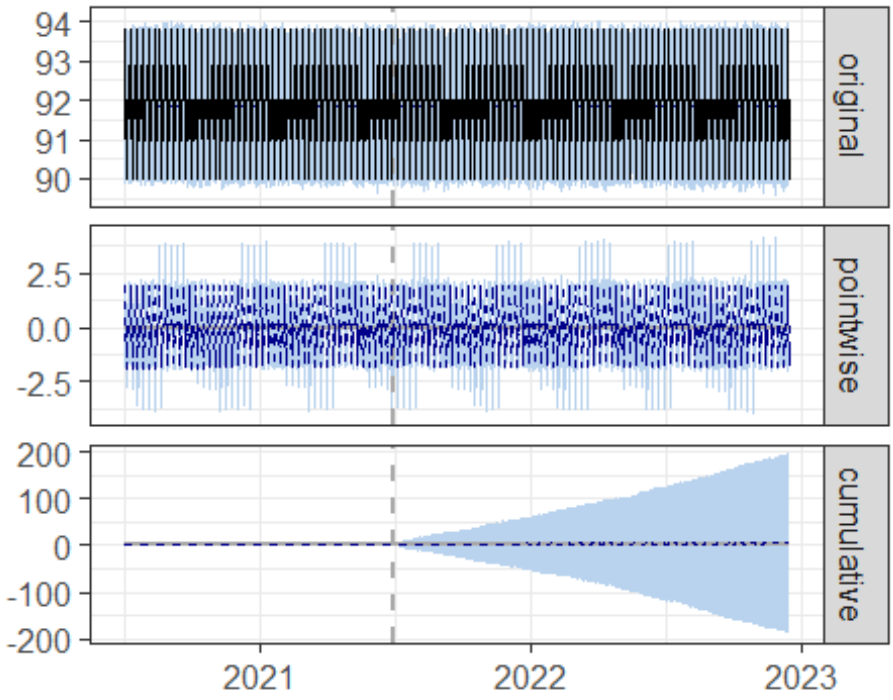

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   88                 47301
## Prediction (s.d.)        88 (0.48)          47308 (256.33)
## 95% CI                   [87, 89]           [46802, 47807]
##
## Absolute effect (s.d.)   -0.012 (0.48)      -6.433 (256.33)
## 95% CI                   [-0.95, 0.93]      [-505.66, 499.13]
##
## Relative effect (s.d.)   -0.014% (0.54%)    -0.014% (0.54%)
## 95% CI                   [-1.1%, 1.1%]      [-1.1%, 1.1%]
##
## Posterior tail-area probability p:   0.498
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 88.41. In the absence of an intervention, we would have
```

```
expected an average response of 88.43. The 95% interval of this
counterfactual prediction is [87.48, 89.36]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.012 with a 95%
interval of [-0.95, 0.93]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 47.30K. Had the intervention not taken place, we
would have expected a sum of 47.31K. The 95% interval of this prediction is
[46.80K, 47.81K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.498. This
means the effect may be spurious and would generally not be considered
statistically significant.

data9 <- zoo(prov9, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data9, pre.period, post.period)
plot(impact)
```



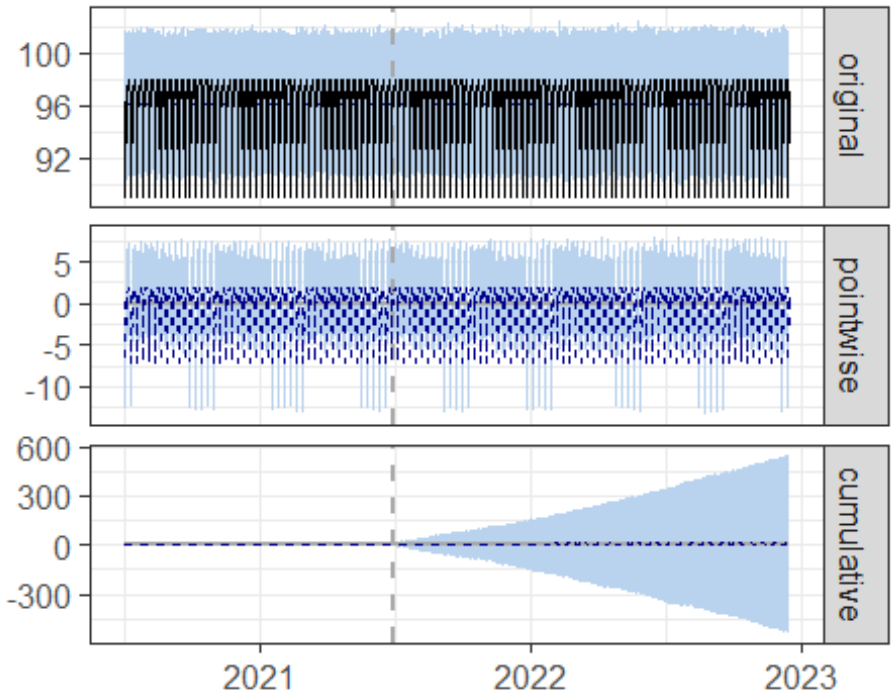

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   92               49141
## Prediction (s.d.)        92 (0.19)        49136 (100.26)
## 95% CI                   [91, 92]         [48945, 49330]
##
## Absolute effect (s.d.)   0.0089 (0.19)    4.7871 (100.26)
## 95% CI                   [-0.35, 0.37]    [-189.41, 195.72]
##
## Relative effect (s.d.)   0.0097% (0.2%)   0.0097% (0.2%)
## 95% CI                   [-0.39%, 0.4%]   [-0.39%, 0.4%]
##
## Posterior tail-area probability p:   0.471
## Posterior prob. of a causal effect:  53%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 91.85. In the absence of an intervention, we would have
```

```
expected an average response of 91.84. The 95% interval of this
counterfactual prediction is [91.49, 92.21]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.0089 with a 95%
interval of [-0.35, 0.37]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.14K. Had the intervention not taken place, we
would have expected a sum of 49.14K. The 95% interval of this prediction is
[48.94K, 49.33K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-0%, +0%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.471. This
means the effect may be spurious and would generally not be considered
statistically significant.

data10 <- zoo(prov10, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data10, pre.period, post.period)
plot(impact)
```



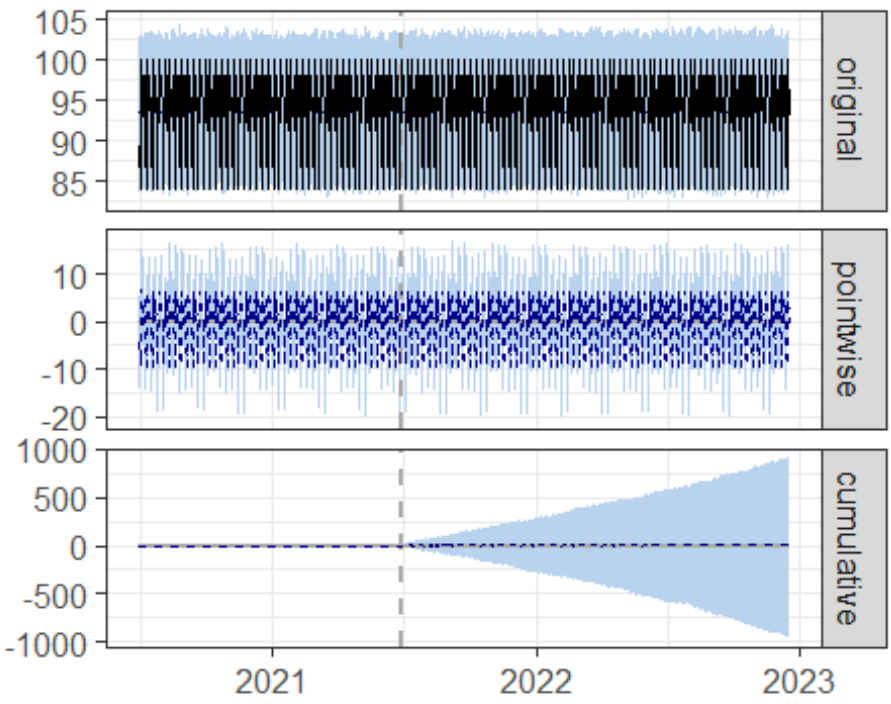

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   96               51446
## Prediction (s.d.)        96 (0.52)        51439 (280.29)
## 95% CI                   [95, 97]         [50898, 51986]
##
## Absolute effect (s.d.)   0.014 (0.52)     7.383 (280.29)
## 95% CI                   [-1, 1]          [-540, 548]
##
## Relative effect (s.d.)   0.014% (0.54%)   0.014% (0.54%)
## 95% CI                   [-1%, 1.1%]      [-1%, 1.1%]
##
## Posterior tail-area probability p:   0.483
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 96.16. In the absence of an intervention, we would have
```

```
expected an average response of 96.15. The 95% interval of this
counterfactual prediction is [95.14, 97.17]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.014 with a 95%
interval of [-1.01, 1.03]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 51.45K. Had the intervention not taken place, we
would have expected a sum of 51.44K. The 95% interval of this prediction is
[50.90K, 51.99K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.483. This
means the effect may be spurious and would generally not be considered
statistically significant.

data11 <- zoo(prov11, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data11, pre.period, post.period)
plot(impact)
```



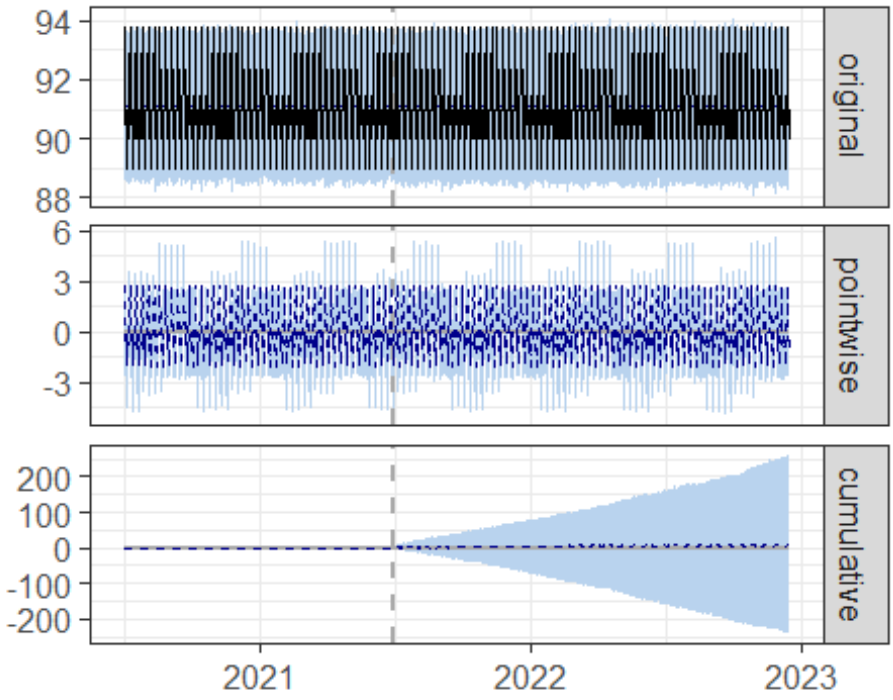

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   94               50109
## Prediction (s.d.)        94 (0.9)         50098 (483.4)
## 95% CI                   [92, 95]         [49196, 51064]
##
## Absolute effect (s.d.)   0.021 (0.9)      11.194 (483.4)
## 95% CI                   [-1.8, 1.7]      [-955.3, 913.4]
##
## Relative effect (s.d.)   0.022% (0.96%)   0.022% (0.96%)
## 95% CI                   [-1.9%, 1.8%]    [-1.9%, 1.8%]
##
## Posterior tail-area probability p:   0.492
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 93.66. In the absence of an intervention, we would have
```

```
expected an average response of 93.64. The 95% interval of this
counterfactual prediction is [91.95, 95.45]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.021 with a 95%
interval of [-1.79, 1.71]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 50.11K. Had the intervention not taken place, we
would have expected a sum of 50.10K. The 95% interval of this prediction is
[49.20K, 51.06K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-2%, +2%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.492. This
means the effect may be spurious and would generally not be considered
statistically significant.

data12 <- zoo(prov12, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data12, pre.period, post.period)
plot(impact)
```



