DDM

2023-07-21

Lets start off making a function that simulates the weiner process:

```
set.seed(1111)

make_weiner = function(data){

timesteps = data$max_time
w0 = data$bias
sd = data$sd

bound = data$bound

drift = data$drift
#keeping track of position
w = array(NA,timesteps+1)
w[1] = 0

for(i in 1:timesteps){
    if(w[i] > bound){
      w[i:(i+5)] = bound

      break
    }else if(w[i] < -bound){
      w[i:(i+5)] = -bound
      break
    }
    w[i+1] = w[i]+rnorm(1,0,sd)+drift
}

q = data.frame(x = 1:timesteps,
            y = w[1:timesteps],
            bound = bound,
            bias = bias,
            sd = sd,
            max_time = max_time,
            drift = drift,
            col = round(rnorm(1,100,1000),0)) #this is id
q = q %>% mutate(resp = ifelse(y == bound, "upper","lower"))

return(list(q))
}
```

Next we then simulate 5 such process!

```
max_time = seq(500,length.out = 1)

bias = seq(0.5,length.out = 1)

sd = seq(0.1,length.out = 1)

bound = seq(1,2,length.out = 1)

drift = seq(0,length.out = 1)

replicate = 1:5


params = expand.grid(max_time = max_time,
                     bias = bias,
                     sd = sd,
                     bound = bound,
                     drift = drift,
                     replicate = replicate) %>%
  mutate(id = 1:nrow(.))

data_list <- split(params, params$id)

plan(multisession, workers = 3)
weiners = future_map(data_list, ~make_weiner(.x), .progress = TRUE, .options = furrr_options(seed = TRU

