

USFirearm

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Generate some insightful visualizations to display this data.

Does the rate of change in total firearms background checks over time vary across states?

```
suppressMessages(library(tidyverse))
suppressMessages(library(dplyr))
suppressMessages(library(tidyr))
suppressMessages(library(fpp3))
suppressMessages(library(readr))
suppressMessages(library(forecast))
suppressMessages(library(ggplot2))

url <- "https://raw.githubusercontent.com/BuzzFeedNews/nics-firearm-background-checks/master/data/nics-

firearm <- read.csv(url, header = TRUE)
glimpse(firearm)
```

```
## Rows: 16,115
## Columns: 27
## $ month                <chr> "2023-03", "2023-03", "2023-03", "2023-03", ~
## $ state                <chr> "Alabama", "Alaska", "Arizona", "Arkansas", ~
## $ permit               <int> 14315, 354, 12965, 4460, 25878, 11466, 9850, ~
## $ permit_recheck       <int> 263, 7, 1377, 595, 13200, 5, 640, 0, 0, 0, ~
## $ handgun              <int> 23132, 3295, 20940, 8827, 40714, 24432, 7098~
## $ long_gun             <int> 15158, 2610, 10397, 6436, 26473, 15658, 2405~
## $ other                <int> 1314, 397, 1772, 573, 5455, 2504, 1076, 94, ~
## $ multiple             <int> 1269, 221, 1249, 547, 0, 2464, 0, 94, 8, 335~
## $ admin                <int> 0, 0, 0, 4, 0, 0, 5, 0, 3, 0, 0, 0, 0, 0, ~
## $ prepawn_handgun      <int> 17, 1, 7, 14, 1, 0, 0, 0, 0, 16, 16, 0, 0, 3~
## $ prepawn_long_gun     <int> 3, 0, 2, 11, 1, 0, 0, 0, 0, 6, 9, 0, 0, 1, 0~
## $ prepawn_other        <int> 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, ~
## $ redemption_handgun   <int> 2564, 136, 1446, 1280, 746, 0, 0, 30, 0, 405~
## $ redemption_long_gun  <int> 1116, 95, 503, 918, 409, 0, 0, 6, 0, 975, 88~
## $ redemption_other     <int> 16, 2, 5, 3, 16, 0, 0, 0, 0, 6, 13, 0, 0, 1, ~
## $ returned_handgun     <int> 46, 29, 260, 0, 1731, 340, 0, 63, 2, 1495, 7~
## $ returned_long_gun    <int> 3, 15, 22, 0, 927, 46, 0, 0, 0, 138, 0, 0, 1~
## $ returned_other       <int> 0, 0, 0, 0, 82, 0, 0, 0, 54, 4, 0, 0, 0, 2, ~
## $ rentals_handgun      <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, ~
## $ rentals_long_gun     <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, ~
## $ private_sale_handgun <int> 35, 0, 7, 7, 8581, 0, 627, 51, 0, 308, 12, 0~
```

```
## $ private_sale_long_gun      <int> 34, 1, 1, 12, 3392, 0, 196, 23, 0, 204, 3, 0~
## $ private_sale_other        <int> 8, 0, 2, 4, 626, 0, 87, 0, 0, 67, 1, 0, 0, 0~
## $ return_to_seller_handgun  <int> 0, 1, 0, 0, 116, 0, 0, 0, 0, 58, 0, 0, 0, 1, ~
## $ return_to_seller_long_gun <int> 0, 0, 1, 0, 51, 0, 0, 0, 0, 41, 0, 0, 0, 0, ~
## $ return_to_seller_other    <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, ~
## $ totals                    <int> 59294, 7164, 50957, 23692, 128399, 56915, 21~
```