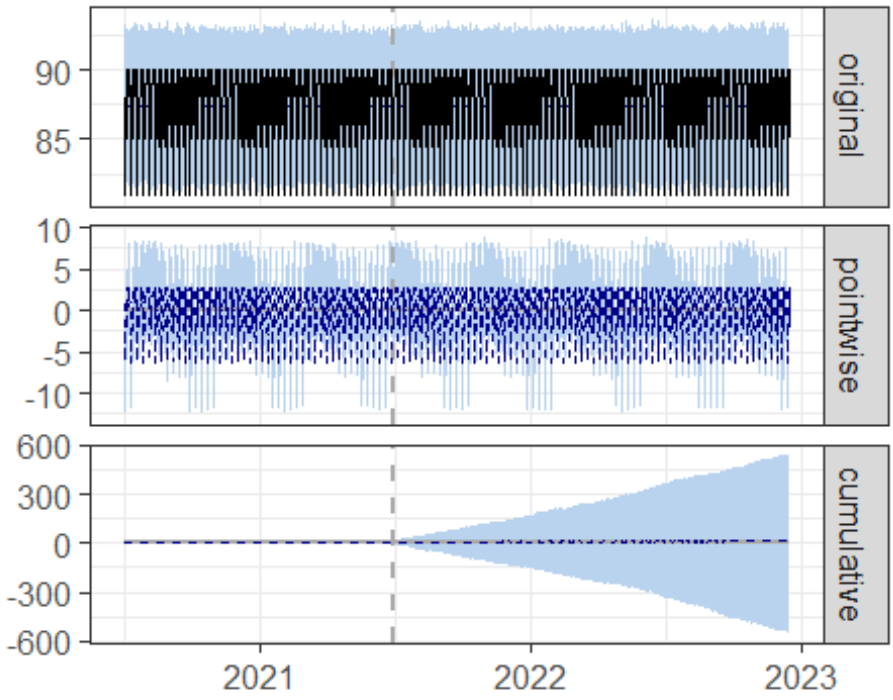

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   91               48741
## Prediction (s.d.)        91 (0.24)        48732 (129.73)
## 95% CI                   [91, 92]         [48476, 48977]
##
## Absolute effect (s.d.)   0.016 (0.24)     8.481 (129.73)
## 95% CI                   [-0.44, 0.49]    [-236.86, 264.74]
##
## Relative effect (s.d.)   0.017% (0.27%)   0.017% (0.27%)
## 95% CI                   [-0.49%, 0.54%]  [-0.49%, 0.54%]
##
## Posterior tail-area probability p:   0.466
## Posterior prob. of a causal effect:  53%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 91.10. In the absence of an intervention, we would have
```

```
expected an average response of 91.09. The 95% interval of this
counterfactual prediction is [90.61, 91.55]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.016 with a 95%
interval of [-0.44, 0.49]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.74K. Had the intervention not taken place, we
would have expected a sum of 48.73K. The 95% interval of this prediction is
[48.48K, 48.98K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-0%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.466. This
means the effect may be spurious and would generally not be considered
statistically significant.

data13 <- zoo(prov13, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data13, pre.period, post.period)
plot(impact)
```



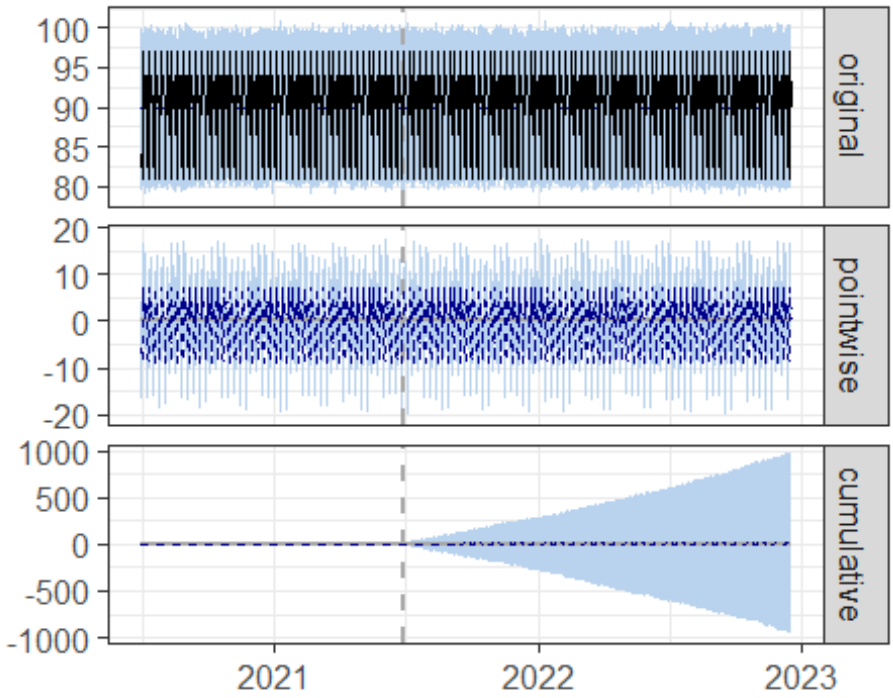

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   87               46746
## Prediction (s.d.)        87 (0.53)        46733 (282.74)
## 95% CI                   [86, 88]         [46196, 47302]
##
## Absolute effect (s.d.)   0.025 (0.53)     13.295 (282.74)
## 95% CI                   [-1, 1]          [-556, 550]
##
## Relative effect (s.d.)   0.028% (0.61%)   0.028% (0.61%)
## 95% CI                   [-1.2%, 1.2%]    [-1.2%, 1.2%]
##
## Posterior tail-area probability p:   0.483
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 87.38. In the absence of an intervention, we would have
```

```
expected an average response of 87.35. The 95% interval of this
counterfactual prediction is [86.35, 88.41]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.025 with a 95%
interval of [-1.04, 1.03]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 46.75K. Had the intervention not taken place, we
would have expected a sum of 46.73K. The 95% interval of this prediction is
[46.20K, 47.30K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.483. This
means the effect may be spurious and would generally not be considered
statistically significant.

data14 <- zoo(prov14, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data14, pre.period, post.period)
plot(impact)
```



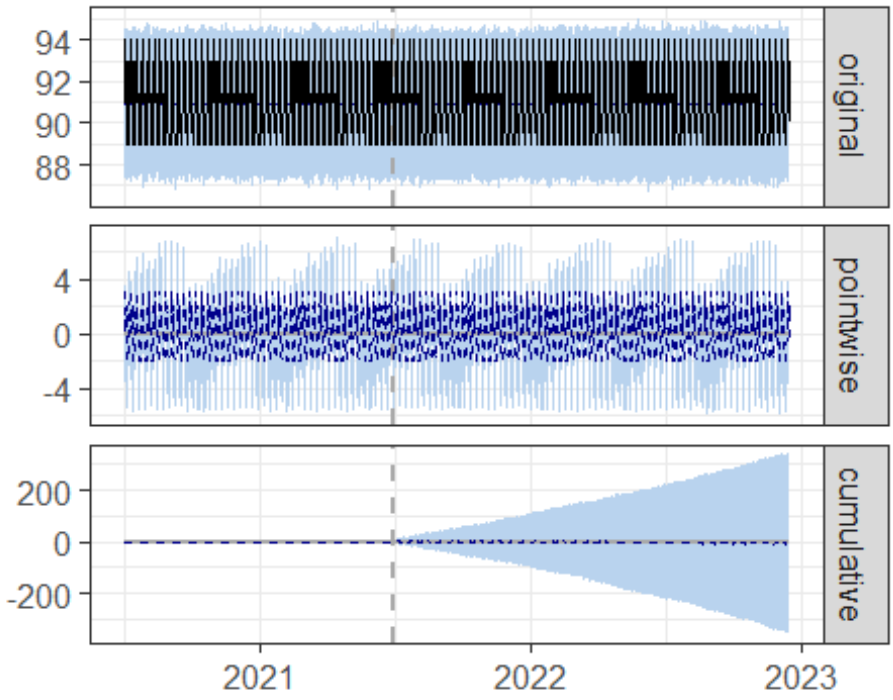

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average         Cumulative
## Actual                   90              48149
## Prediction (s.d.)        90 (0.92)       48144 (492.84)
## 95% CI                   [88, 92]        [47175, 49108]
##
## Absolute effect (s.d.)   0.0087 (0.92)   4.6612 (492.84)
## 95% CI                   [-1.8, 1.8]     [-958.6, 974.1]
##
## Relative effect (s.d.)   0.0097% (1%)    0.0097% (1%)
## 95% CI                   [-2%, 2%]       [-2%, 2%]
##
## Posterior tail-area probability p:   0.485
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 90.00. In the absence of an intervention, we would have
```

```
expected an average response of 89.99. The 95% interval of this
counterfactual prediction is [88.18, 91.79]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.0087 with a 95%
interval of [-1.79, 1.82]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.15K. Had the intervention not taken place, we
would have expected a sum of 48.14K. The 95% interval of this prediction is
[47.17K, 49.11K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-2%, +2%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.485. This
means the effect may be spurious and would generally not be considered
statistically significant.