data = map_dfr(weiners,1)

q = na.omit(data) %>%
  ggplot(aes(x = x, y = y, color = as.factor(col)))+
  xlab("Time")+
  ylab("x")+
  coord_cartesian(ylim = c(min(na.omit(data)$y),max(na.omit(data)$y)))+
  geom_line(linewidth=1)+
  theme_classic()+
  geom_hline(yintercept = bound, linetype = 2)+
  geom_hline(yintercept = -bound, linetype = 2)+
  theme(legend.position="none")+
  theme(axis.title.x=element_blank(),
        axis.text.x=element_blank(),
        axis.ticks.x=element_blank())+
  #transition_time(x)+
  #shadow_wake(wake_length = 0.1, alpha = FALSE)+
  #shadow_mark(alpha = 0.3, size = 0.5)+
  transition_reveal(x)

q
```

```
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?

## Warning in formals(fun): argument is not a function

## `geom_line()`: Each group consists of only one observation.
```

```
## i Do you need to adjust the group aesthetic?
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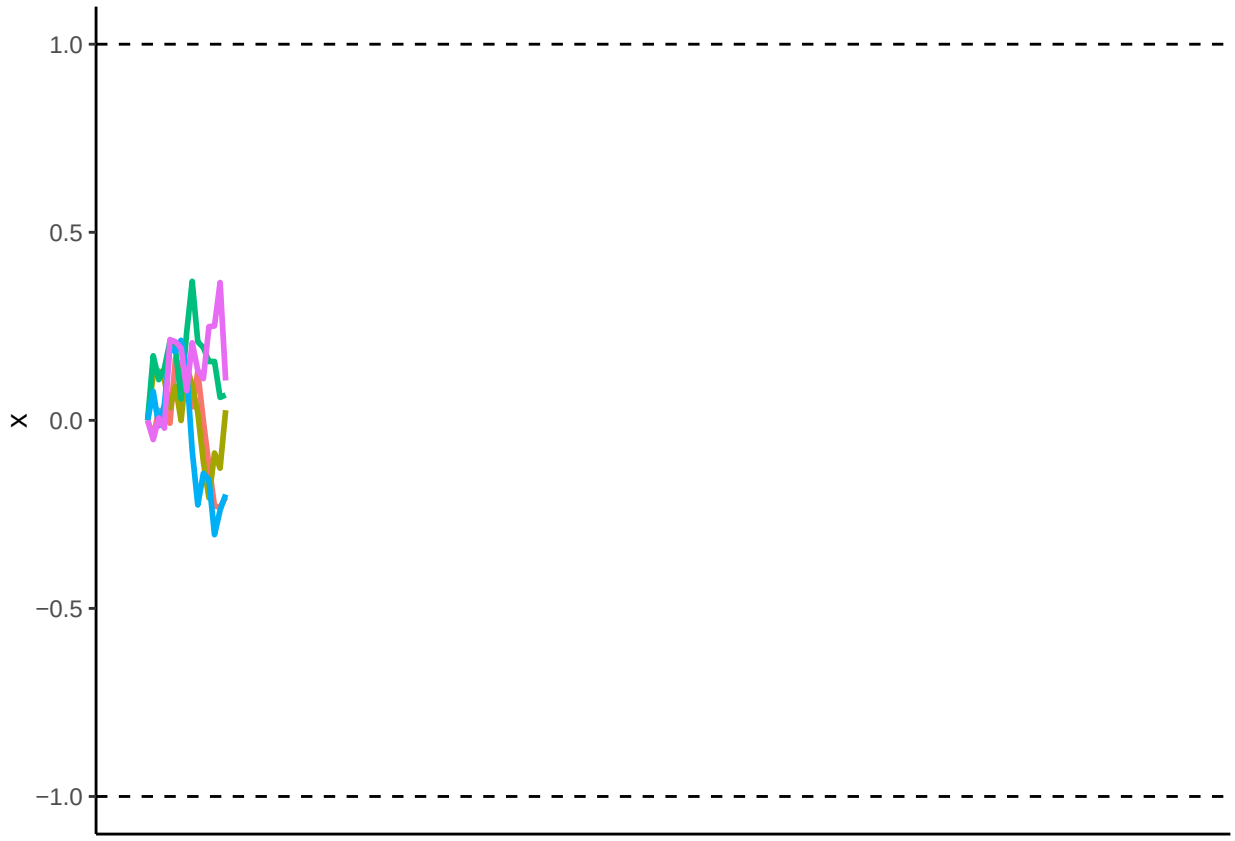
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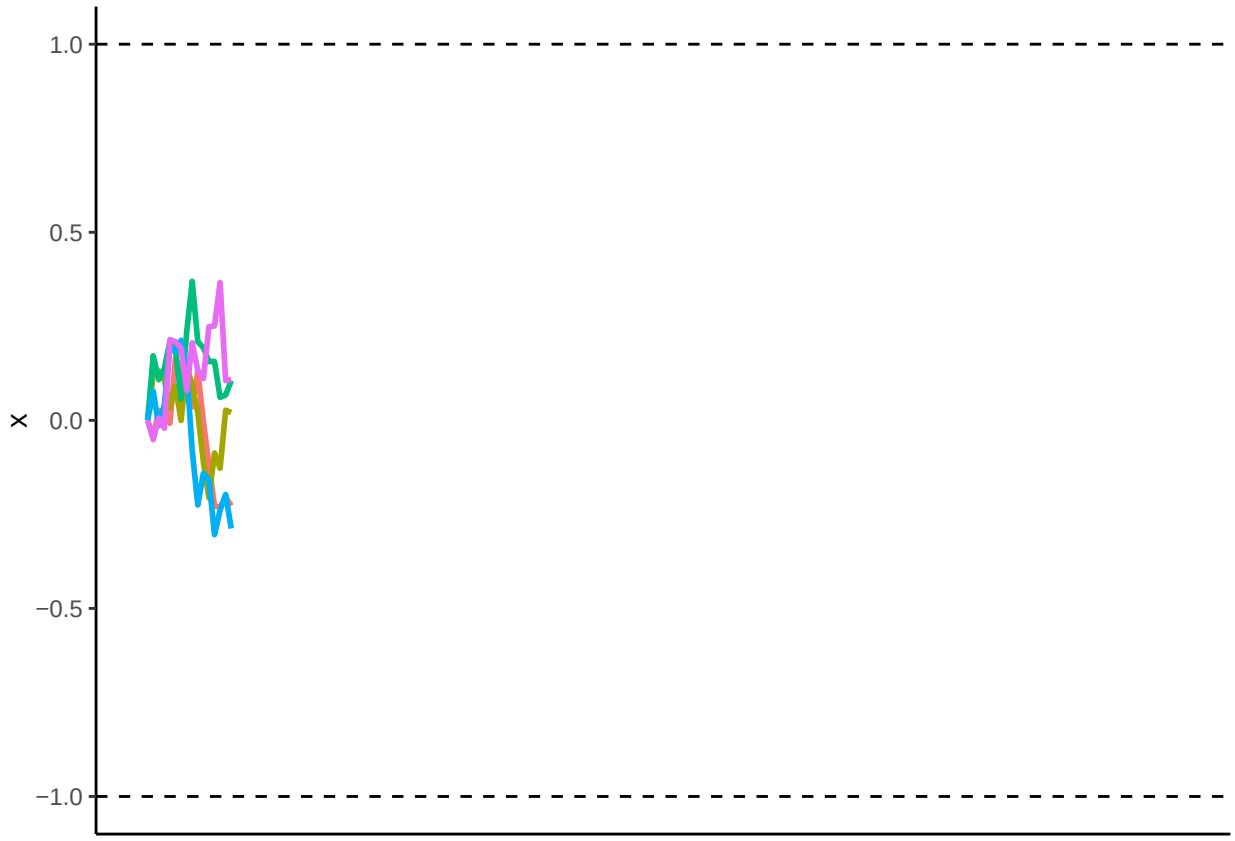
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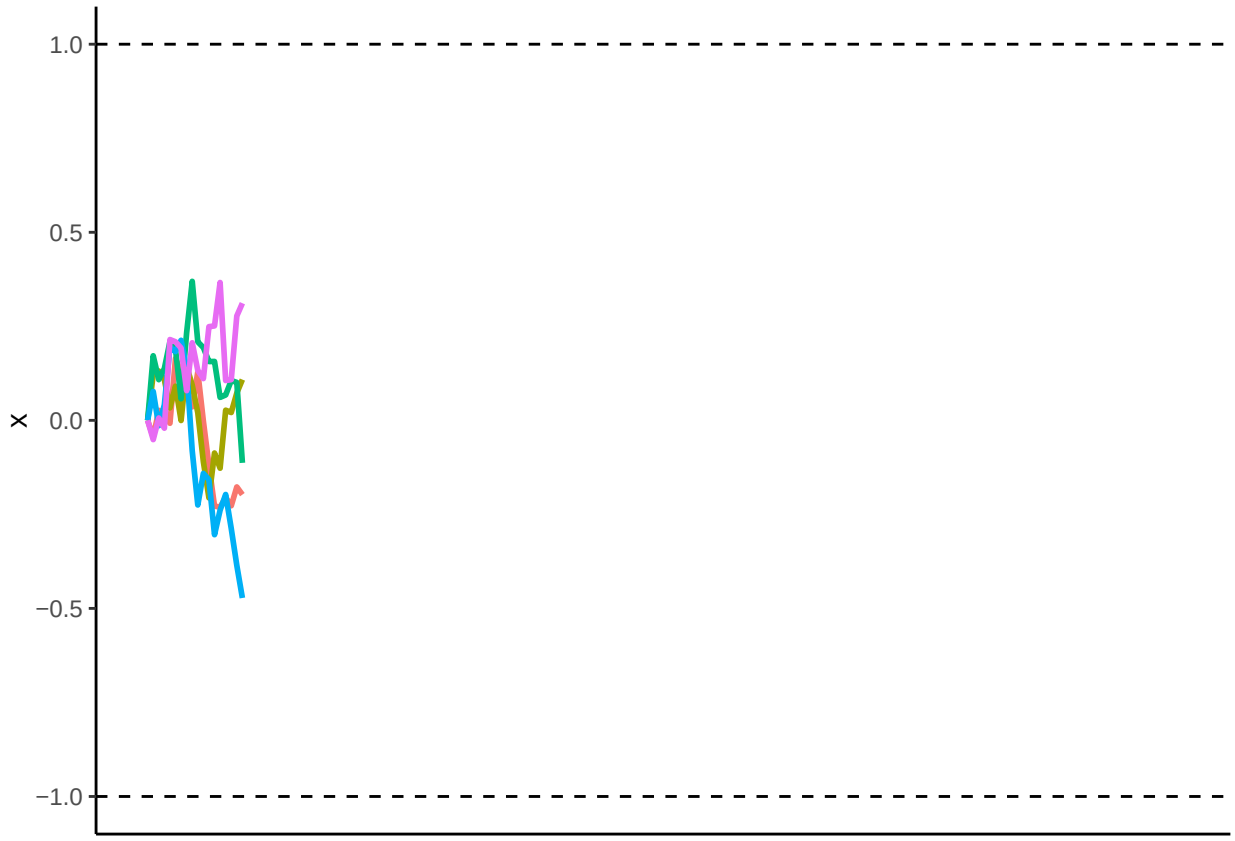
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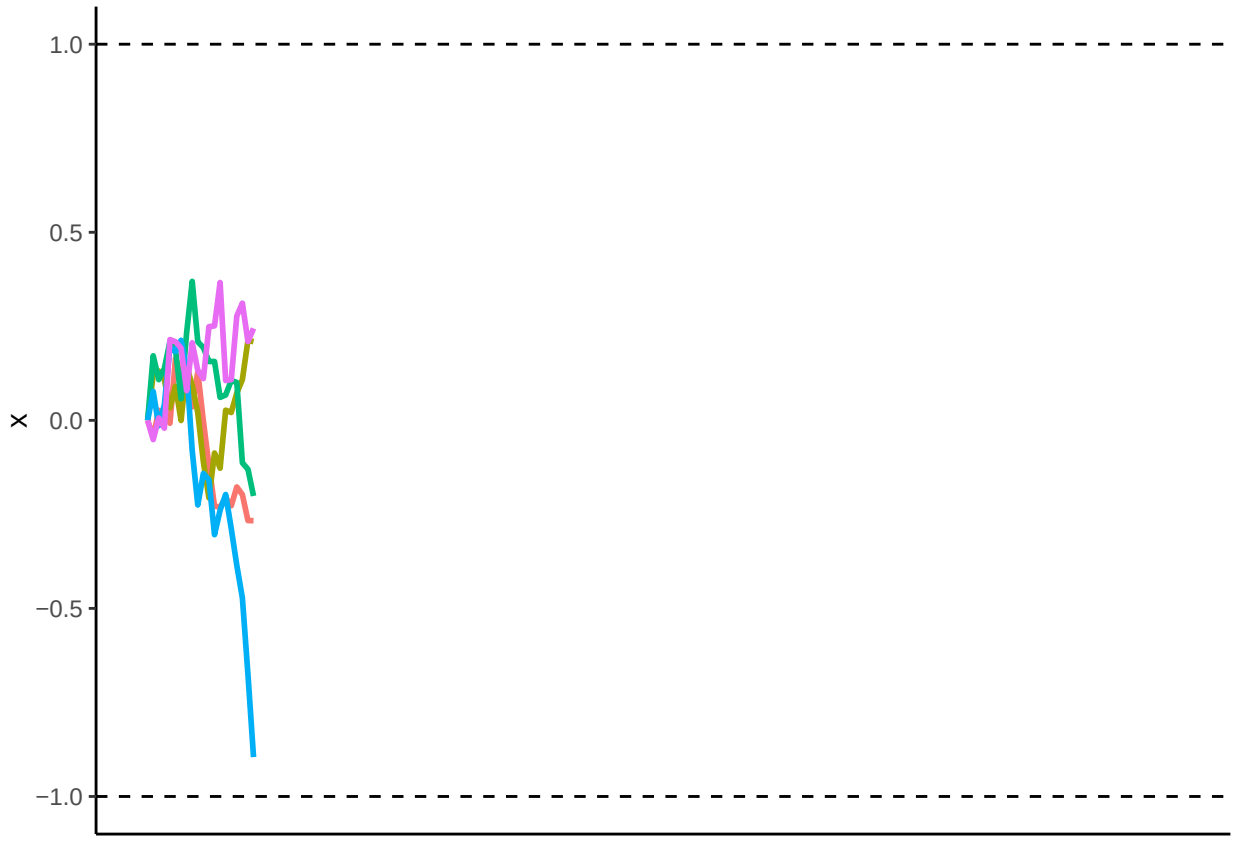
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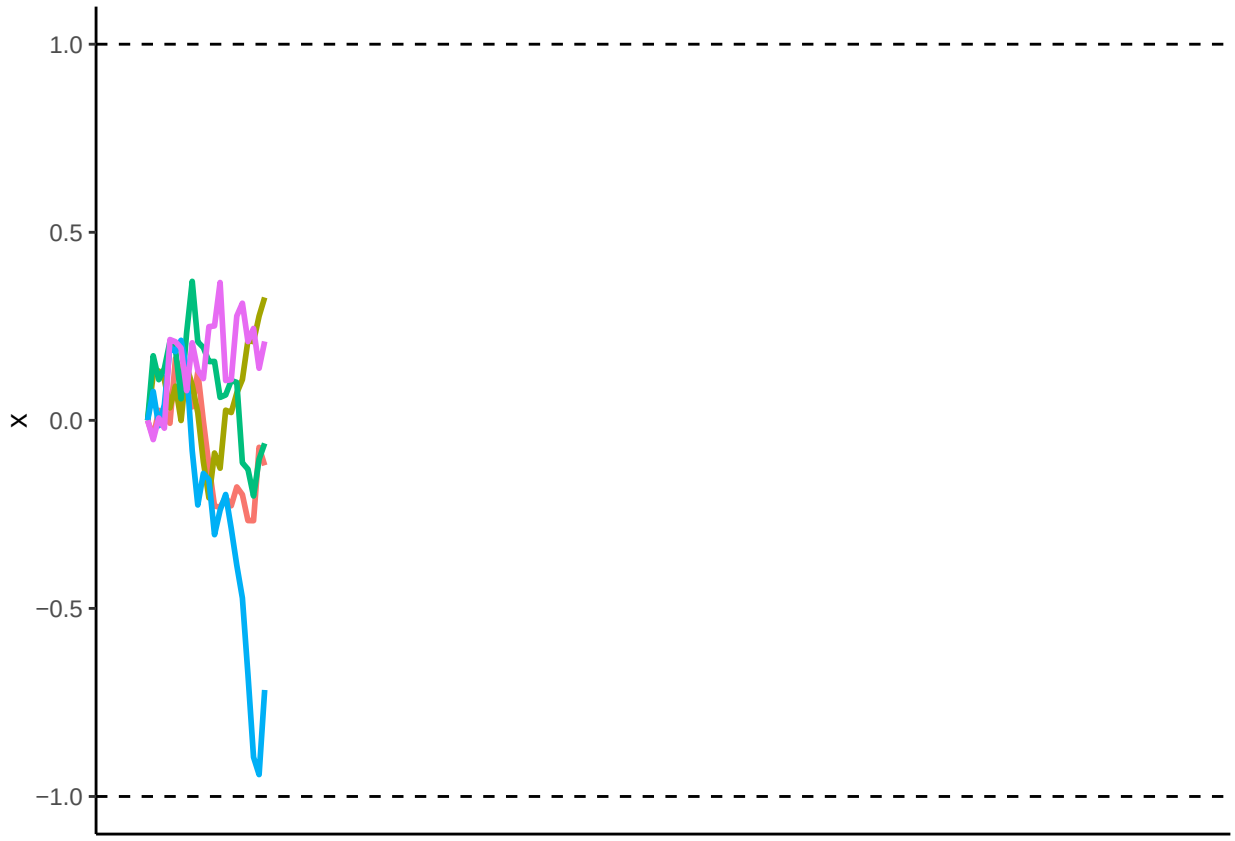
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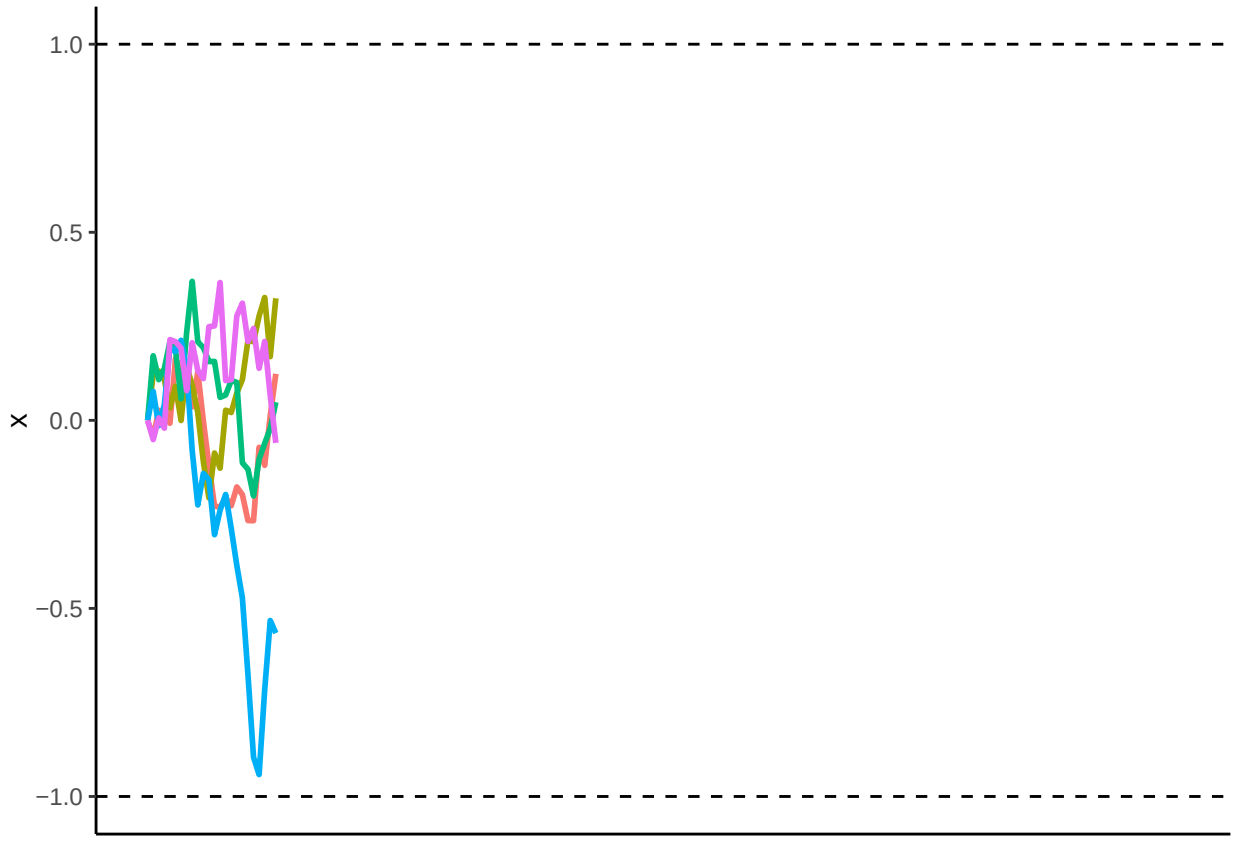