Cleaning and filtering original data for analysis

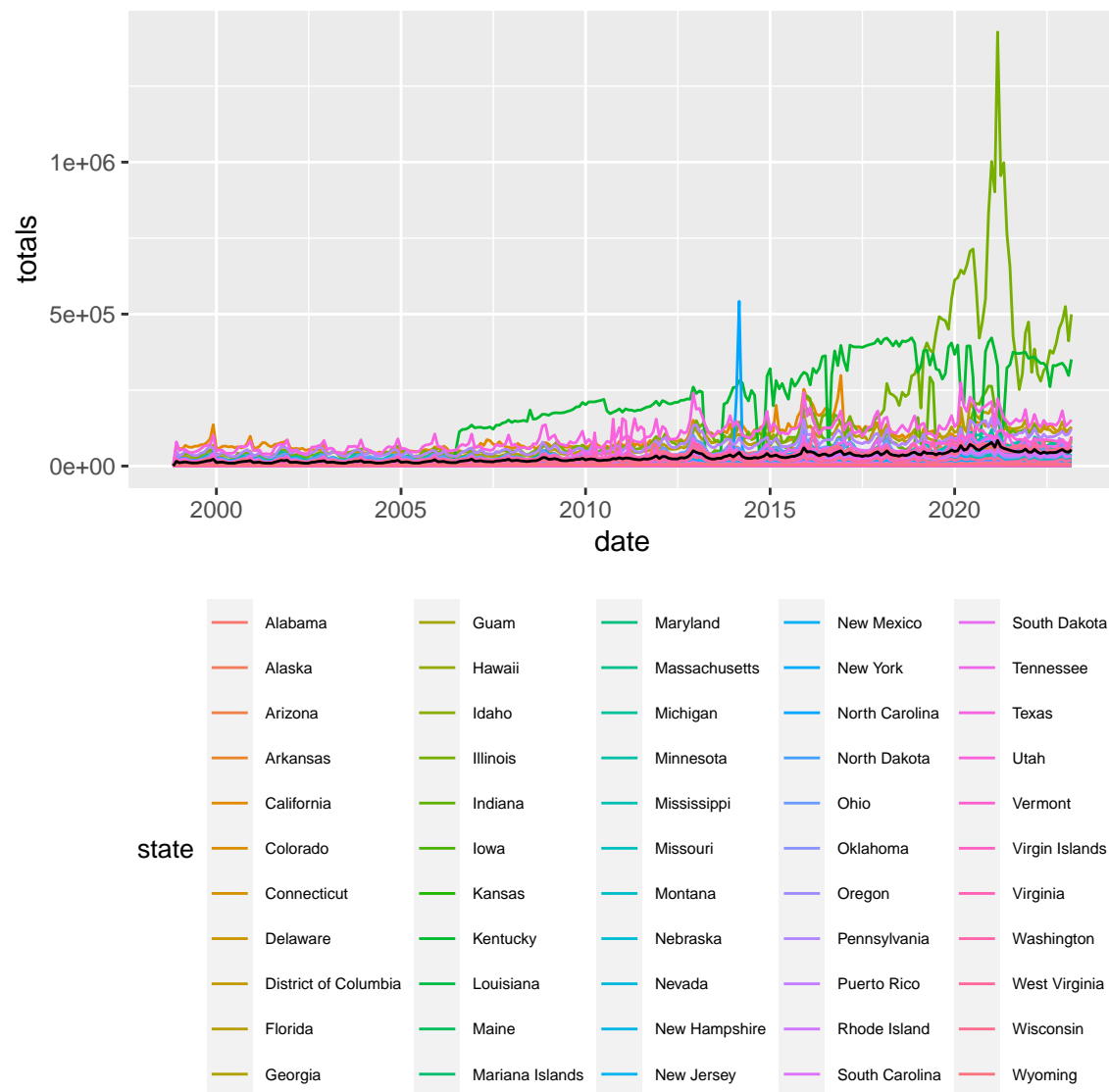
```
dat <- firearm %>%
  mutate(date = ymd(paste(month, "01"))) %>%
  select(date, state, totals) %>%
  filter(complete.cases(.))

glimpse(dat)
```

```
## Rows: 16,115
## Columns: 3
## $ date      <date> 2023-03-01, 2023-03-01, 2023-03-01, 2023-03-01, 2023-03-01, 20~
## $ state     <chr> "Alabama", "Alaska", "Arizona", "Arkansas", "California", "Colo~
## $ totals    <int> 59294, 7164, 50957, 23692, 128399, 56915, 21984, 4650, 1601, 12~
```