data15 <- zoo(prov15, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data15, pre.period, post.period)
plot(impact)
```



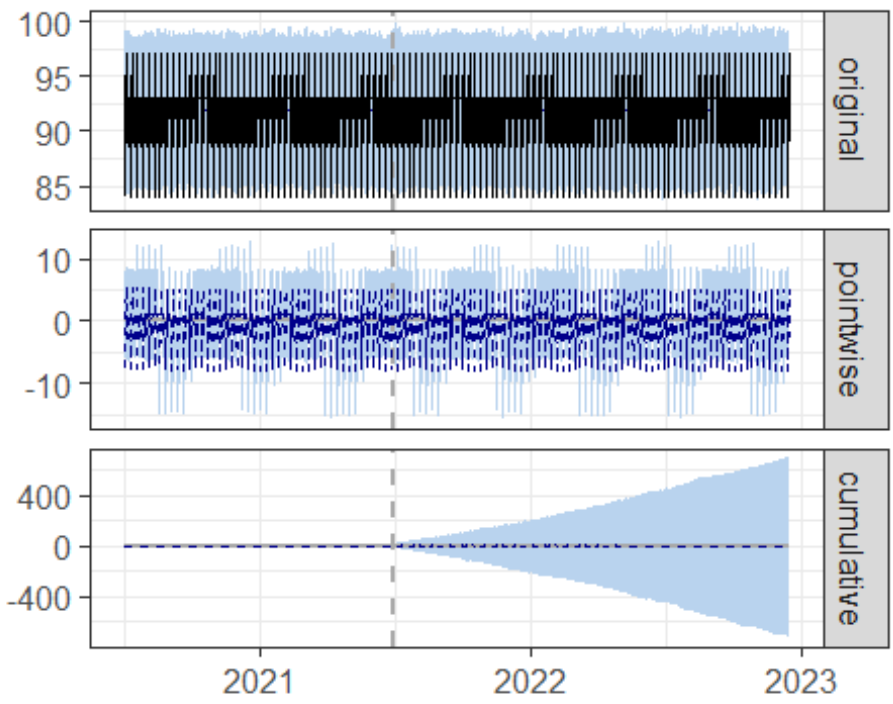

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   91                 48620
## Prediction (s.d.)        91 (0.34)          48622 (182.75)
## 95% CI                   [90, 92]           [48278, 48978]
##
## Absolute effect (s.d.)   -0.0046 (0.34)     -2.4494 (182.75)
## 95% CI                   [-0.67, 0.64]      [-357.51, 341.91]
##
## Relative effect (s.d.)   -0.005% (0.38%)    -0.005% (0.38%)
## 95% CI                   [-0.74%, 0.7%]     [-0.74%, 0.7%]
##
## Posterior tail-area probability p:   0.497
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 90.88. In the absence of an intervention, we would have
```

```
expected an average response of 90.88. The 95% interval of this
counterfactual prediction is [90.24, 91.55]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0046 with a 95%
interval of [-0.67, 0.64]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.62K. Had the intervention not taken place, we
would have expected a sum of 48.62K. The 95% interval of this prediction is
[48.28K, 48.98K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.497. This
means the effect may be spurious and would generally not be considered
statistically significant.

data16 <- zoo(prov16, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data16, pre.period, post.period)
plot(impact)
```



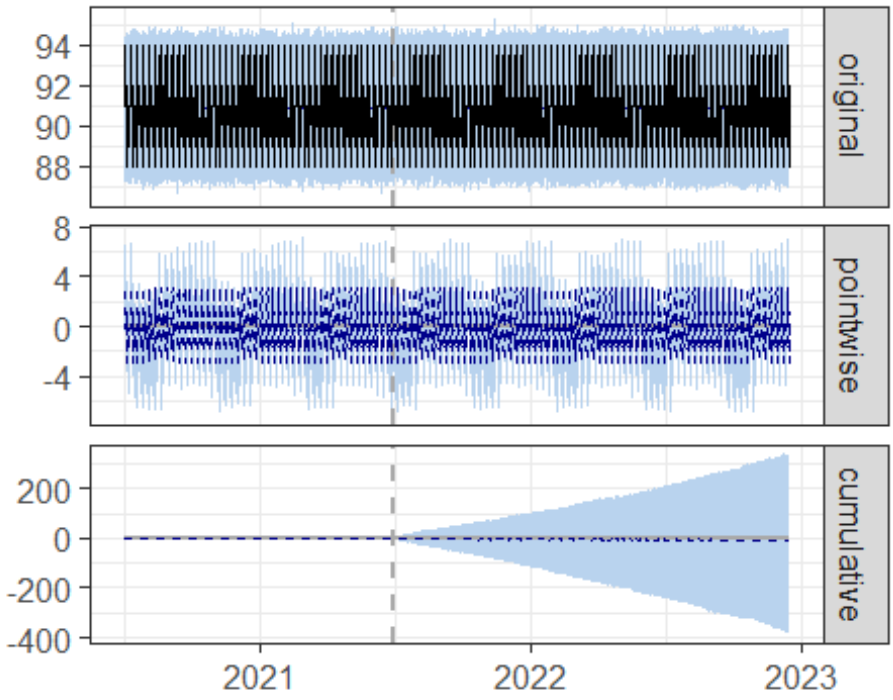

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   92                 49152
## Prediction (s.d.)        92 (0.68)          49154 (361.70)
## 95% CI                   [91, 93]           [48457, 49874]
##
## Absolute effect (s.d.)   -0.0031 (0.68)     -1.6839 (361.70)
## 95% CI                   [-1.4, 1.3]        [-722.3, 695.1]
##
## Relative effect (s.d.)   -0.0034% (0.74%)   -0.0034% (0.74%)
## 95% CI                   [-1.5%, 1.4%]      [-1.5%, 1.4%]
##
## Posterior tail-area probability p:   0.5
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 91.87. In the absence of an intervention, we would have
```

```
expected an average response of 91.88. The 95% interval of this
counterfactual prediction is [90.57, 93.22]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0031 with a 95%
interval of [-1.35, 1.30]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.15K. Had the intervention not taken place, we
would have expected a sum of 49.15K. The 95% interval of this prediction is
[48.46K, 49.87K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.5. This means
the effect may be spurious and would generally not be considered
statistically significant.

data17 <- zoo(prov17, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data17, pre.period, post.period)
plot(impact)
```



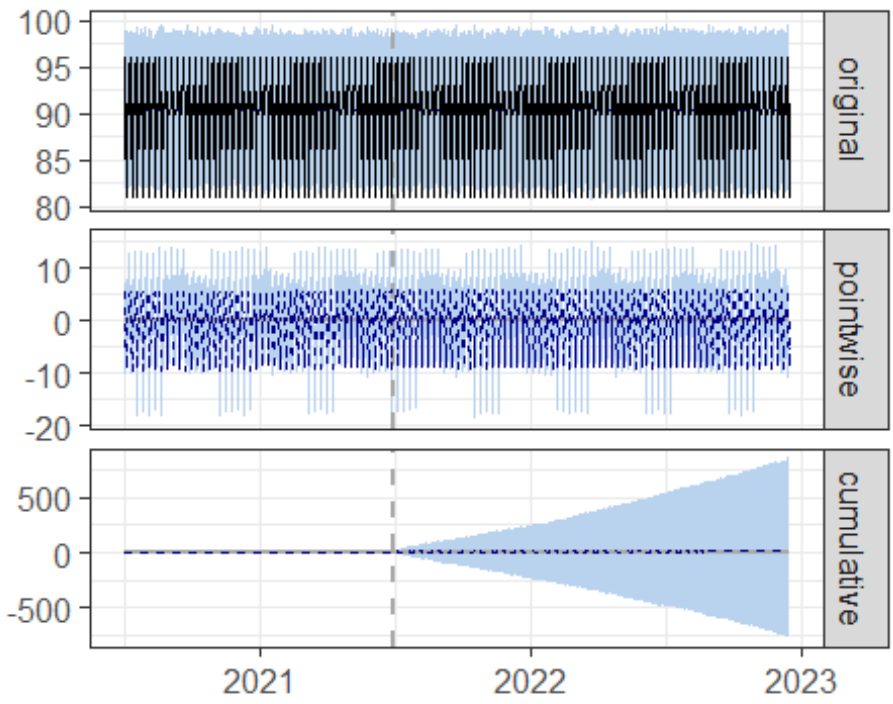

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   91                 48618
## Prediction (s.d.)        91 (0.35)          48626 (188.80)
## 95% CI                   [90, 92]           [48278, 49002]
##
## Absolute effect (s.d.)   -0.015 (0.35)      -8.072 (188.80)
## 95% CI                   [-0.72, 0.64]      [-384.32, 340.23]
##
## Relative effect (s.d.)   -0.017% (0.39%)    -0.017% (0.39%)
## 95% CI                   [-0.79%, 0.7%]     [-0.79%, 0.7%]
##
## Posterior tail-area probability p:   0.495
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 90.87. In the absence of an intervention, we would have
```

```
expected an average response of 90.89. The 95% interval of this
counterfactual prediction is [90.24, 91.59]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.015 with a 95%
interval of [-0.72, 0.64]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.62K. Had the intervention not taken place, we
would have expected a sum of 48.63K. The 95% interval of this prediction is
[48.28K, 49.00K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.495. This
means the effect may be spurious and would generally not be considered
statistically significant.

data18 <- zoo(prov18, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data18, pre.period, post.period)
plot(impact)
```



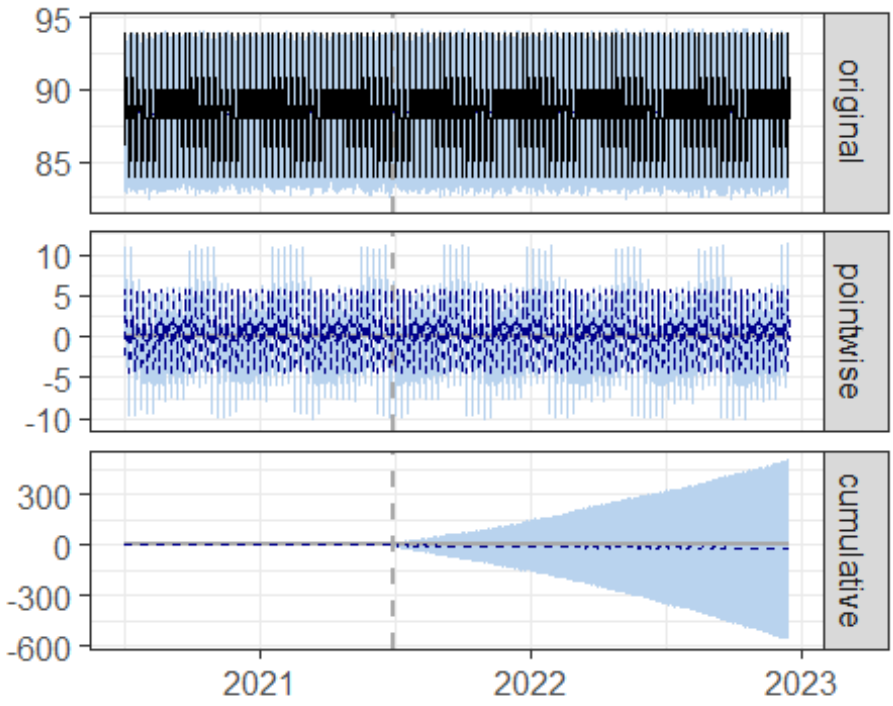

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   90               48351
## Prediction (s.d.)        90 (0.78)        48337 (419.73)
## 95% CI                   [89, 92]         [47492, 49123]
##
## Absolute effect (s.d.)   0.025 (0.78)     13.605 (419.73)
## 95% CI                   [-1.4, 1.6]      [-771.9, 858.7]
##
## Relative effect (s.d.)   0.028% (0.87%)   0.028% (0.87%)
## 95% CI                   [-1.6%, 1.8%]    [-1.6%, 1.8%]
##
## Posterior tail-area probability p:   0.493
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 90.38. In the absence of an intervention, we would have
```