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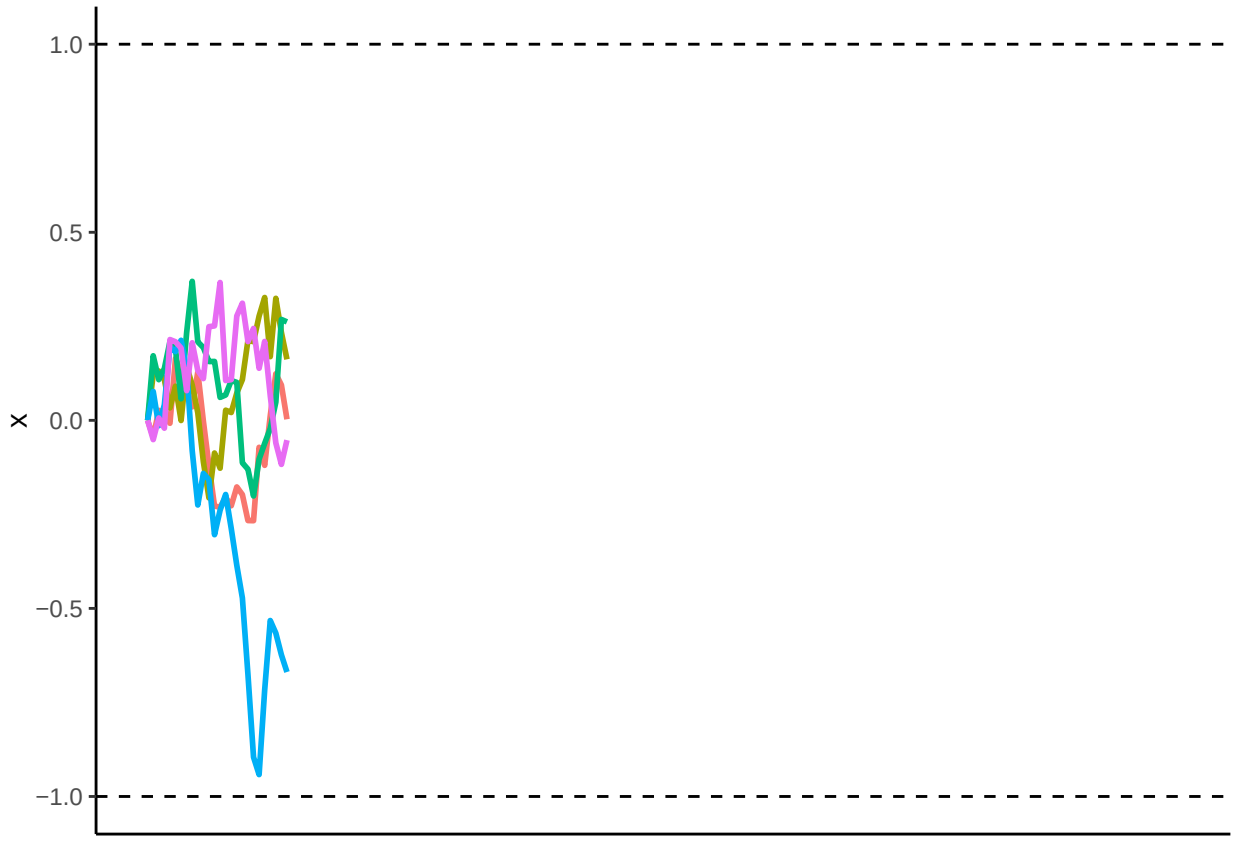
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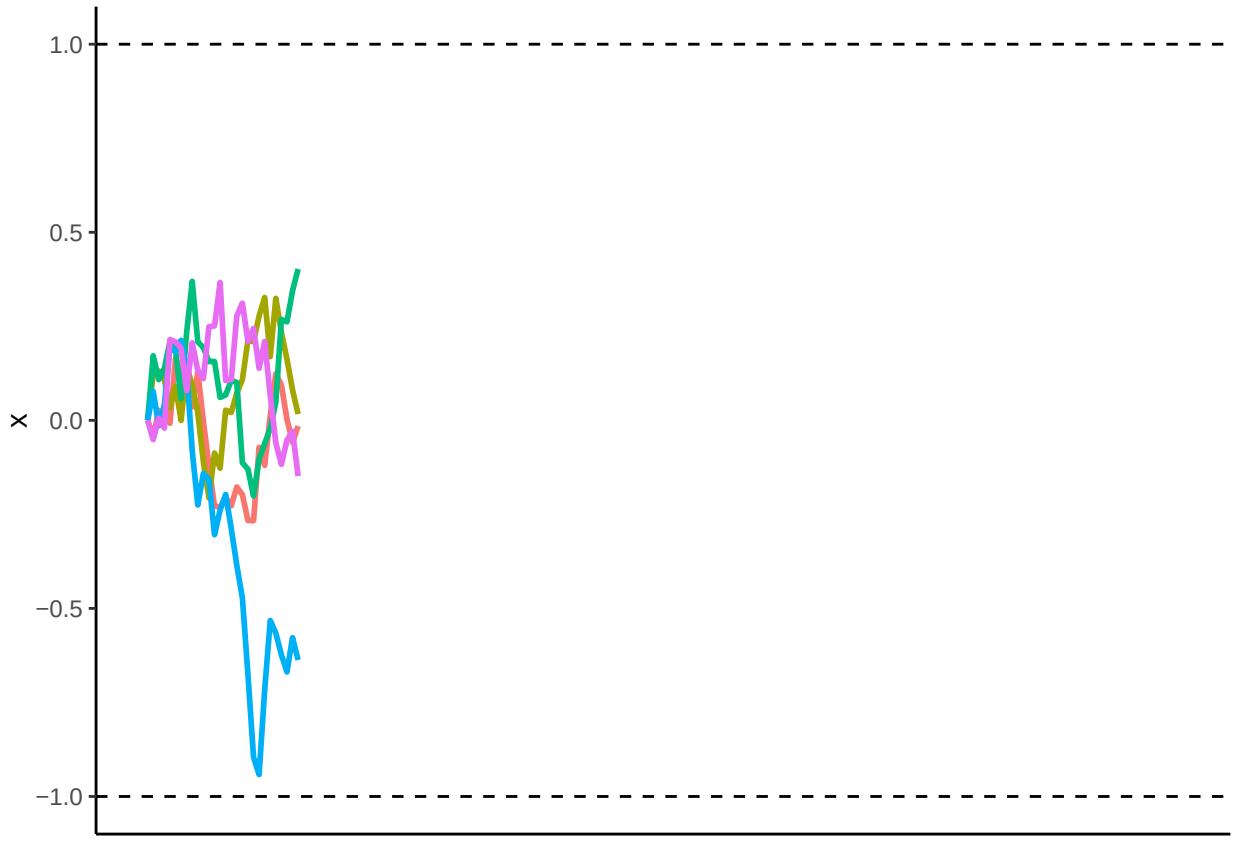
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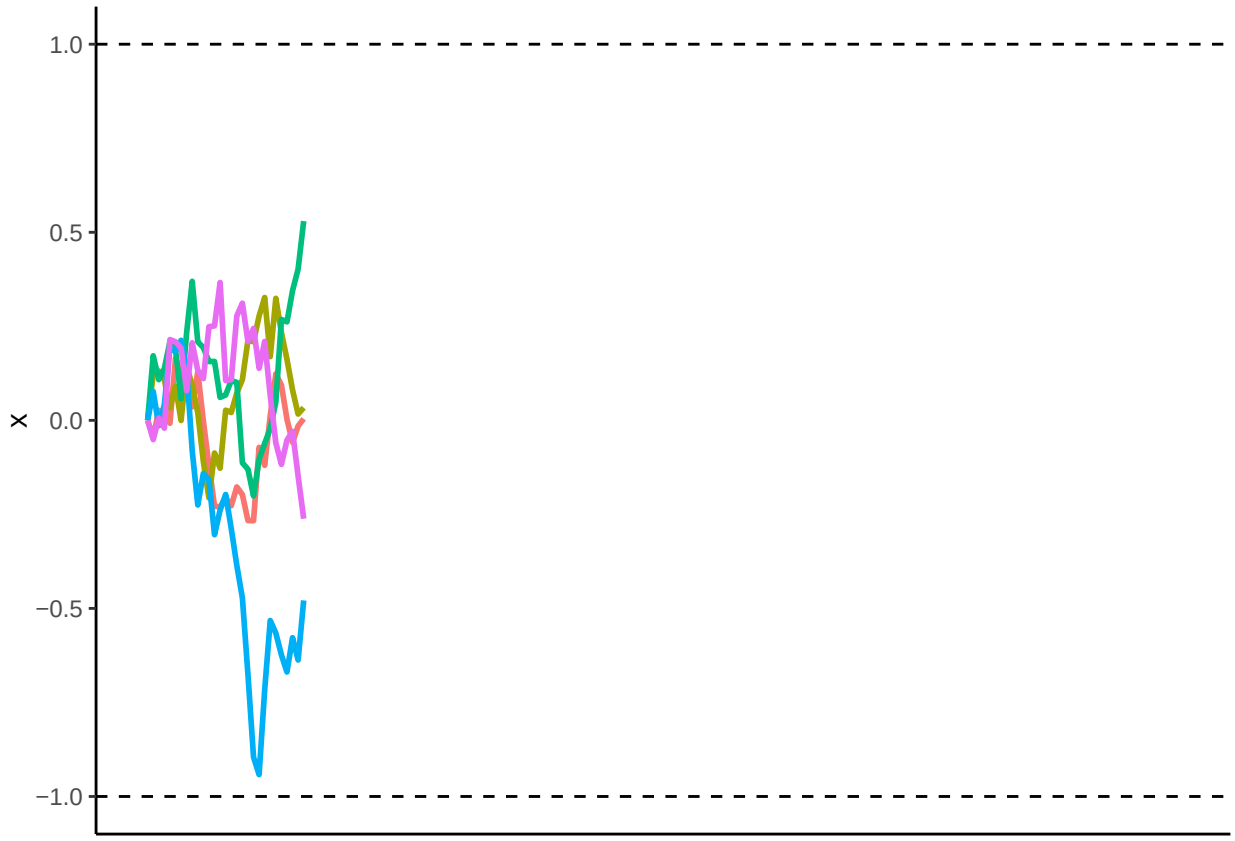
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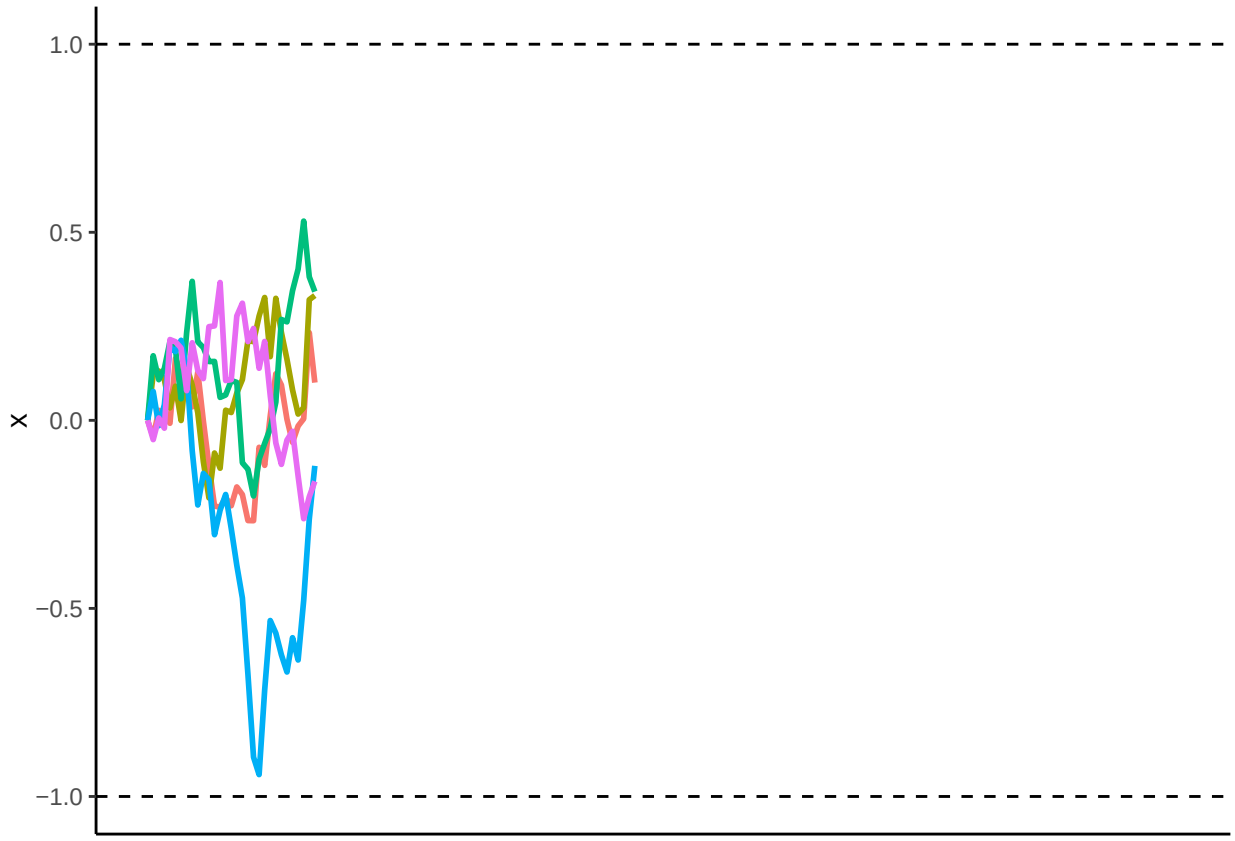
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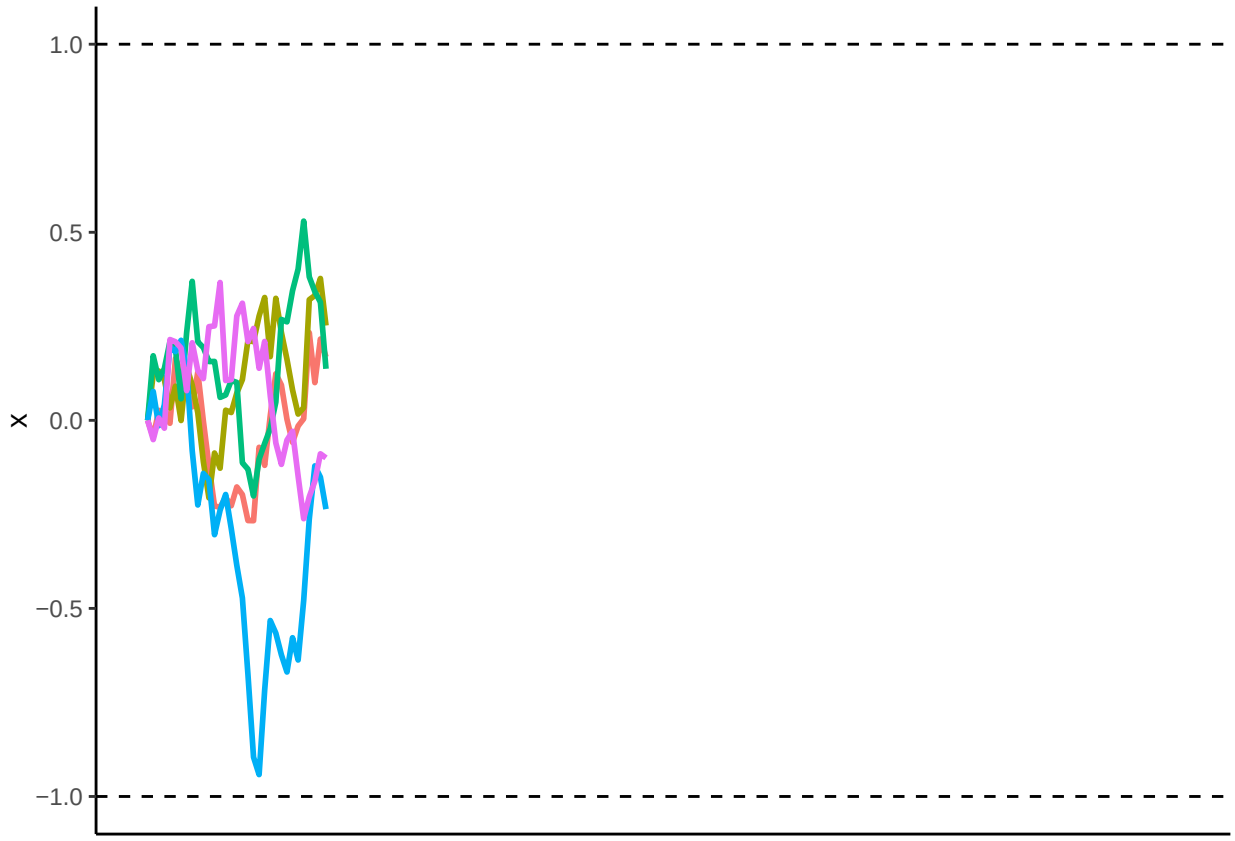
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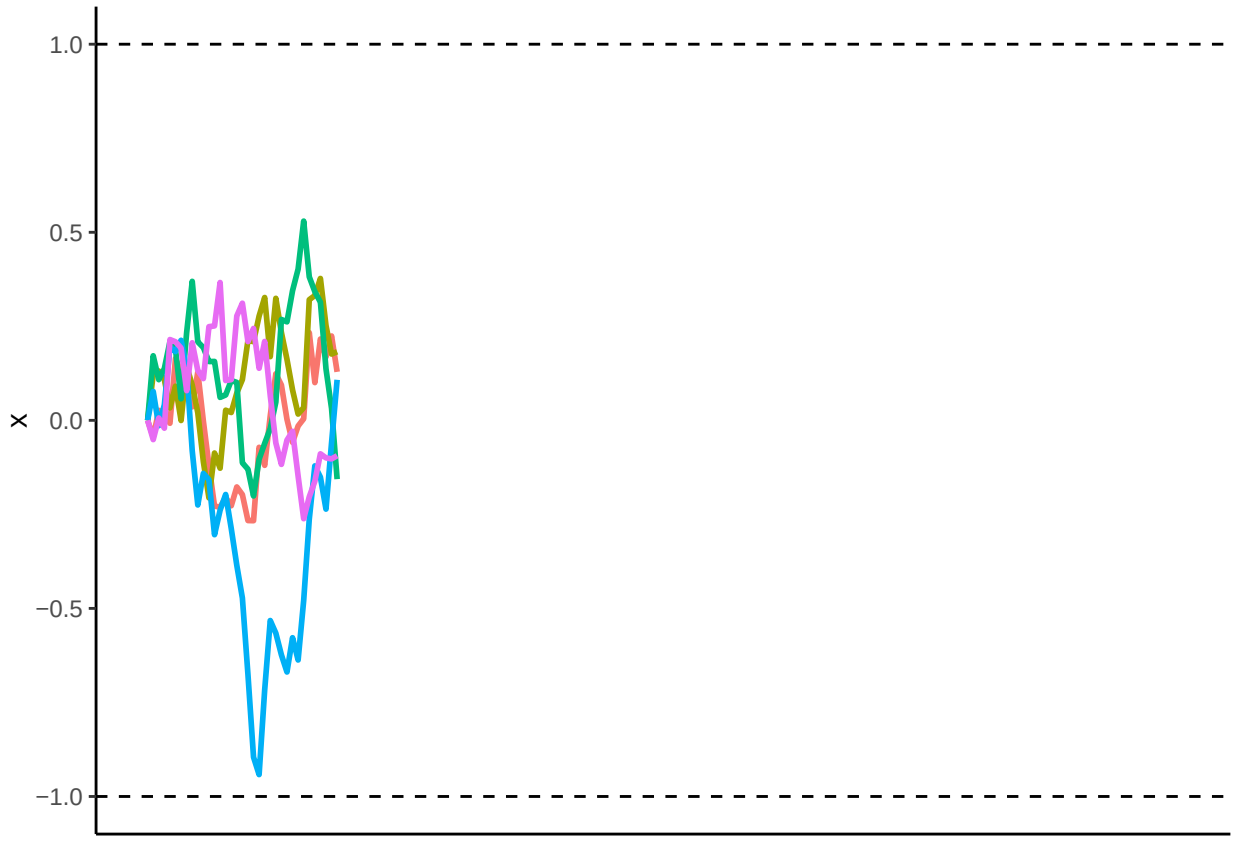
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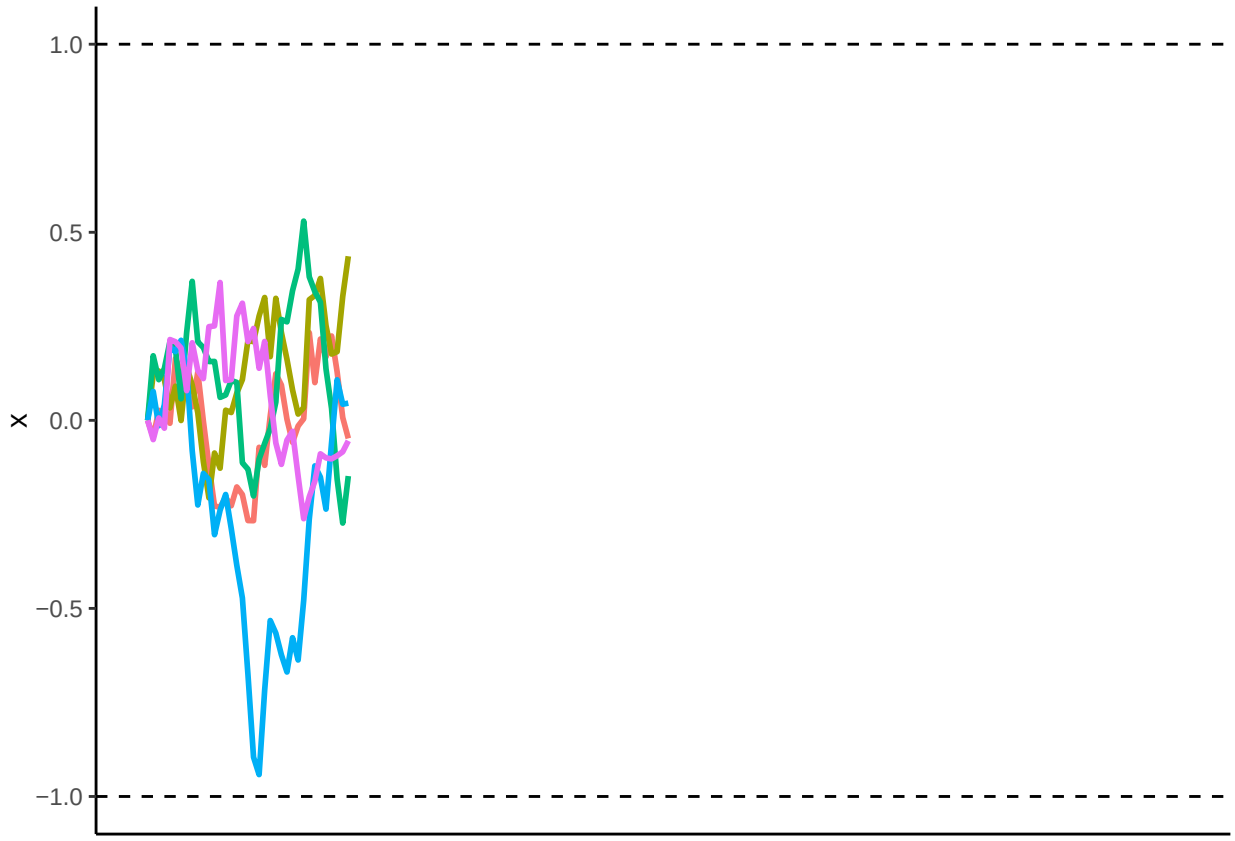
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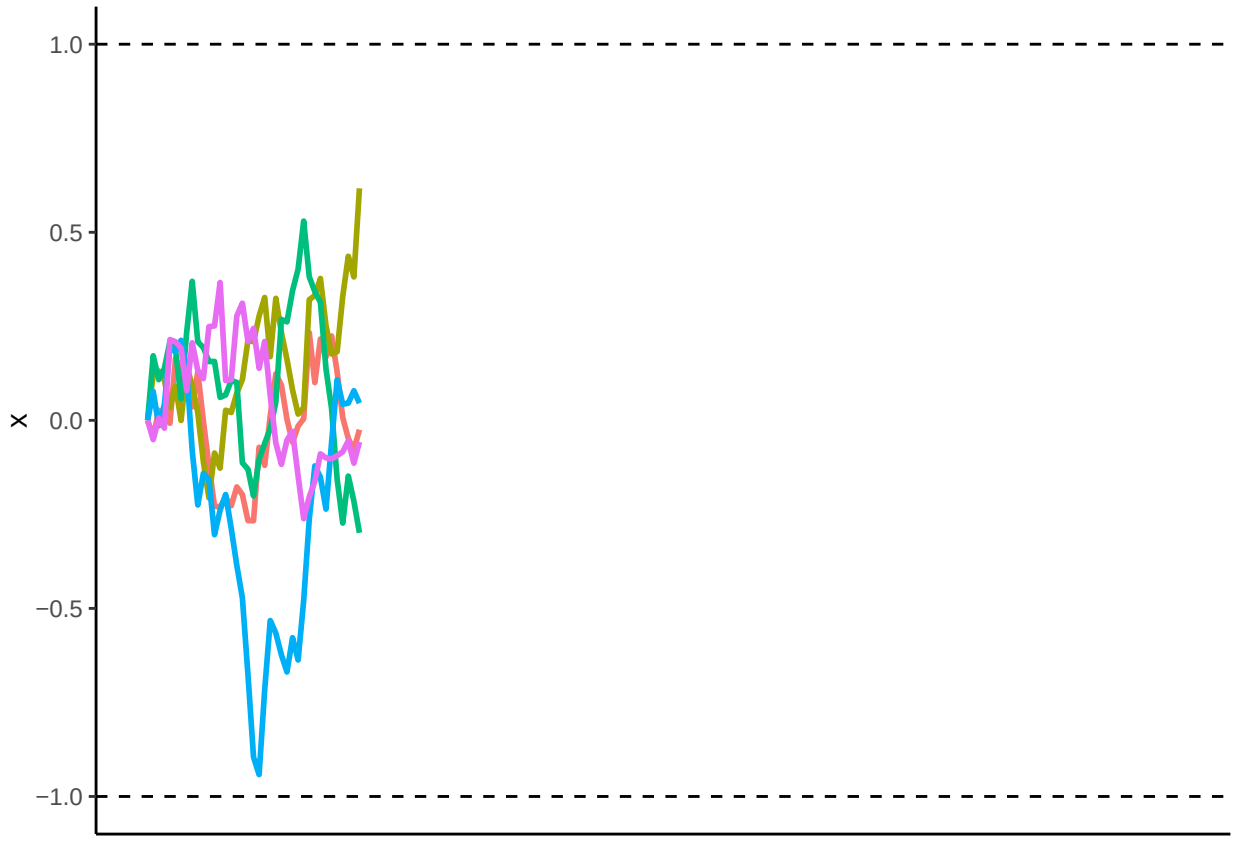
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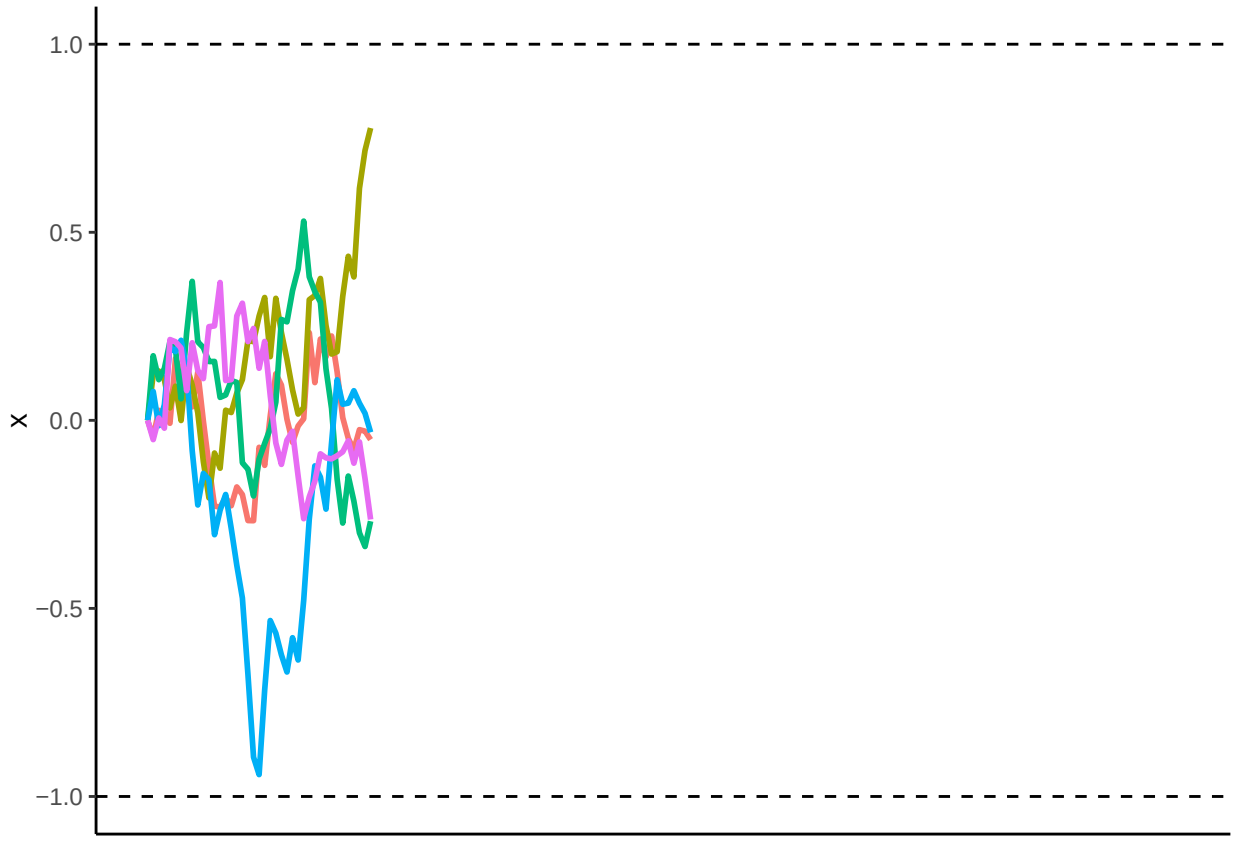
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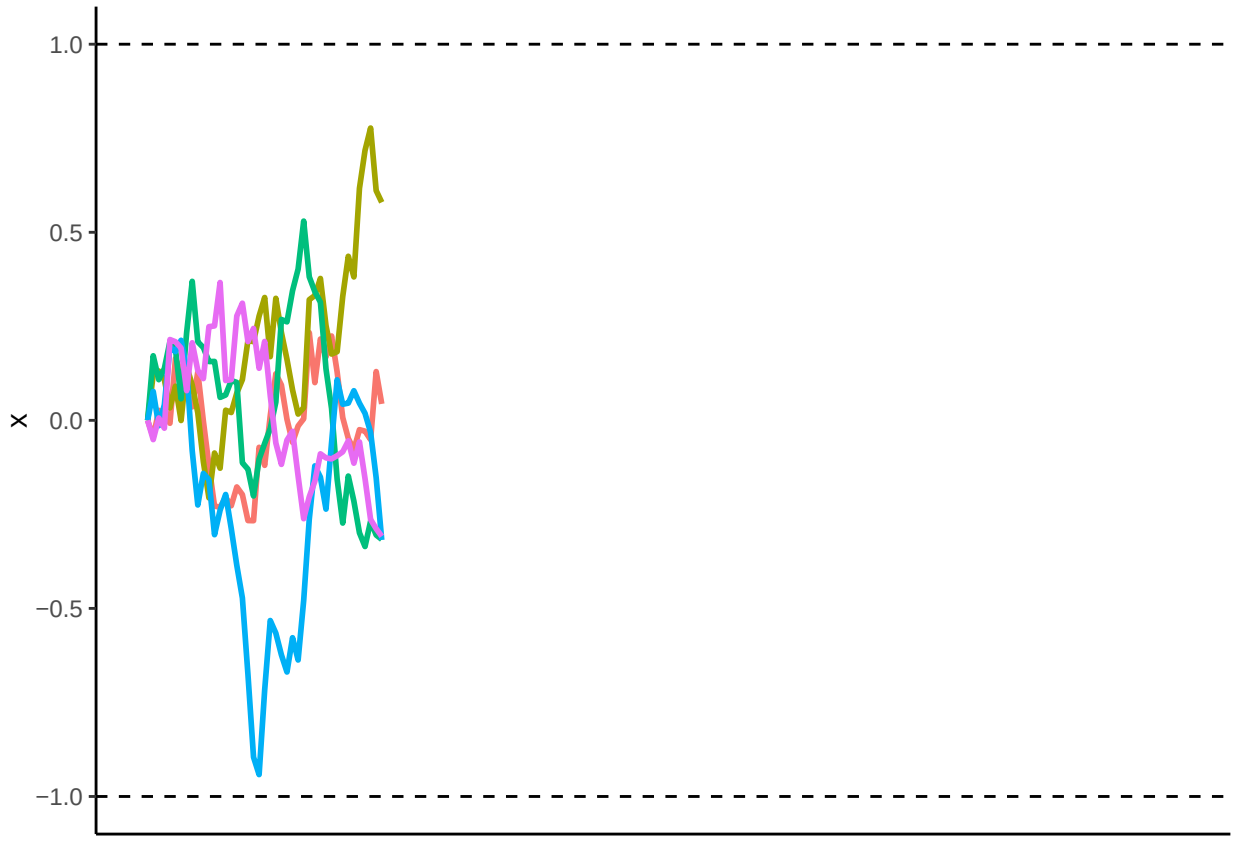
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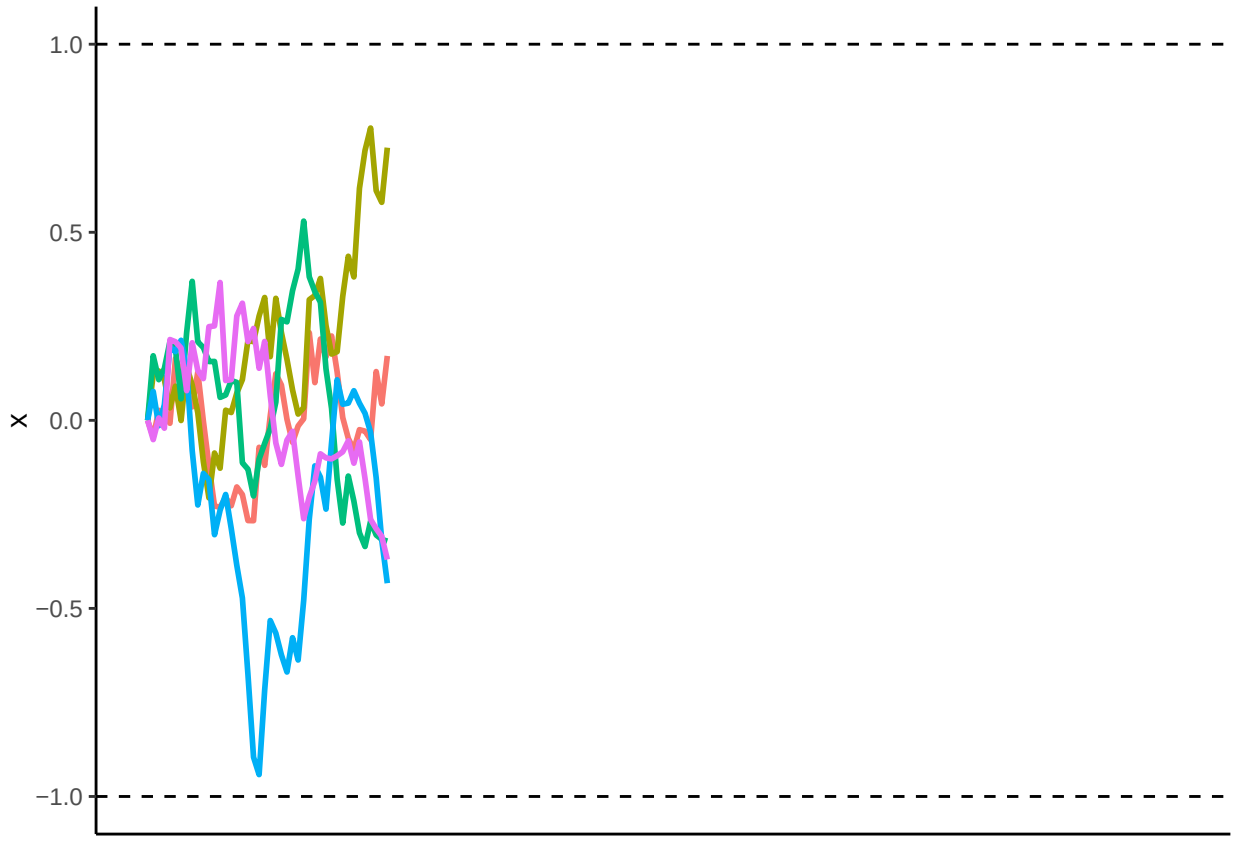
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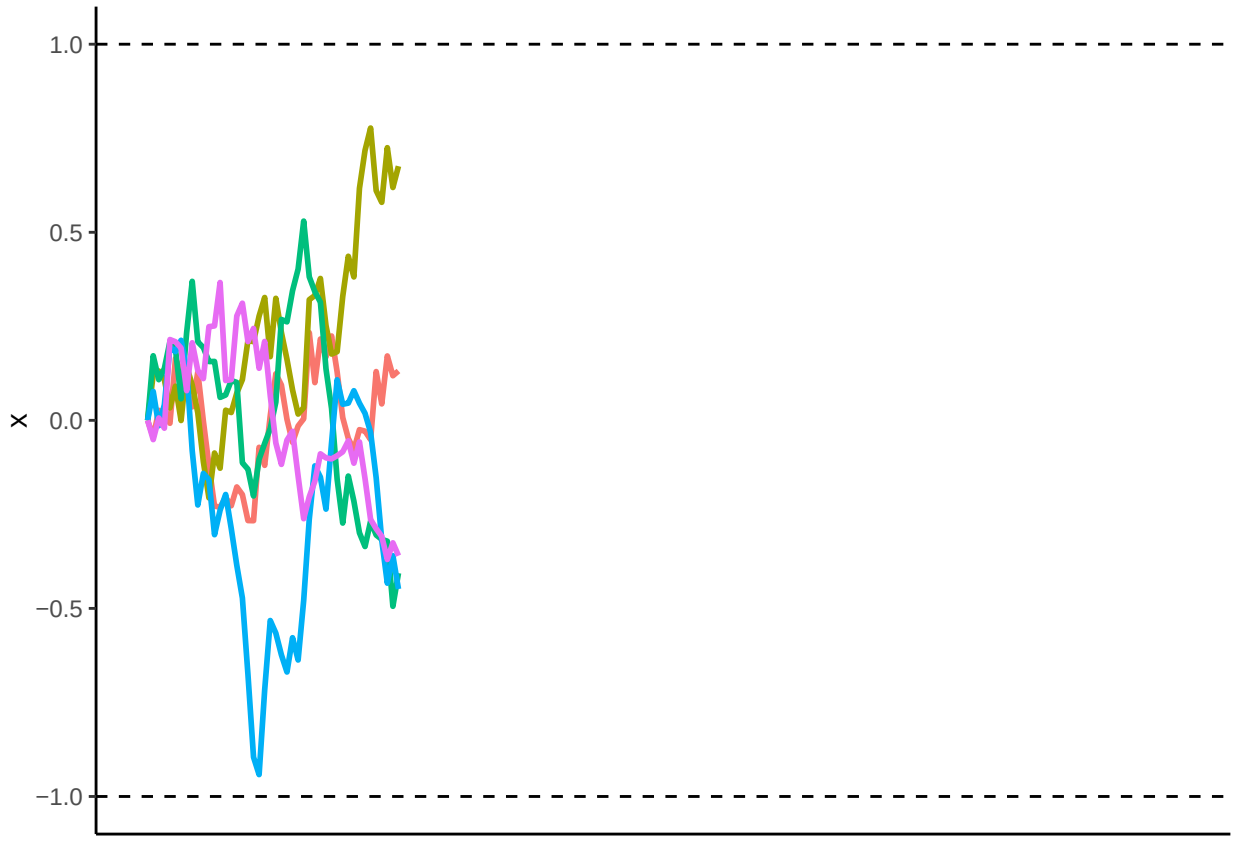
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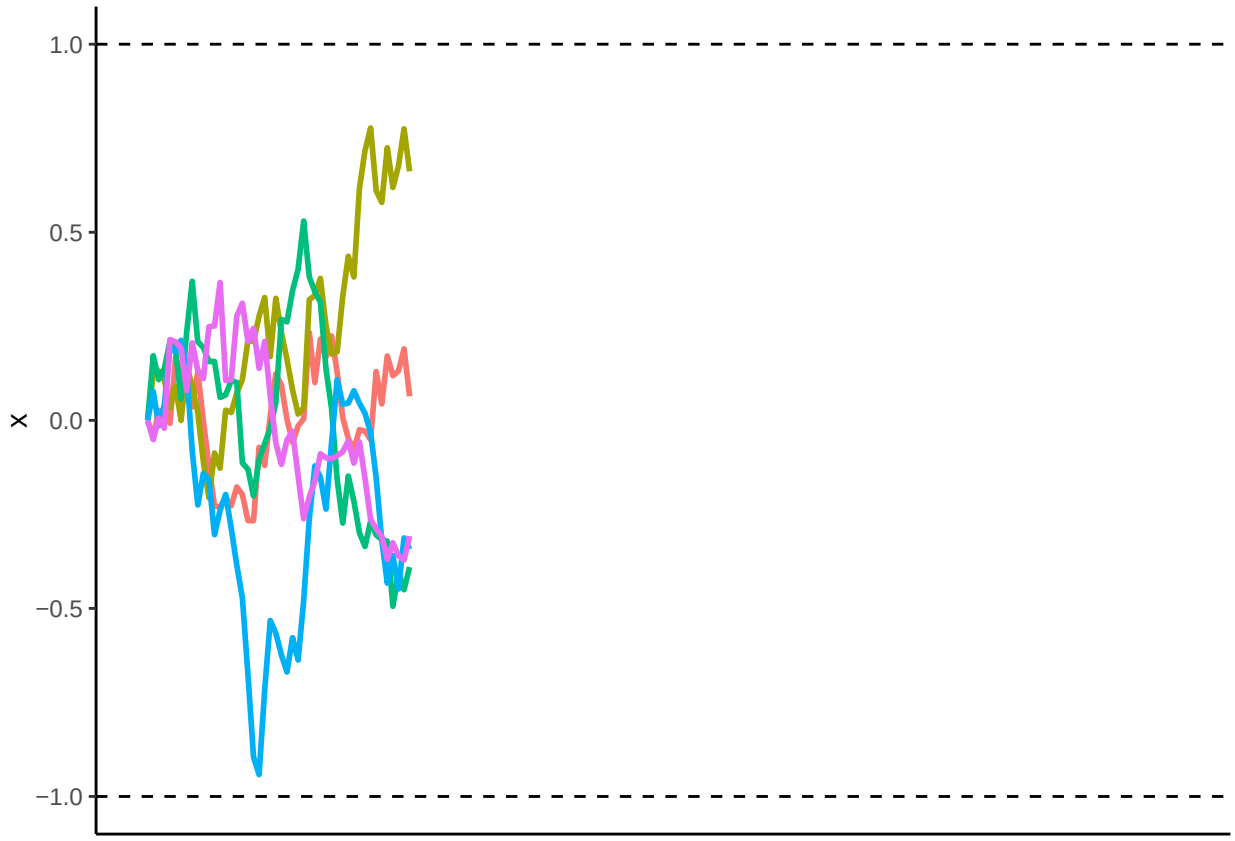
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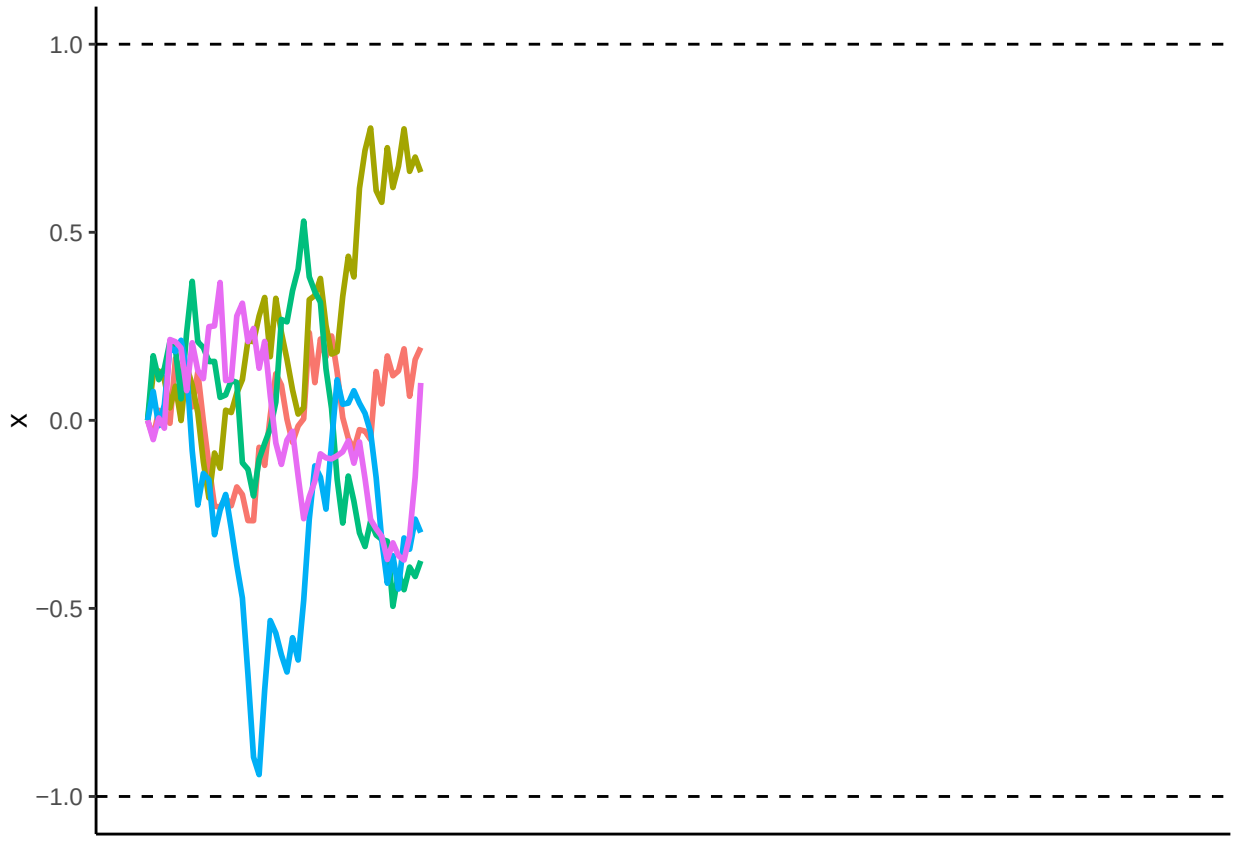
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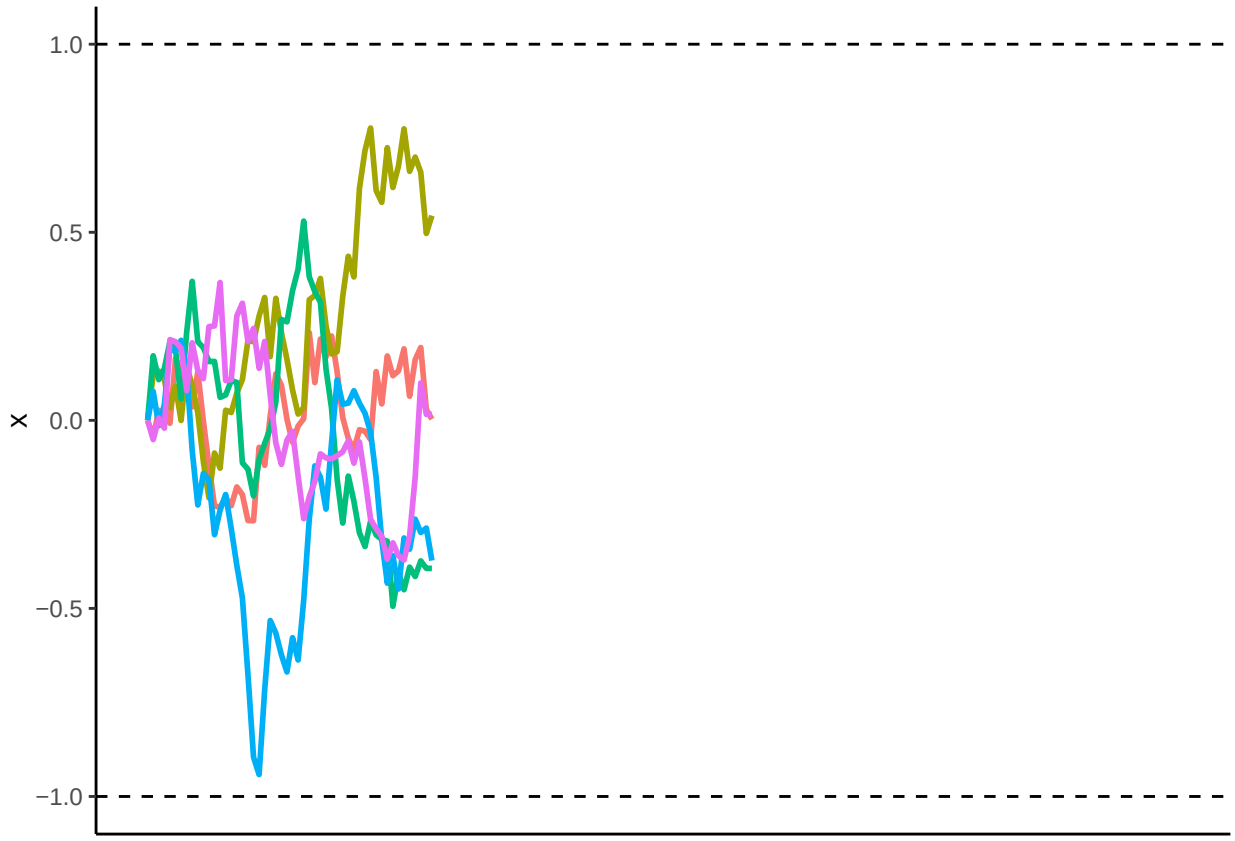
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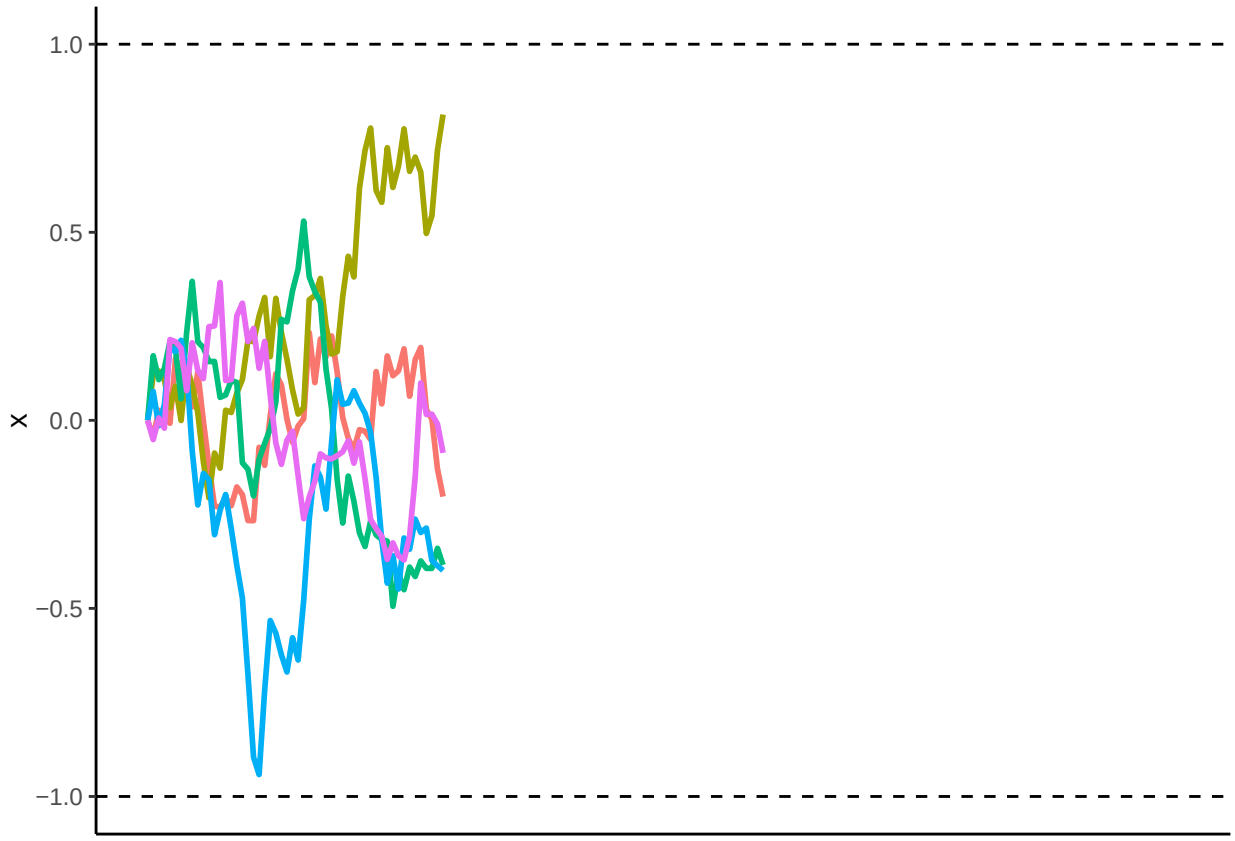