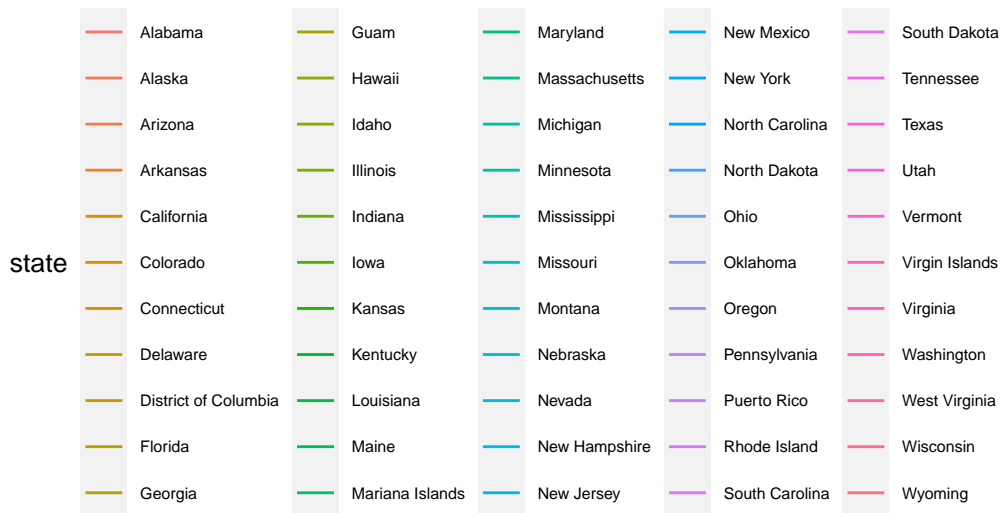
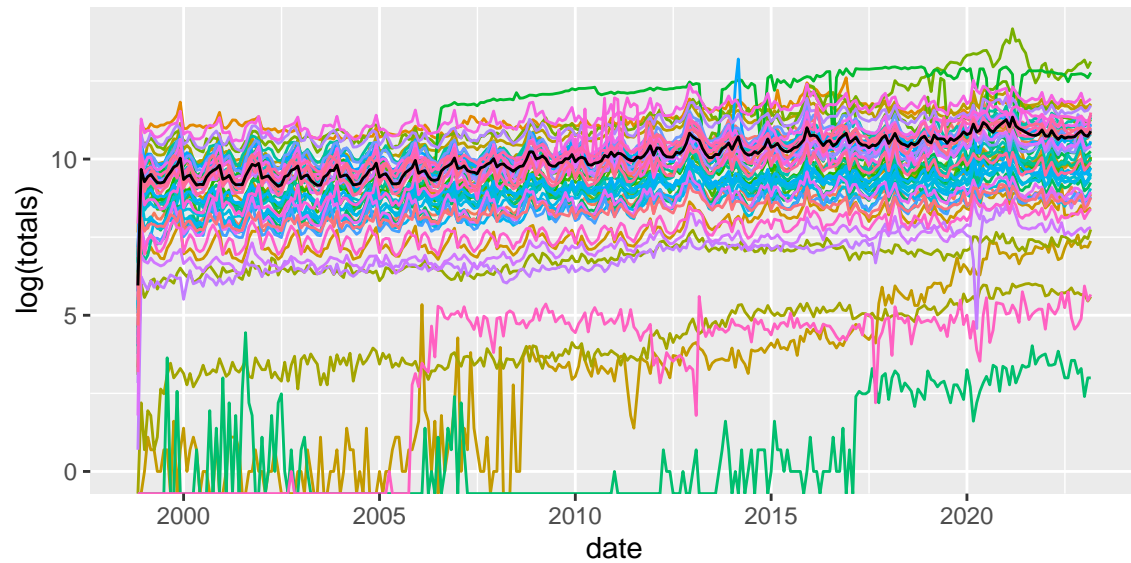
Plot of total background checks in each state as well as overall mean.

```
ggplot(dat) +
  geom_line(mapping=aes(x=date, y=totals, color=state)) +
  geom_line(dat %>% group_by(date) %>% summarise(totals=mean(totals)),
            mapping=aes(x=date, y=totals)) +
  theme(legend.position="bottom",
        legend.title = element_text(size=10),
        legend.text=element_text(size=6))
```