```
expected an average response of 90.35. The 95% interval of this
counterfactual prediction is [88.77, 91.82]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.025 with a 95%
interval of [-1.44, 1.61]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.35K. Had the intervention not taken place, we
would have expected a sum of 48.34K. The 95% interval of this prediction is
[47.49K, 49.12K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-2%, +2%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.493. This
means the effect may be spurious and would generally not be considered
statistically significant.

data19 <- zoo(prov19, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data19, pre.period, post.period)
plot(impact)
```



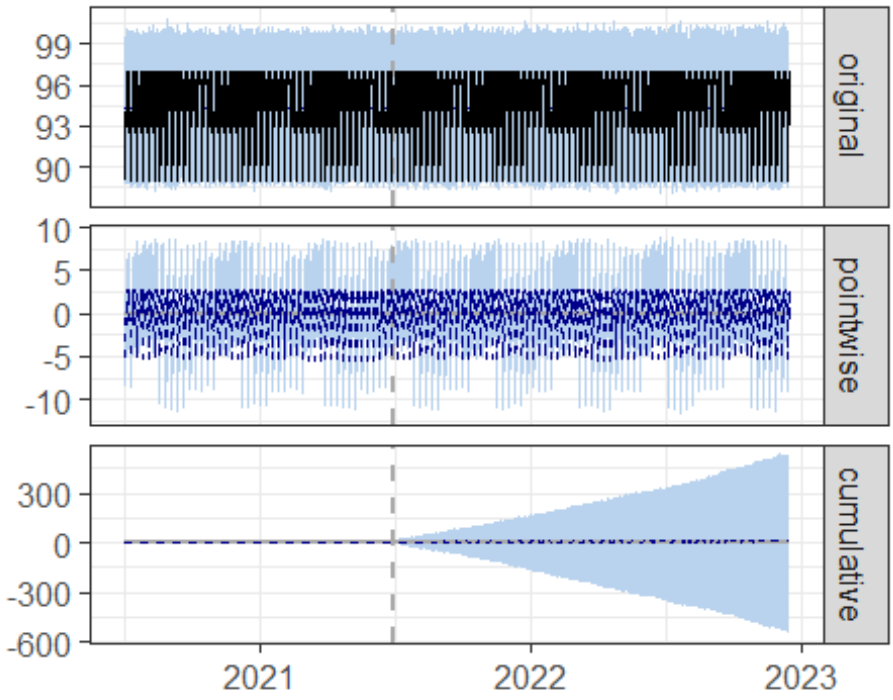

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   88                 47279
## Prediction (s.d.)        88 (0.51)          47297 (273.31)
## 95% CI                   [87, 89]           [46771, 47837]
##
## Absolute effect (s.d.)   -0.033 (0.51)      -17.779 (273.31)
## 95% CI                   [-1, 0.95]         [-558, 507.91]
##
## Relative effect (s.d.)   -0.038% (0.58%)    -0.038% (0.58%)
## 95% CI                   [-1.2%, 1.1%]      [-1.2%, 1.1%]
##
## Posterior tail-area probability p:   0.483
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 88.37. In the absence of an intervention, we would have
```

```
expected an average response of 88.41. The 95% interval of this
counterfactual prediction is [87.42, 89.42]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.033 with a 95%
interval of [-1.04, 0.95]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 47.28K. Had the intervention not taken place, we
would have expected a sum of 47.30K. The 95% interval of this prediction is
[46.77K, 47.84K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.483. This
means the effect may be spurious and would generally not be considered
statistically significant.

data20 <- zoo(prov20, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data20, pre.period, post.period)
plot(impact)
```



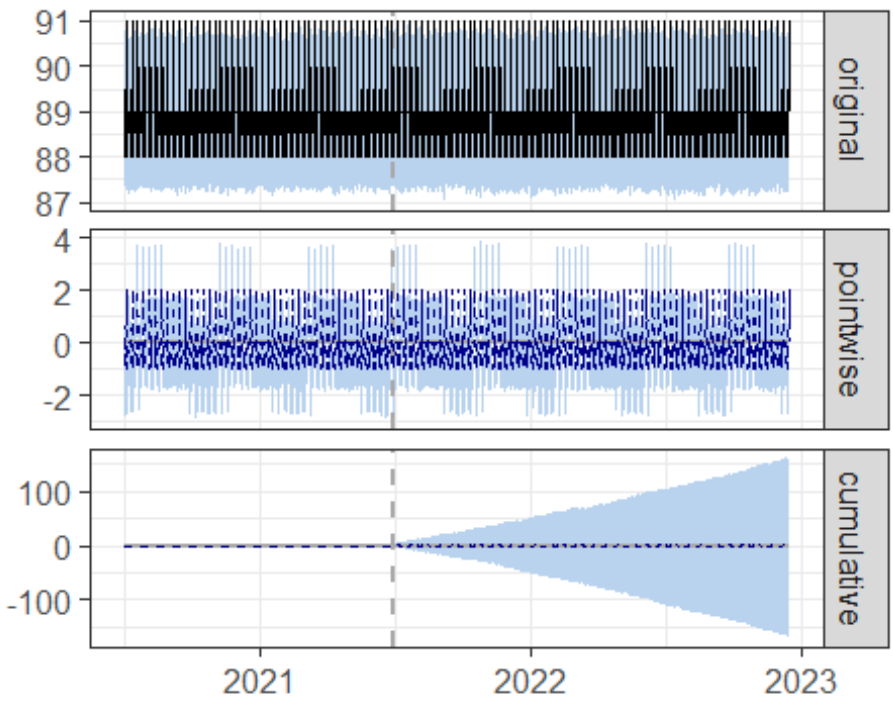

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   94               50490
## Prediction (s.d.)        94 (0.53)        50480 (284.90)
## 95% CI                   [93, 95]         [49954, 51040]
##
## Absolute effect (s.d.)   0.018 (0.53)     9.768 (284.90)
## 95% CI                   [-1, 1]          [-550, 536]
##
## Relative effect (s.d.)   0.019% (0.56%)   0.019% (0.56%)
## 95% CI                   [-1.1%, 1.1%]    [-1.1%, 1.1%]
##
## Posterior tail-area probability p:   0.485
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 94.37. In the absence of an intervention, we would have
```

```
expected an average response of 94.36. The 95% interval of this
counterfactual prediction is [93.37, 95.40]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.018 with a 95%
interval of [-1.03, 1.00]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 50.49K. Had the intervention not taken place, we
would have expected a sum of 50.48K. The 95% interval of this prediction is
[49.95K, 51.04K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.485. This
means the effect may be spurious and would generally not be considered
statistically significant.

data21 <- zoo(prov21, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data21, pre.period, post.period)
plot(impact)
```



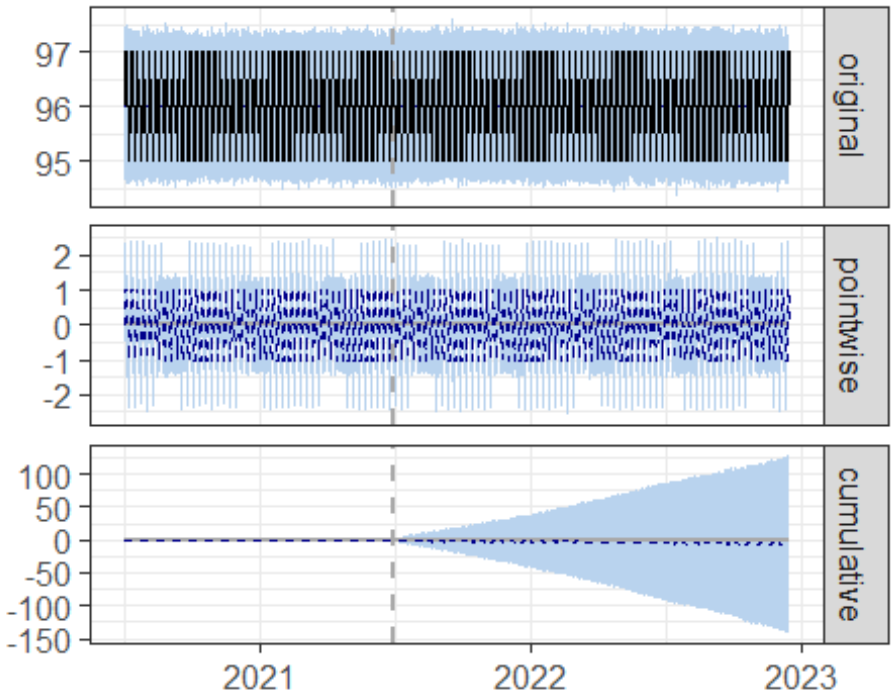

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   89                 47616
## Prediction (s.d.)        89 (0.16)          47615 (86.61)
## 95% CI                   [89, 89]           [47454, 47785]
##
## Absolute effect (s.d.)   0.0019 (0.16)      1.0320 (86.61)
## 95% CI                   [-0.32, 0.3]       [-168.77, 161.9]
##
## Relative effect (s.d.)   0.0022% (0.18%)    0.0022% (0.18%)
## 95% CI                   [-0.35%, 0.34%]    [-0.35%, 0.34%]
##
## Posterior tail-area probability p:   0.496
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 89.00. In the absence of an intervention, we would have
```

```
expected an average response of 89.00. The 95% interval of this
counterfactual prediction is [88.70, 89.32]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.0019 with a 95%
interval of [-0.32, 0.30]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 47.62K. Had the intervention not taken place, we
would have expected a sum of 47.61K. The 95% interval of this prediction is
[47.45K, 47.78K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-0%, +0%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.496. This
means the effect may be spurious and would generally not be considered
statistically significant.

data22 <- zoo(prov22, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data22, pre.period, post.period)
plot(impact)
```