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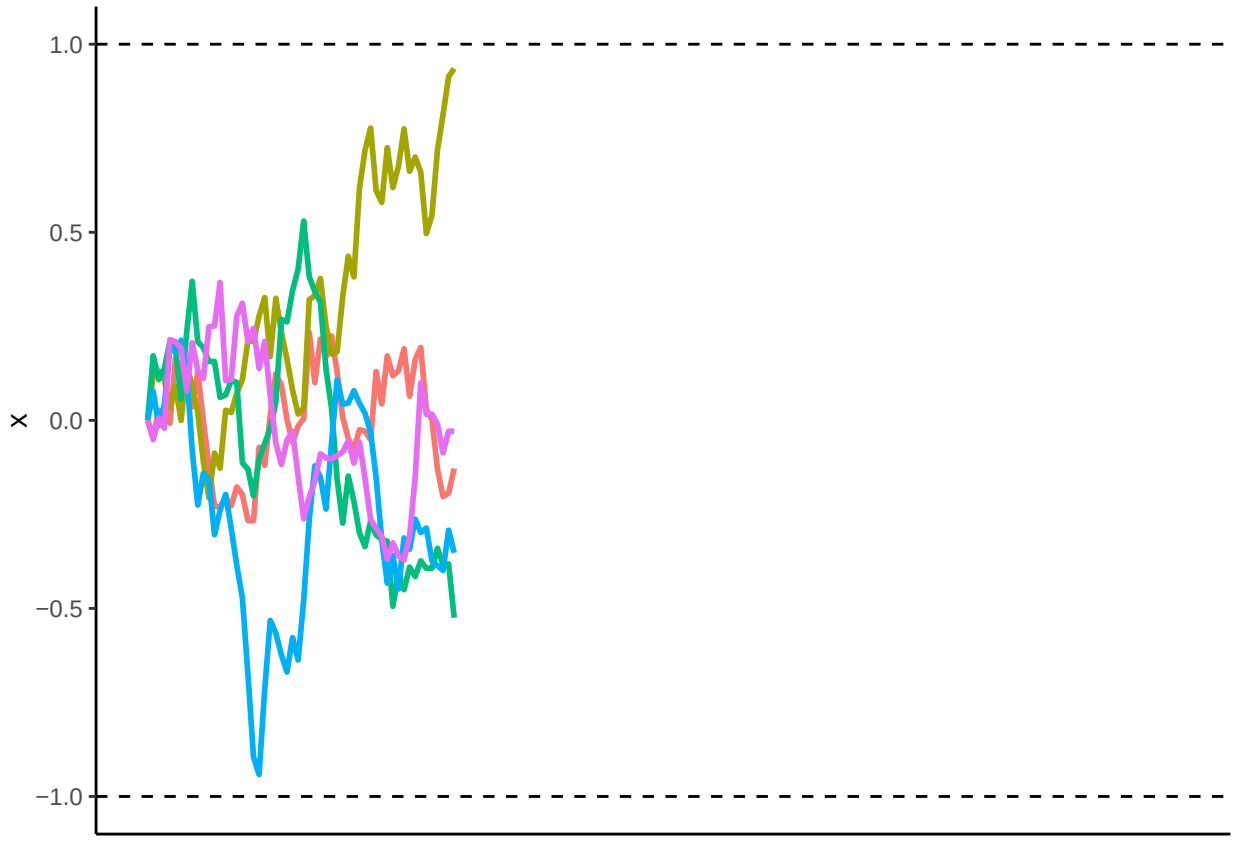
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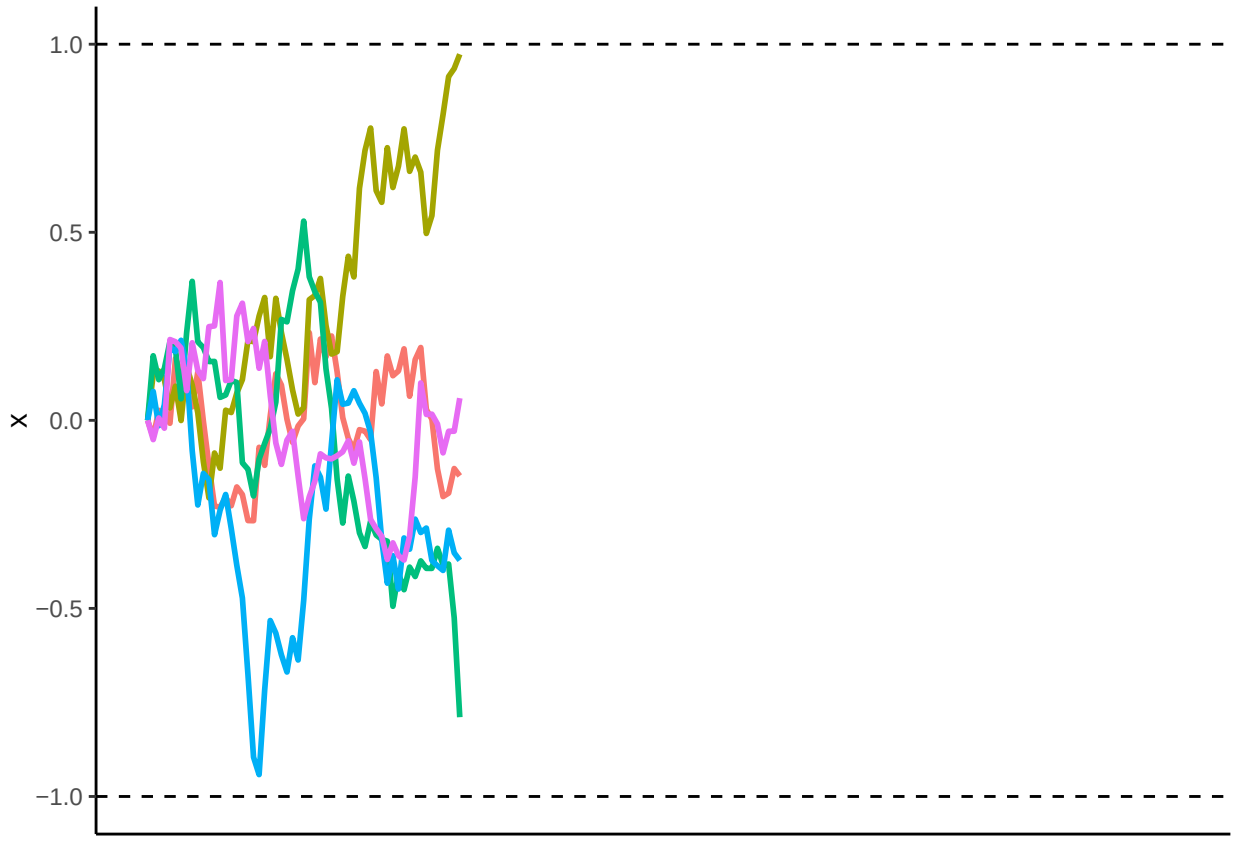
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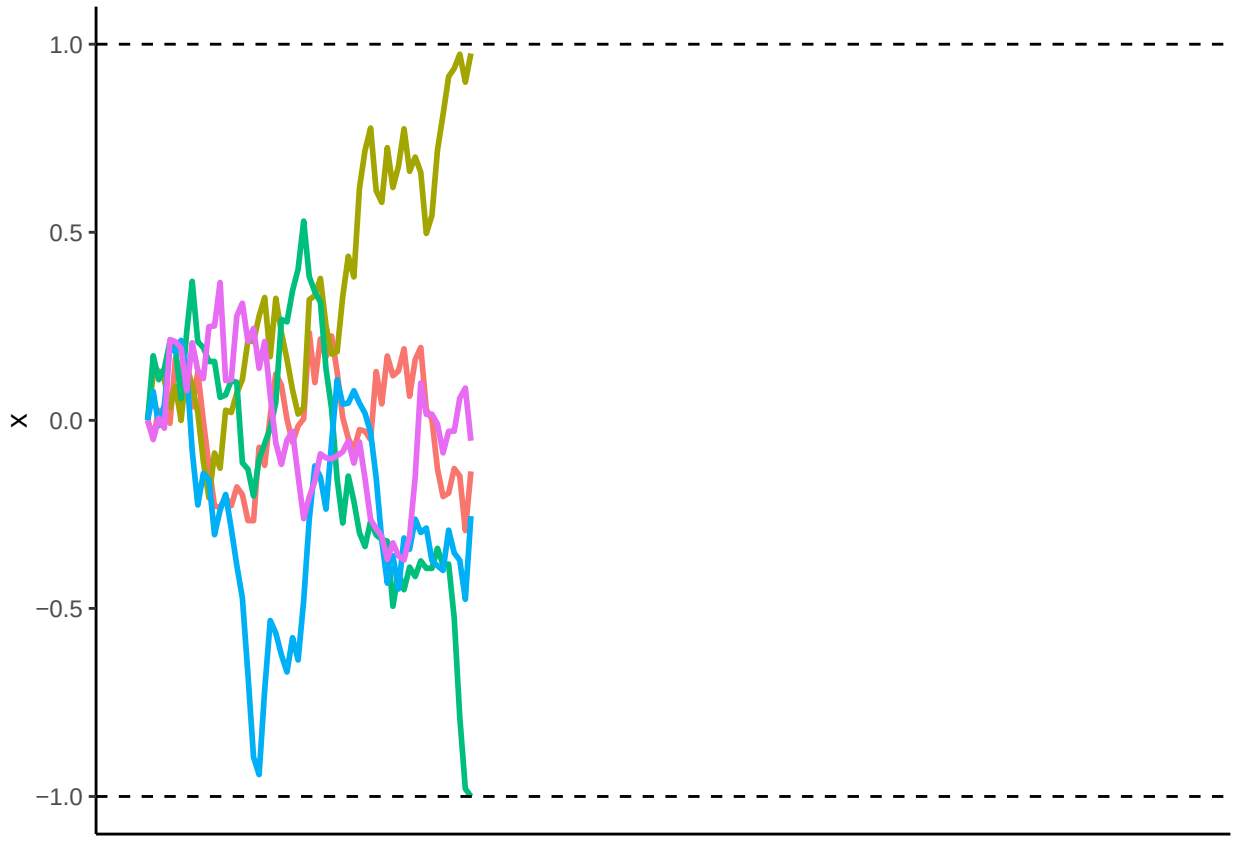
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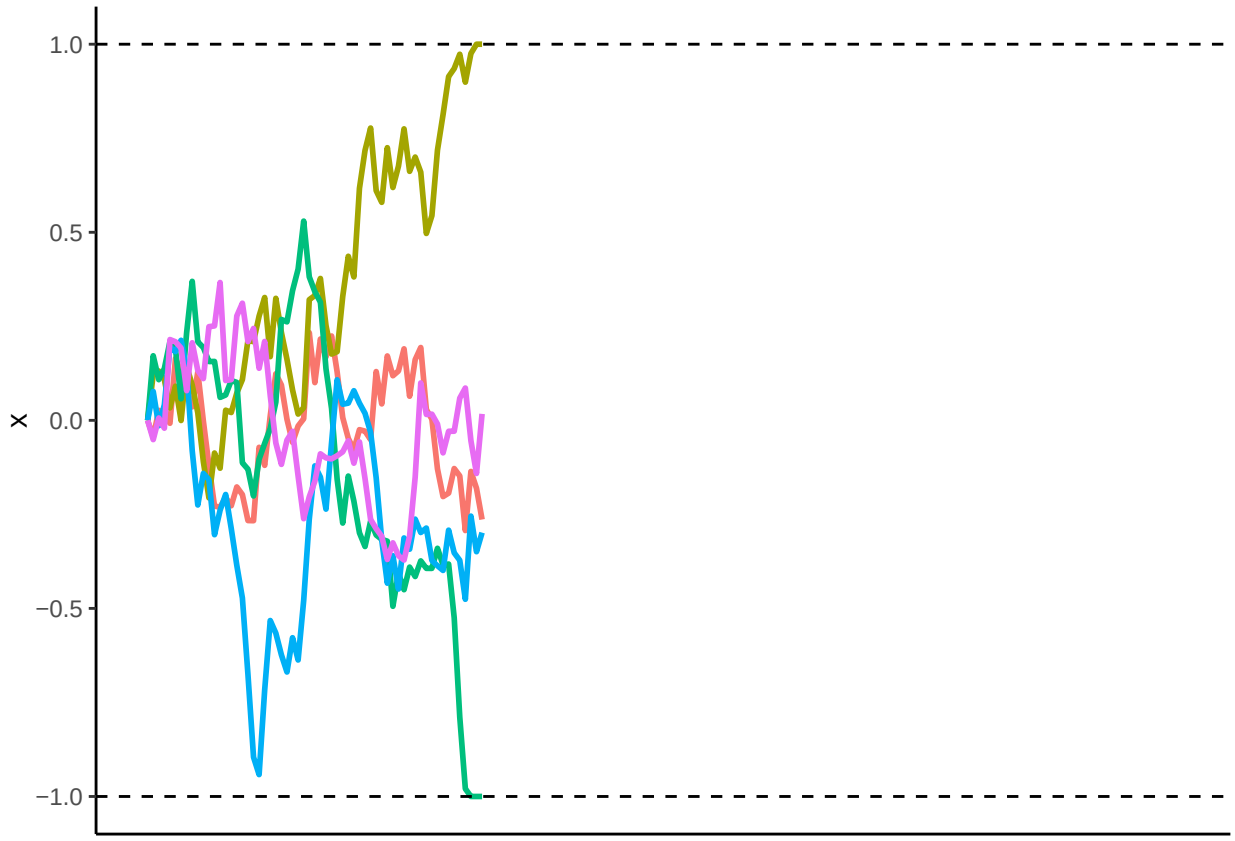
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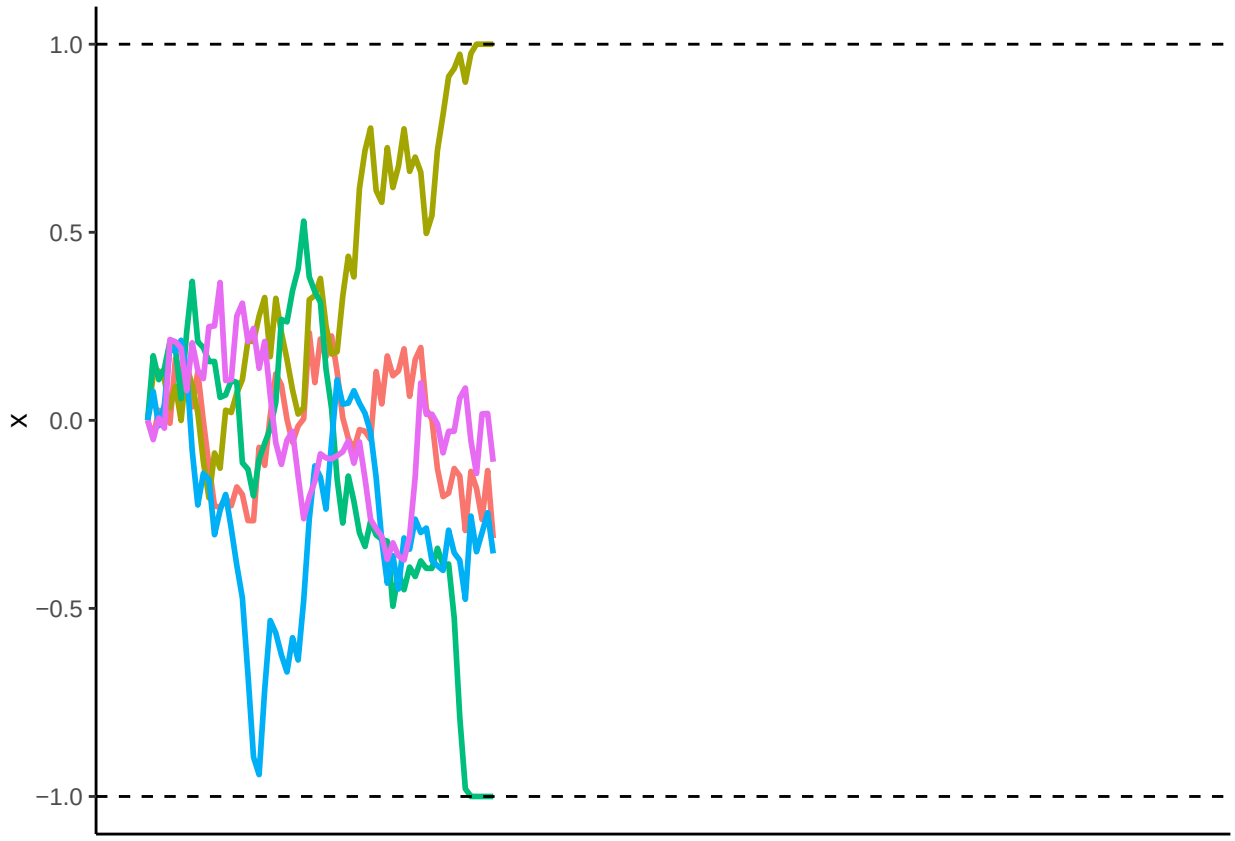
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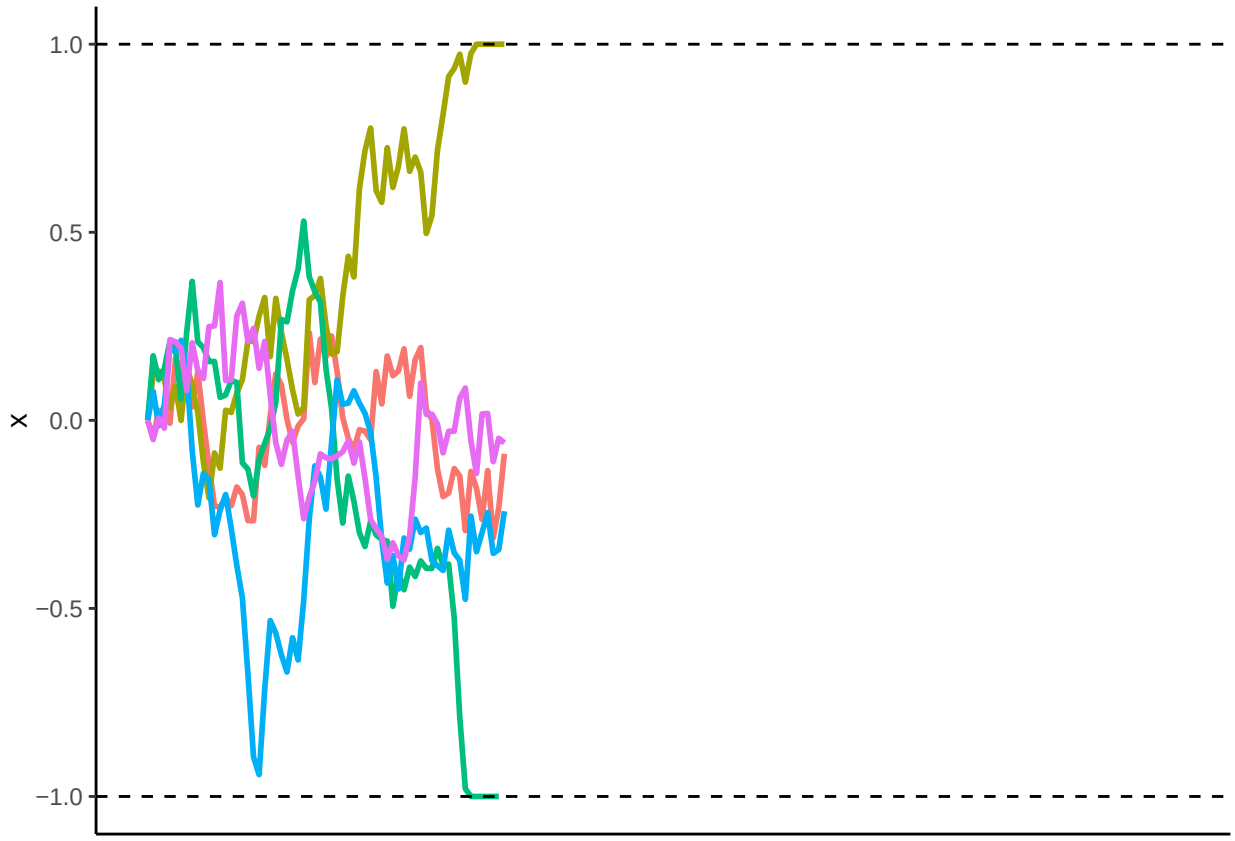
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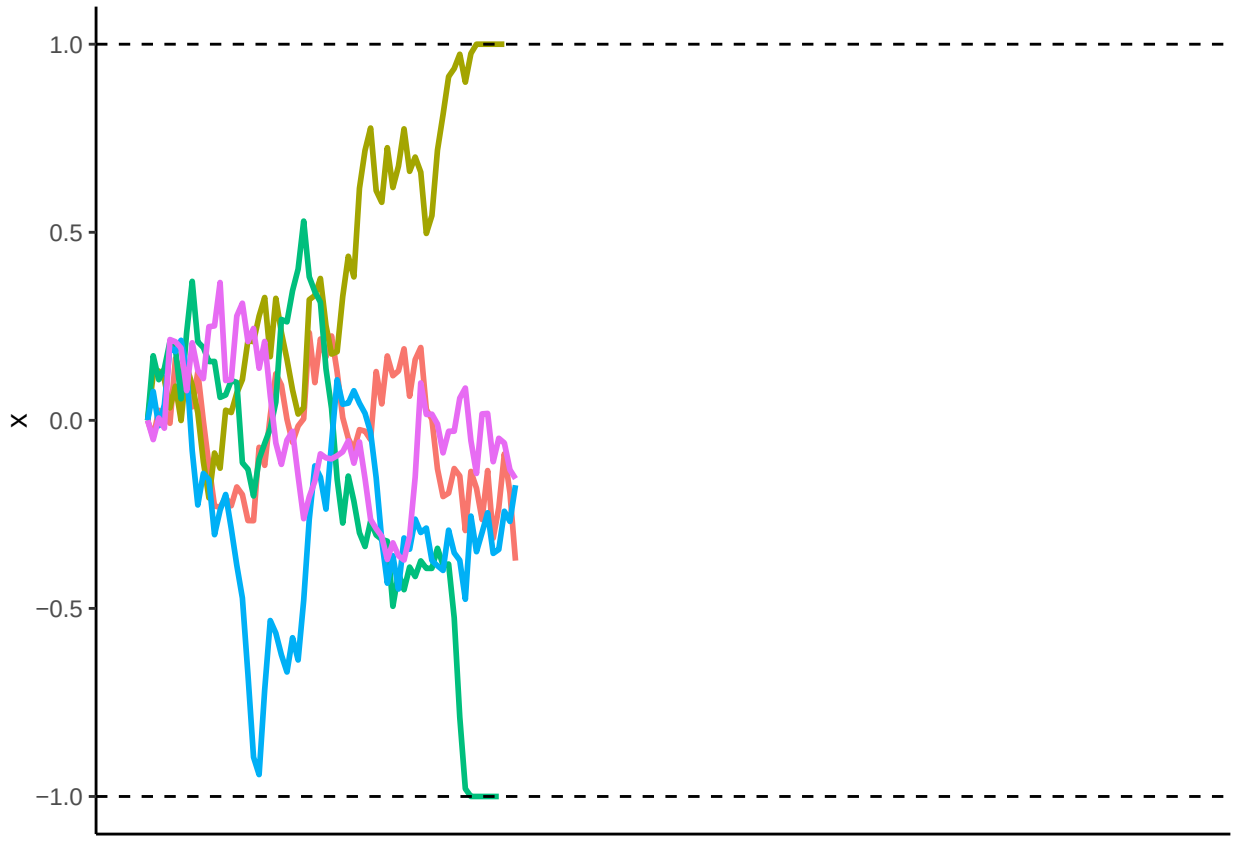
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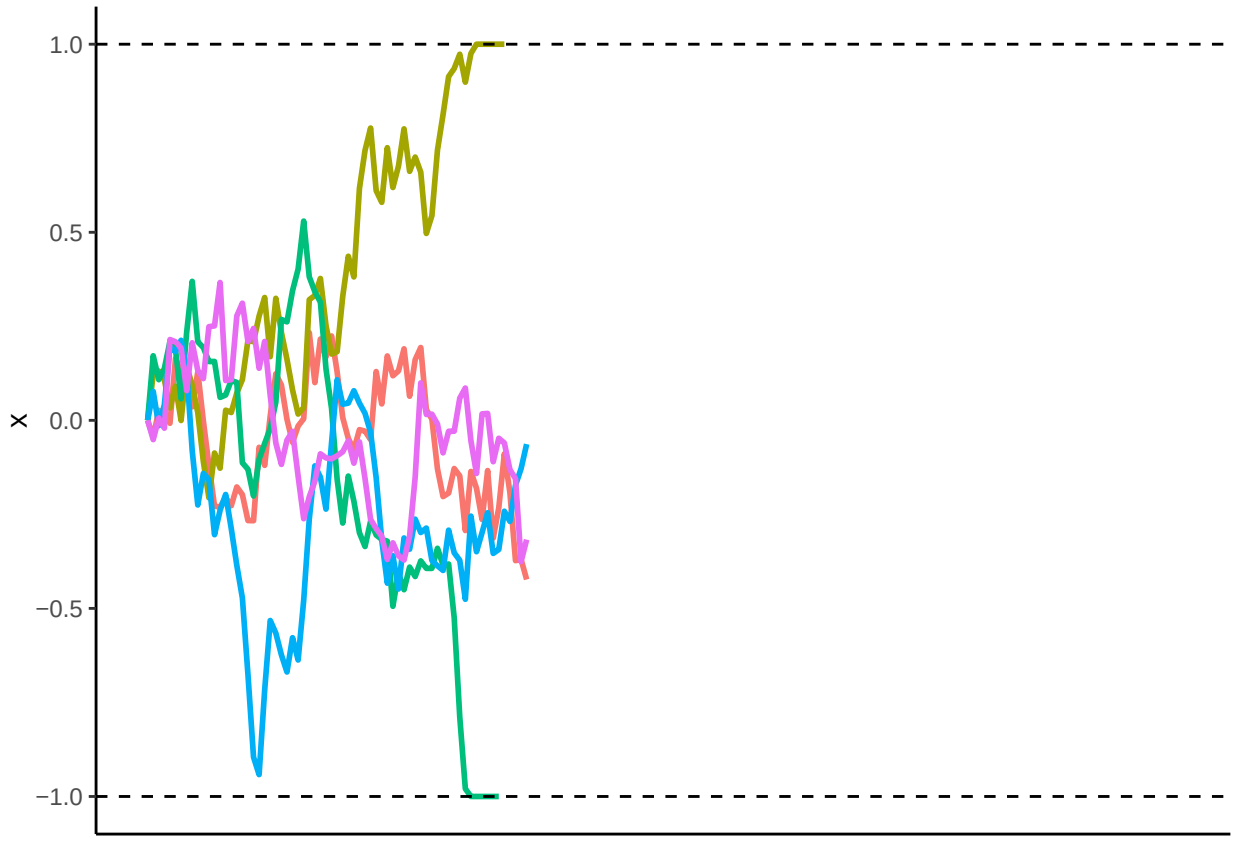
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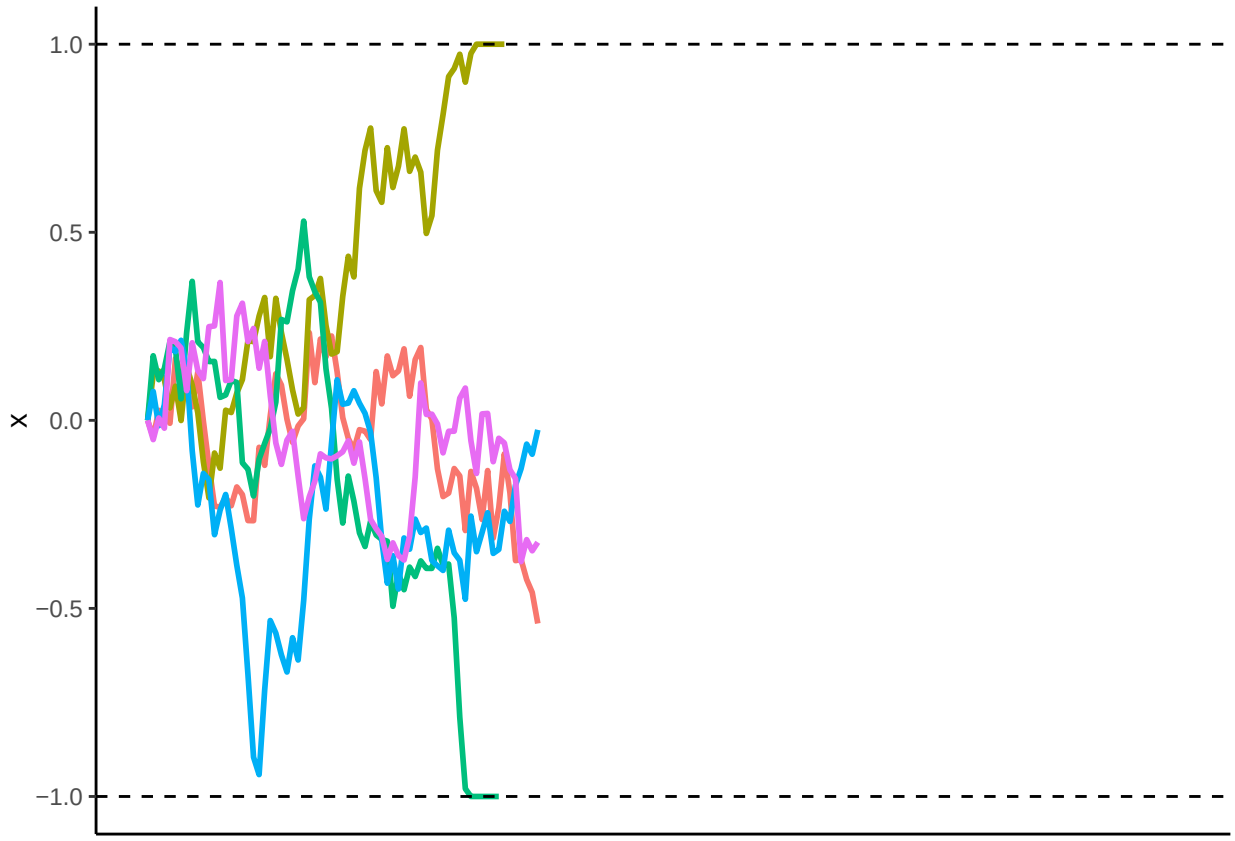
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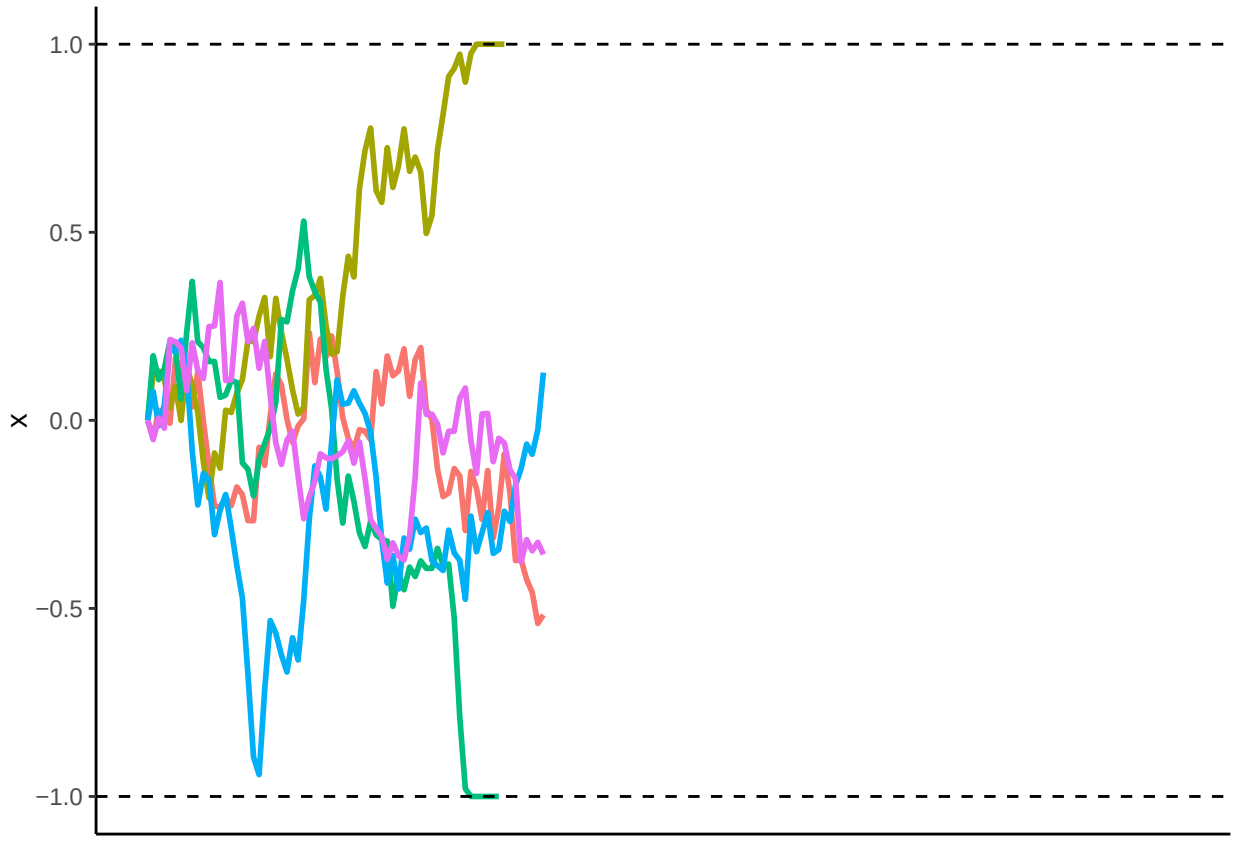
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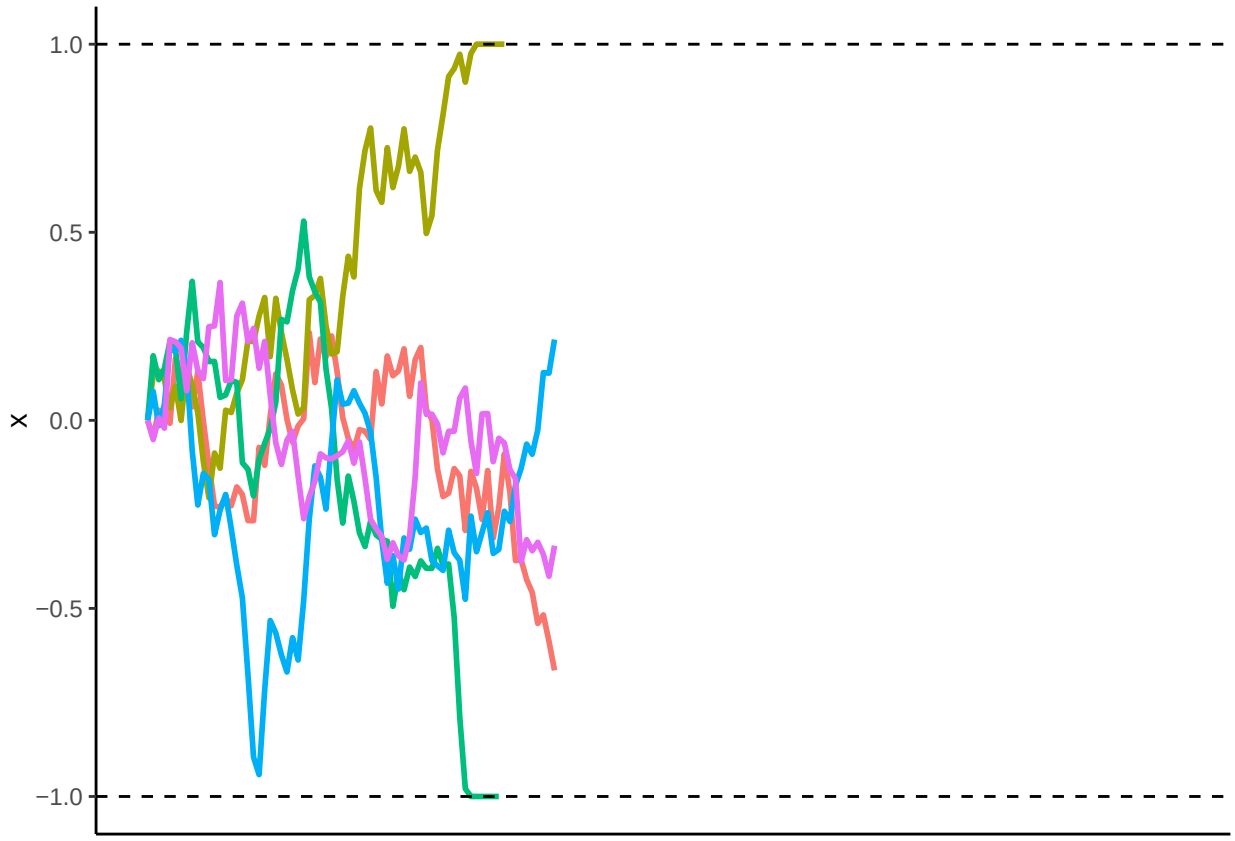
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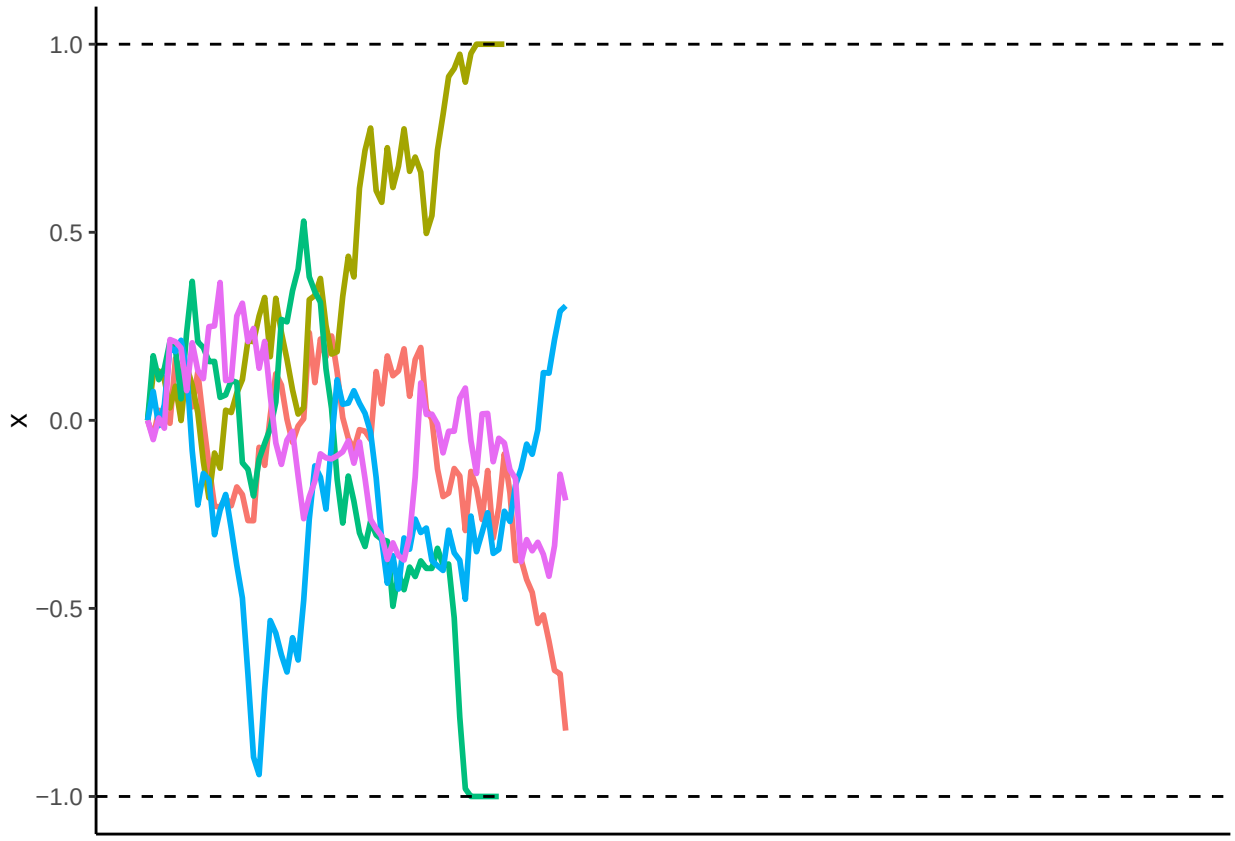
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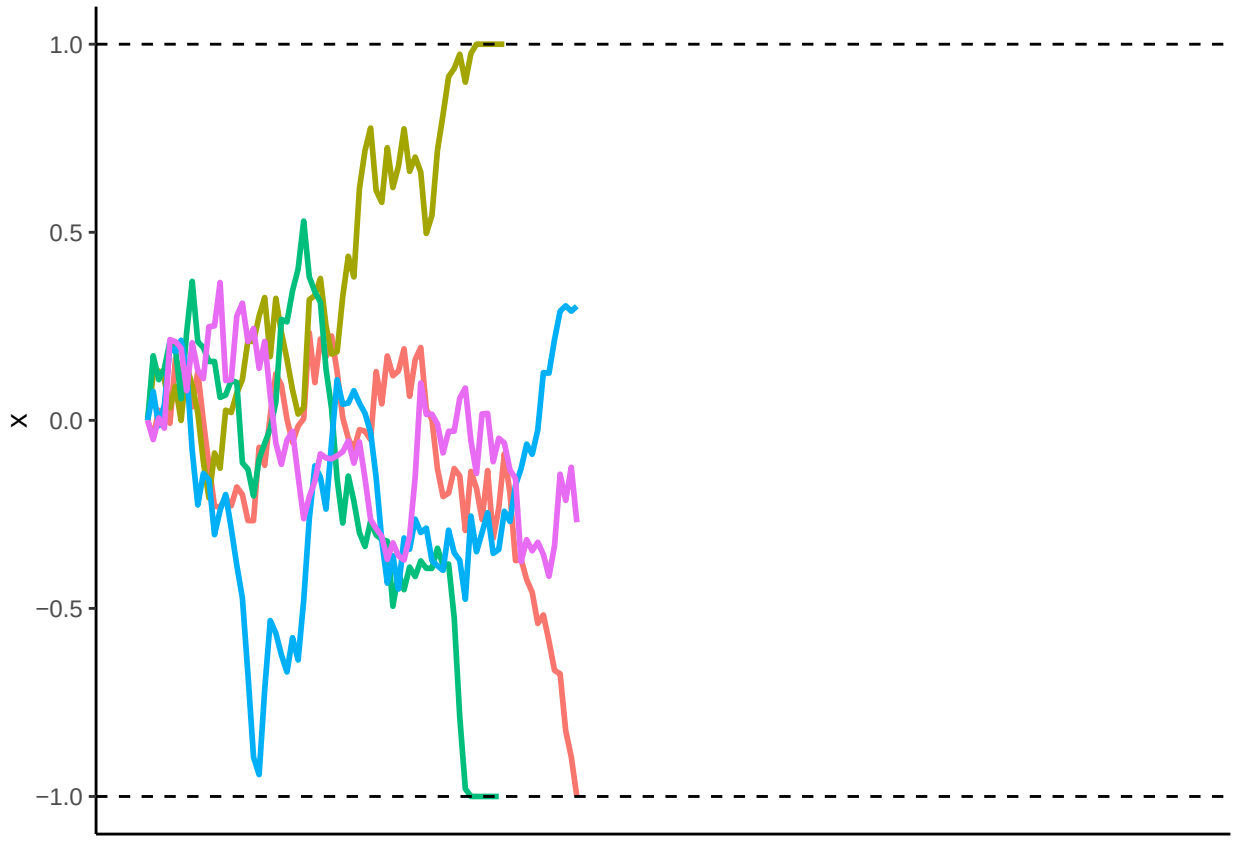
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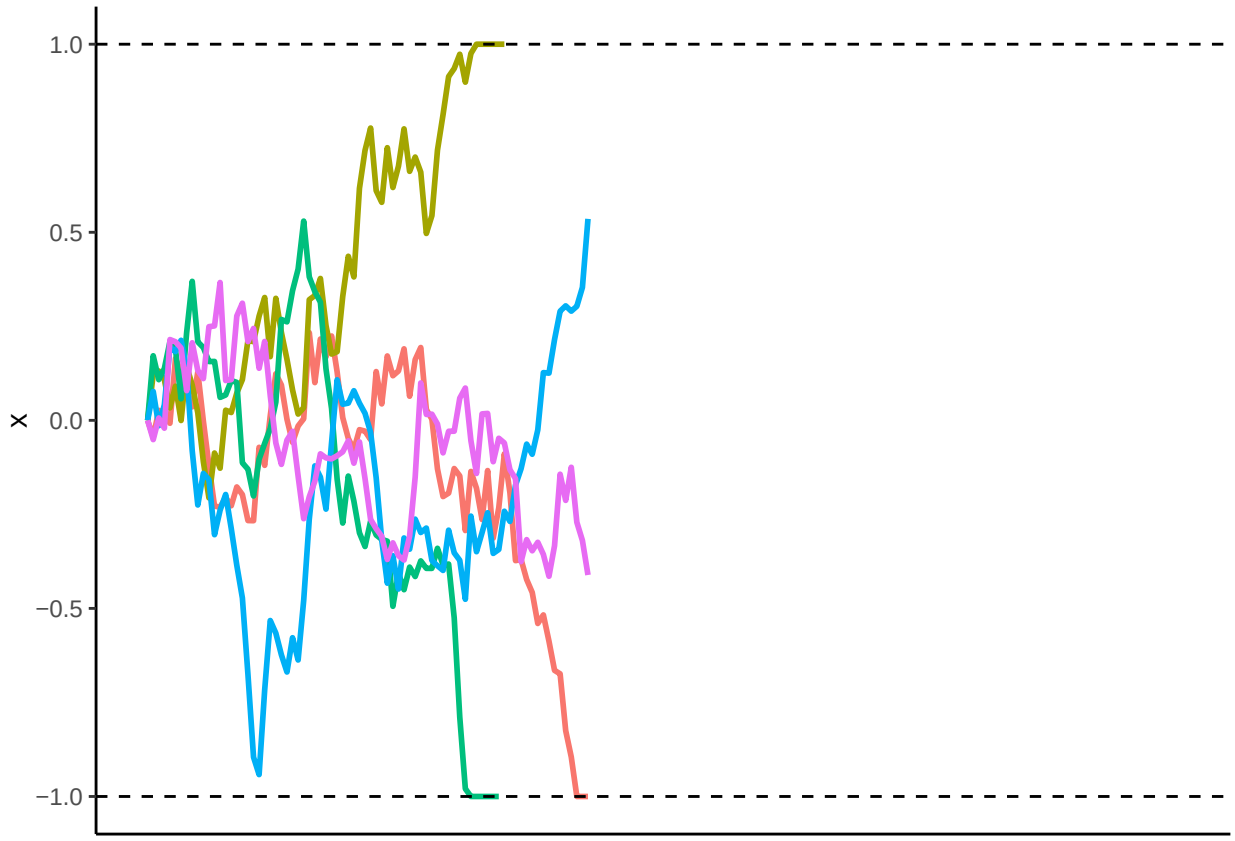
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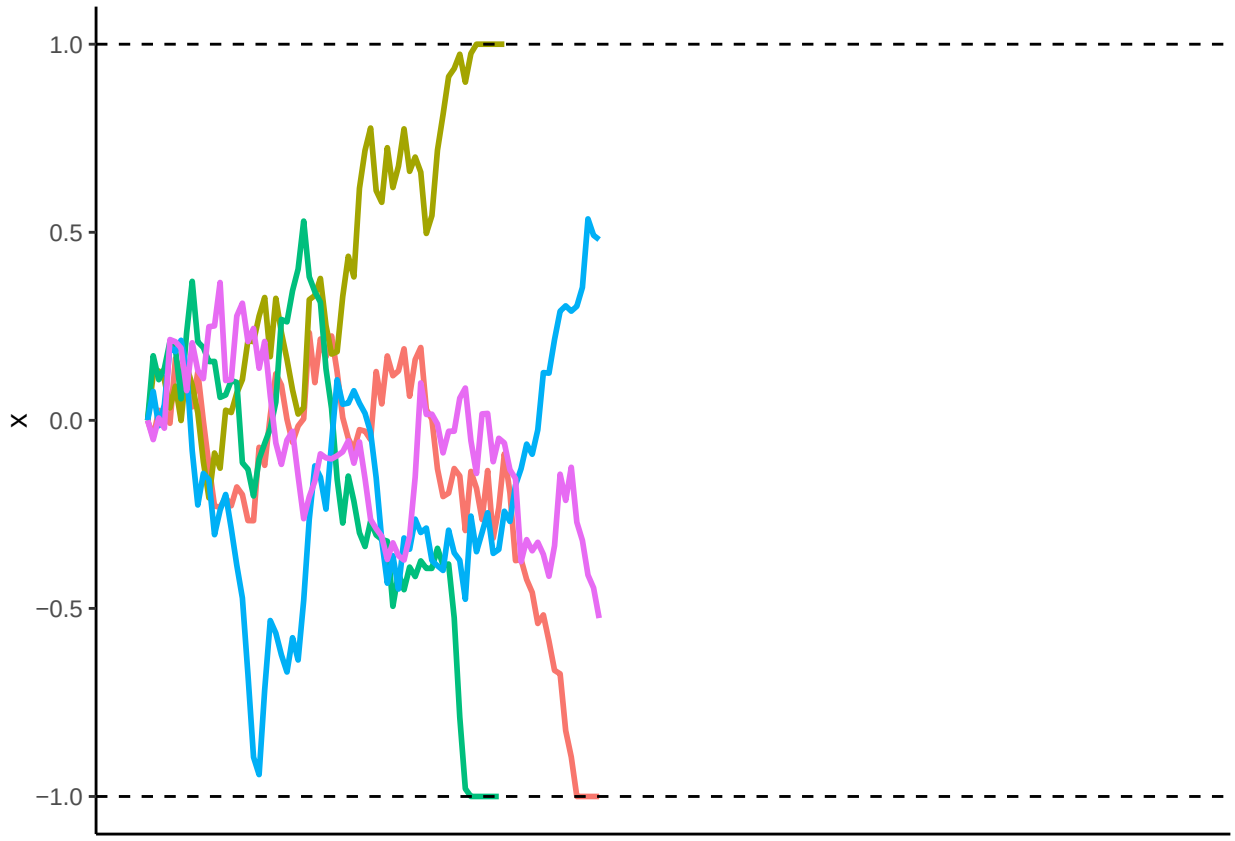
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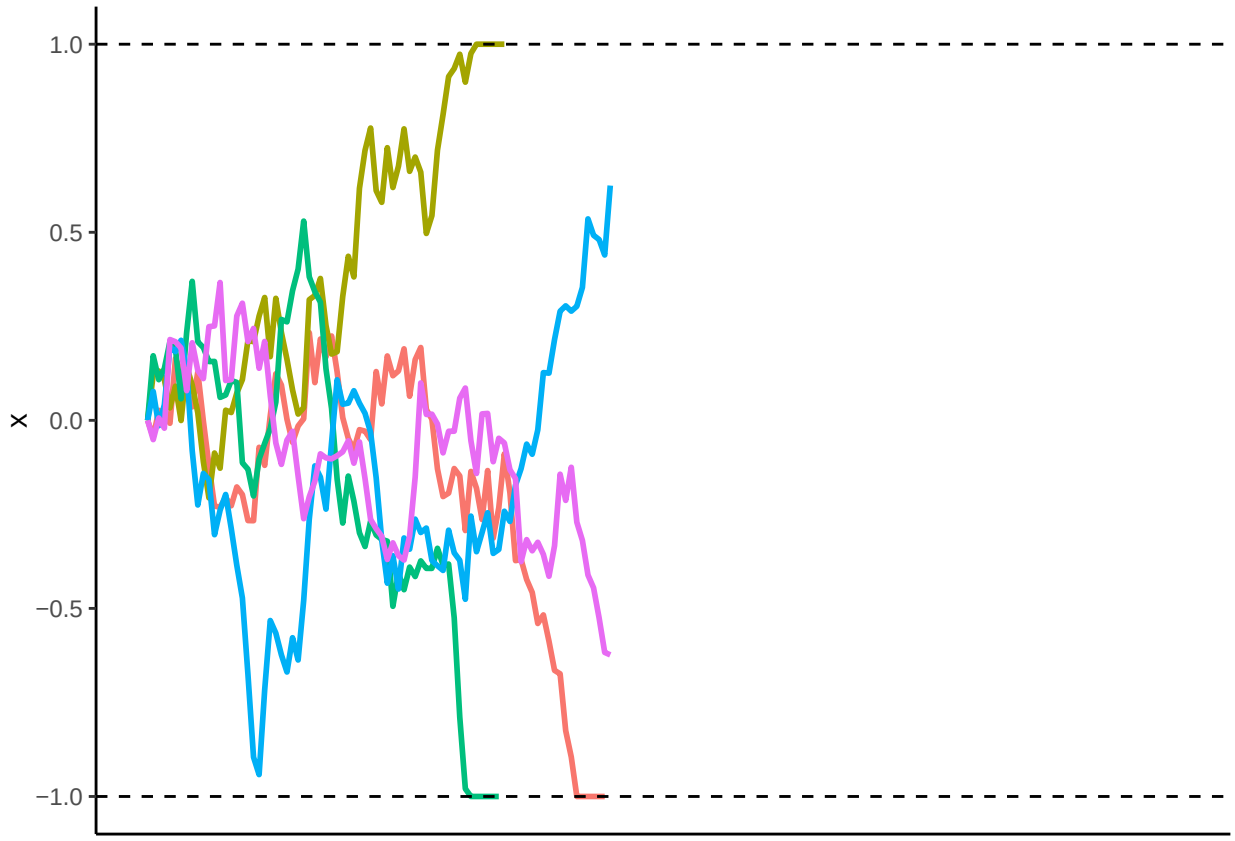