Plot of total background checks in each state as well as overall mean on the *log* scale

```
ggplot(dat) +
  geom_line(mapping=aes(x=date, y=log(totals), color=state)) +
  geom_line(dat %>% group_by(date) %>% summarise(totals=mean(totals)),
            mapping=aes(x=date, y=log(totals))) +
  theme(legend.position="bottom",
        legend.title = element_text(size=10),
        legend.text=element_text(size=6))
```

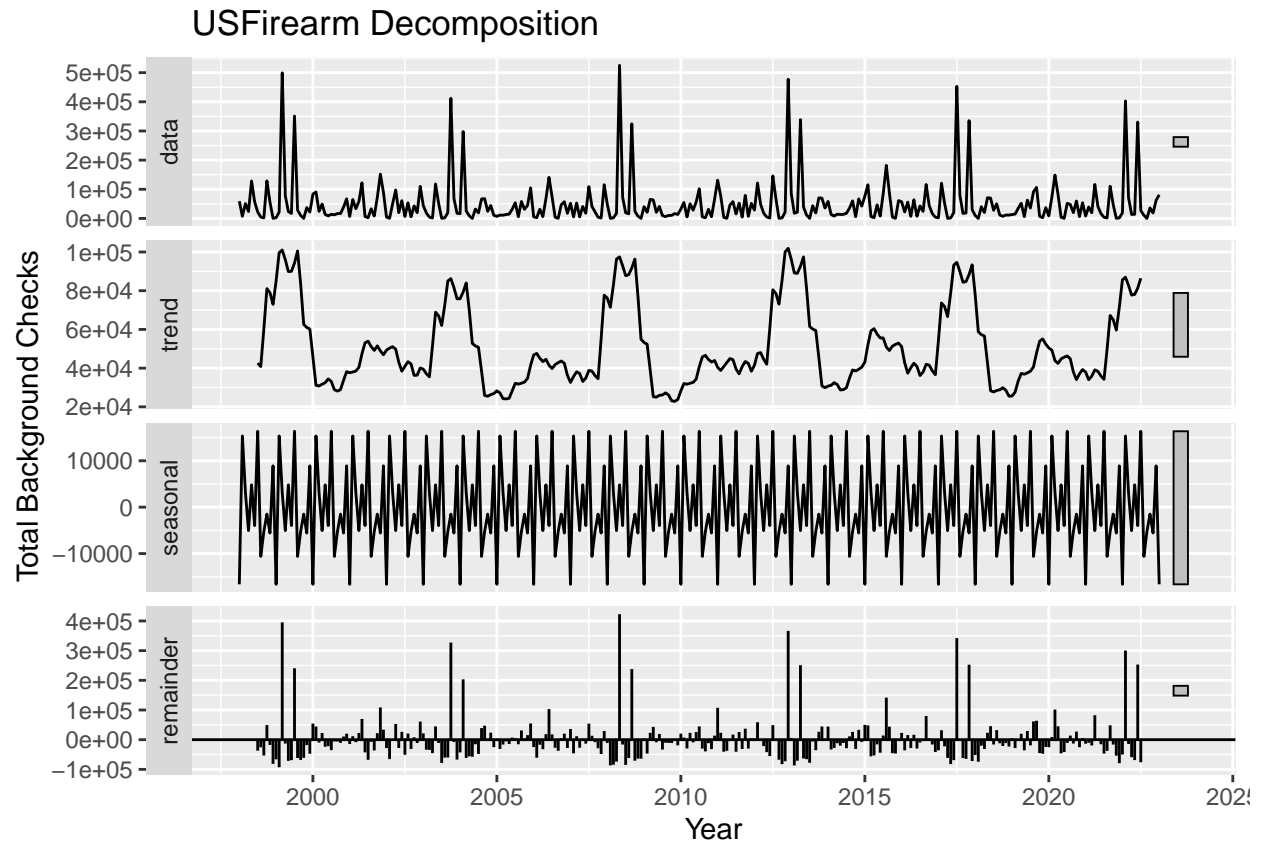


Time series decomposition of total background firearm checks

we are only interested in trend but we need to get rid of seasonal effect

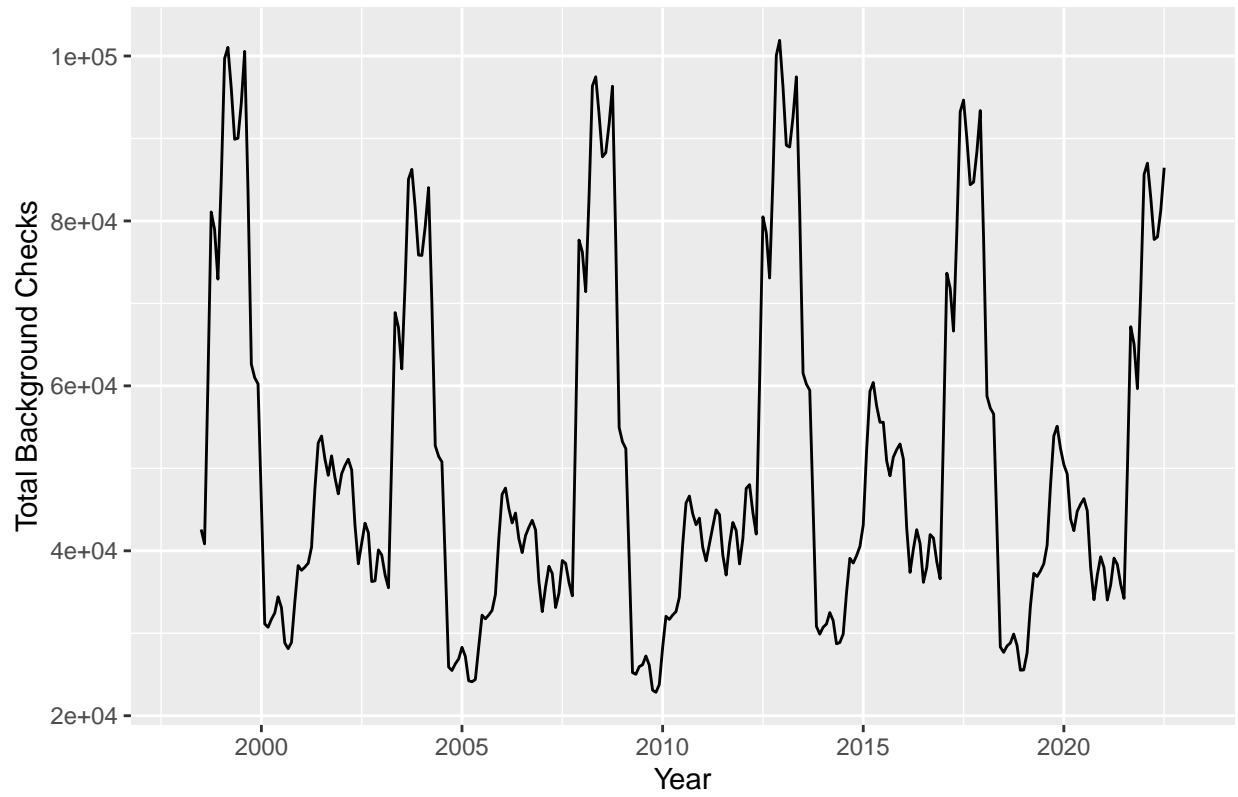
```
firearm_ts <- ts(dat$totals,
  start = min(year(dat$date)),
  end = max(year(dat$date)),
  frequency = 12)
# Decomposing the model and extracting trend component
fit_dcmp <- decompose(firearm_ts)
trend <- fit_dcmp$trend # important
# firearm_seasonal <- fit_dcmp$seasonal
# firearm_remainder <- fit_dcmp$random

autoplot(fit_dcmp) +
  xlab("Year") +
  ylab("Total Background Checks") +
  ggtitle("USFirearm Decomposition")
```



```
autoplot(trend) + xlab("Year") + ylab("Total Background Checks") +
  ggtitle("Overall Trend of firearm background checks in US")
```

Overall Trend of firearm background checks in US



we can see that there is cyclone repeating every 4 years or so.