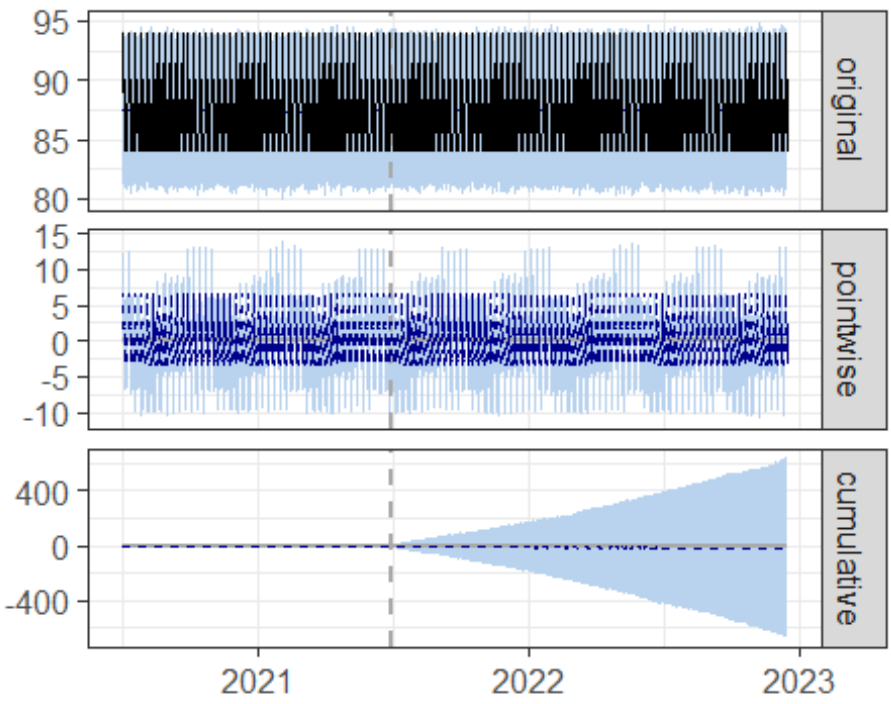

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   96               51360
## Prediction (s.d.)        96 (0.13)        51365 (69.69)
## 95% CI                   [96, 96]         [51229, 51502]
##
## Absolute effect (s.d.)   -0.0096 (0.13)   -5.1128 (69.69)
## 95% CI                   [-0.26, 0.25]    [-141.60, 131.35]
##
## Relative effect (s.d.)   -0.01% (0.14%)   -0.01% (0.14%)
## 95% CI                   [-0.28%, 0.26%]  [-0.28%, 0.26%]
##
## Posterior tail-area probability p:   0.47
## Posterior prob. of a causal effect:  53%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 96.00. In the absence of an intervention, we would have
```

```
expected an average response of 96.01. The 95% interval of this
counterfactual prediction is [95.75, 96.26]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0096 with a 95%
interval of [-0.26, 0.25]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 51.36K. Had the intervention not taken place, we
would have expected a sum of 51.37K. The 95% interval of this prediction is
[51.23K, 51.50K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-0%, +0%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.47. This means
the effect may be spurious and would generally not be considered
statistically significant.

data23 <- zoo(prov23, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data23, pre.period, post.period)
plot(impact)
```



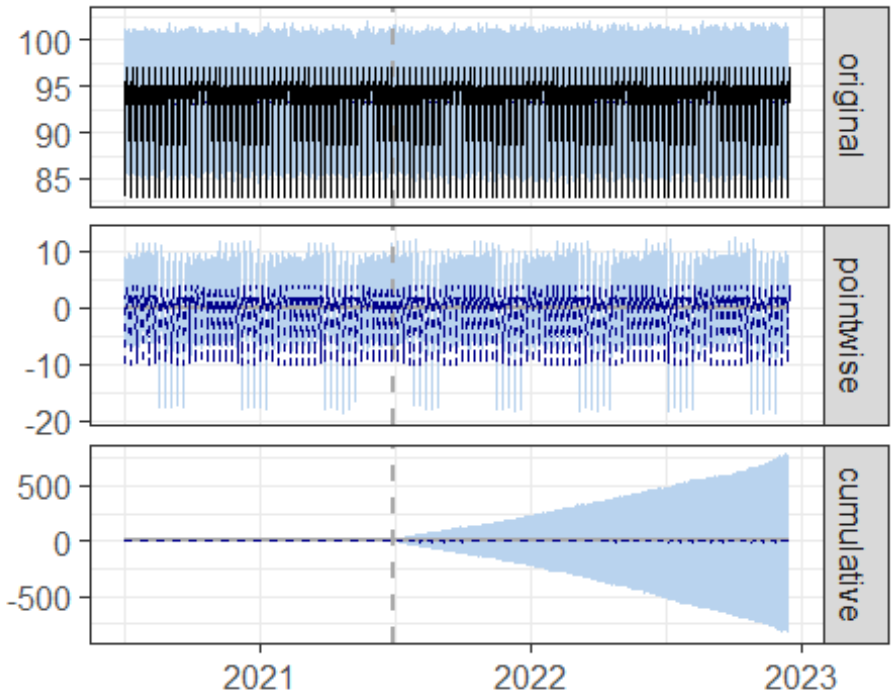

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   87               46746
## Prediction (s.d.)        87 (0.61)        46766 (328.24)
## 95% CI                   [86, 89]         [46103, 47411]
##
## Absolute effect (s.d.)   -0.038 (0.61)    -20.184 (328.24)
## 95% CI                   [-1.2, 1.2]      [-664.7, 642.7]
##
## Relative effect (s.d.)   -0.043% (0.7%)   -0.043% (0.7%)
## 95% CI                   [-1.4%, 1.4%]    [-1.4%, 1.4%]
##
## Posterior tail-area probability p:   0.48
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 87.38. In the absence of an intervention, we would have
```

```
expected an average response of 87.41. The 95% interval of this
counterfactual prediction is [86.17, 88.62]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.038 with a 95%
interval of [-1.24, 1.20]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 46.75K. Had the intervention not taken place, we
would have expected a sum of 46.77K. The 95% interval of this prediction is
[46.10K, 47.41K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.48. This means
the effect may be spurious and would generally not be considered
statistically significant.

data24 <- zoo(prov24, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data24, pre.period, post.period)
plot(impact)
```



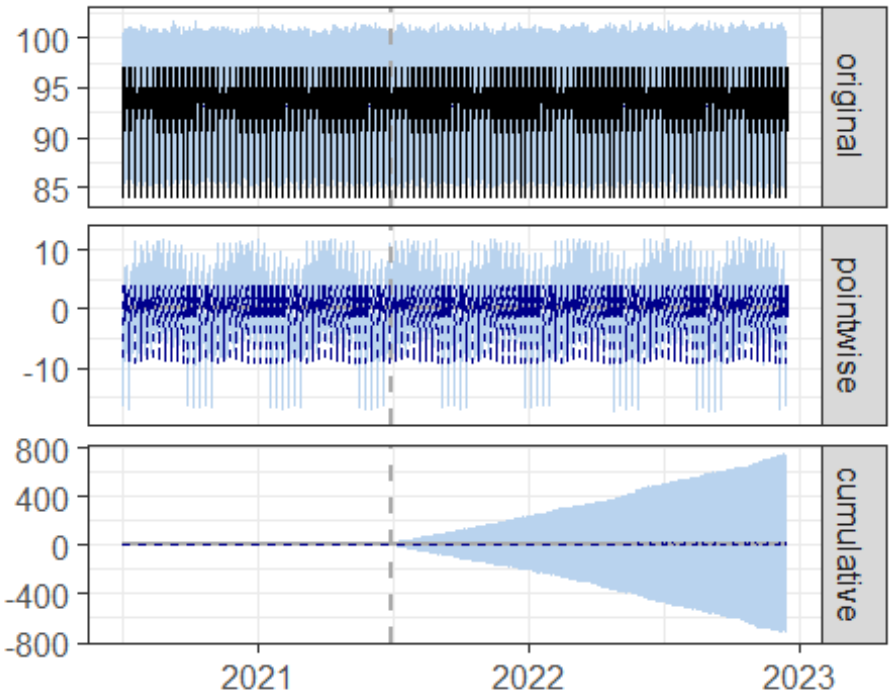

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average             Cumulative
## Actual                   93                  49888
## Prediction (s.d.)        93 (0.76)           49888 (406.82)
## 95% CI                   [92, 95]            [49101, 50724]
##
## Absolute effect (s.d.)   -0.0007 (0.76)      -0.3758 (406.82)
## 95% CI                   [-1.6, 1.5]         [-835.5, 786.6]
##
## Relative effect (s.d.)   -0.00075% (0.82%)   -0.00075% (0.82%)
## 95% CI                   [-1.7%, 1.6%]       [-1.7%, 1.6%]
##
## Posterior tail-area probability p:   0.487
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

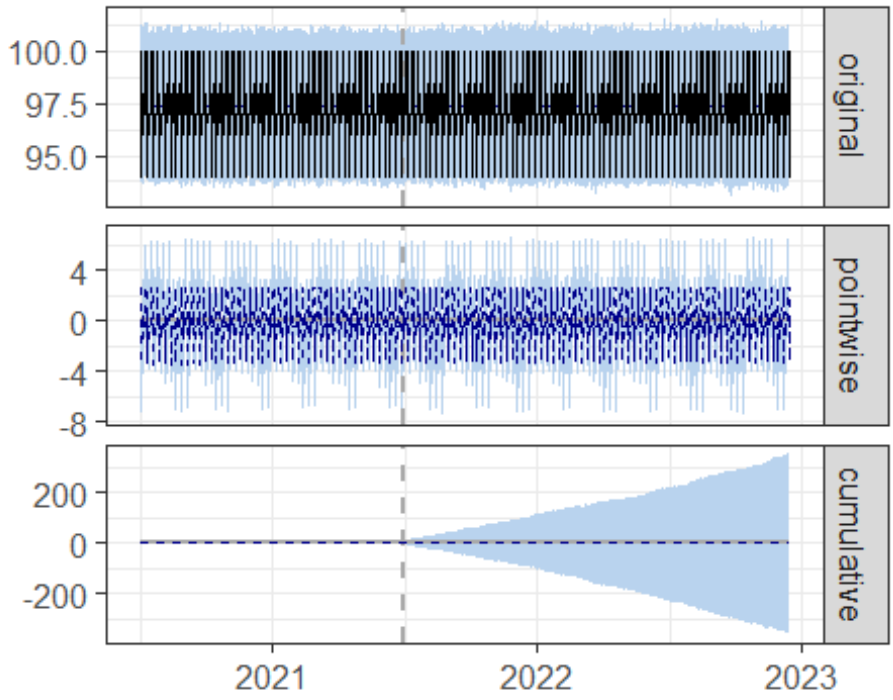
```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 93.25. In the absence of an intervention, we would have
```

```
expected an average response of 93.25. The 95% interval of this
counterfactual prediction is [91.78, 94.81]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.00070 with a 95%
interval of [-1.56, 1.47]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.89K. Had the intervention not taken place, we
would have expected a sum of 49.89K. The 95% interval of this prediction is
[49.10K, 50.72K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-2%, +2%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.487. This
means the effect may be spurious and would generally not be considered
statistically significant.

data25 <- zoo(prov25, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data25, pre.period, post.period)
plot(impact)
```




```
summary(impact)

## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   93               49823
## Prediction (s.d.)        93 (0.73)        49812 (390.52)
## 95% CI                   [92, 94]         [49082, 50550]
##
## Absolute effect (s.d.)   0.02 (0.73)      10.51 (390.52)
## 95% CI                   [-1.4, 1.4]      [-726.6, 741.4]
##
## Relative effect (s.d.)   0.021% (0.78%)   0.021% (0.78%)
## 95% CI                   [-1.5%, 1.5%]    [-1.5%, 1.5%]
##
## Posterior tail-area probability p:   0.49
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")

summary(impact,"report")

## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 93.13. In the absence of an intervention, we would have
```

```
expected an average response of 93.11. The 95% interval of this
counterfactual prediction is [91.74, 94.49]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.020 with a 95%
interval of [-1.36, 1.39]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.82K. Had the intervention not taken place, we
would have expected a sum of 49.81K. The 95% interval of this prediction is
[49.08K, 50.55K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.49. This means
the effect may be spurious and would generally not be considered
statistically significant.

data26 <- zoo(prov26, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data26, pre.period, post.period)
plot(impact)
```