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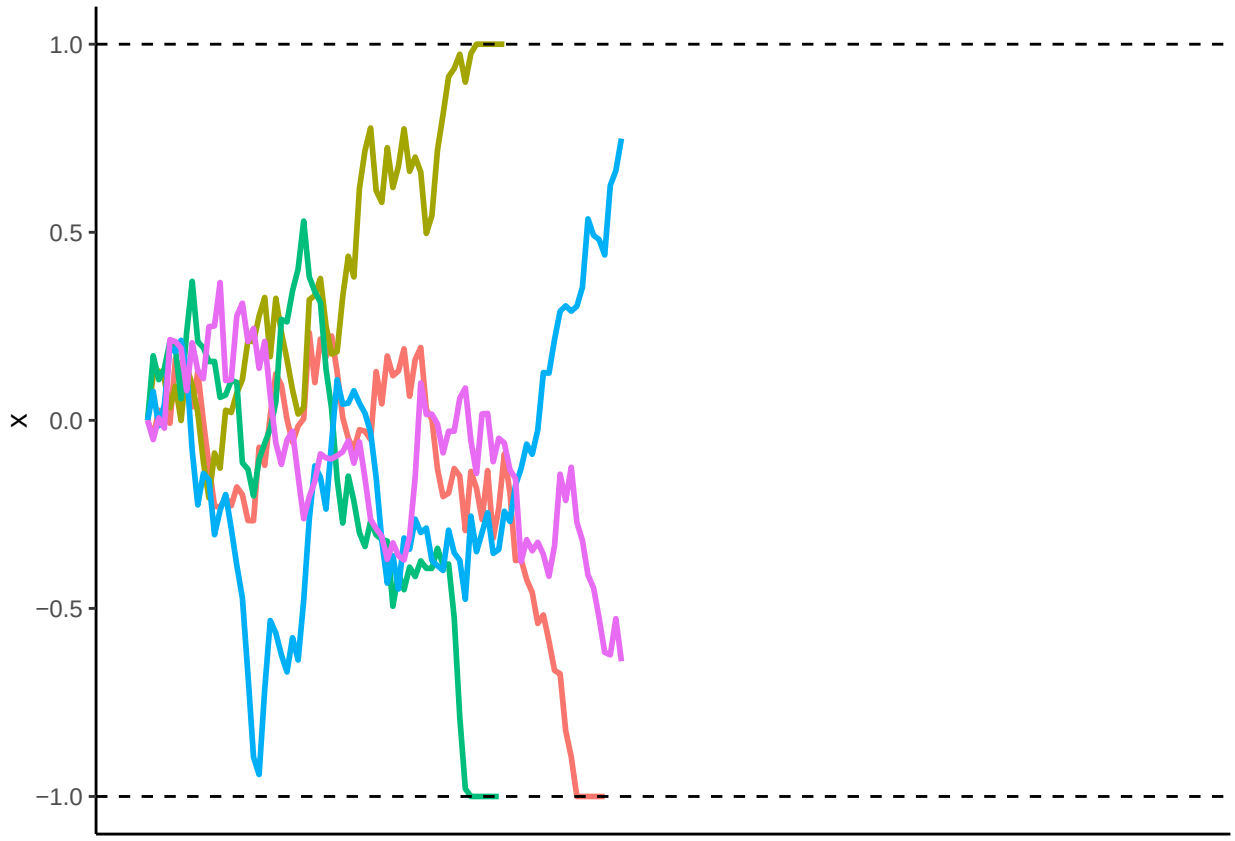
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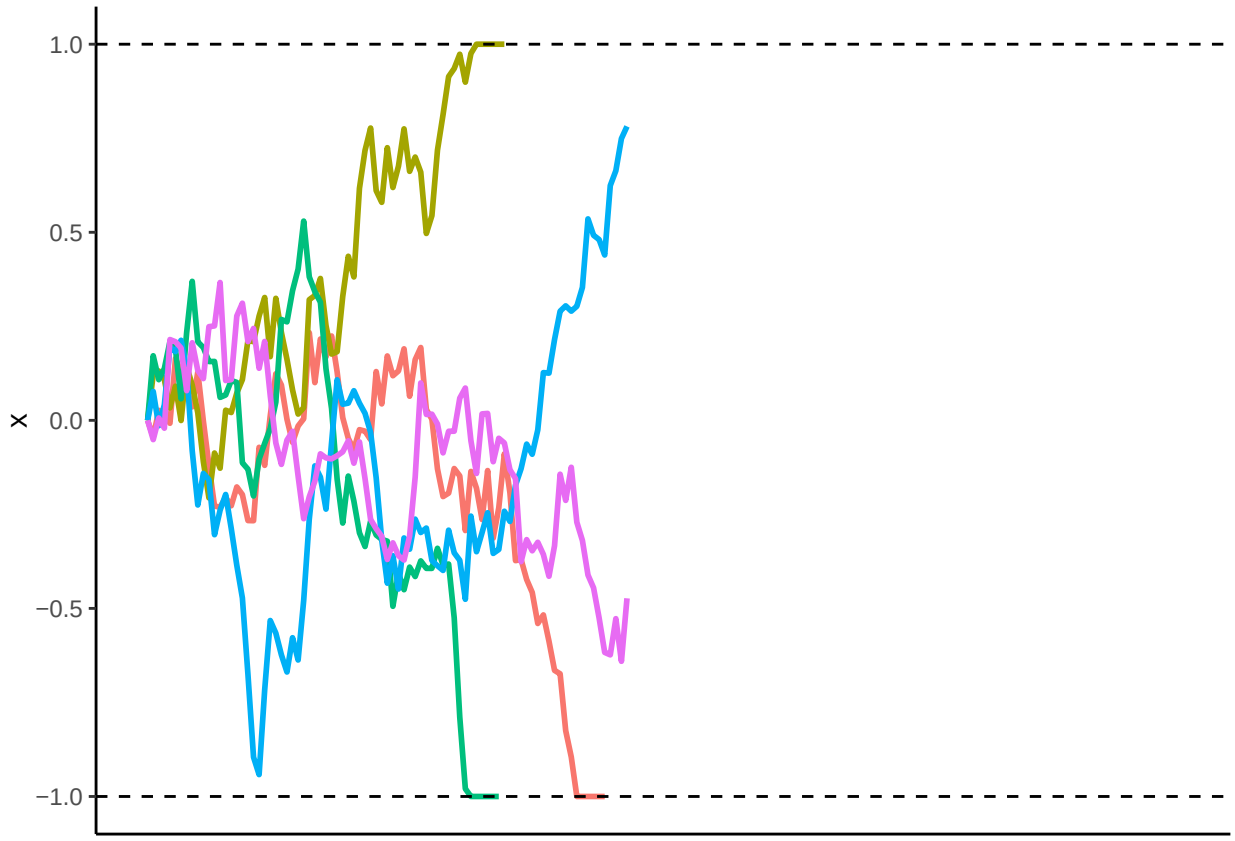
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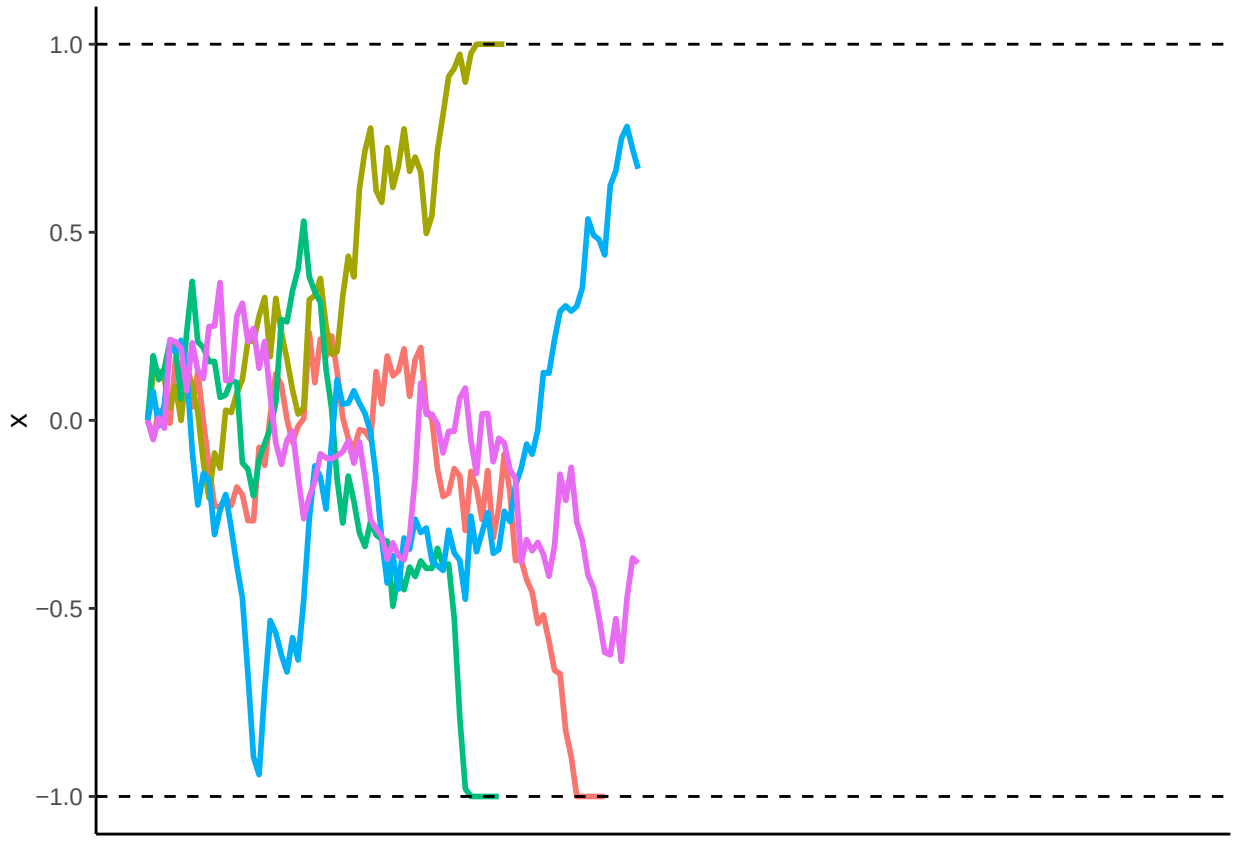
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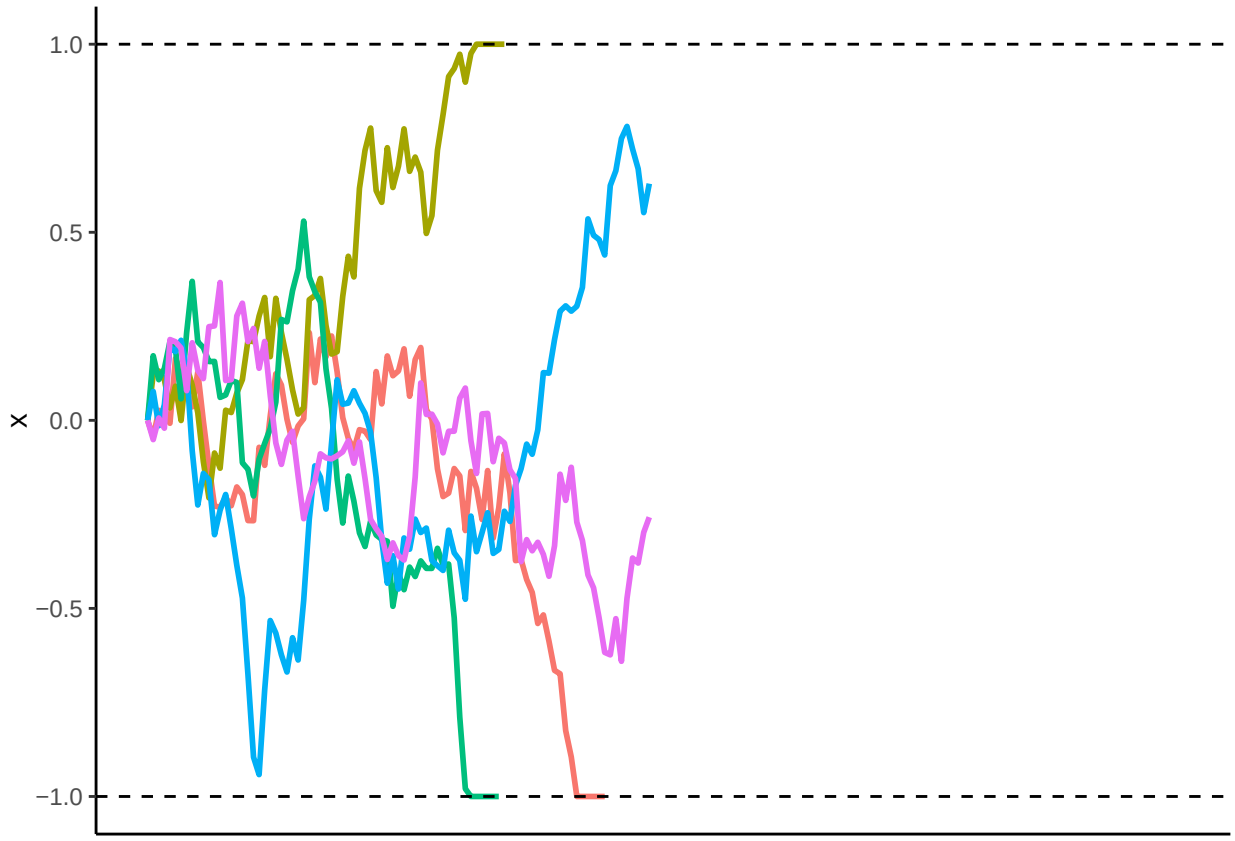
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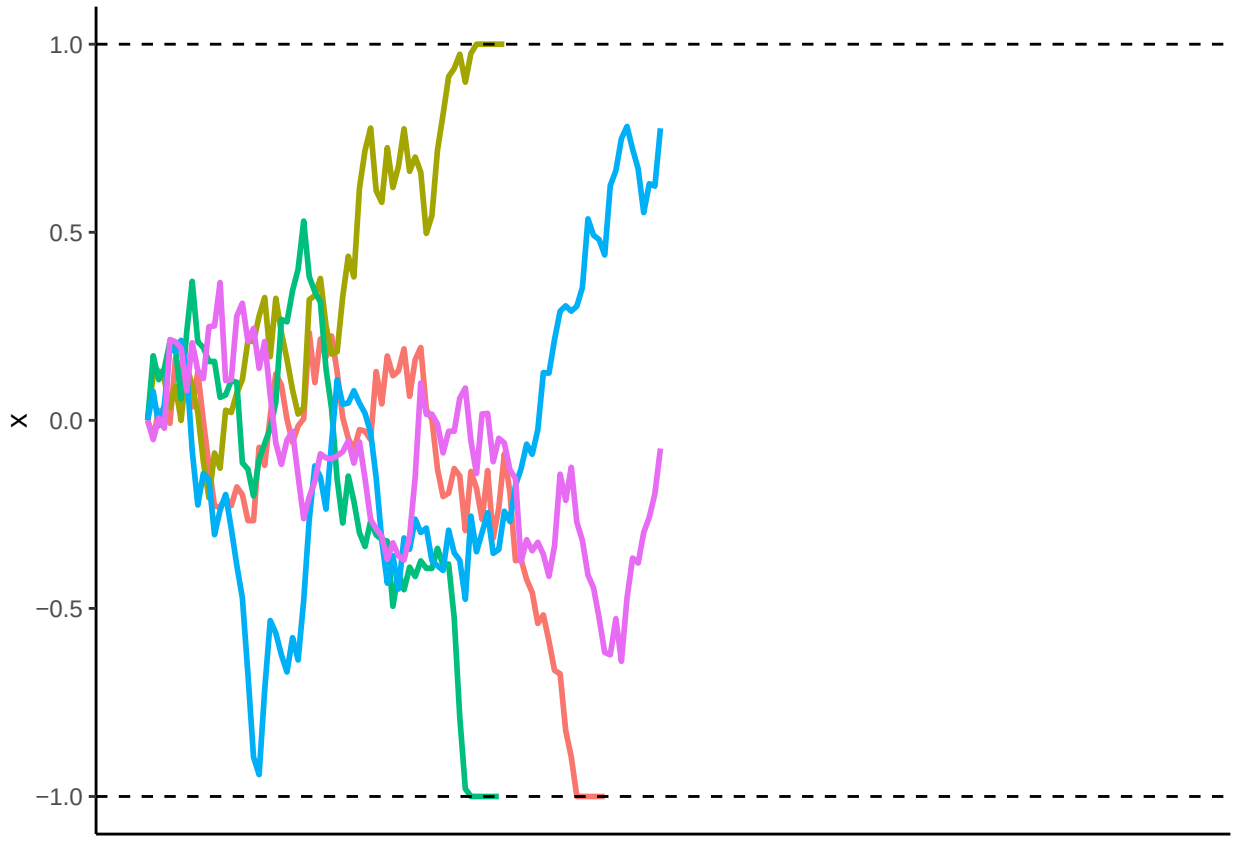
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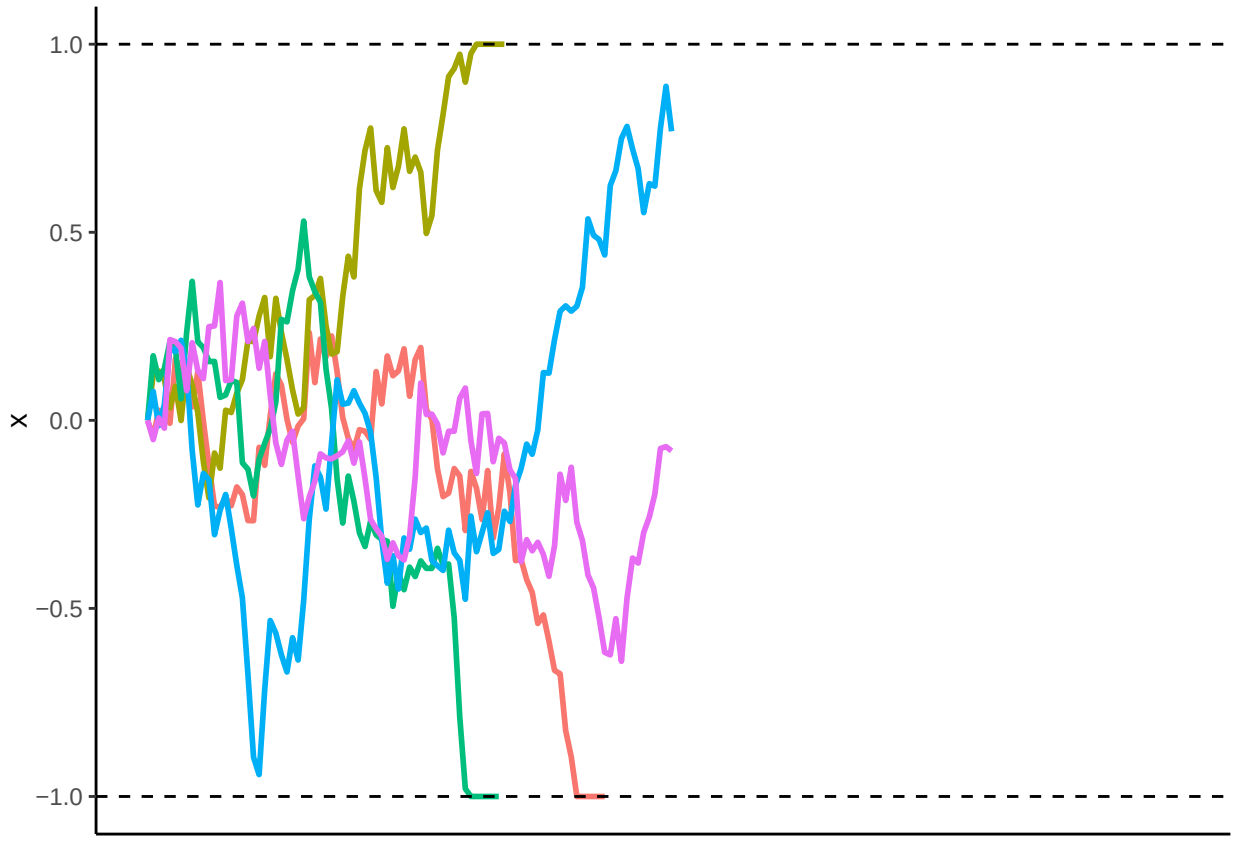
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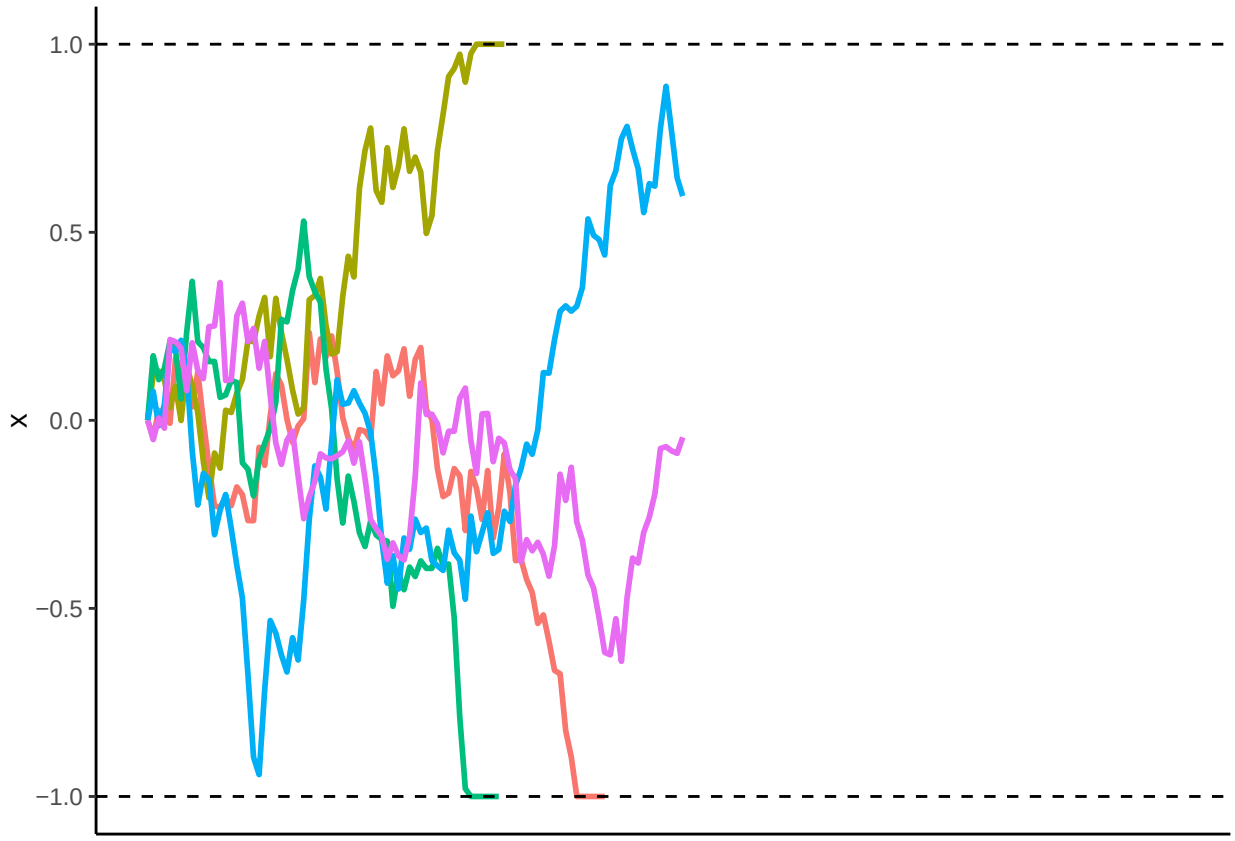
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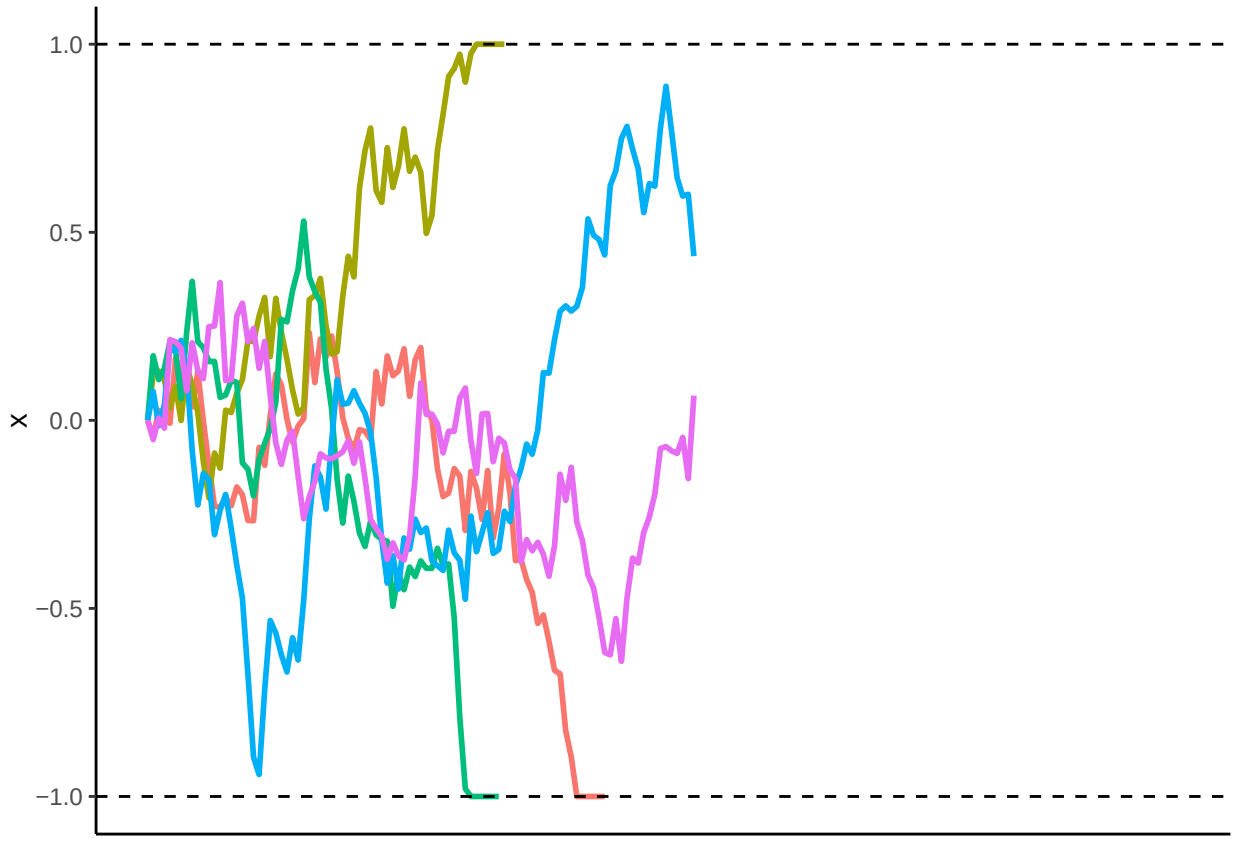
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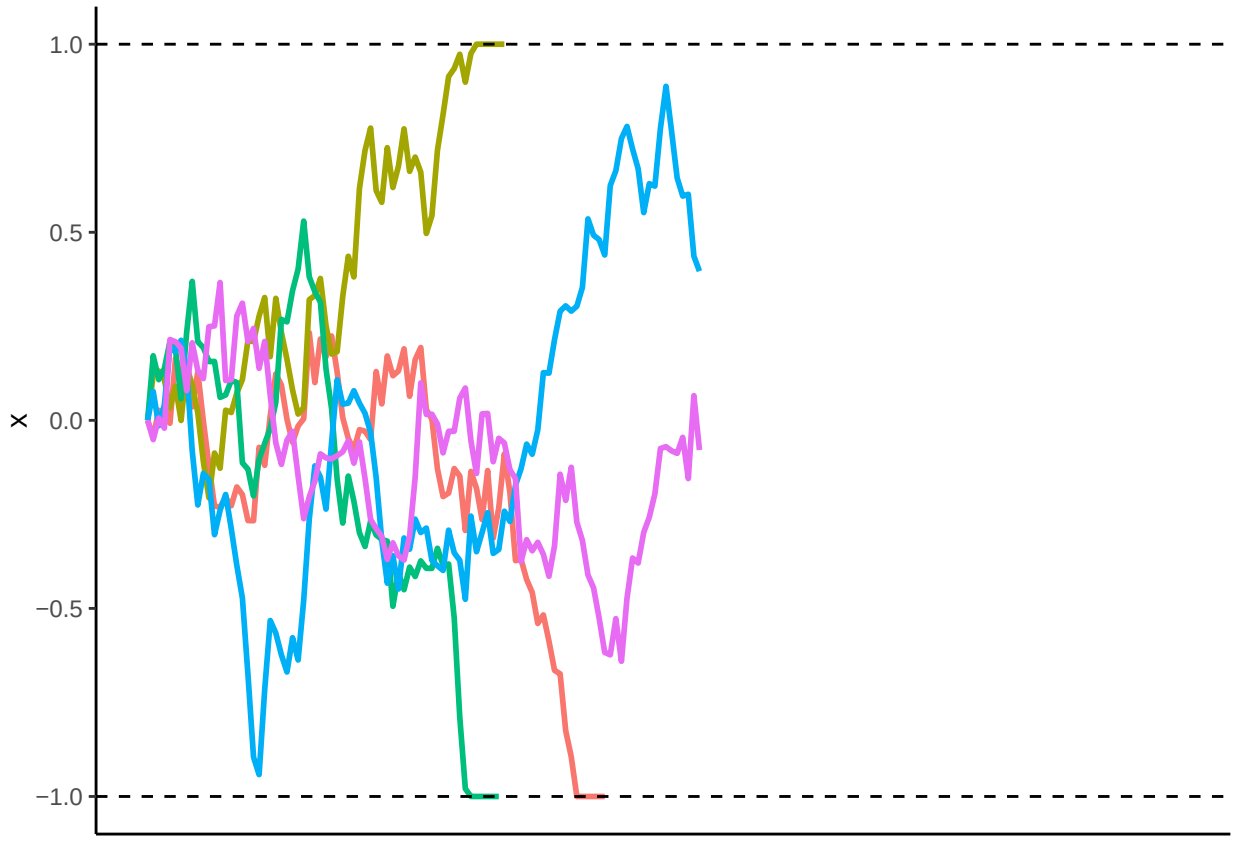
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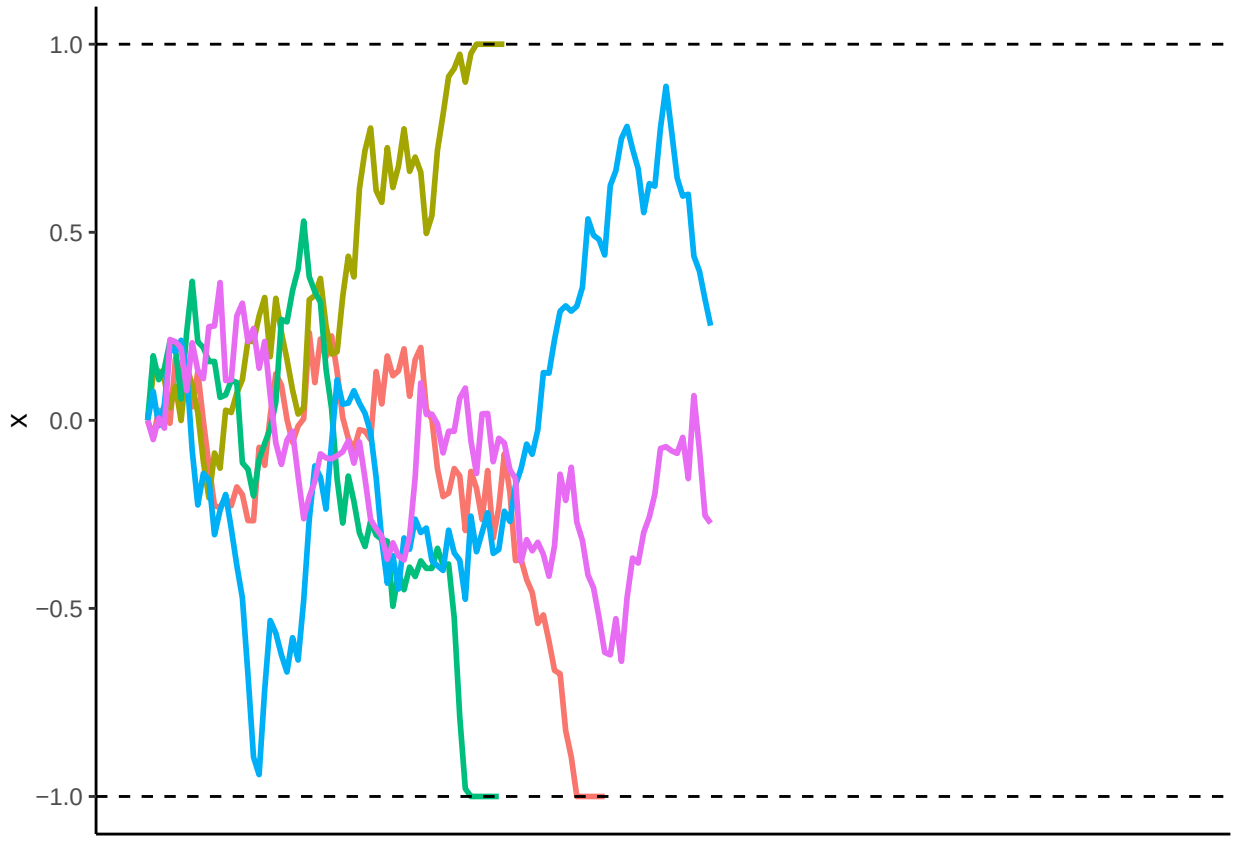
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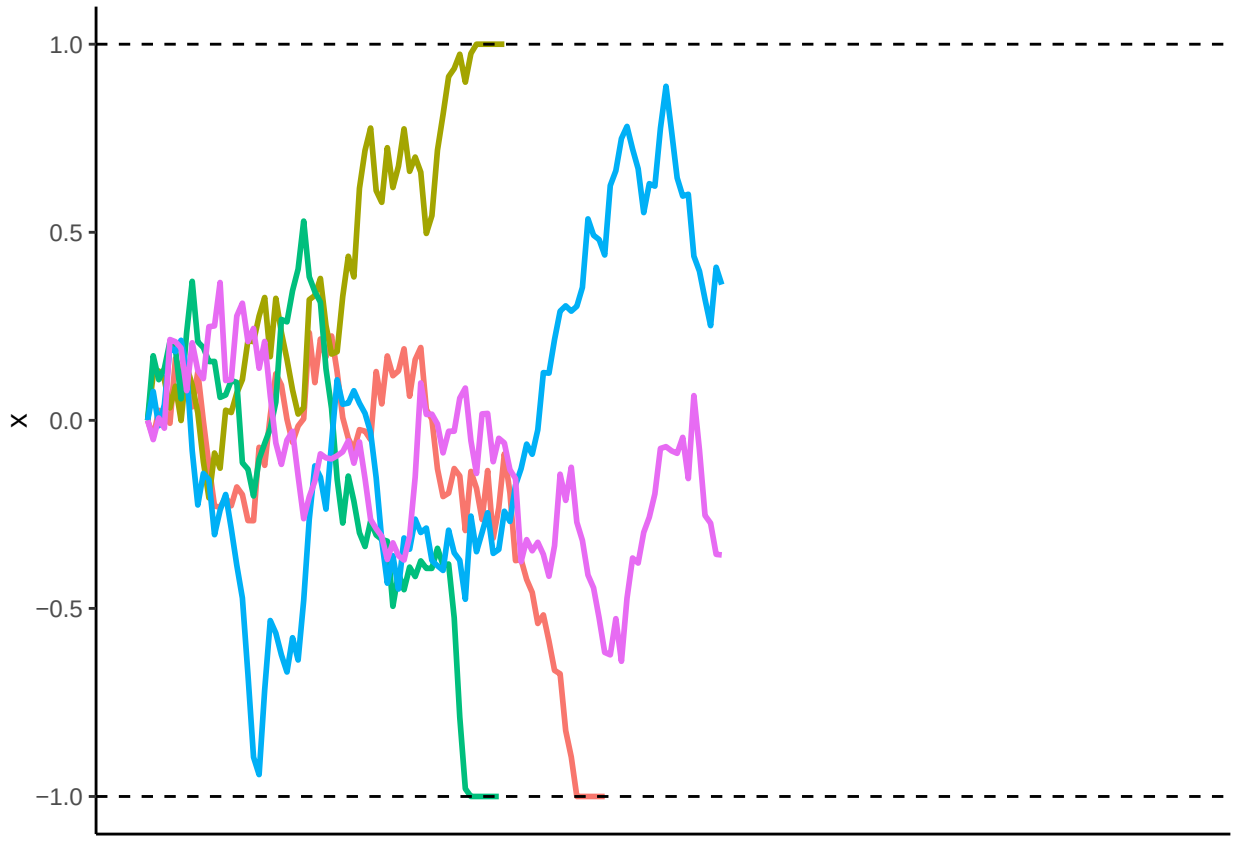
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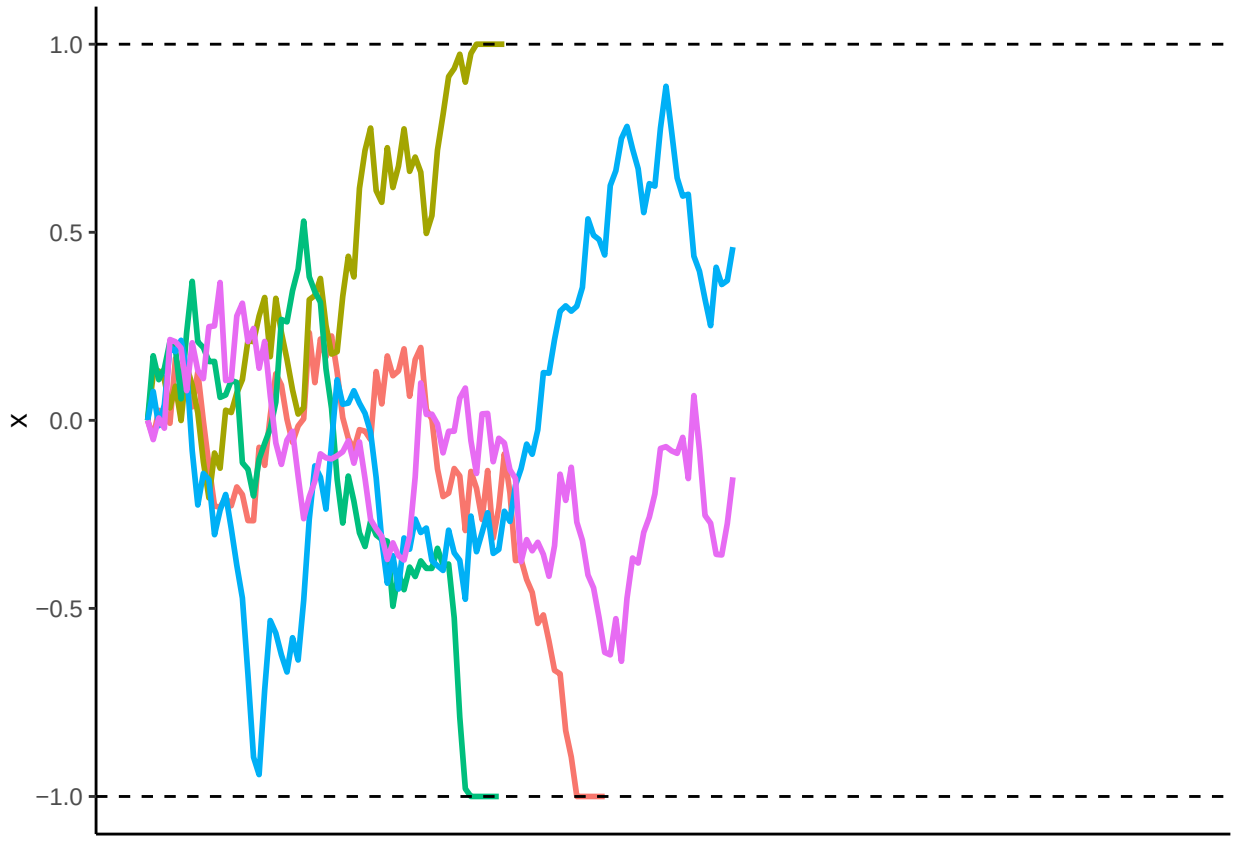
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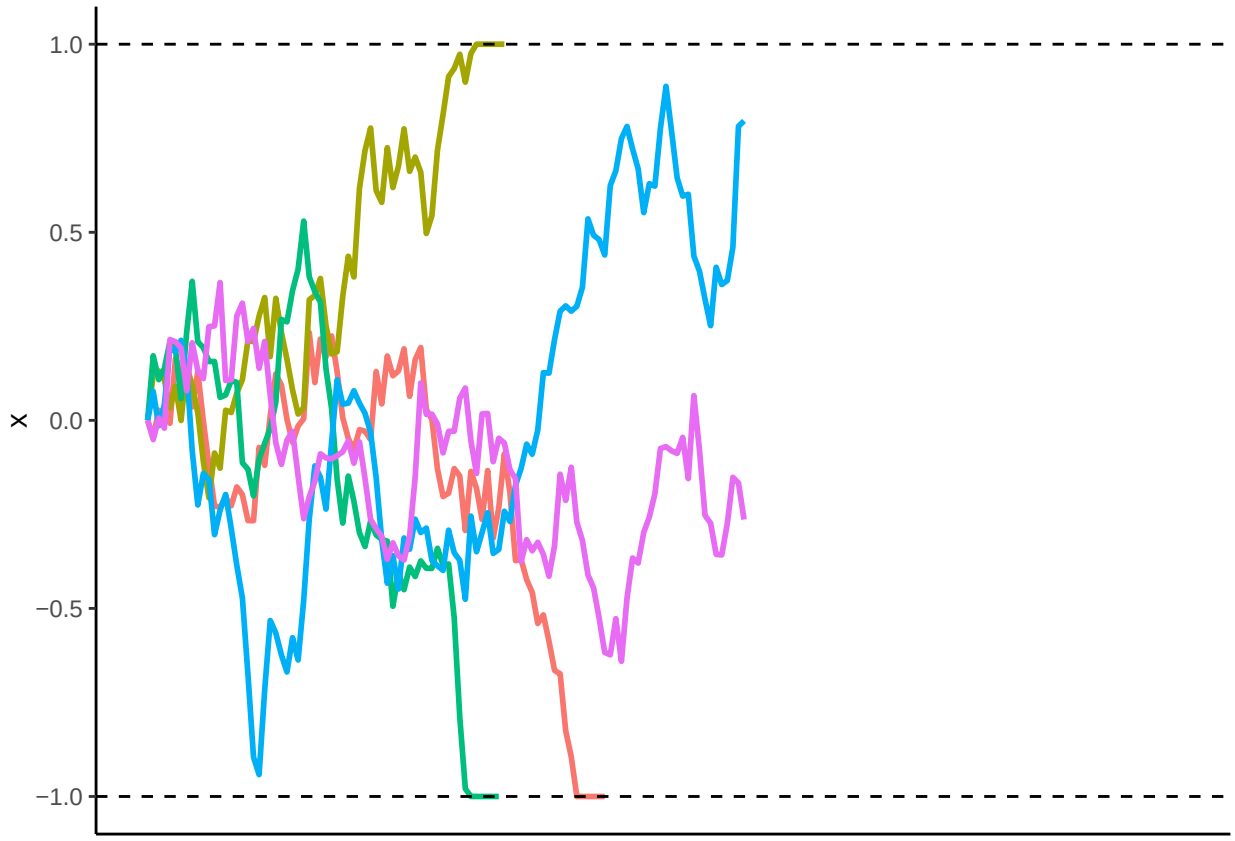
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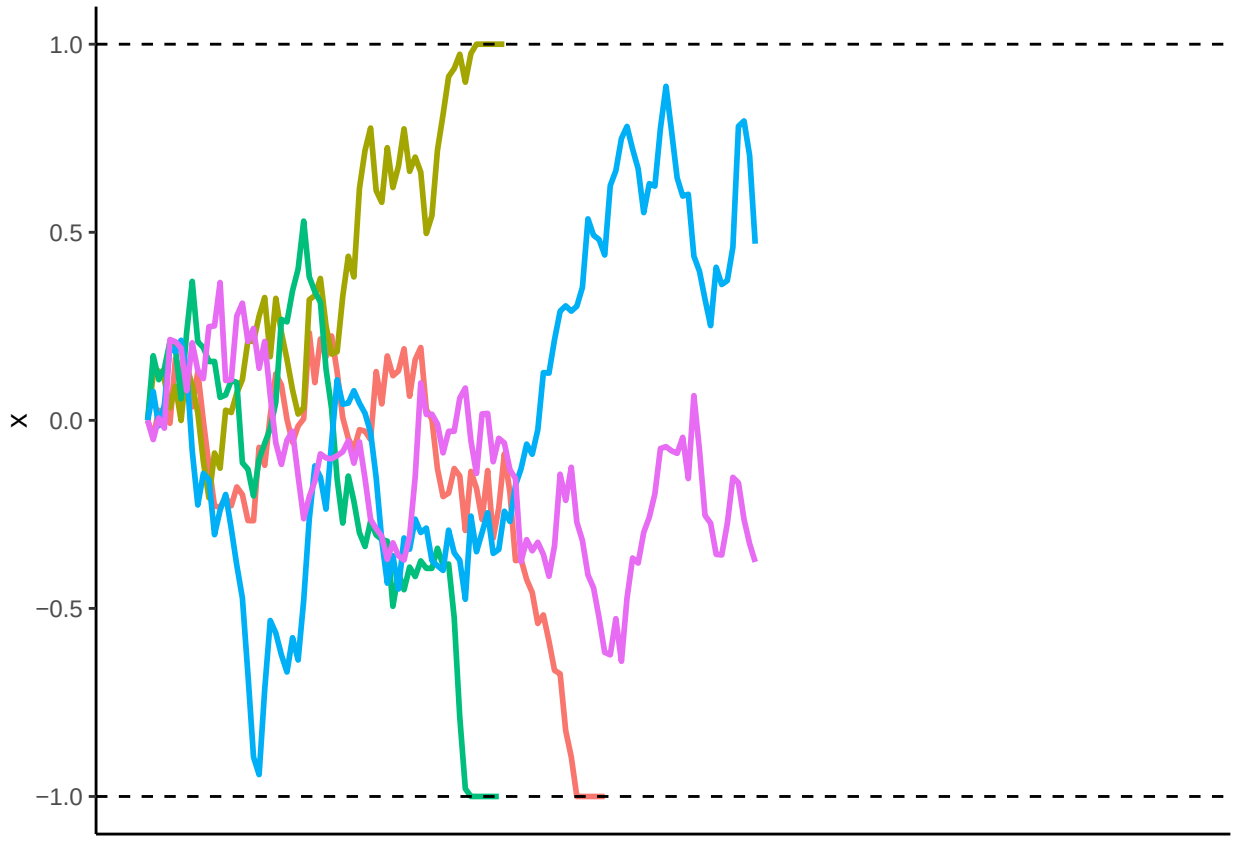
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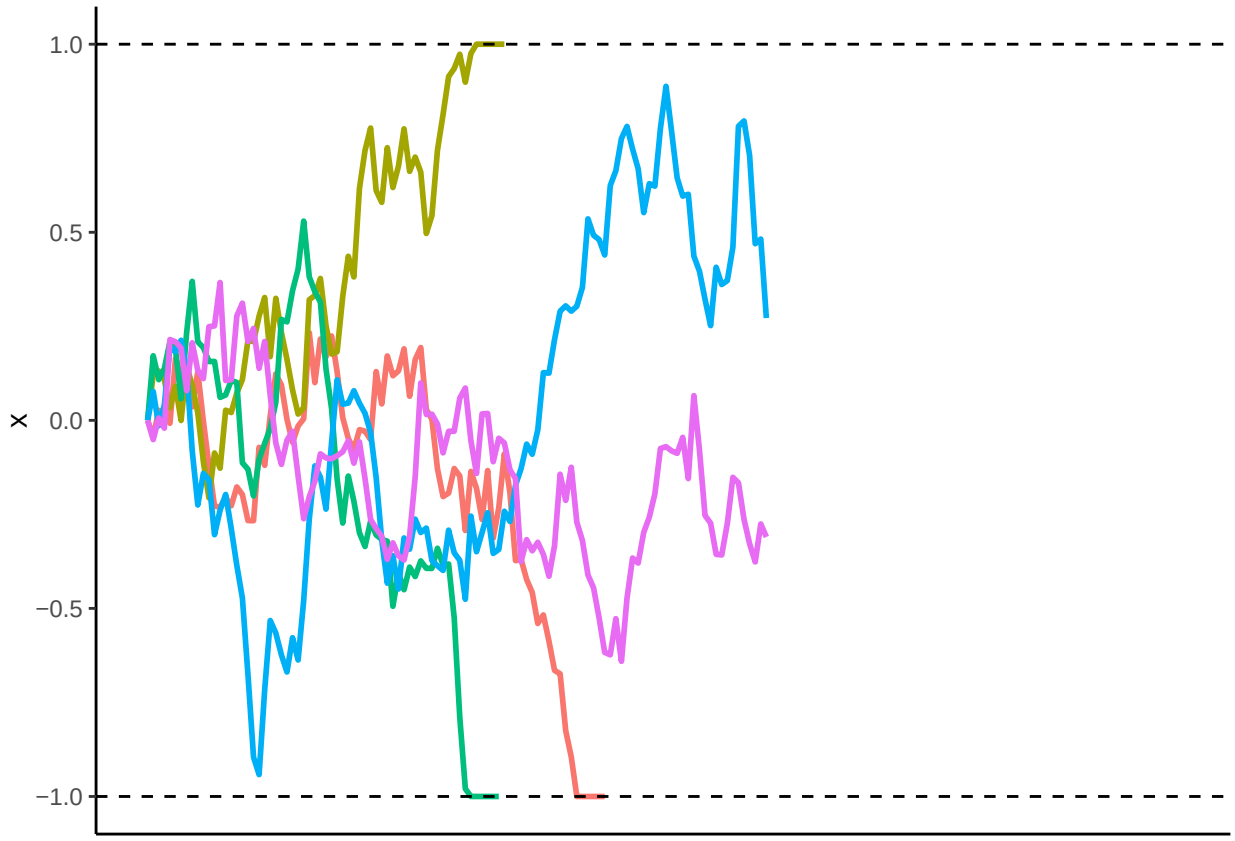
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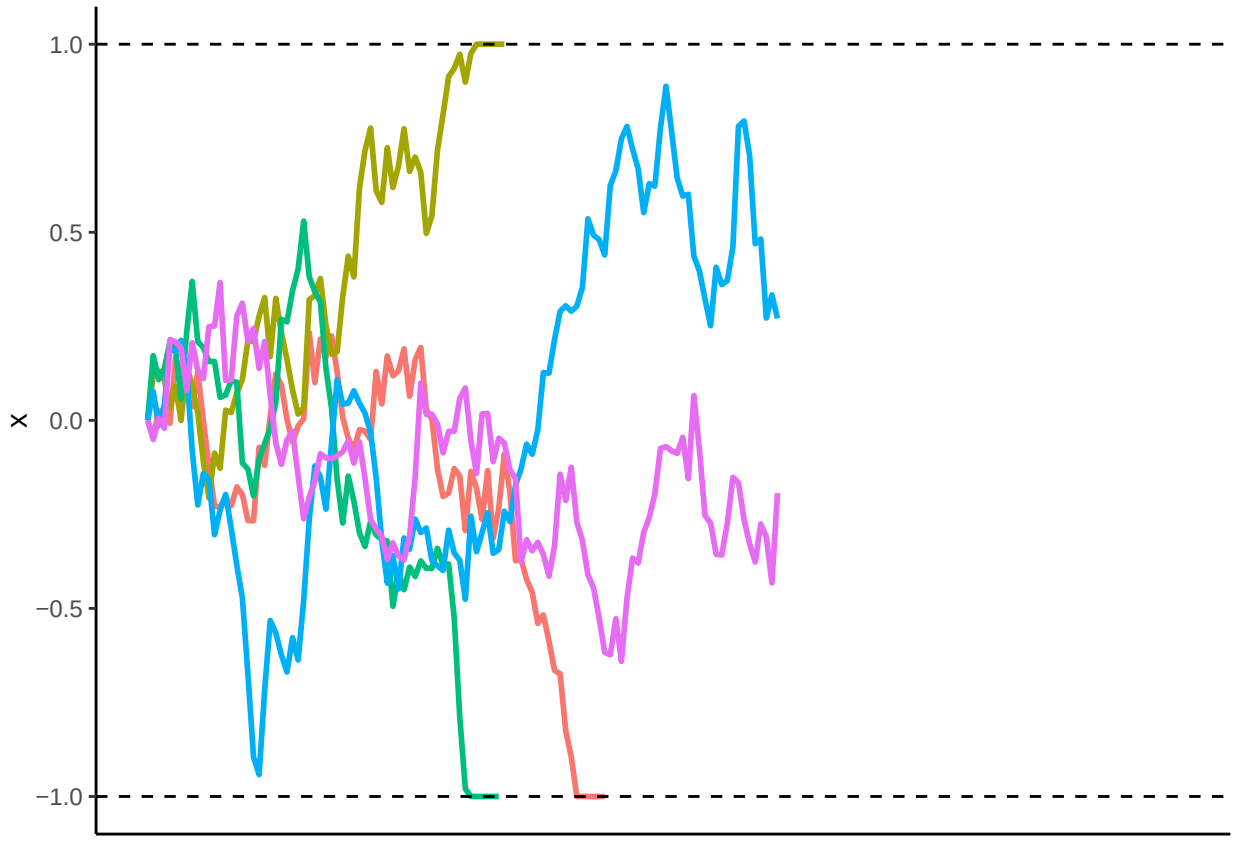
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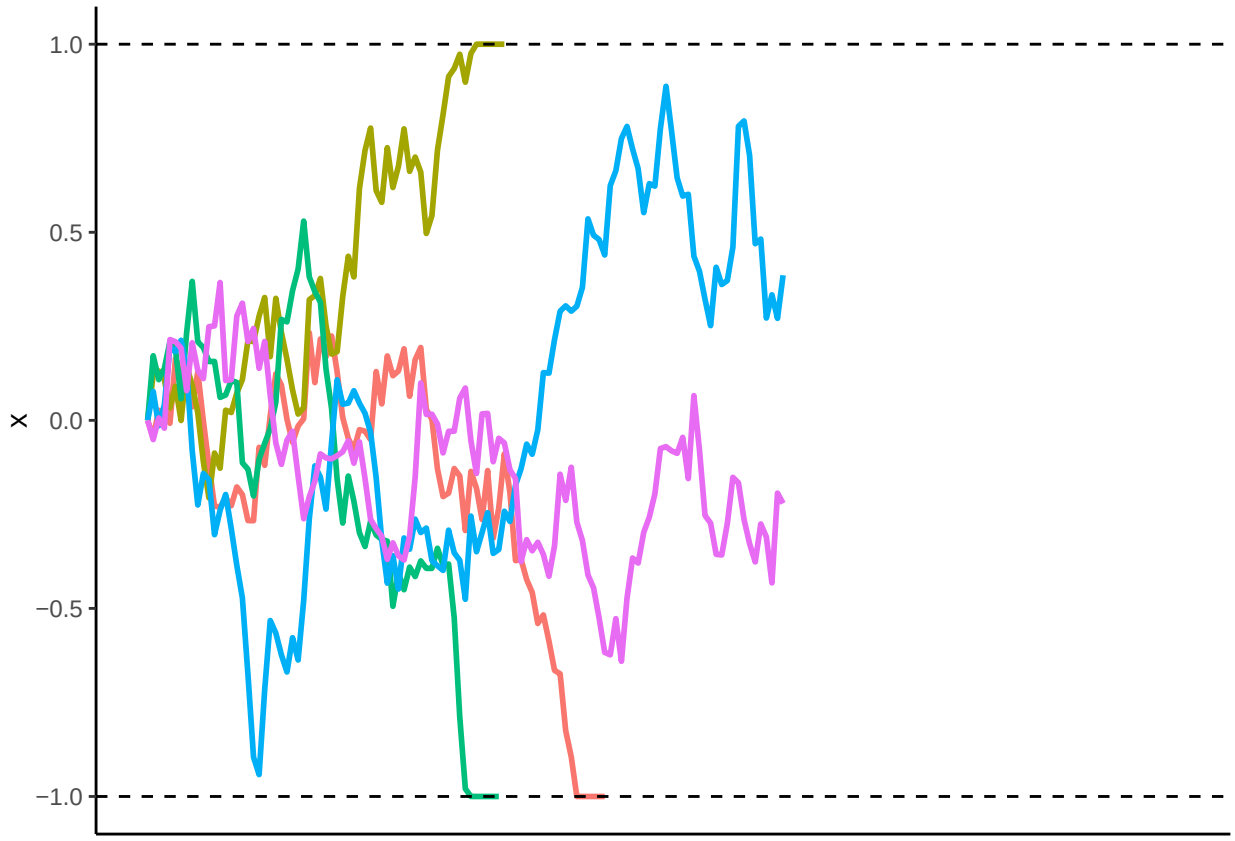
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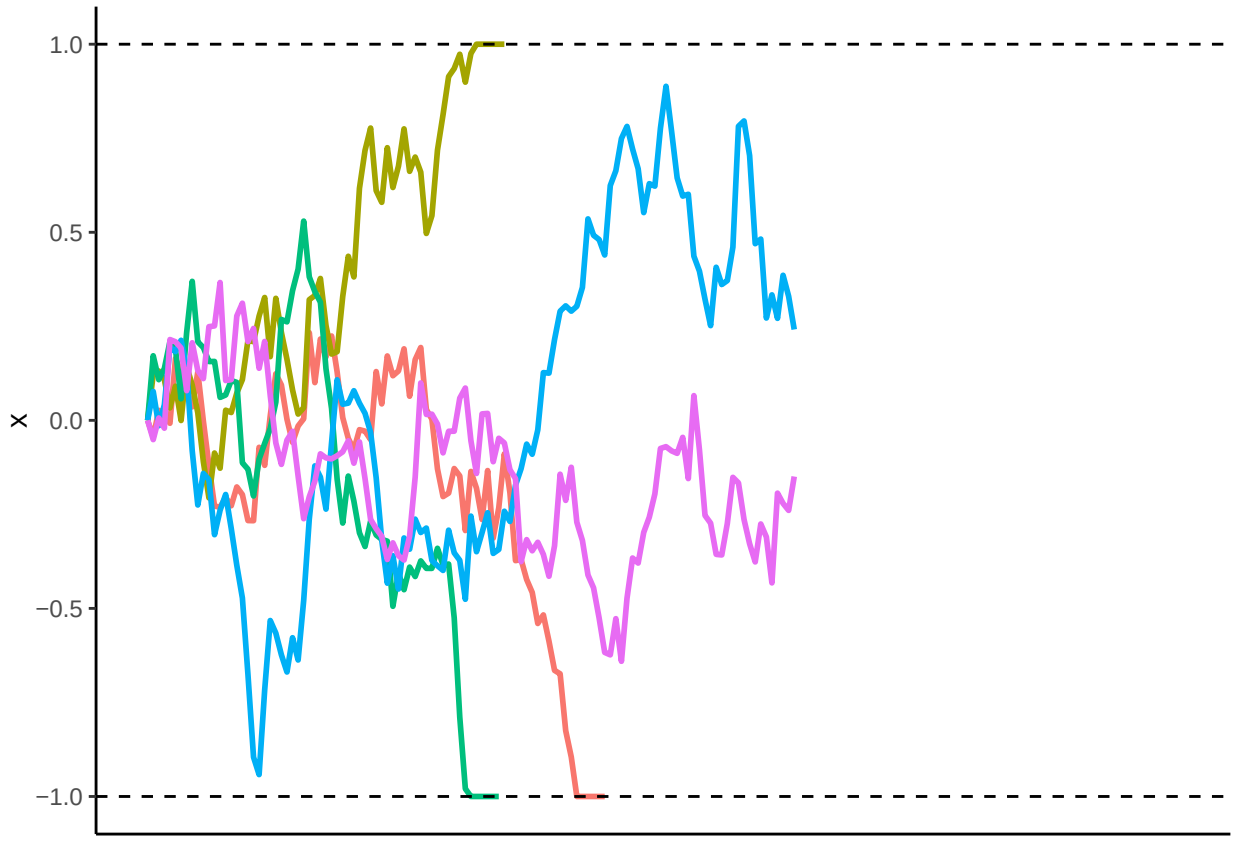
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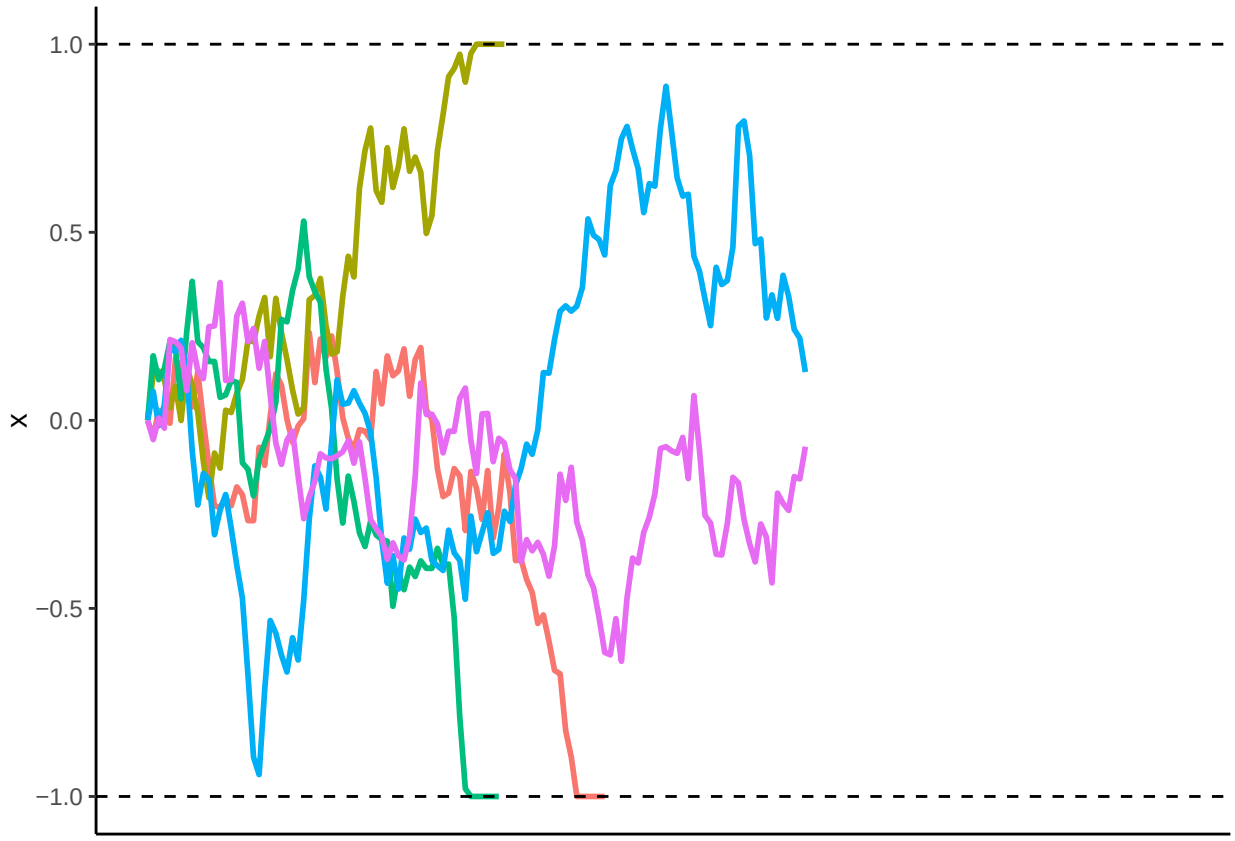
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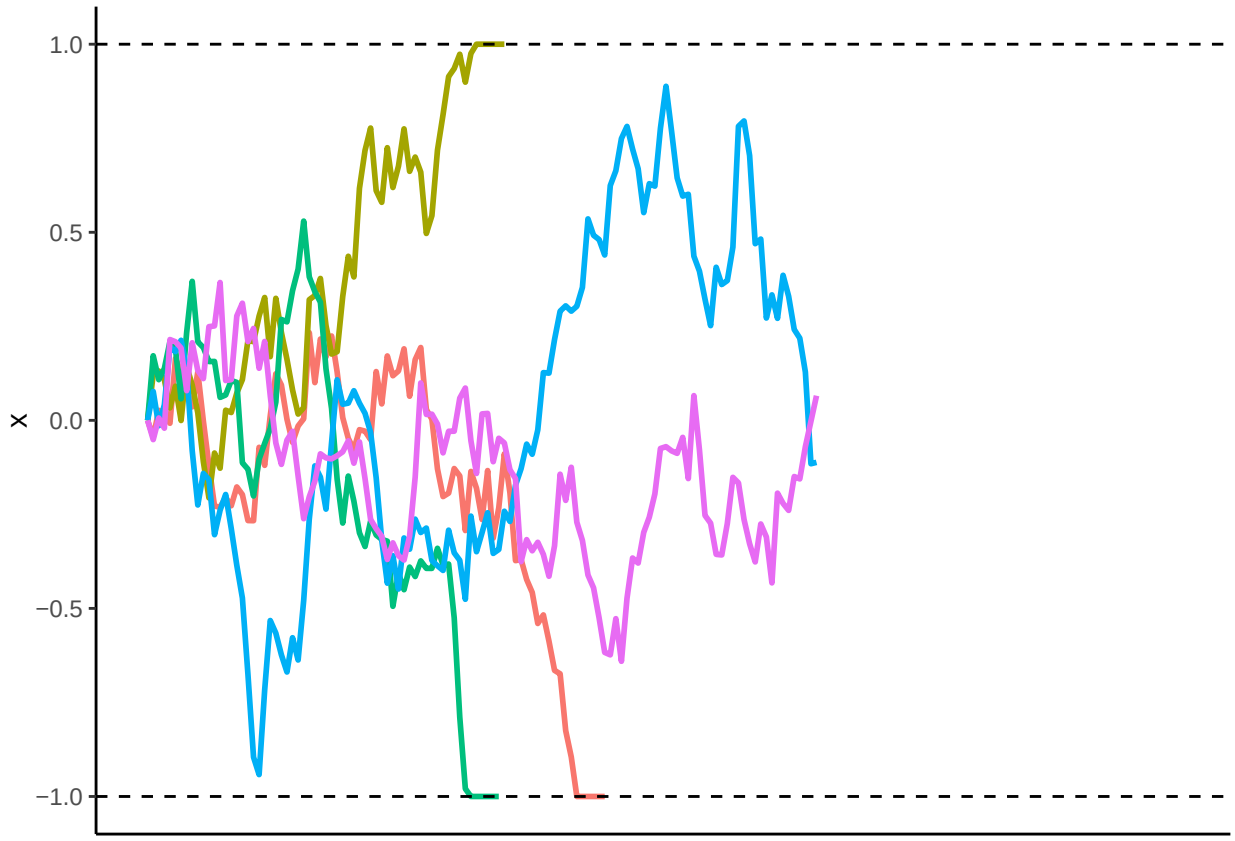
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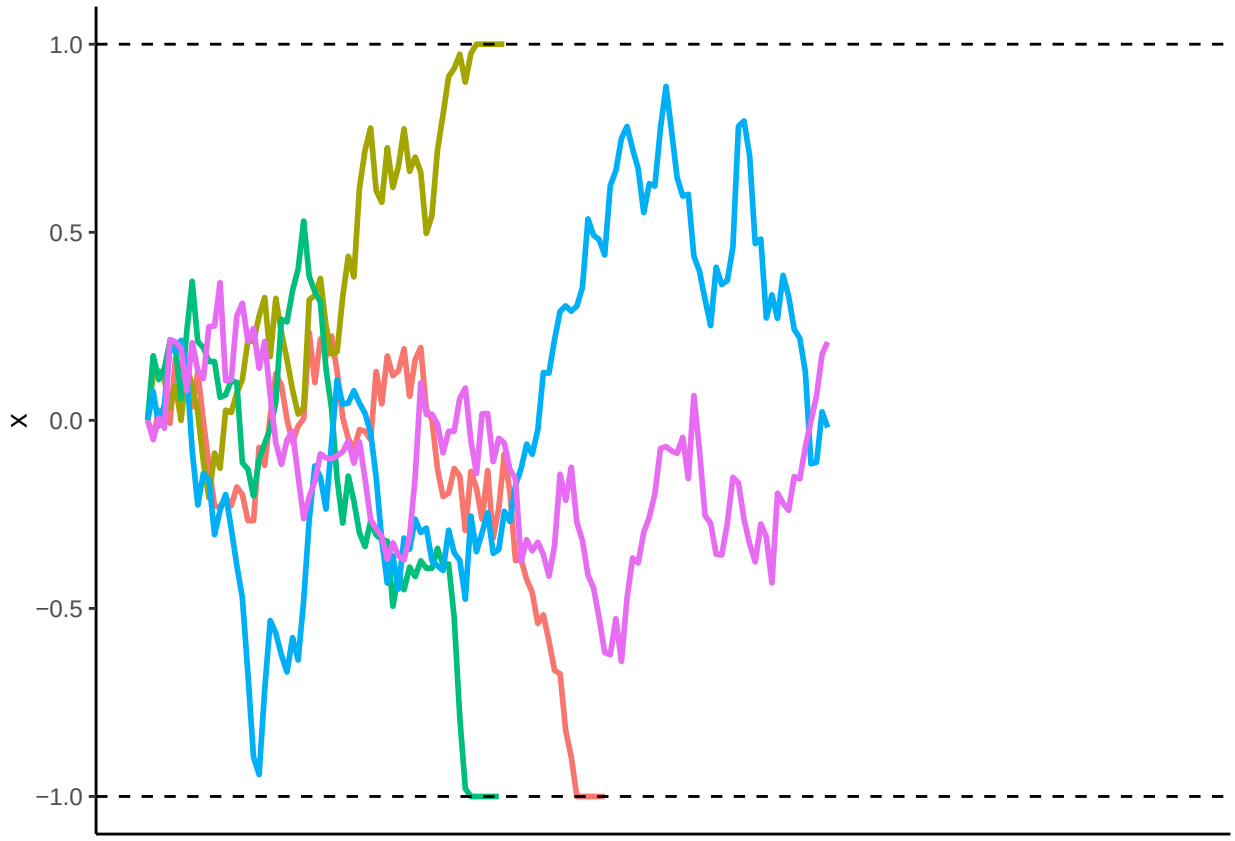
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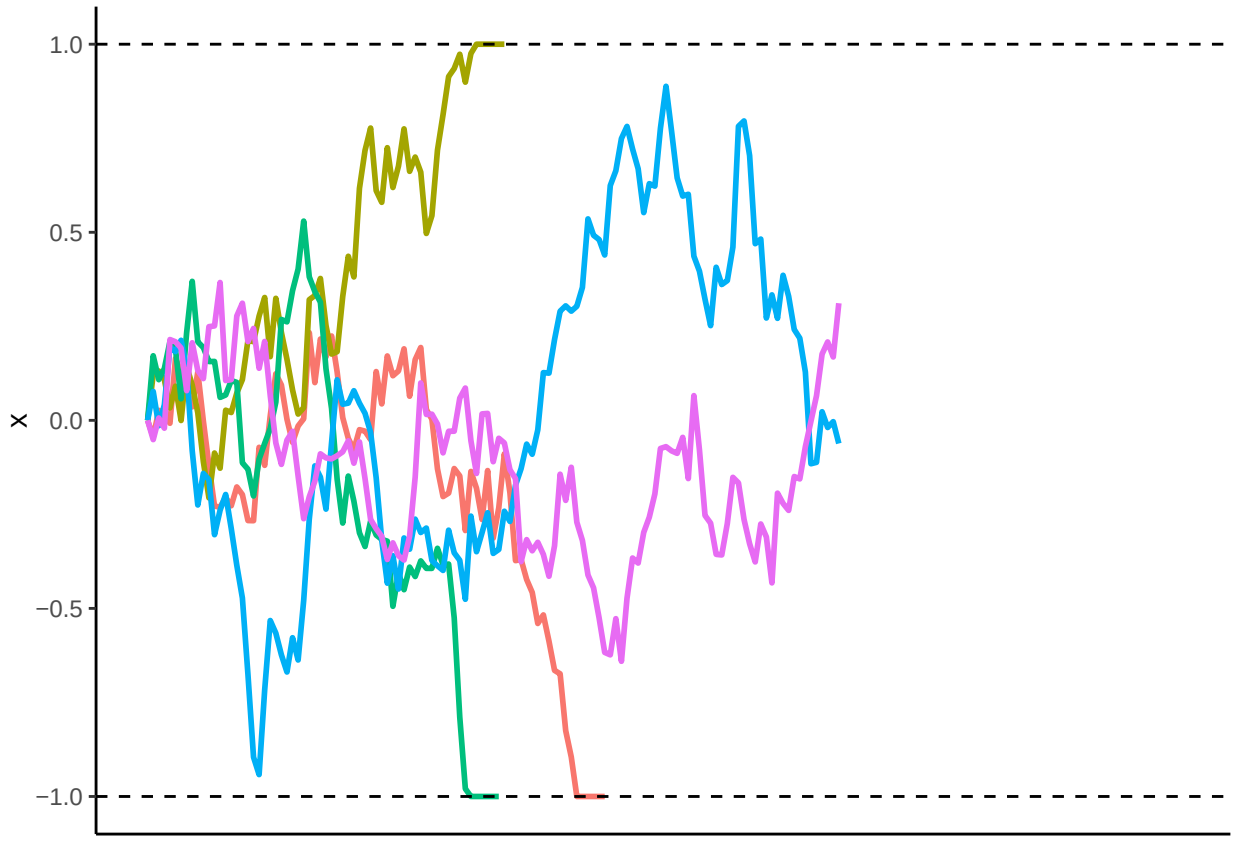
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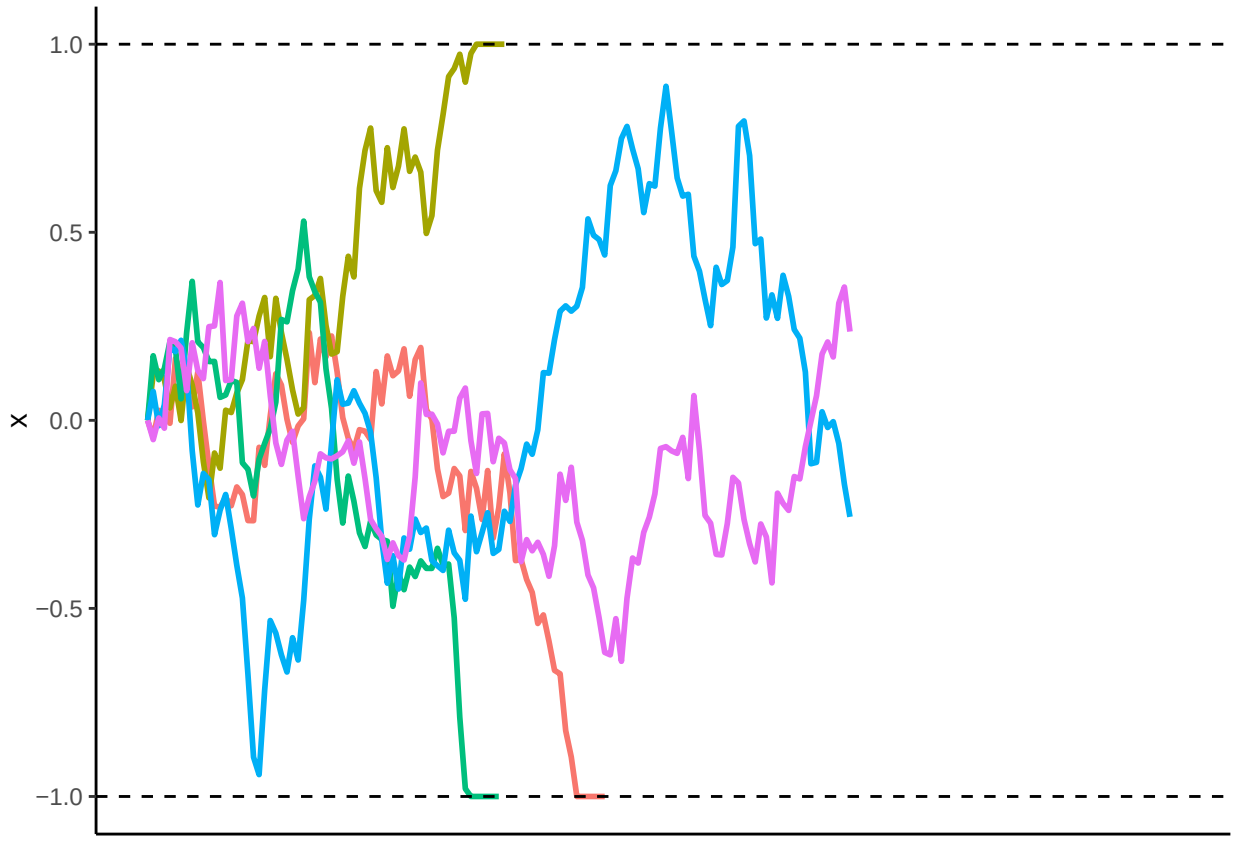
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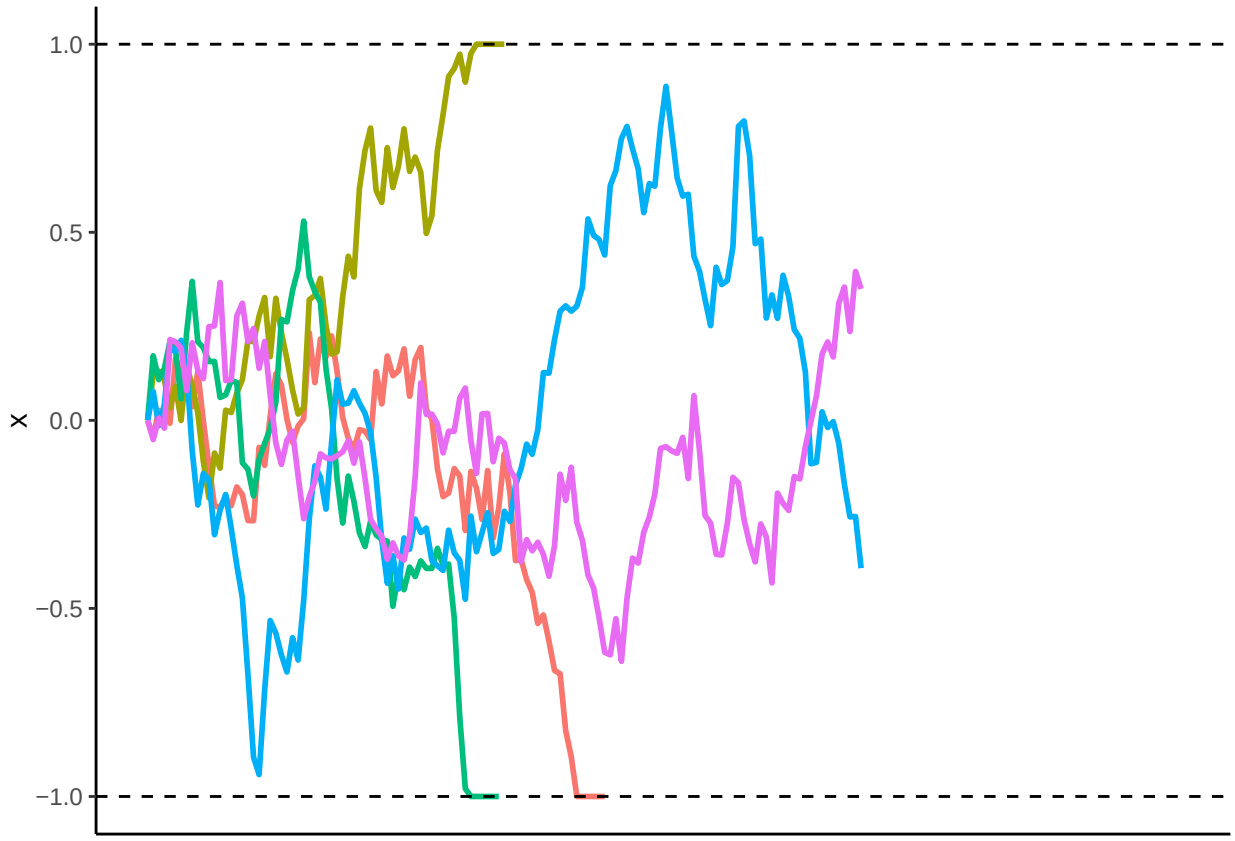
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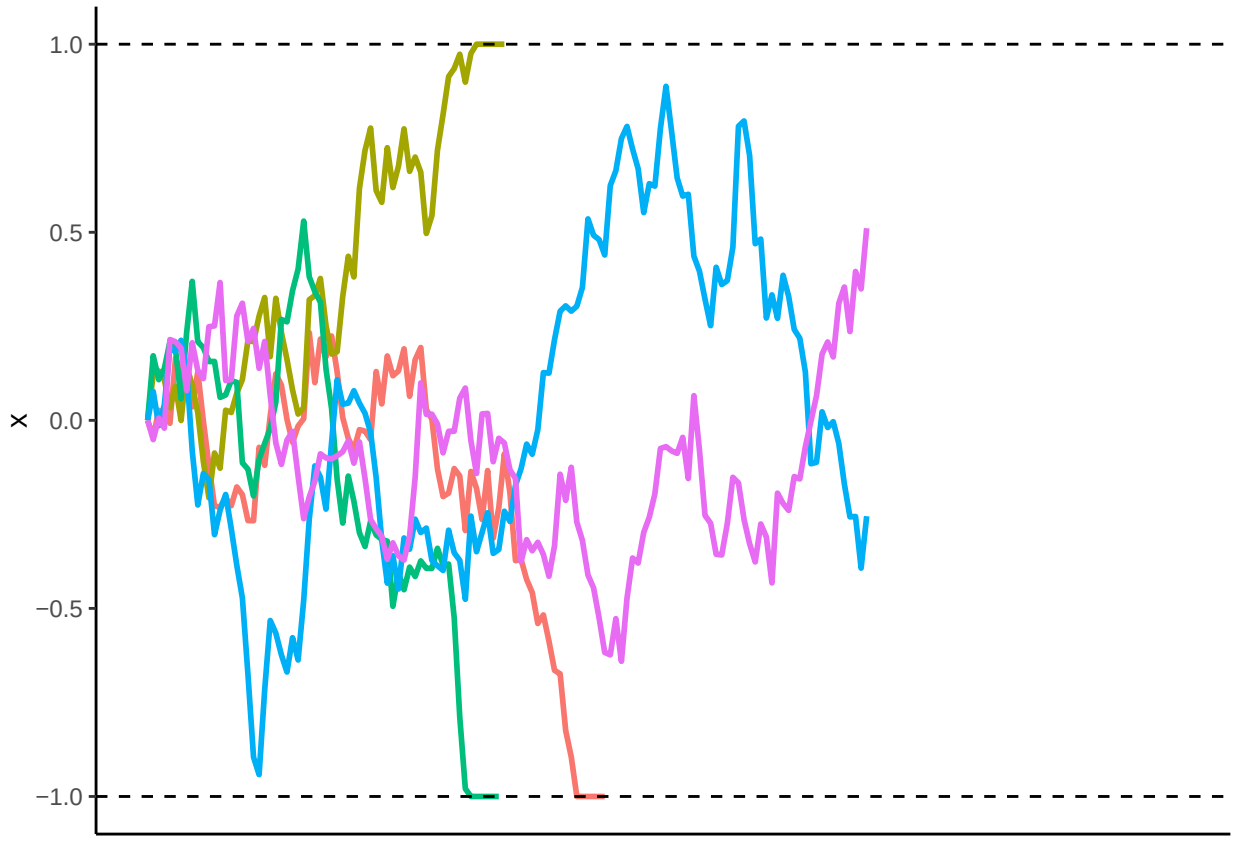
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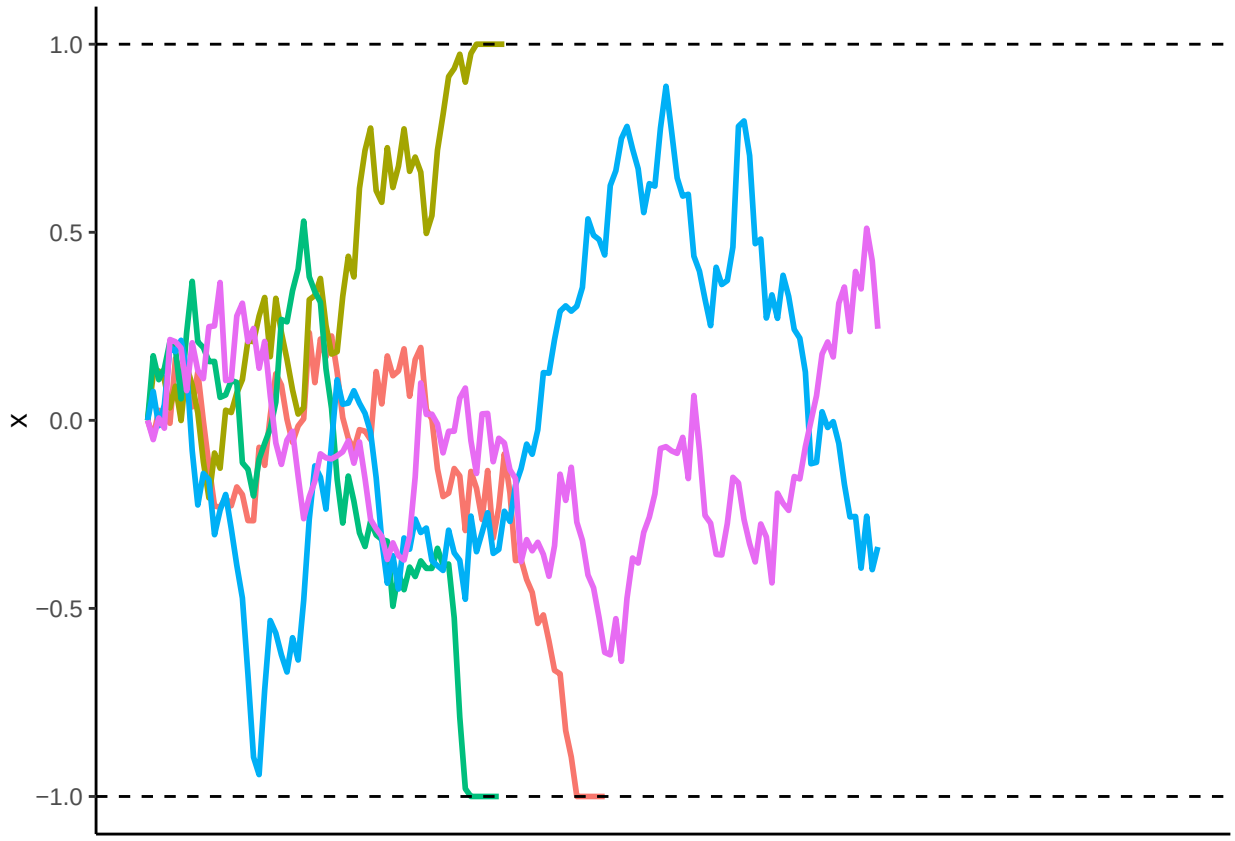
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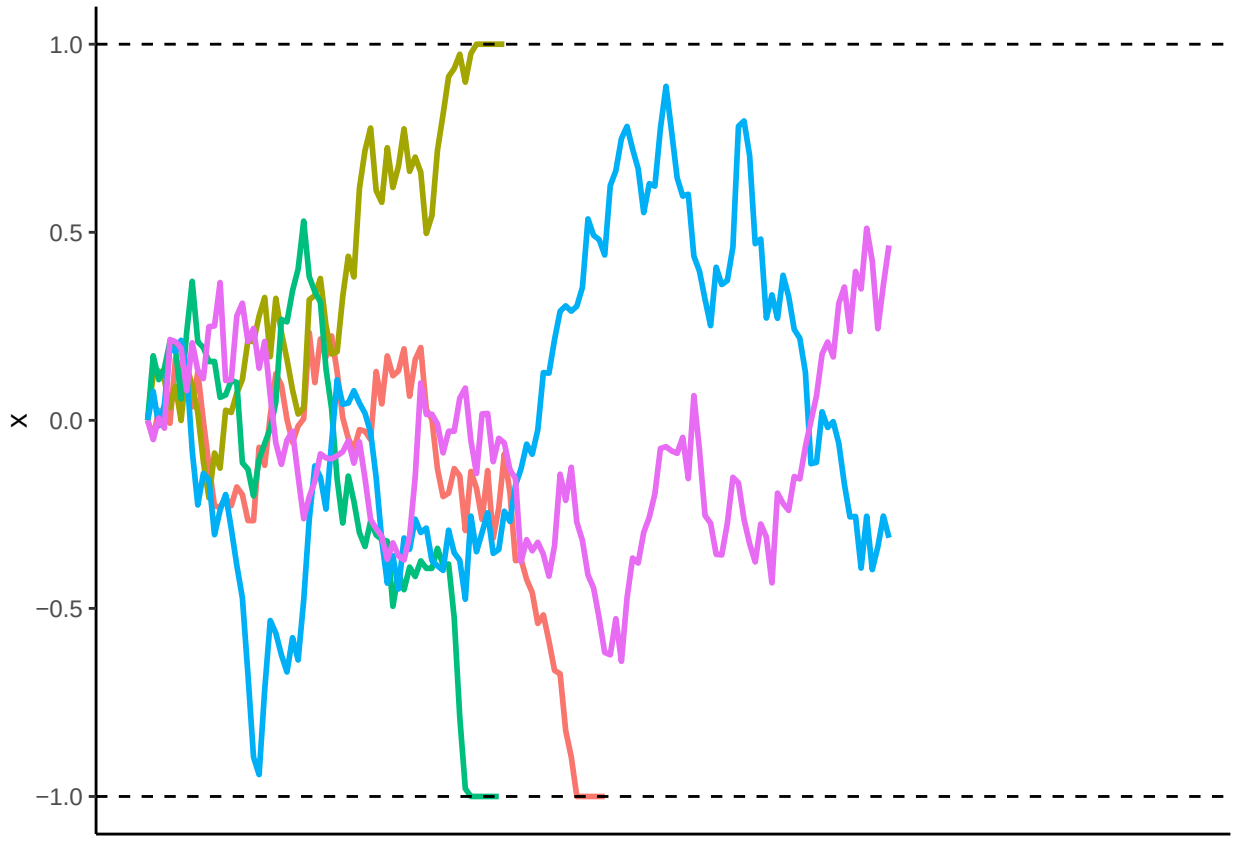
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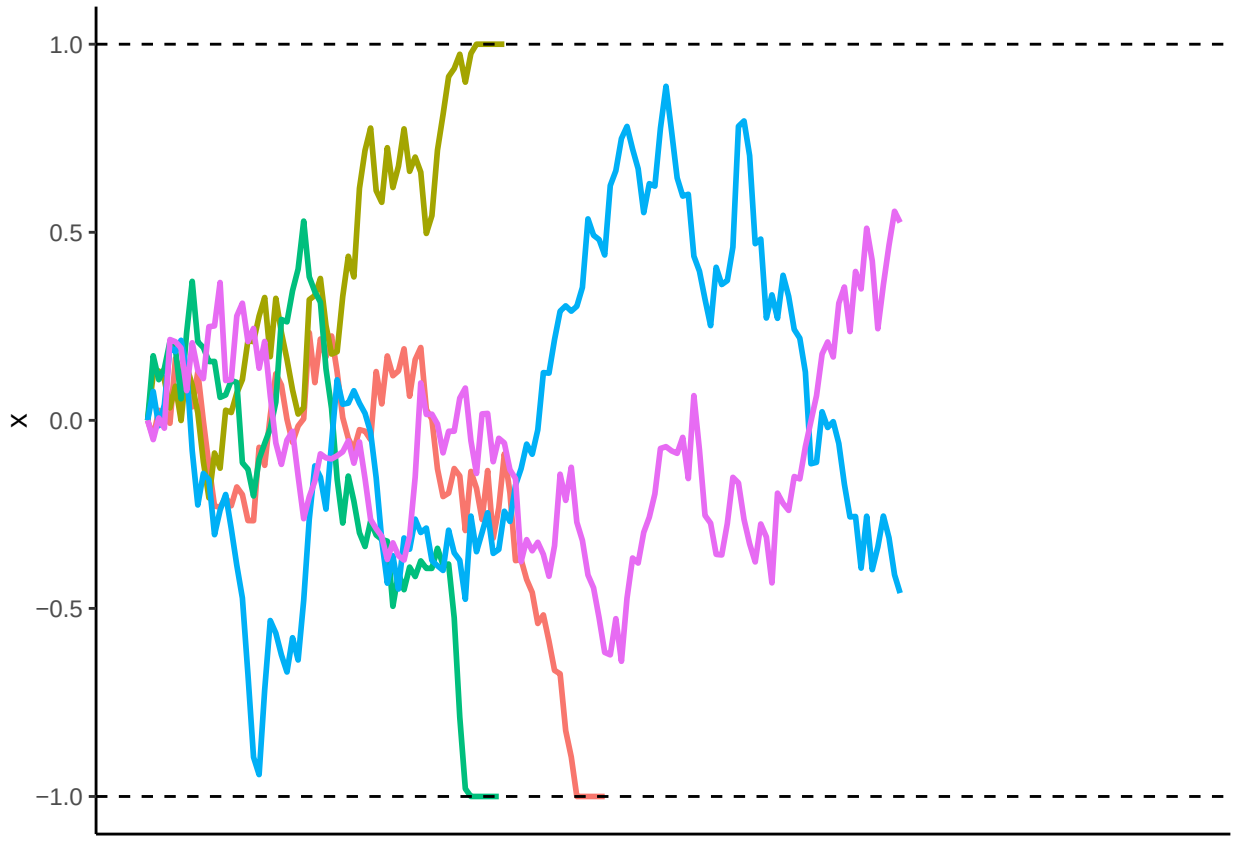
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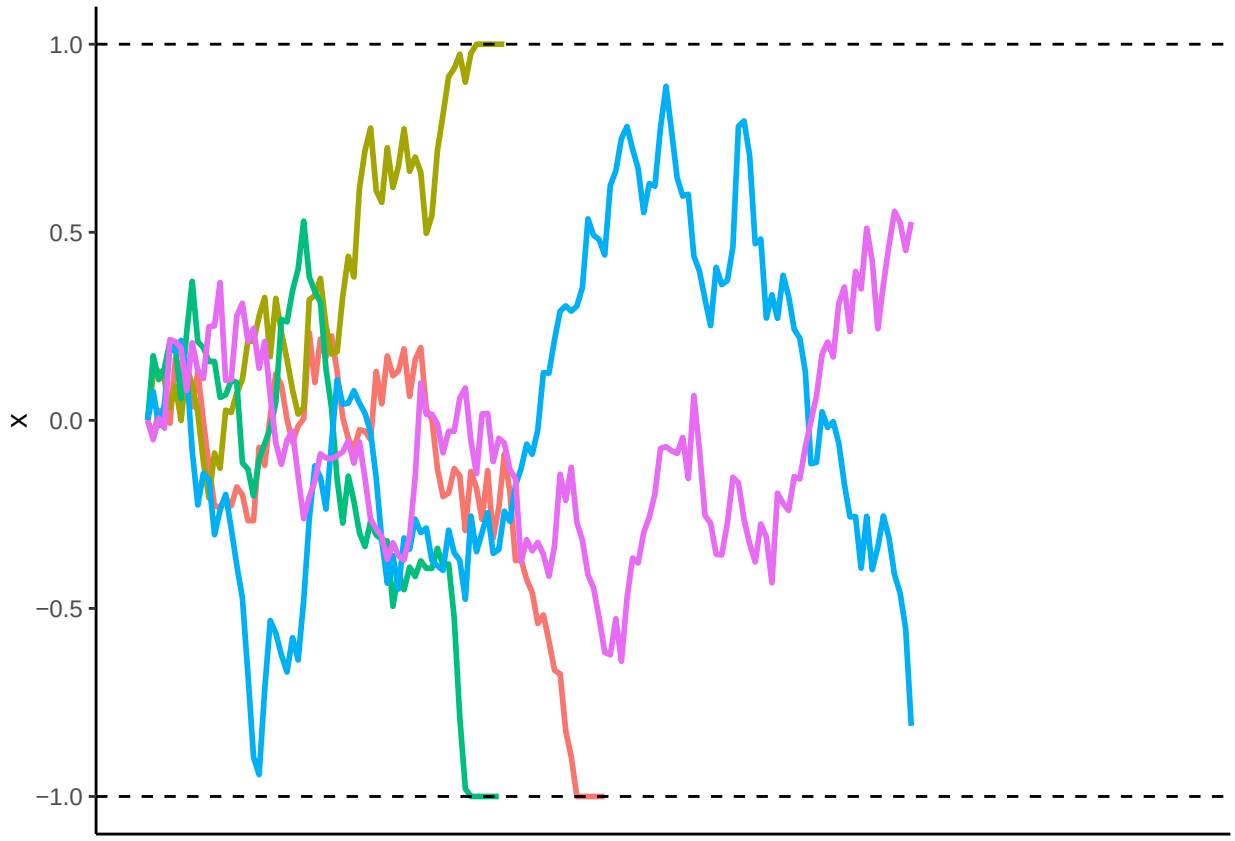
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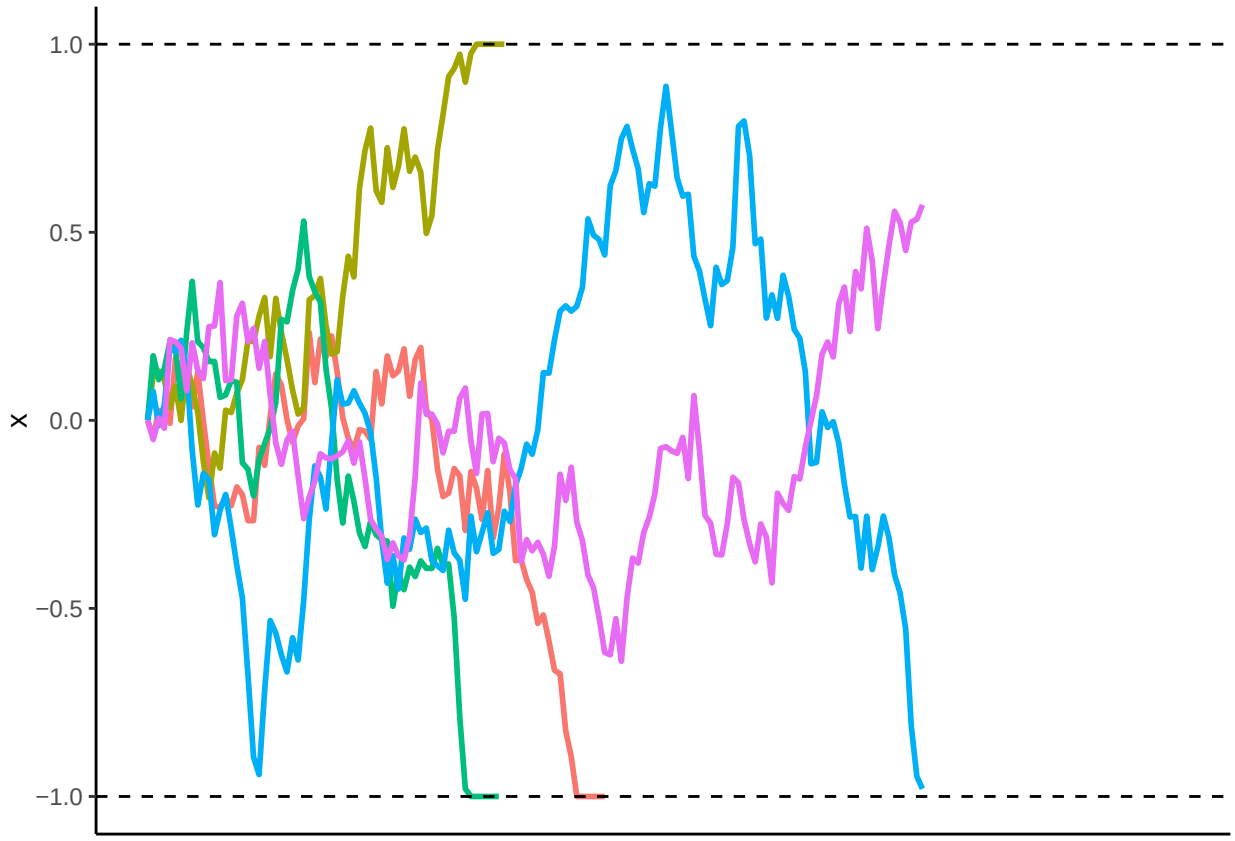
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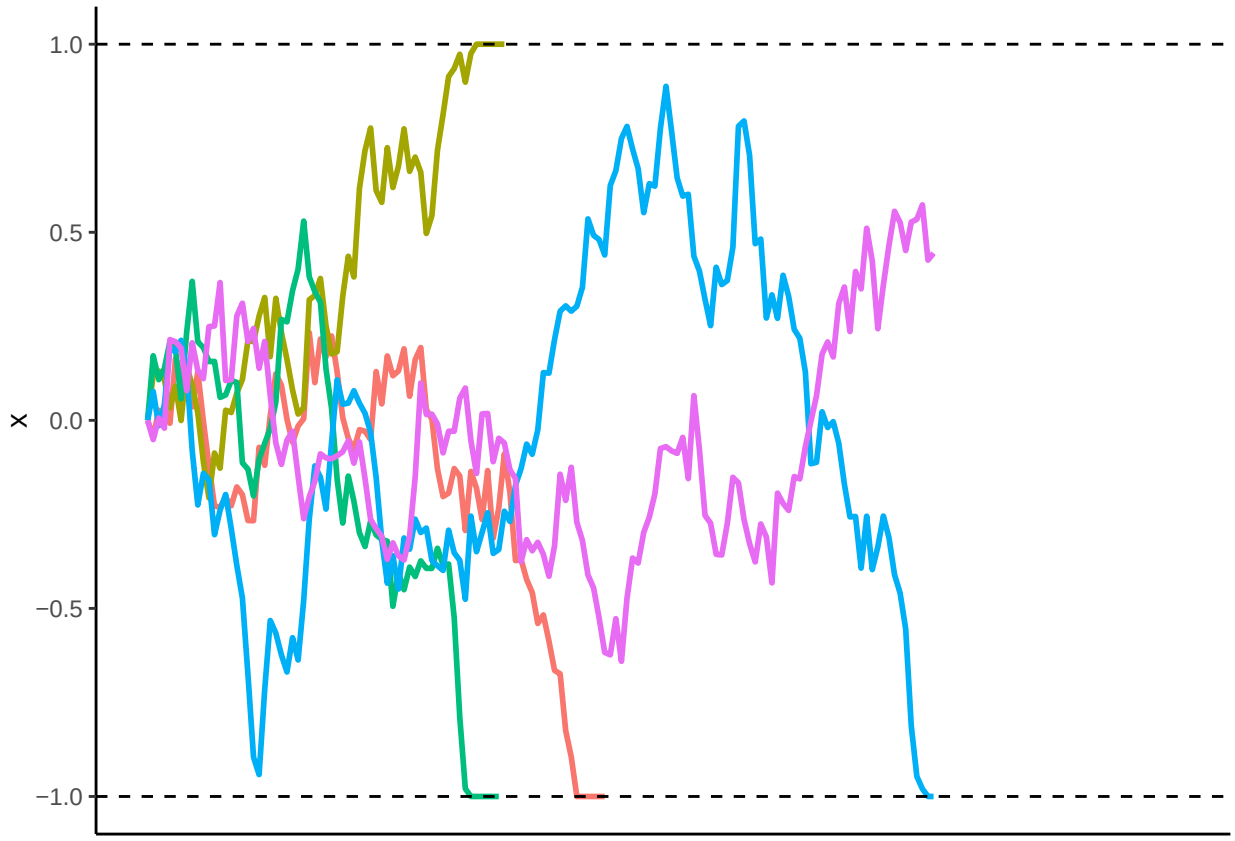