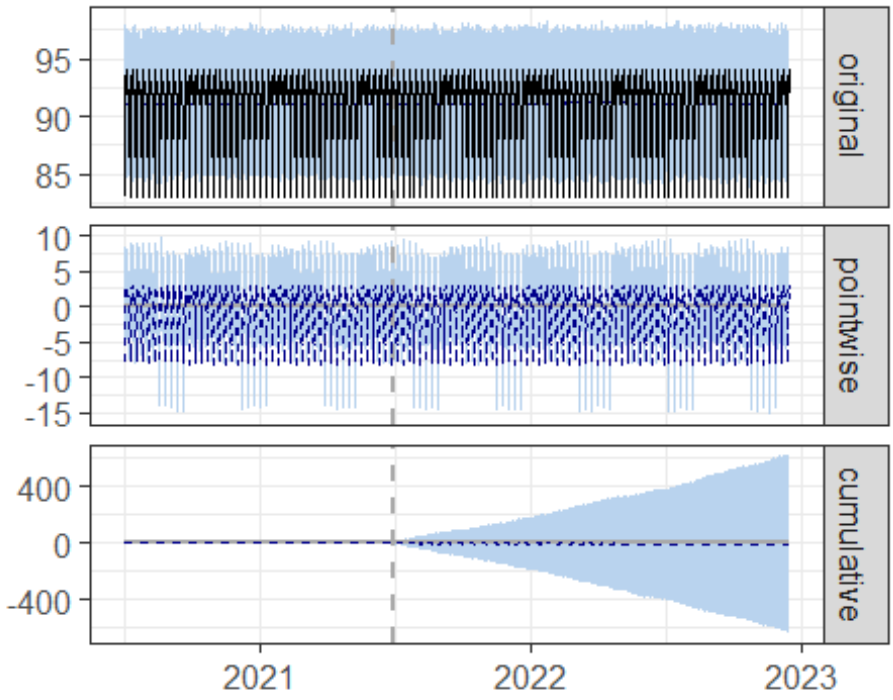

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   97                 52097
## Prediction (s.d.)        97 (0.35)          52094 (185.68)
## 95% CI                   [97, 98]           [51743, 52457]
##
## Absolute effect (s.d.)   0.0053 (0.35)      2.8534 (185.68)
## 95% CI                   [-0.67, 0.66]      [-359.71, 353.99]
##
## Relative effect (s.d.)   0.0055% (0.36%)    0.0055% (0.36%)
## 95% CI                   [-0.69%, 0.68%]    [-0.69%, 0.68%]
##
## Posterior tail-area probability p:   0.497
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 97.38. In the absence of an intervention, we would have
```

```
expected an average response of 97.37. The 95% interval of this
counterfactual prediction is [96.72, 98.05]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.0053 with a 95%
interval of [-0.67, 0.66]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 52.10K. Had the intervention not taken place, we
would have expected a sum of 52.09K. The 95% interval of this prediction is
[51.74K, 52.46K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.497. This
means the effect may be spurious and would generally not be considered
statistically significant.

data27 <- zoo(prov27, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data27, pre.period, post.period)
plot(impact)
```



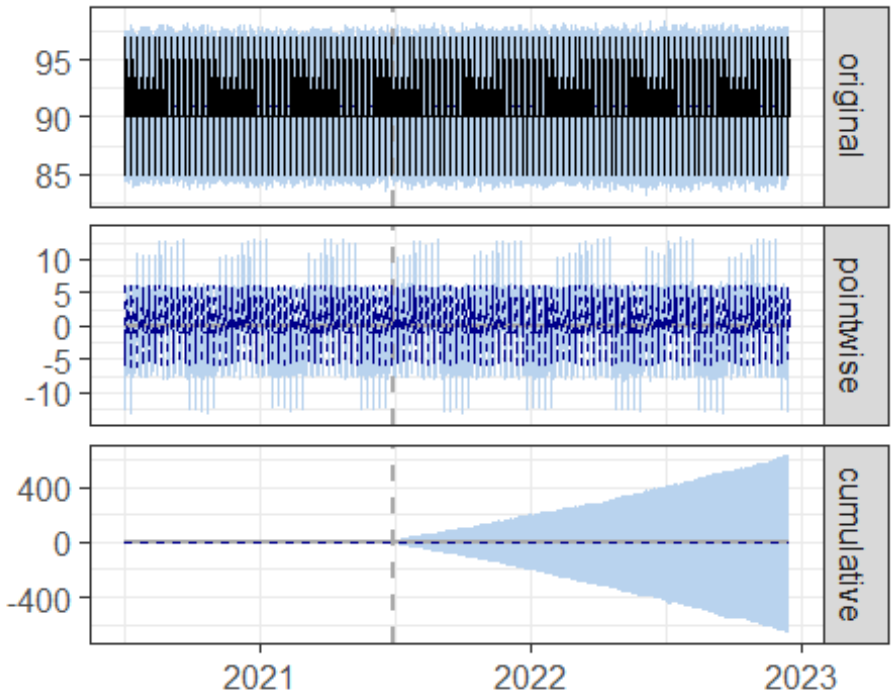

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   91                 48750
## Prediction (s.d.)        91 (0.6)           48762 (322.0)
## 95% CI                   [90, 92]           [48121, 49385]
##
## Absolute effect (s.d.)   -0.023 (0.6)       -12.423 (322.0)
## 95% CI                   [-1.2, 1.2]        [-634.9, 628.7]
##
## Relative effect (s.d.)   -0.025% (0.66%)    -0.025% (0.66%)
## 95% CI                   [-1.3%, 1.3%]      [-1.3%, 1.3%]
##
## Posterior tail-area probability p:   0.493
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 91.12. In the absence of an intervention, we would have
```

```
expected an average response of 91.14. The 95% interval of this
counterfactual prediction is [89.95, 92.31]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.023 with a 95%
interval of [-1.19, 1.18]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.75K. Had the intervention not taken place, we
would have expected a sum of 48.76K. The 95% interval of this prediction is
[48.12K, 49.38K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.493. This
means the effect may be spurious and would generally not be considered
statistically significant.

data28 <- zoo(prov28, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data28, pre.period, post.period)
plot(impact)
```



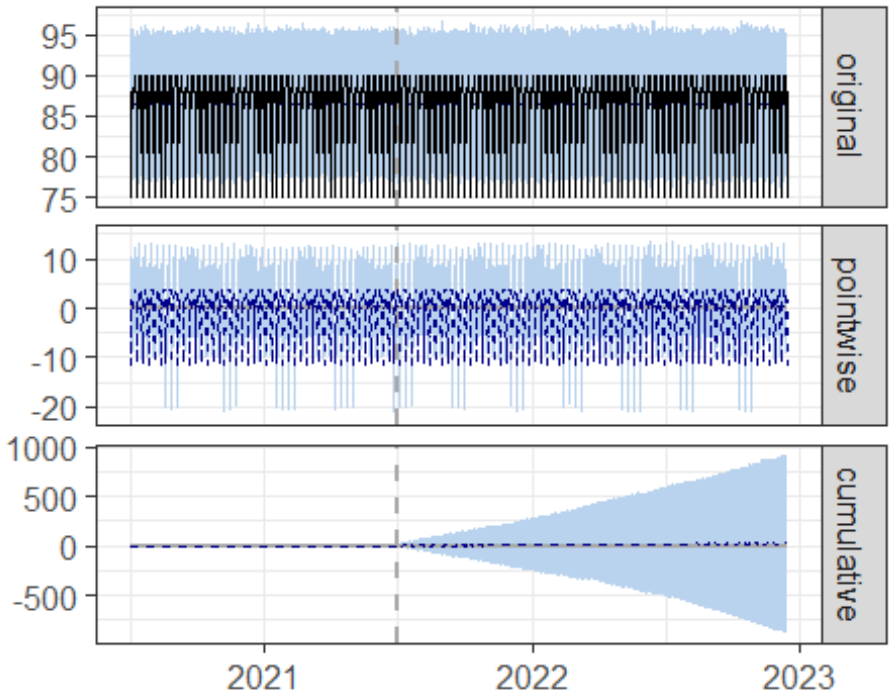

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   91               48619
## Prediction (s.d.)        91 (0.63)        48624 (339.07)
## 95% CI                   [90, 92]         [47973, 49285]
##
## Absolute effect (s.d.)   -0.0091 (0.63)   -4.8601 (339.07)
## 95% CI                   [-1.2, 1.2]      [-666.1, 645.7]
##
## Relative effect (s.d.)   -0.01% (0.7%)    -0.01% (0.7%)
## 95% CI                   [-1.4%, 1.3%]    [-1.4%, 1.3%]
##
## Posterior tail-area probability p:   0.496
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 90.88. In the absence of an intervention, we would have
```

```
expected an average response of 90.89. The 95% interval of this
counterfactual prediction is [89.67, 92.12]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.0091 with a 95%
interval of [-1.25, 1.21]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 48.62K. Had the intervention not taken place, we
would have expected a sum of 48.62K. The 95% interval of this prediction is
[47.97K, 49.29K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.496. This
means the effect may be spurious and would generally not be considered
statistically significant.