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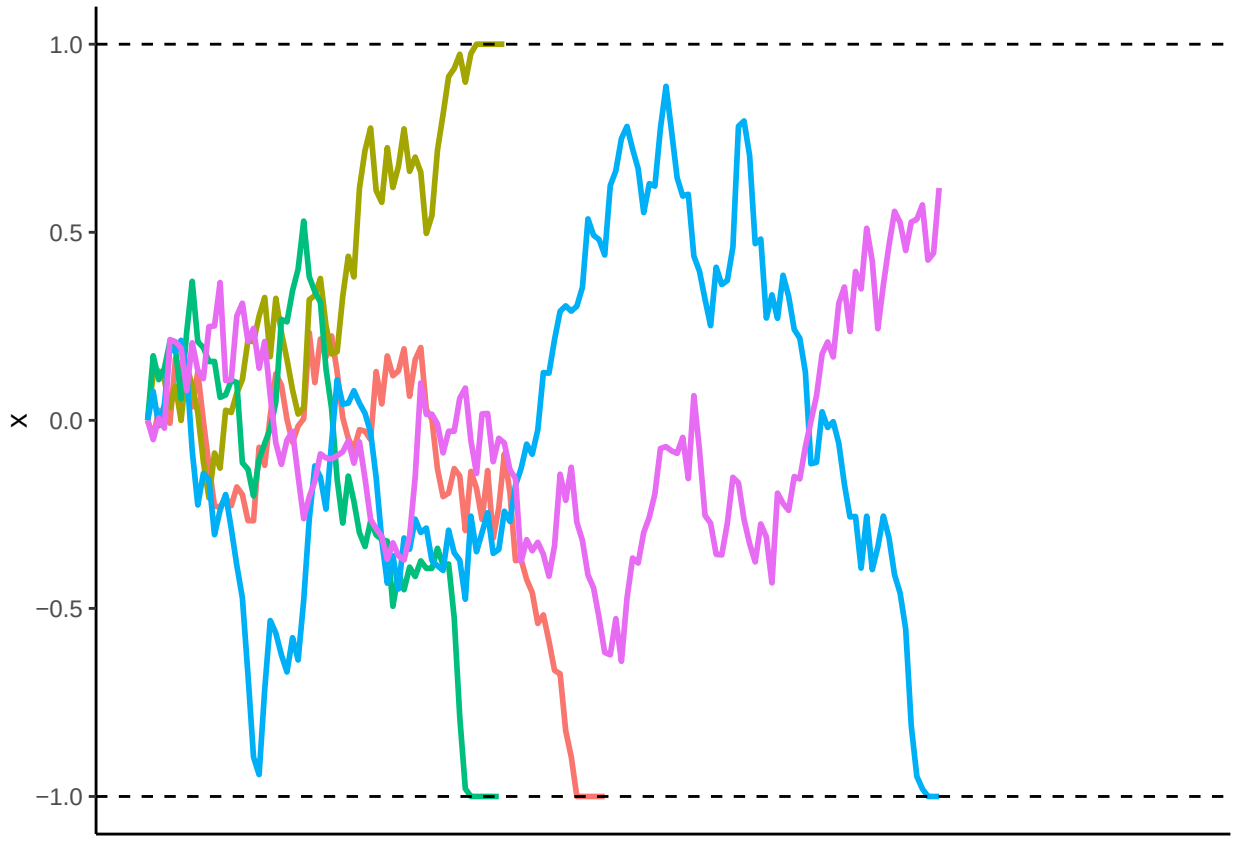
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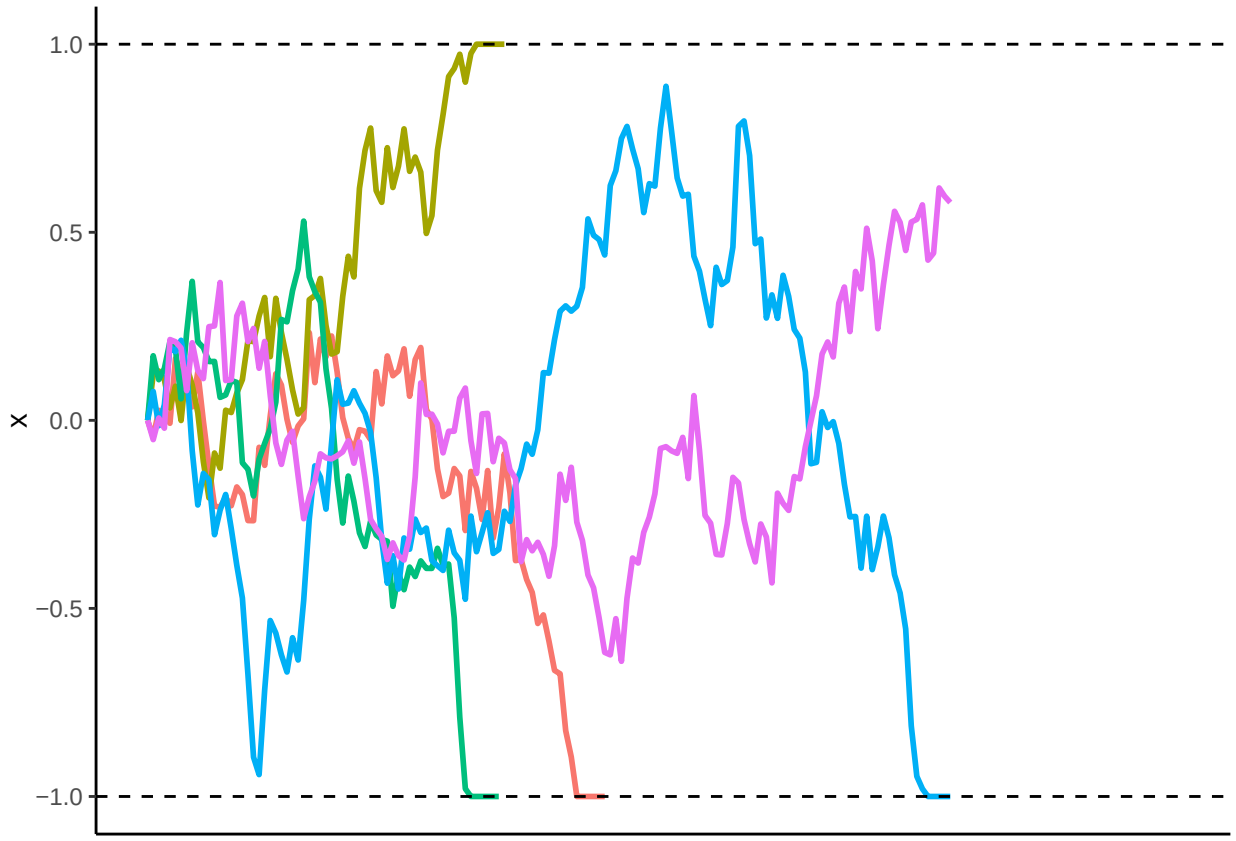
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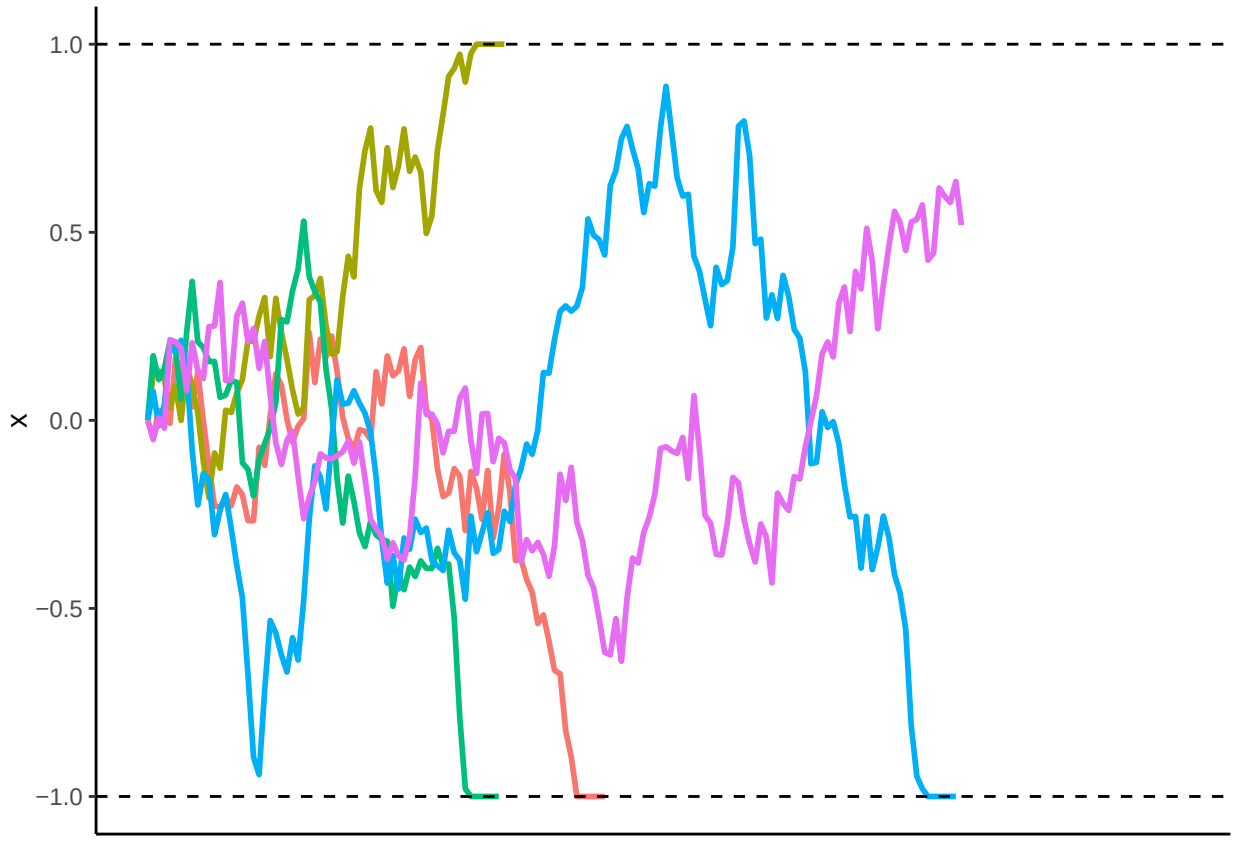
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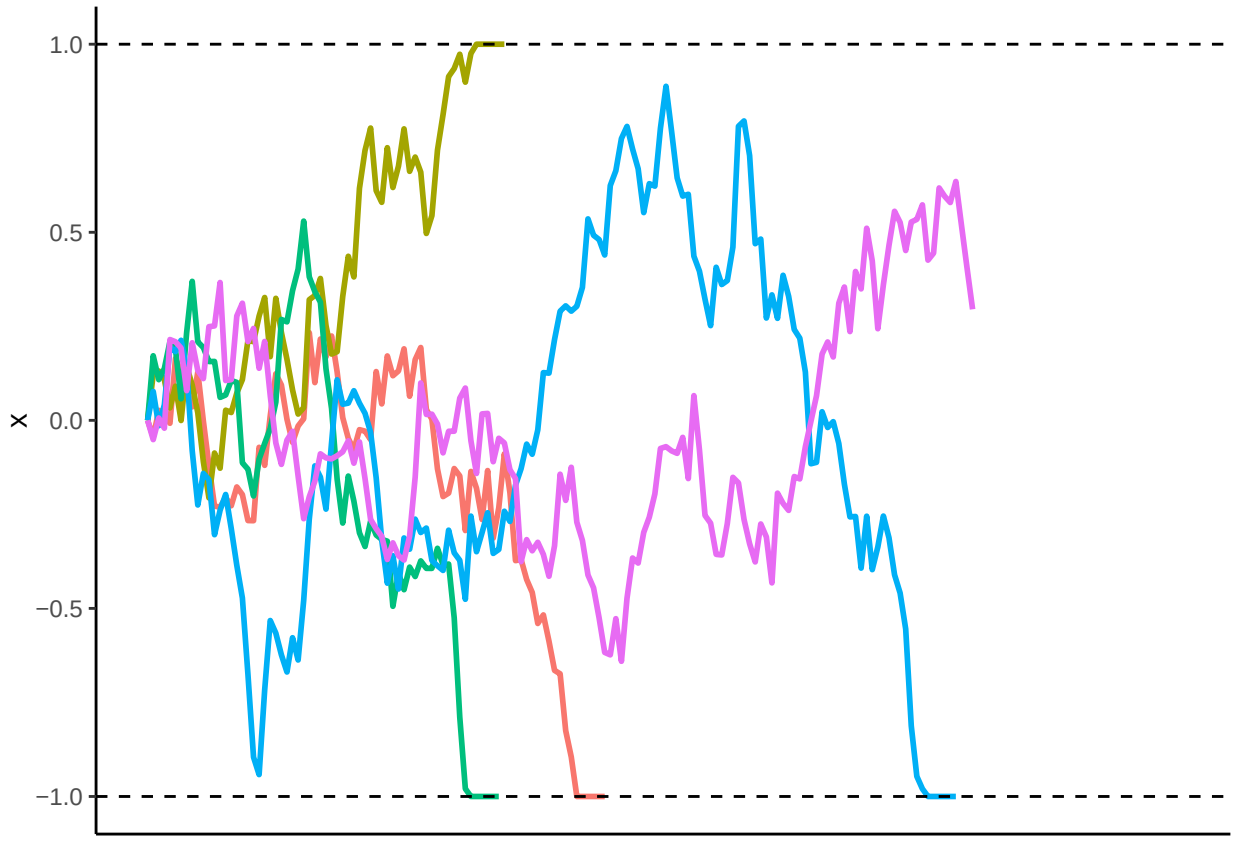
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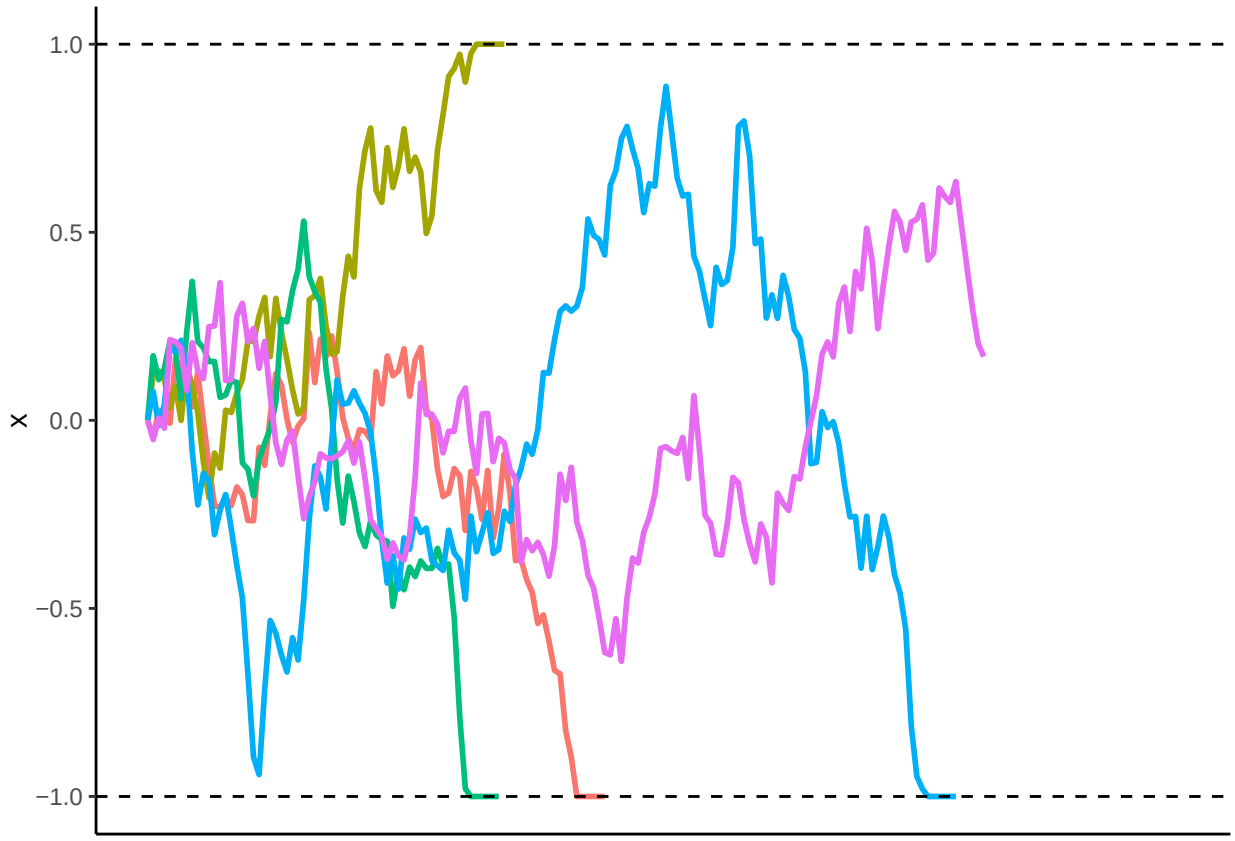
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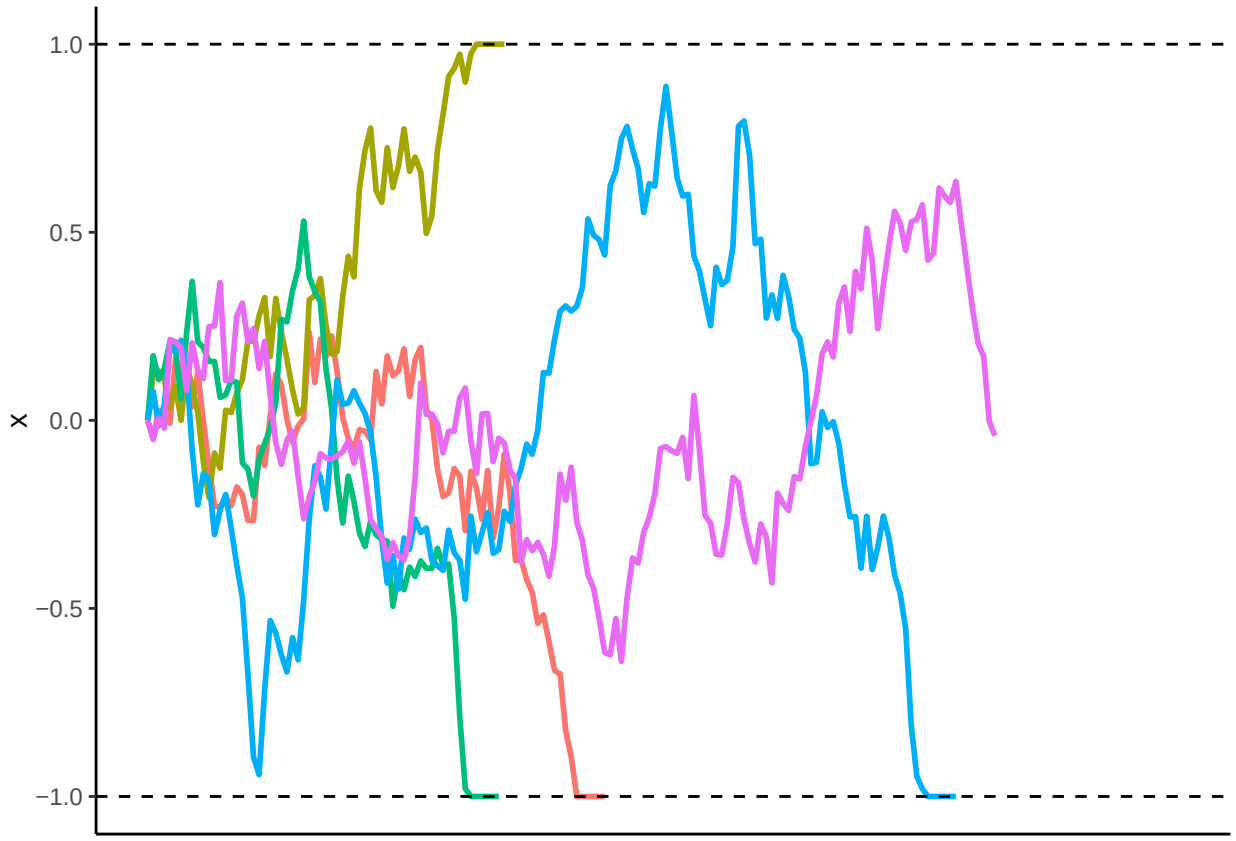
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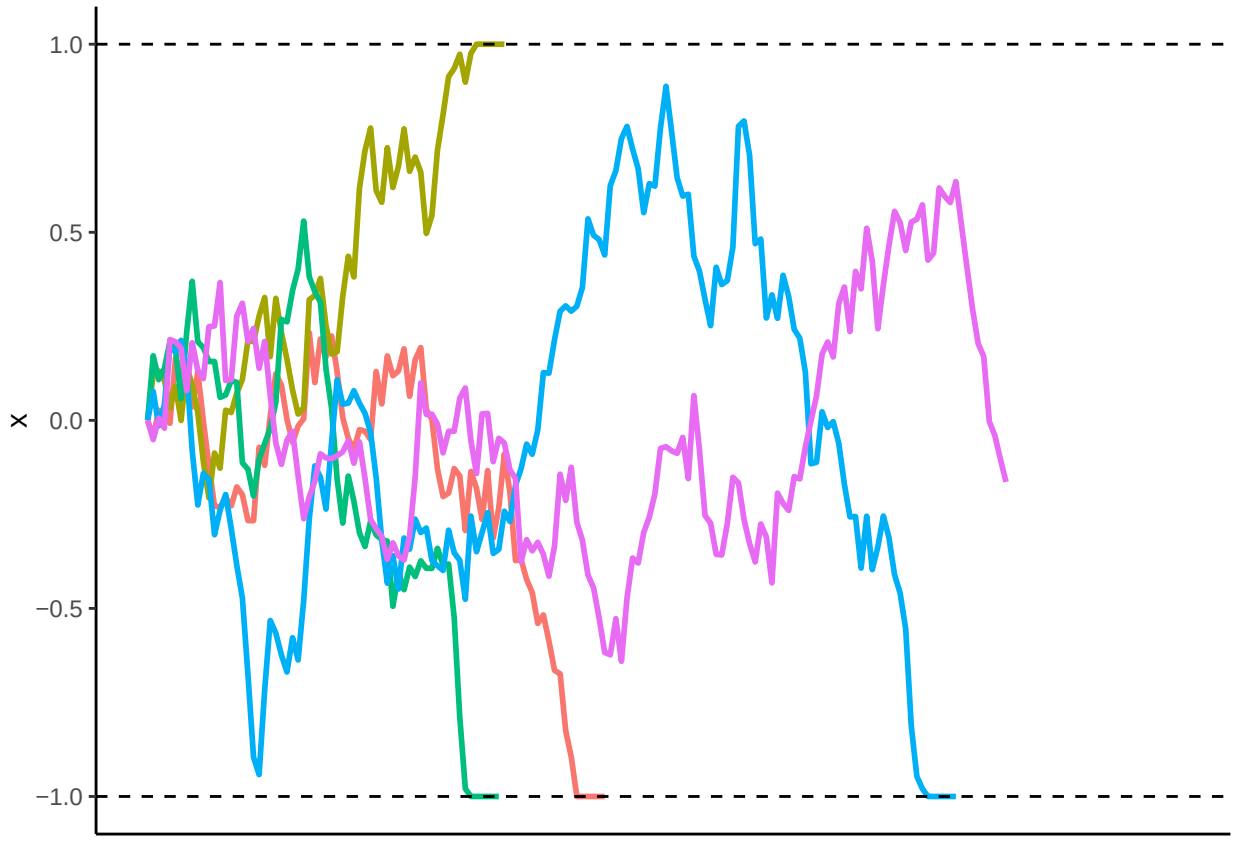
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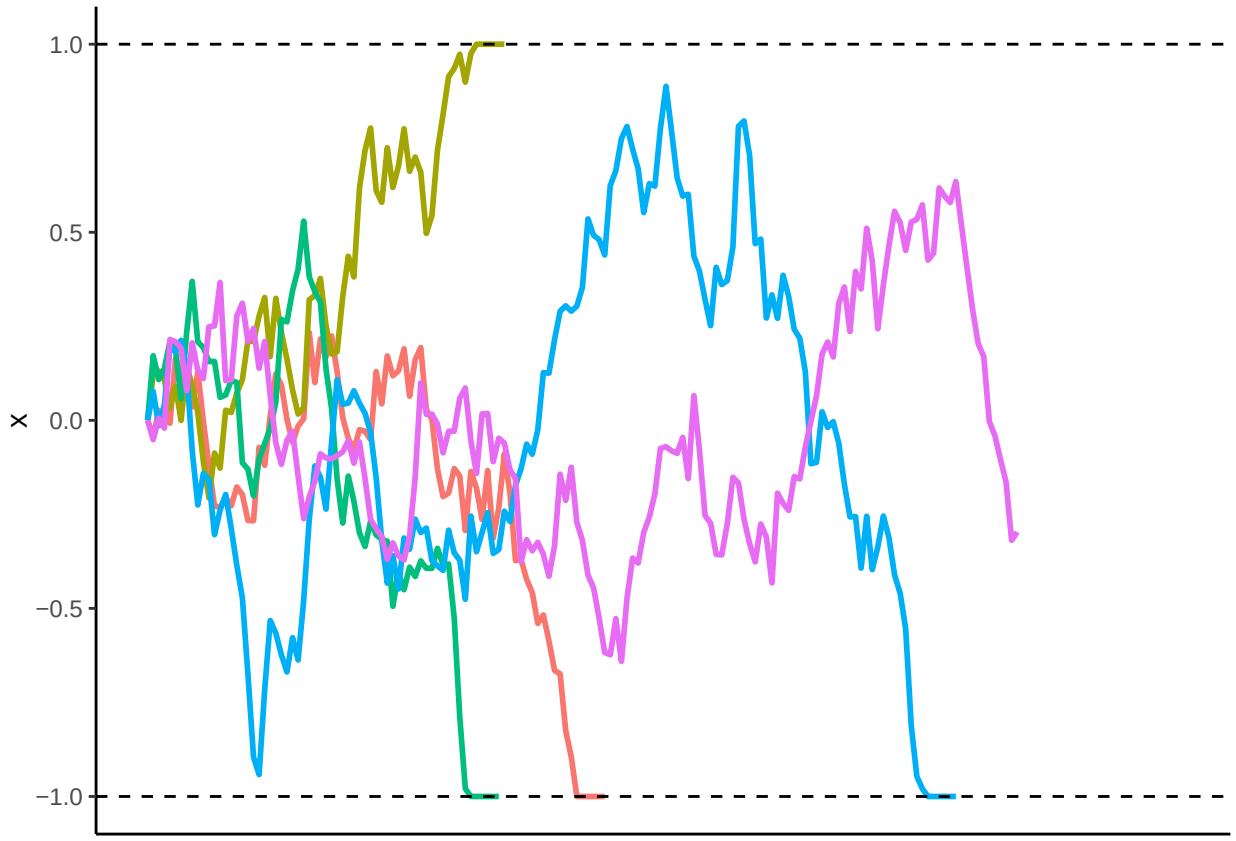
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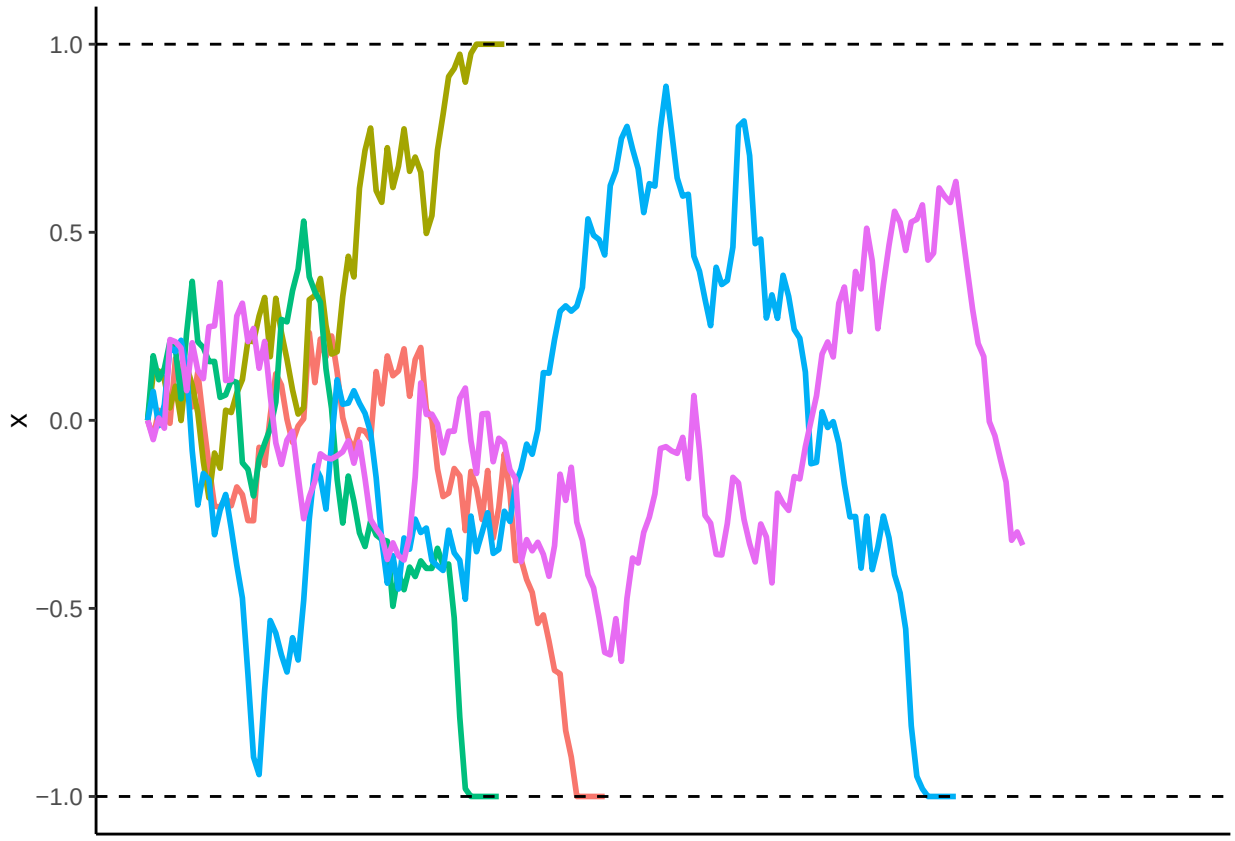
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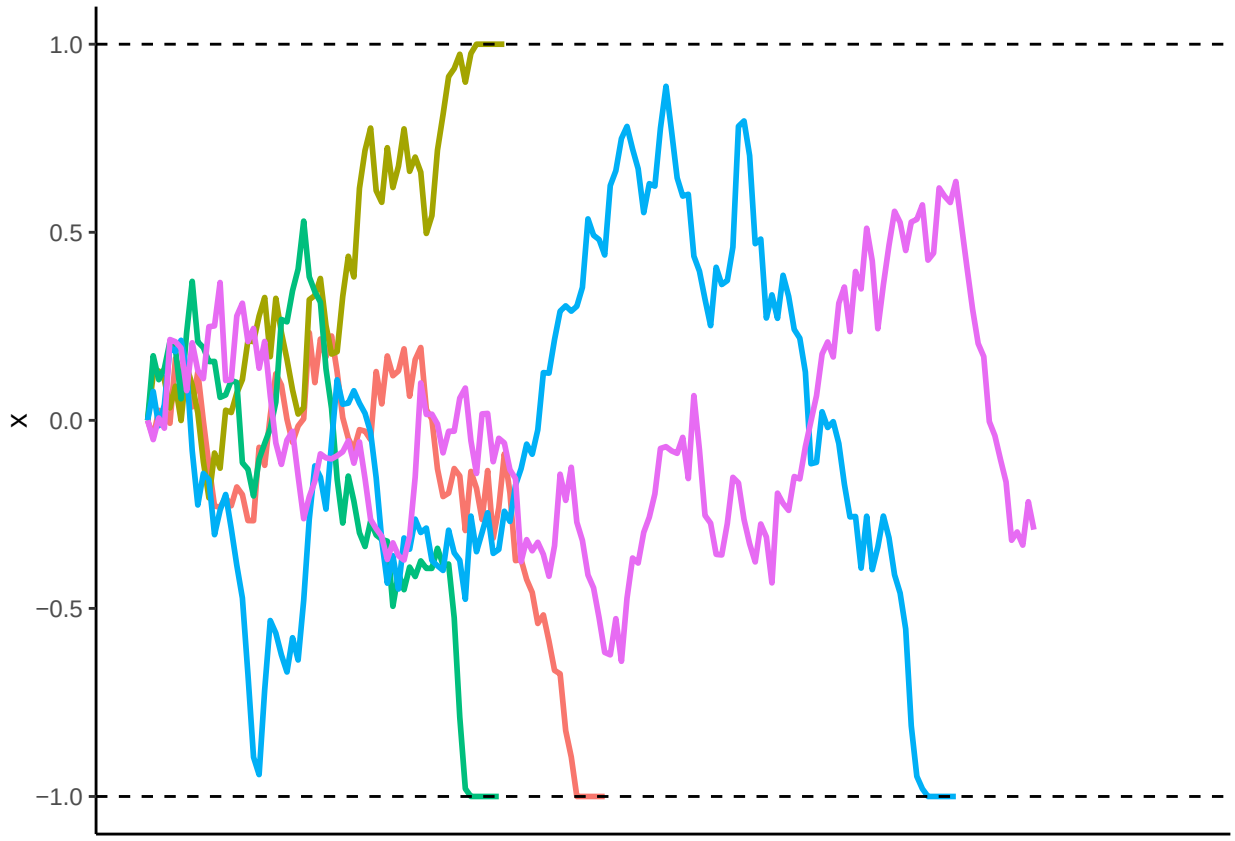
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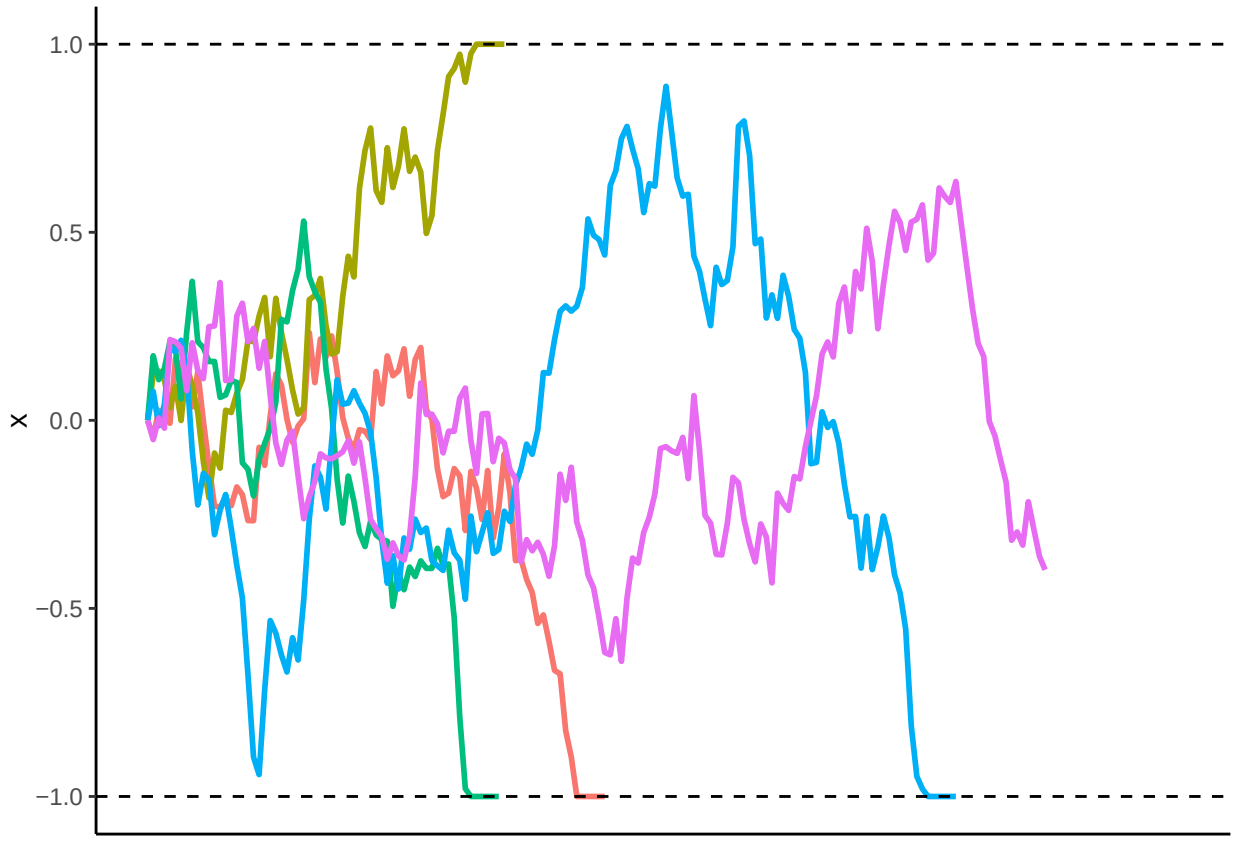
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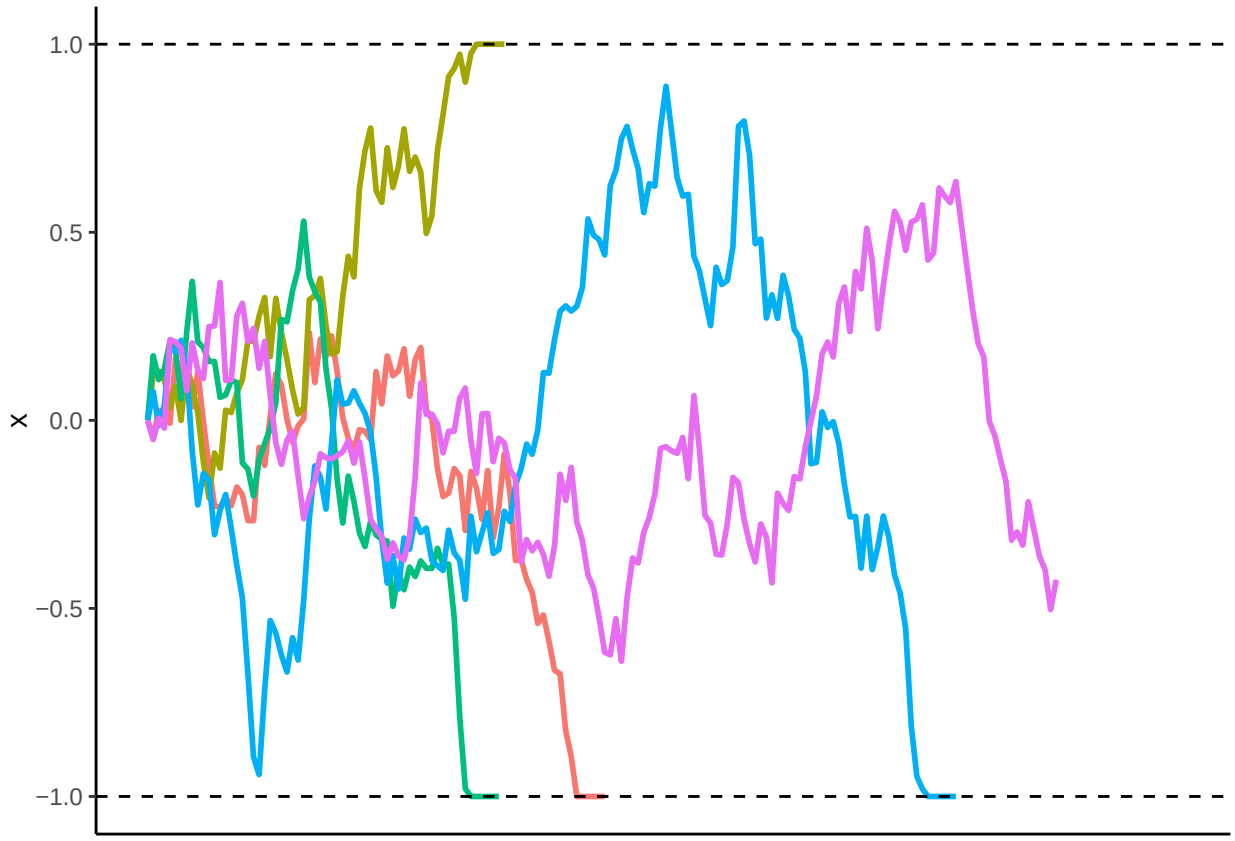
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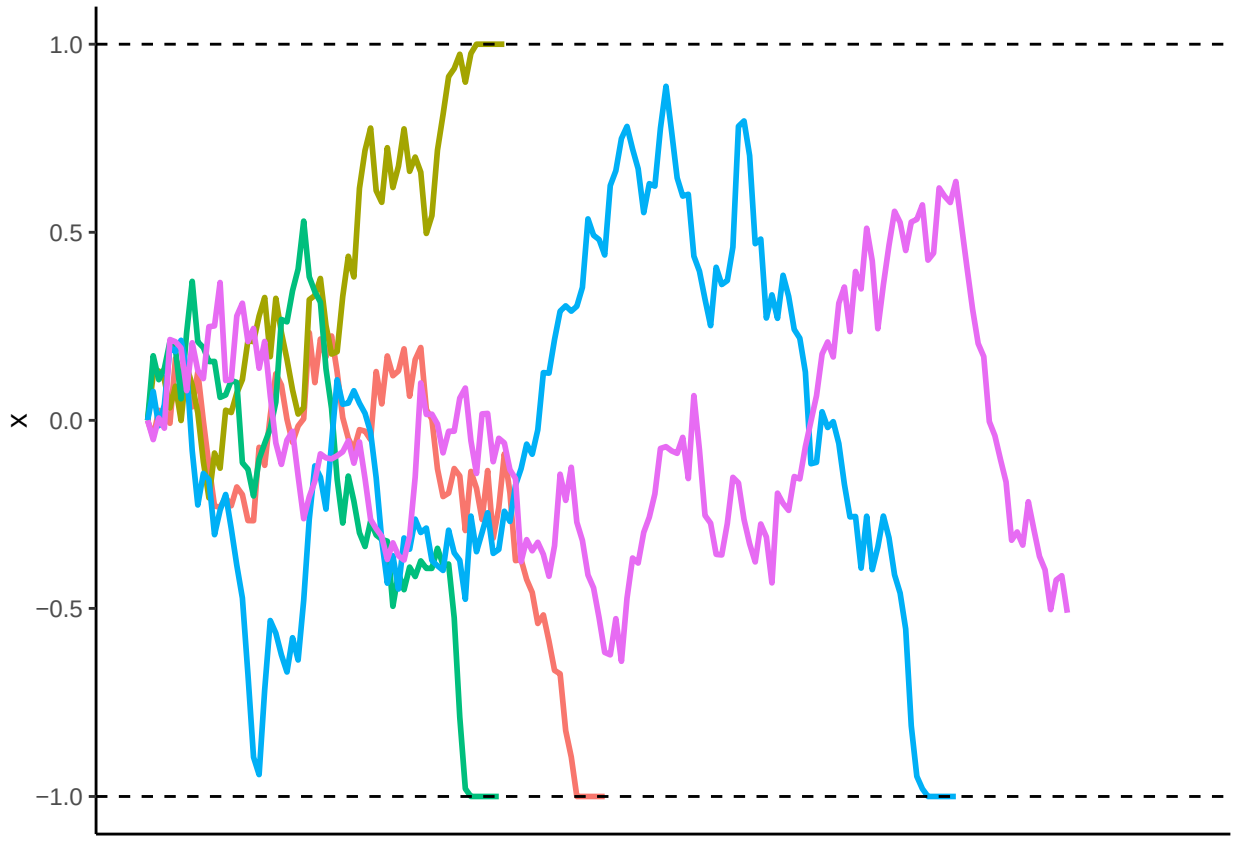
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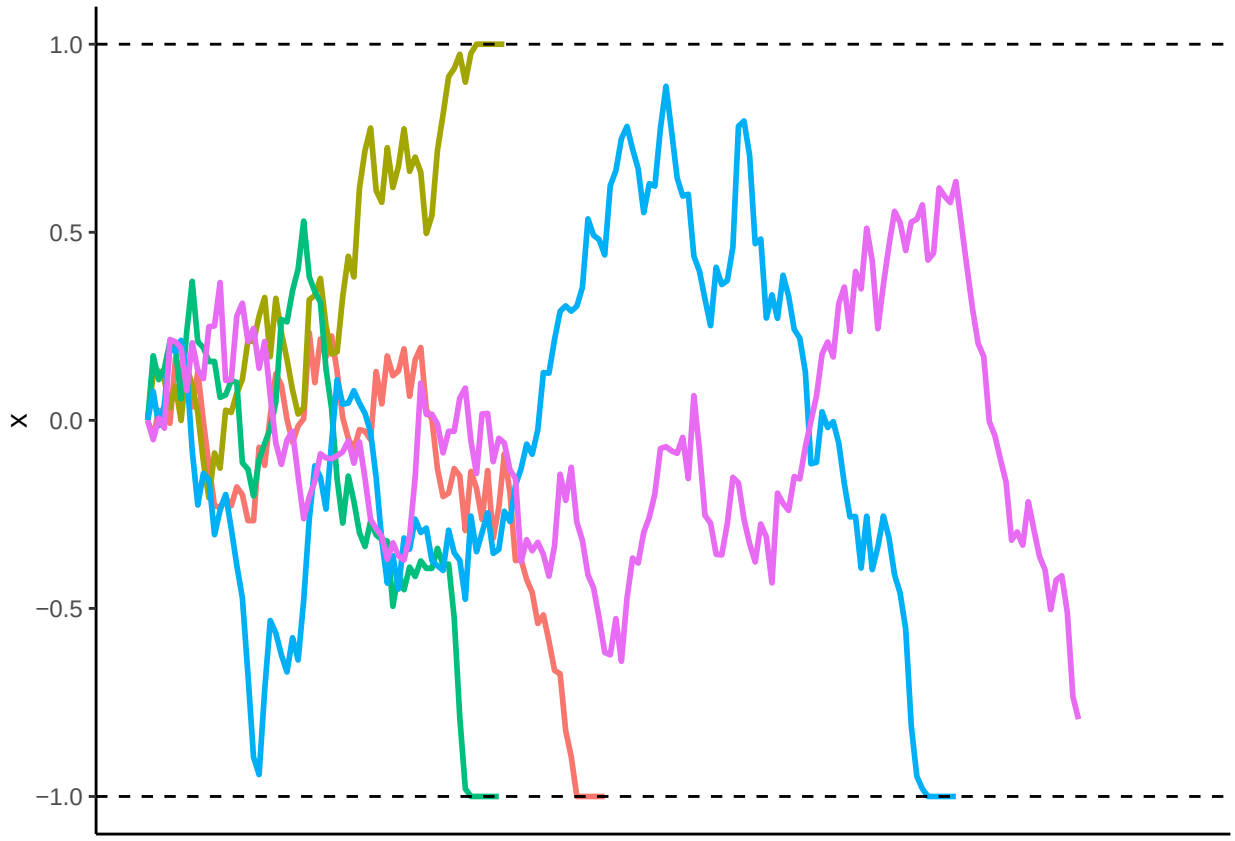
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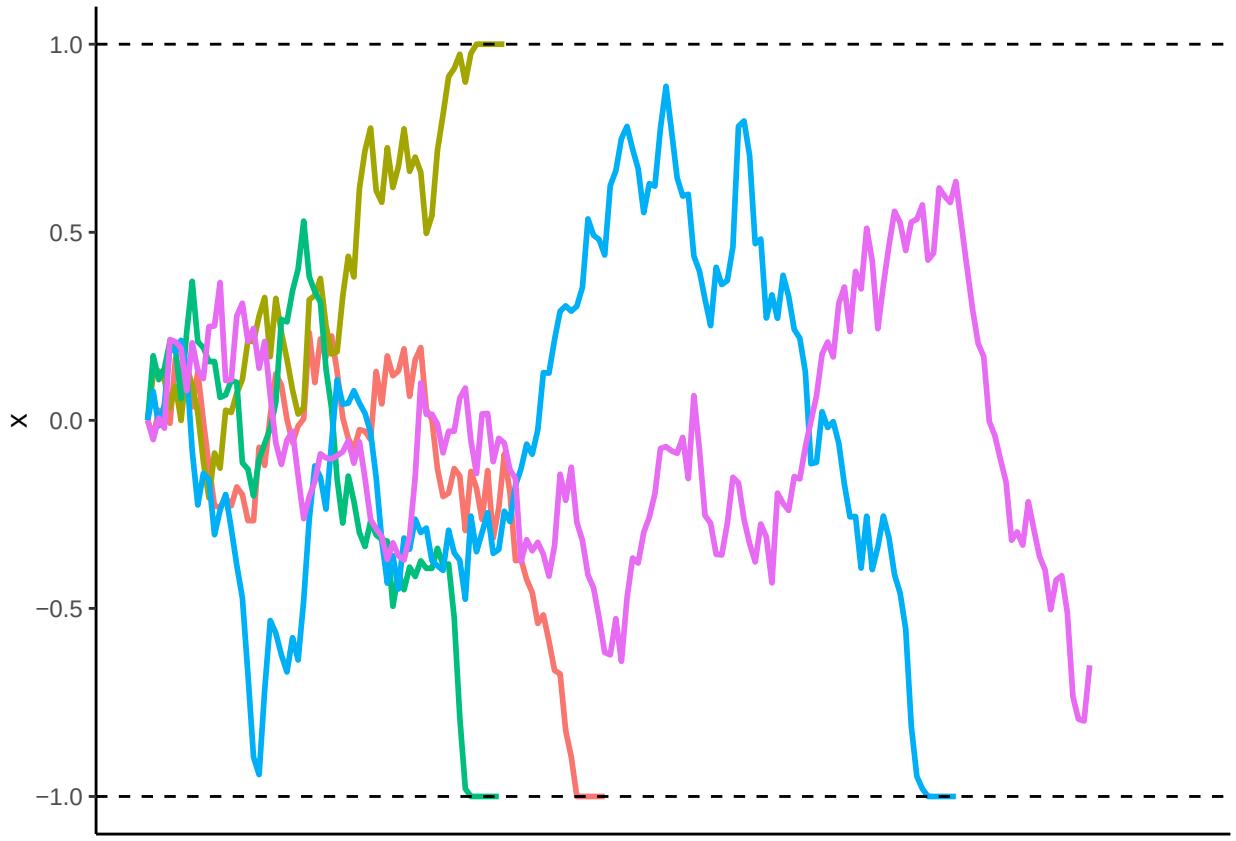
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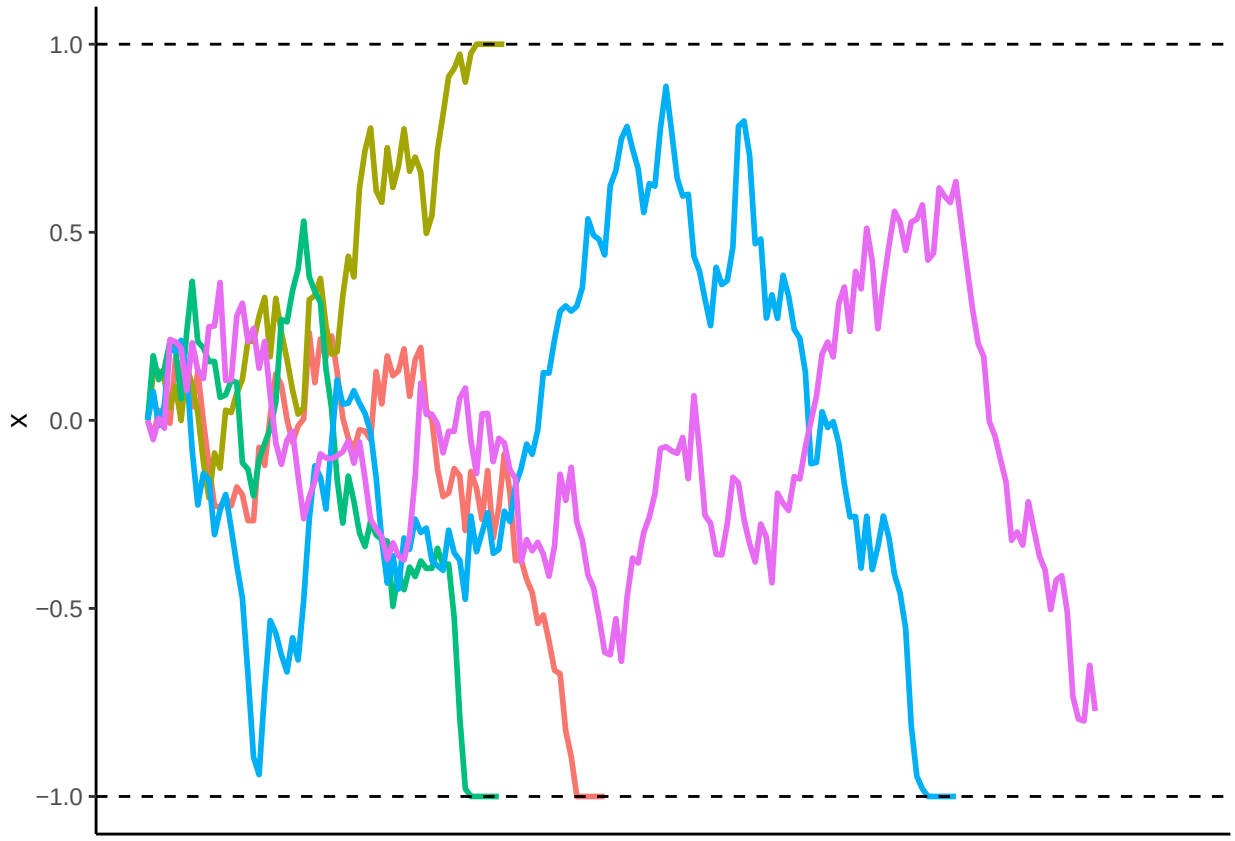