data29 <- zoo(prov29, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data29, pre.period, post.period)
plot(impact)
```



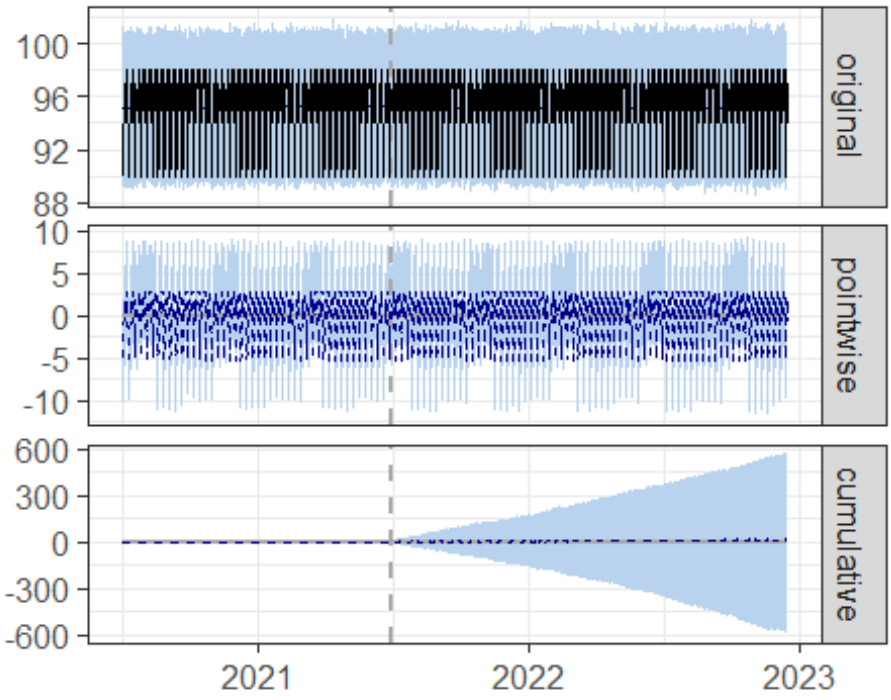

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average        Cumulative
## Actual                   86             46277
## Prediction (s.d.)        86 (0.86)      46259 (462.16)
## 95% CI                   [85, 88]       [45342, 47166]
##
## Absolute effect (s.d.)   0.034 (0.86)   18.008 (462.16)
## 95% CI                   [-1.7, 1.7]    [-889.2, 935.0]
##
## Relative effect (s.d.)   0.039% (1%)    0.039% (1%)
## 95% CI                   [-1.9%, 2%]    [-1.9%, 2%]
##
## Posterior tail-area probability p:   0.479
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 86.50. In the absence of an intervention, we would have
```

```
expected an average response of 86.47. The 95% interval of this
counterfactual prediction is [84.75, 88.16]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.034 with a 95%
interval of [-1.66, 1.75]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 46.28K. Had the intervention not taken place, we
would have expected a sum of 46.26K. The 95% interval of this prediction is
[45.34K, 47.17K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-2%, +2%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.479. This
means the effect may be spurious and would generally not be considered
statistically significant.

data30 <- zoo(prov30, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data30, pre.period, post.period)
plot(impact)
```



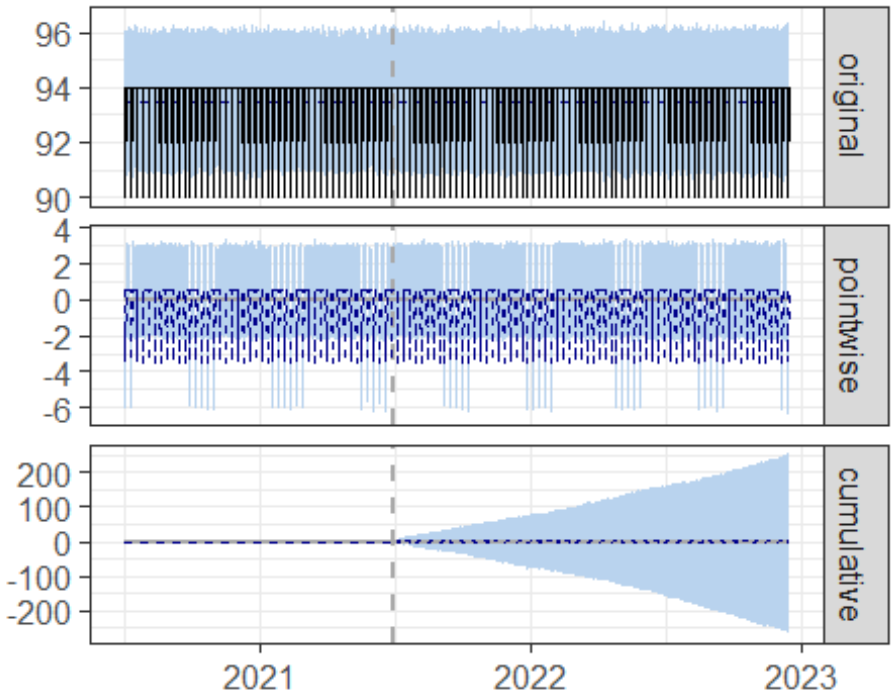

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average          Cumulative
## Actual                   95               50959
## Prediction (s.d.)        95 (0.55)        50945 (295.54)
## 95% CI                   [94, 96]         [50386, 51548]
##
## Absolute effect (s.d.)   0.026 (0.55)     13.930 (295.54)
## 95% CI                   [-1.1, 1.1]      [-589.1, 572.7]
##
## Relative effect (s.d.)   0.027% (0.58%)   0.027% (0.58%)
## 95% CI                   [-1.2%, 1.1%]    [-1.2%, 1.1%]
##
## Posterior tail-area probability p:   0.484
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 95.25. In the absence of an intervention, we would have
```

```
expected an average response of 95.22. The 95% interval of this
counterfactual prediction is [94.18, 96.35]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.026 with a 95%
interval of [-1.10, 1.07]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 50.96K. Had the intervention not taken place, we
would have expected a sum of 50.95K. The 95% interval of this prediction is
[50.39K, 51.55K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.484. This
means the effect may be spurious and would generally not be considered
statistically significant.

data31 <- zoo(prov31, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data31, pre.period, post.period)
plot(impact)
```



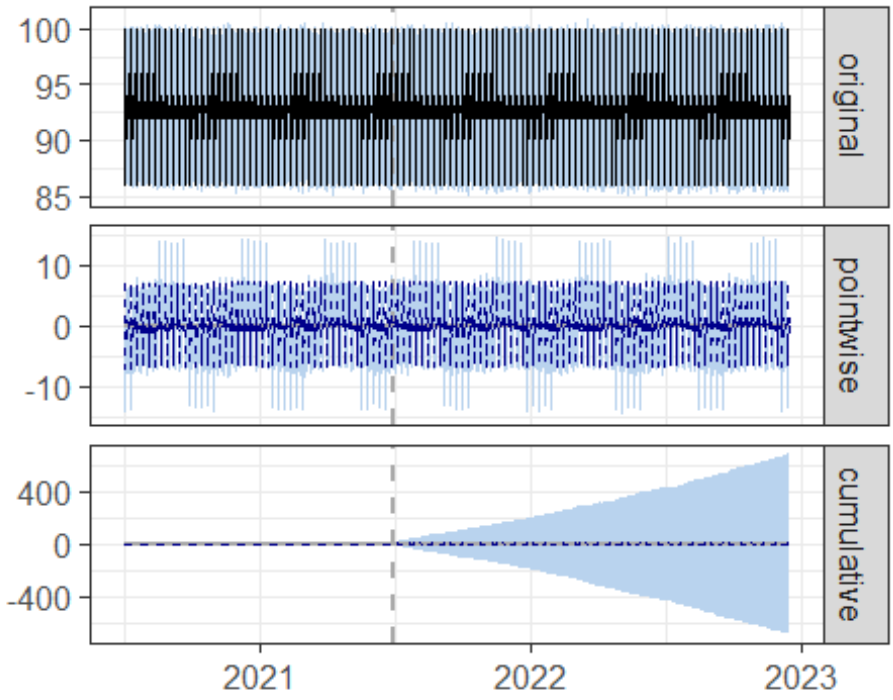

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average             Cumulative
## Actual                   93                  50022
## Prediction (s.d.)        93 (0.25)           50022 (132.31)
## 95% CI                   [93, 94]            [49770, 50288]
##
## Absolute effect (s.d.)   -3.3e-05 (0.25)     -1.7e-02 (132.31)
## 95% CI                   [-0.5, 0.47]        [-266.2, 252.04]
##
## Relative effect (s.d.)   -3.5e-05% (0.26%)   -3.5e-05% (0.26%)
## 95% CI                   [-0.53%, 0.5%]      [-0.53%, 0.5%]
##
## Posterior tail-area probability p:   0.496
## Posterior prob. of a causal effect:  50%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 93.50. In the absence of an intervention, we would have
```

```
expected an average response of 93.50. The 95% interval of this
counterfactual prediction is [93.03, 94.00]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.000033 with a
95% interval of [-0.50, 0.47]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 50.02K. Had the intervention not taken place, we
would have expected a sum of 50.02K. The 95% interval of this prediction is
[49.77K, 50.29K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.496. This
means the effect may be spurious and would generally not be considered
statistically significant.

data32 <- zoo(prov32, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data32, pre.period, post.period)
plot(impact)
```



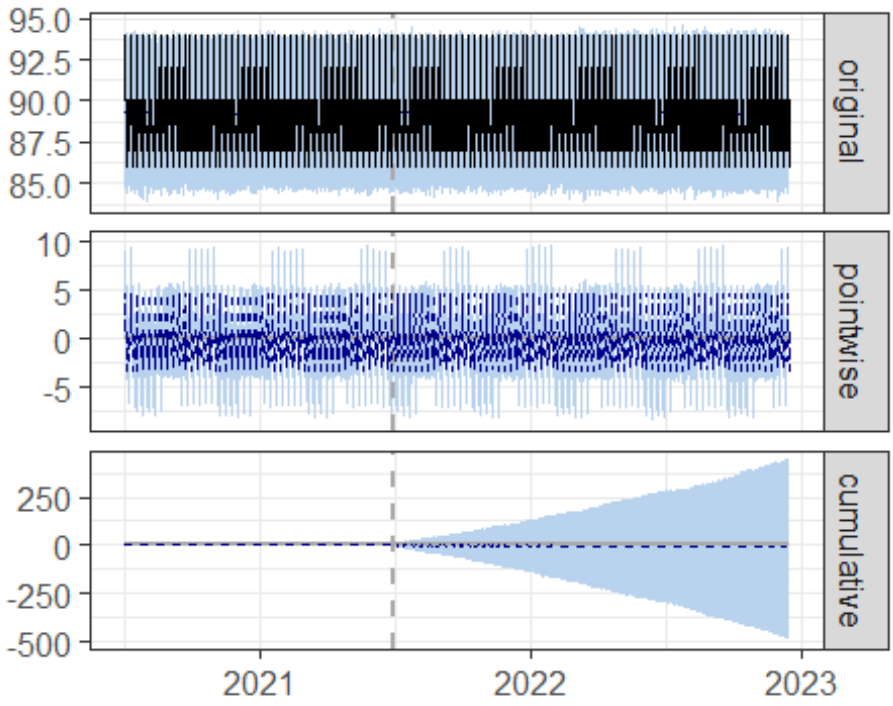

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   93                 49689
## Prediction (s.d.)        93 (0.66)          49688 (351.57)
## 95% CI                   [92, 94]           [49012, 50365]
##
## Absolute effect (s.d.)   0.0025 (0.66)      1.3385 (351.57)
## 95% CI                   [-1.3, 1.3]        [-676.2, 677.0]
##
## Relative effect (s.d.)   0.0027% (0.71%)    0.0027% (0.71%)
## 95% CI                   [-1.4%, 1.4%]      [-1.4%, 1.4%]
##
## Posterior tail-area probability p:   0.489
## Posterior prob. of a causal effect:  51%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 92.88. In the absence of an intervention, we would have
```

```
expected an average response of 92.87. The 95% interval of this
counterfactual prediction is [91.61, 94.14]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.0025 with a 95%
interval of [-1.26, 1.27]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.69K. Had the intervention not taken place, we
would have expected a sum of 49.69K. The 95% interval of this prediction is
[49.01K, 50.37K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.489. This
means the effect may be spurious and would generally not be considered
statistically significant.

data33 <- zoo(prov33, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data33, pre.period, post.period)
plot(impact)
```



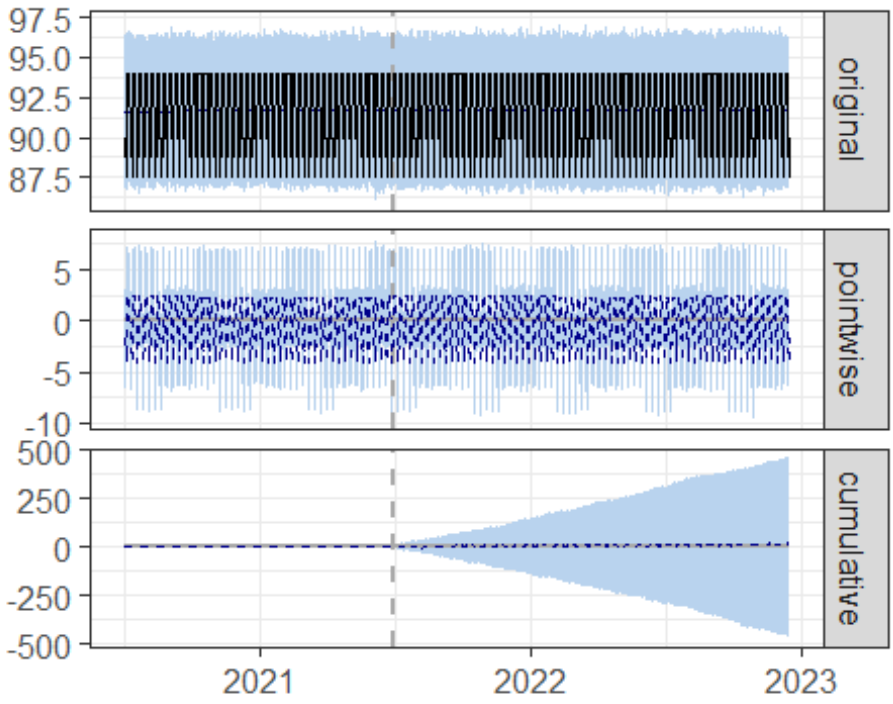

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   89                 47748
## Prediction (s.d.)        89 (0.44)          47757 (234.53)
## 95% CI                   [88, 90]           [47305, 48238]
##
## Absolute effect (s.d.)   -0.017 (0.44)      -9.171 (234.53)
## 95% CI                   [-0.92, 0.83]      [-490.04, 443.29]
##
## Relative effect (s.d.)   -0.019% (0.49%)    -0.019% (0.49%)
## 95% CI                   [-1%, 0.93%]       [-1%, 0.93%]
##
## Posterior tail-area probability p:   0.479
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 89.25. In the absence of an intervention, we would have
```

```
expected an average response of 89.27. The 95% interval of this
counterfactual prediction is [88.42, 90.16]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.017 with a 95%
interval of [-0.92, 0.83]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 47.75K. Had the intervention not taken place, we
would have expected a sum of 47.76K. The 95% interval of this prediction is
[47.30K, 48.24K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.479. This
means the effect may be spurious and would generally not be considered
statistically significant.

data34 <- zoo(prov34, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data34, pre.period, post.period)
plot(impact)
```



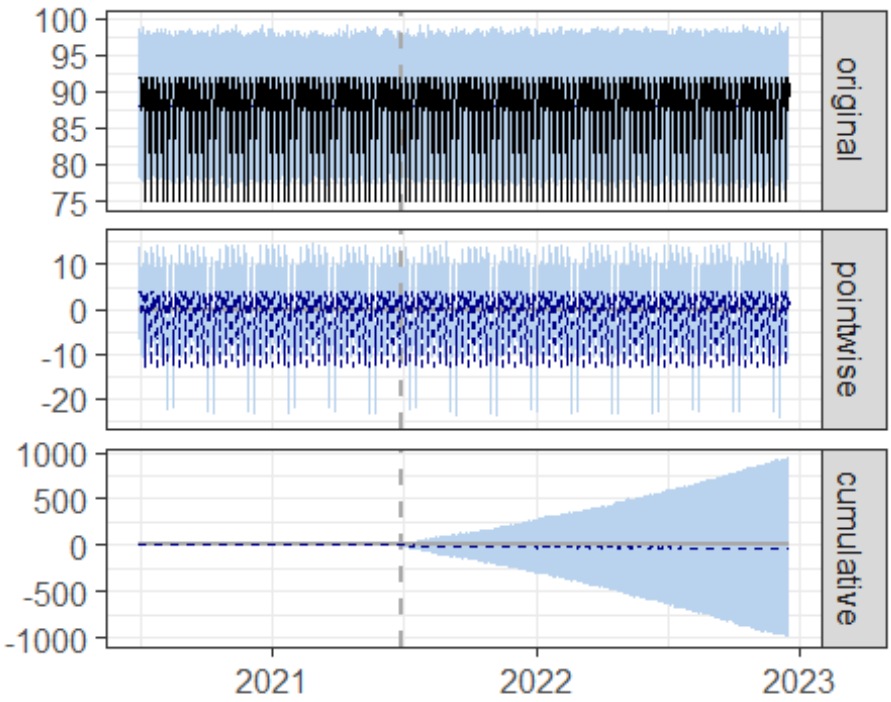

```
summary(impact)
```

```
## Posterior inference {CausalImpact}
##
##                          Average            Cumulative
## Actual                   92                 49051
## Prediction (s.d.)        92 (0.45)          49039 (242.36)
## 95% CI                   [91, 93]           [48591, 49516]
##
## Absolute effect (s.d.)   0.021 (0.45)       11.127 (242.36)
## 95% CI                   [-0.87, 0.86]      [-465.50, 459.80]
##
## Relative effect (s.d.)   0.023% (0.49%)     0.023% (0.49%)
## 95% CI                   [-0.95%, 0.94%]    [-0.95%, 0.94%]
##
## Posterior tail-area probability p:   0.48
## Posterior prob. of a causal effect:  52%
##
## For more details, type: summary(impact, "report")
```

```
summary(impact,"report")
```

```
## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 91.68. In the absence of an intervention, we would have
```

```
expected an average response of 91.66. The 95% interval of this
counterfactual prediction is [90.82, 92.55]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is 0.021 with a 95%
interval of [-0.87, 0.86]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 49.05K. Had the intervention not taken place, we
would have expected a sum of 49.04K. The 95% interval of this prediction is
[48.59K, 49.52K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed an increase of +0%. The 95% interval of
this percentage is [-1%, +1%].
##
## This means that, although the intervention appears to have caused a
positive effect, this effect is not statistically significant when
considering the entire post-intervention period as a whole. Individual days
or shorter stretches within the intervention period may of course still have
had a significant effect, as indicated whenever the lower limit of the impact
time series (lower plot) was above zero. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.48. This means
the effect may be spurious and would generally not be considered
statistically significant.

data35 <- zoo(prov35, time.points)
pre.period=as.Date(c("2020-07-01","2021-06-30"))
post.period=as.Date(c("2021-07-01","2022-12-17"))
impact <- CausalImpact(data35, pre.period, post.period)
plot(impact)
```




```
summary(impact)

## Posterior inference {CausalImpact}
##
##                          Average         Cumulative
## Actual                   88              47045
## Prediction (s.d.)        88 (0.95)       47077 (509.73)
## 95% CI                   [86, 90]        [46098, 48028]
##
## Absolute effect (s.d.)   -0.062 (0.95)   -32.970 (509.73)
## 95% CI                   [-1.8, 1.8]     [-983.3, 946.2]
##
## Relative effect (s.d.)   -0.07% (1.1%)   -0.07% (1.1%)
## 95% CI                   [-2.1%, 2%]     [-2.1%, 2%]
##
## Posterior tail-area probability p:   0.473
## Posterior prob. of a causal effect:  53%
##
## For more details, type: summary(impact, "report")

summary(impact,"report")

## Analysis report {CausalImpact}
##
##
## During the post-intervention period, the response variable had an average
value of approx. 87.93. In the absence of an intervention, we would have
```

```
expected an average response of 88.00. The 95% interval of this
counterfactual prediction is [86.17, 89.77]. Subtracting this prediction from
the observed response yields an estimate of the causal effect the
intervention had on the response variable. This effect is -0.062 with a 95%
interval of [-1.84, 1.77]. For a discussion of the significance of this
effect, see below.
##
## Summing up the individual data points during the post-intervention period
(which can only sometimes be meaningfully interpreted), the response variable
had an overall value of 47.04K. Had the intervention not taken place, we
would have expected a sum of 47.08K. The 95% interval of this prediction is
[46.10K, 48.03K].
##
## The above results are given in terms of absolute numbers. In relative
terms, the response variable showed a decrease of -0%. The 95% interval of
this percentage is [-2%, +2%].
##
## This means that, although it may look as though the intervention has
exerted a negative effect on the response variable when considering the
intervention period as a whole, this effect is not statistically significant,
and so cannot be meaningfully interpreted. The apparent effect could be the
result of random fluctuations that are unrelated to the intervention. This is
often the case when the intervention period is very long and includes much of
the time when the effect has already worn off. It can also be the case when
the intervention period is too short to distinguish the signal from the
noise. Finally, failing to find a significant effect can happen when there
are not enough control variables or when these variables do not correlate
well with the response variable during the learning period.
##
## The probability of obtaining this effect by chance is p = 0.473. This
means the effect may be spurious and would generally not be considered
statistically significant.
```