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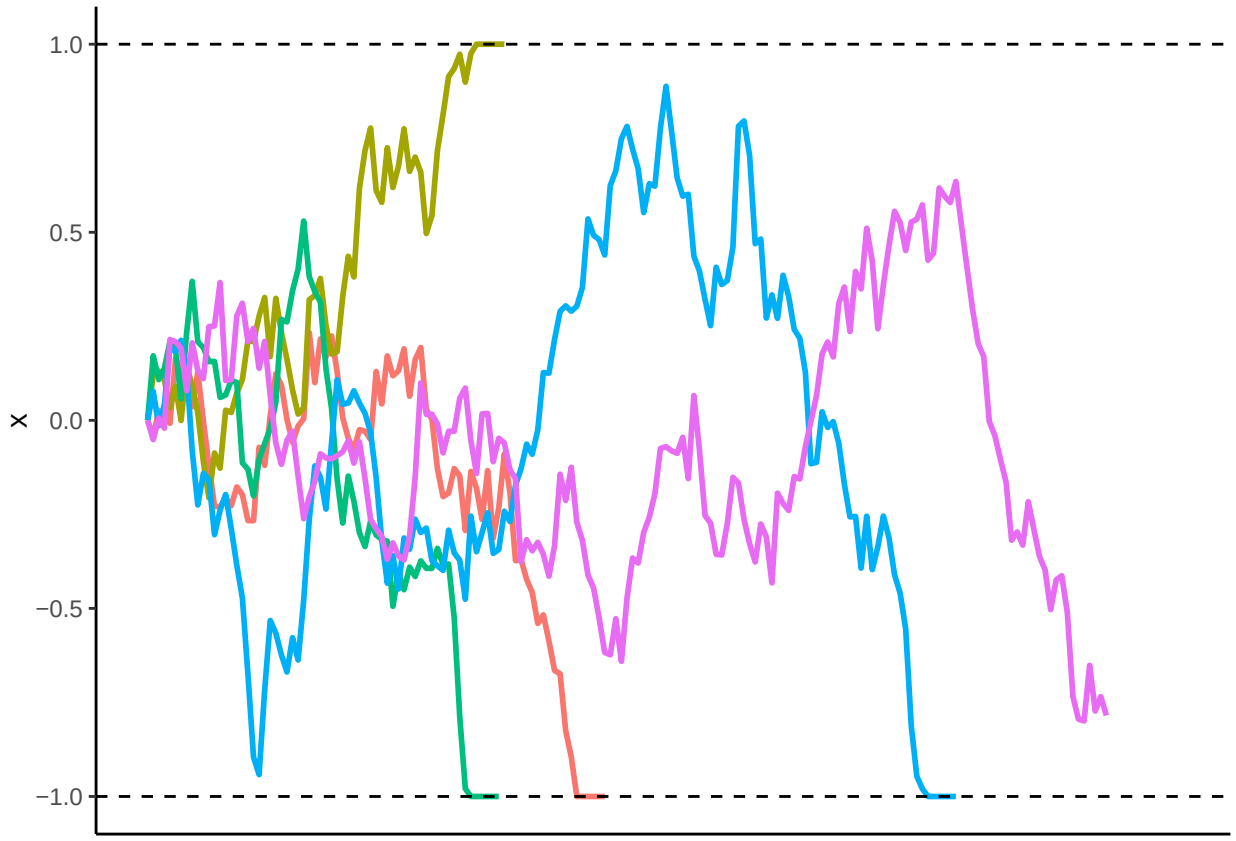
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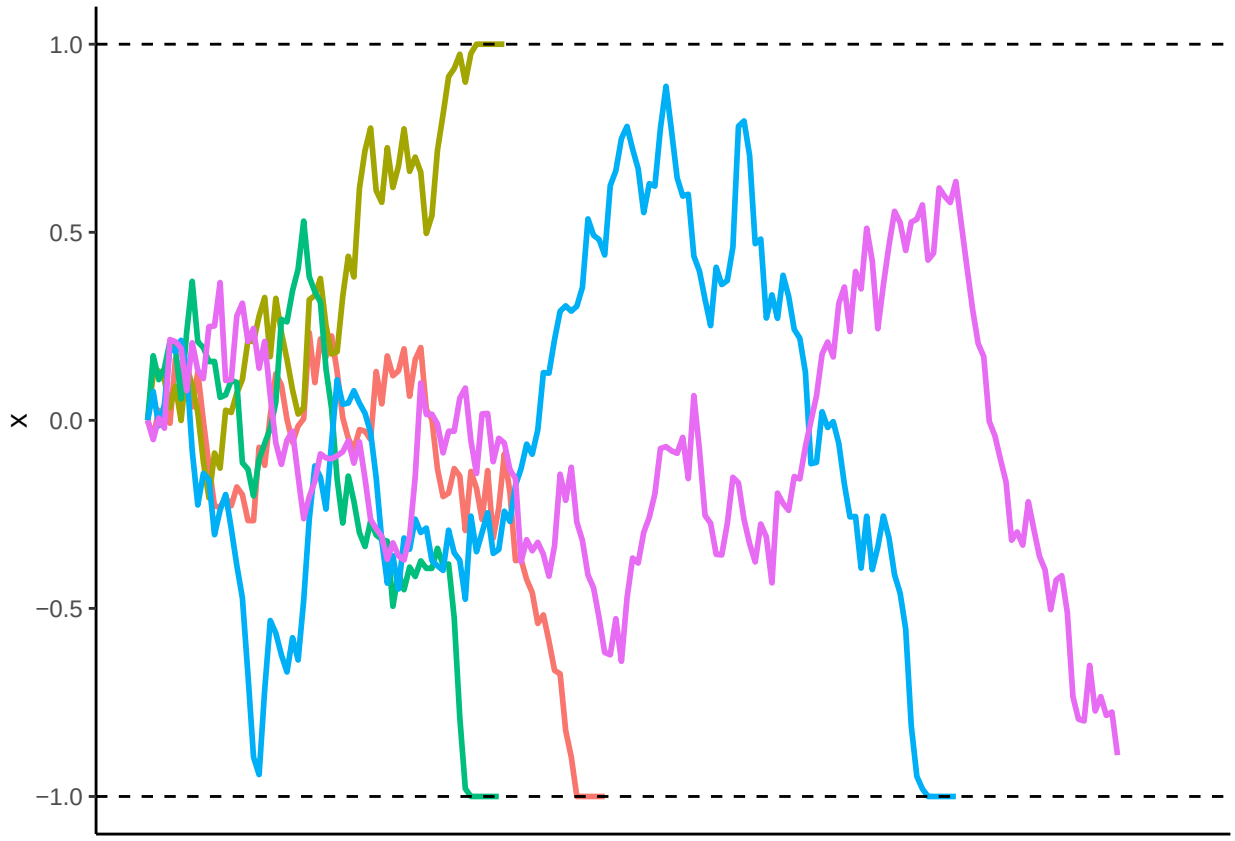
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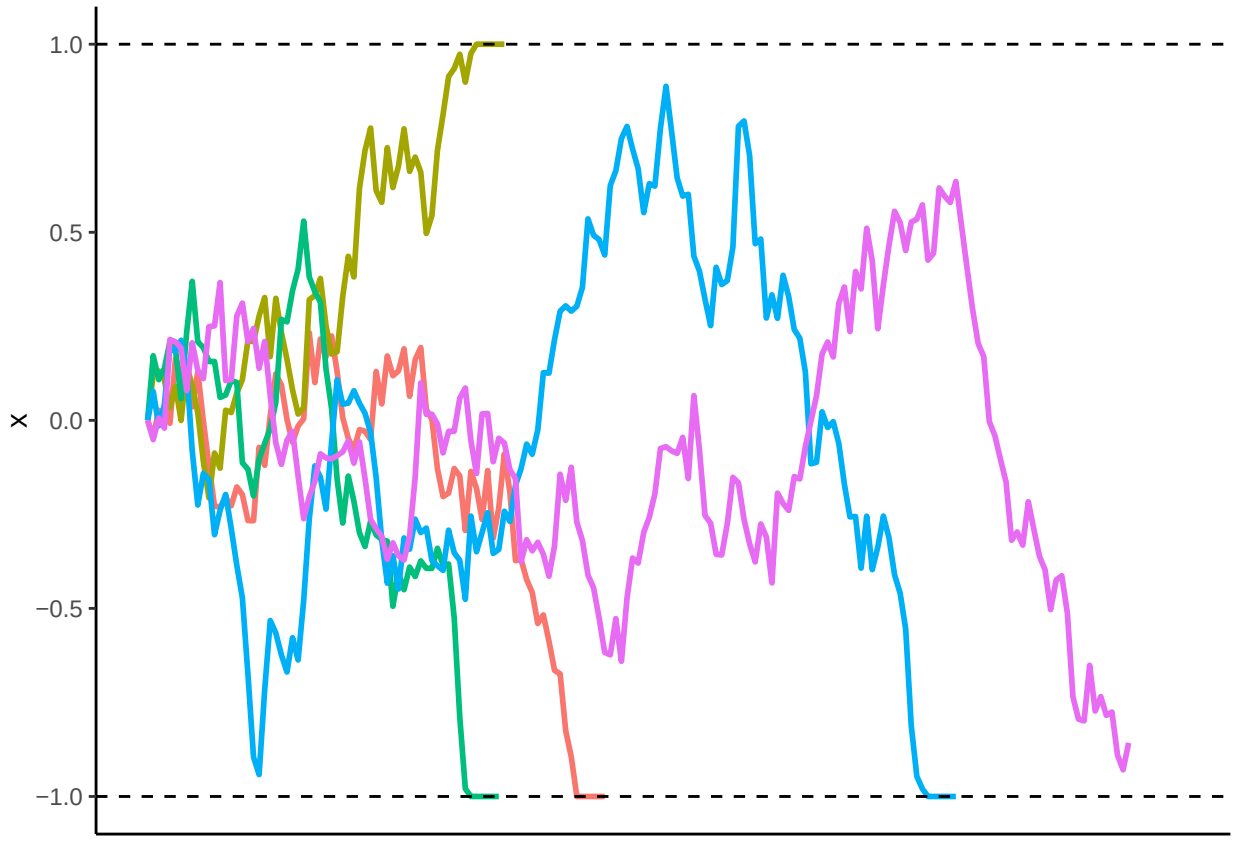
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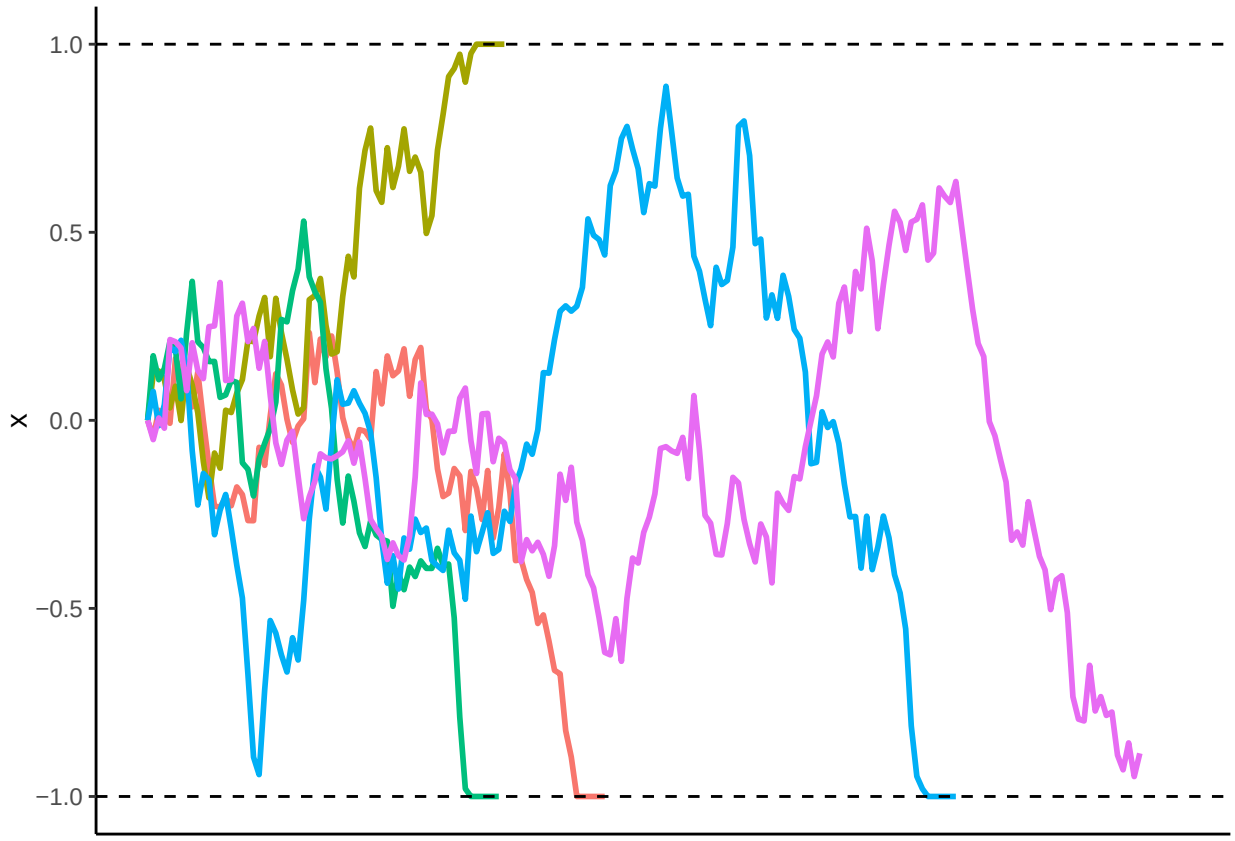
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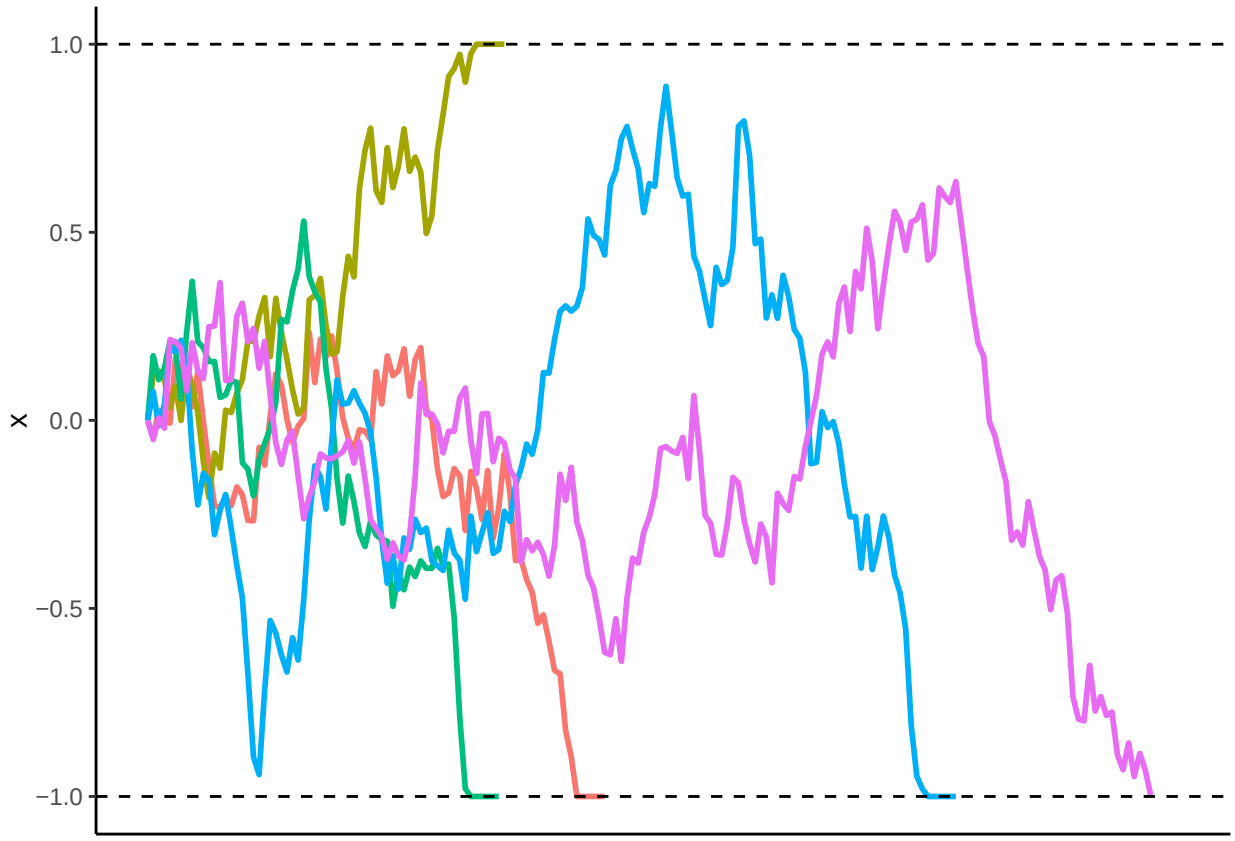
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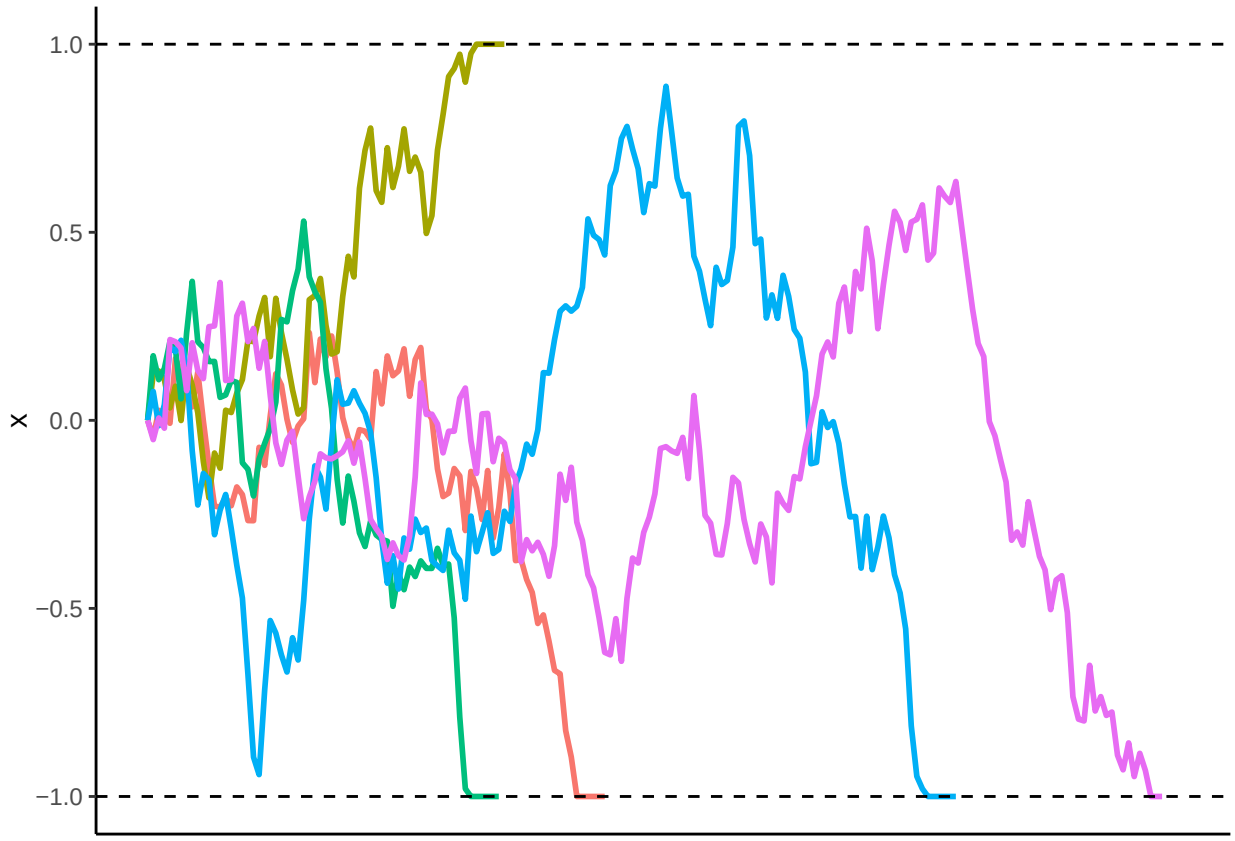
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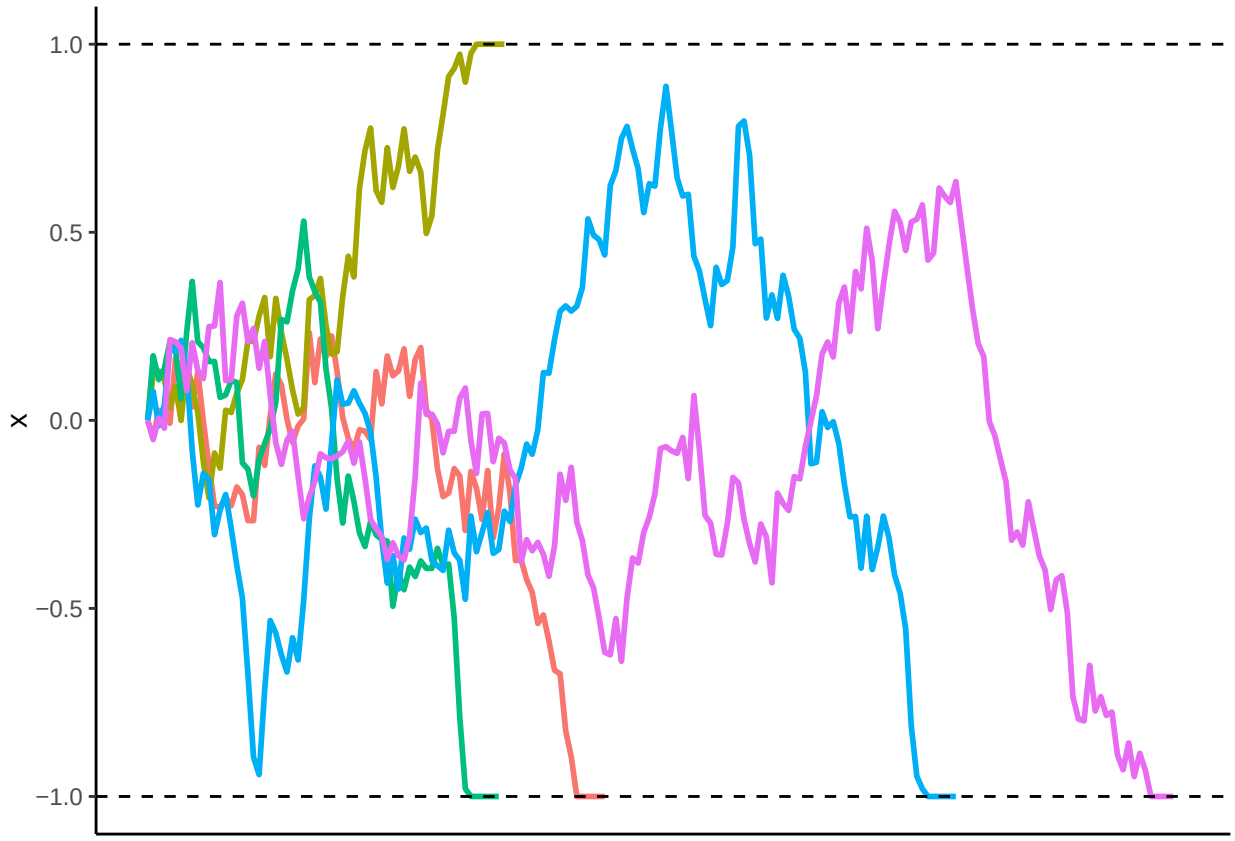
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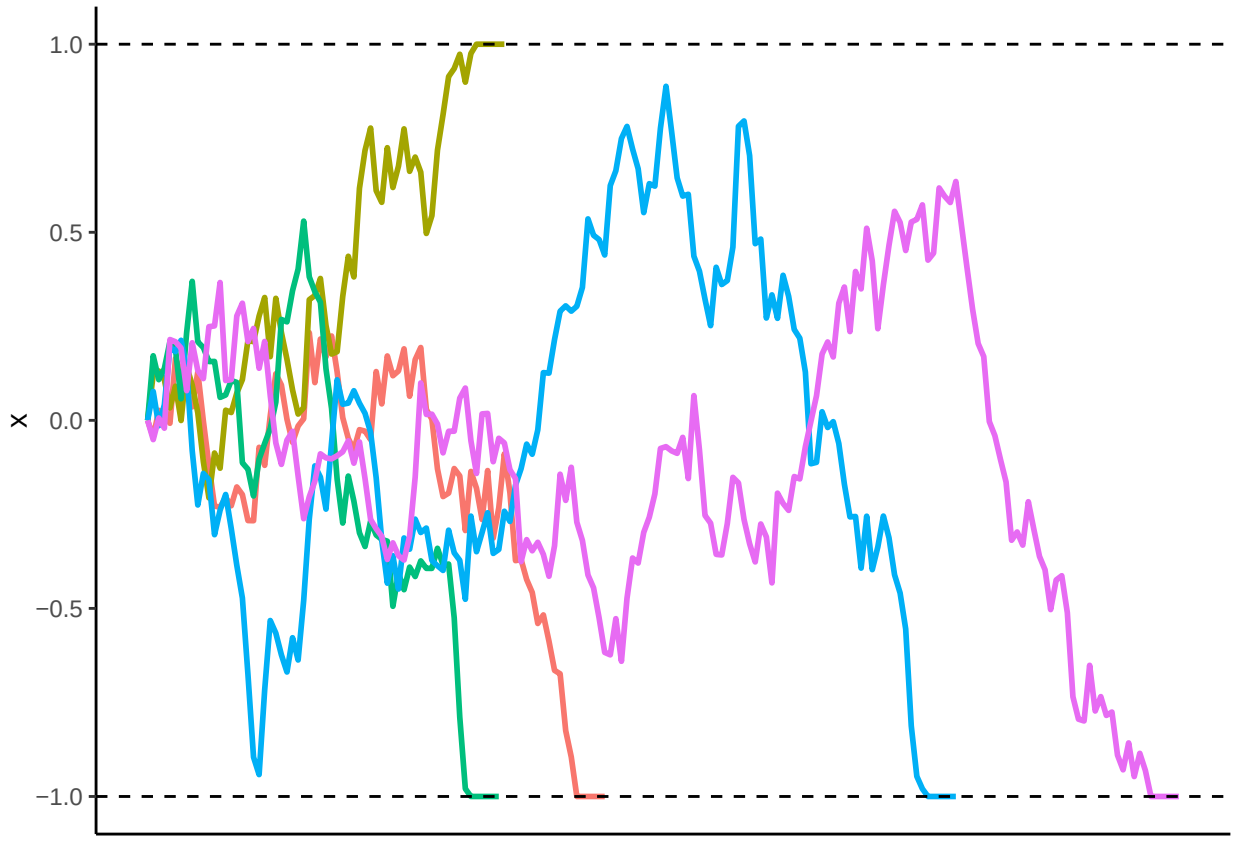


We can now play around with different drift rates and animate those!

```
max_time = seq(500,length.out = 1)

bias = seq(0.5,length.out = 1)

sd = seq(1,length.out = 1)

bound = seq(1,2,length.out = 1)

drift = seq(-1,1,length.out = 5)

replicate = 1:5


params = expand.grid(max_time = max_time,
                     bias = bias,
                     sd = sd,
                     bound = bound,
                     drift = drift,
                     replicate = replicate) %>%
  mutate(id = 1:nrow(.))

data_list <- split(params, params$id)

plan(multisession, workers = 3)
```

```
weiners = future_map(data_list, ~make_weiner(.x), .progress = TRUE, .options = furrr_options(seed = TRU

data = map_dfr(weiners,1)

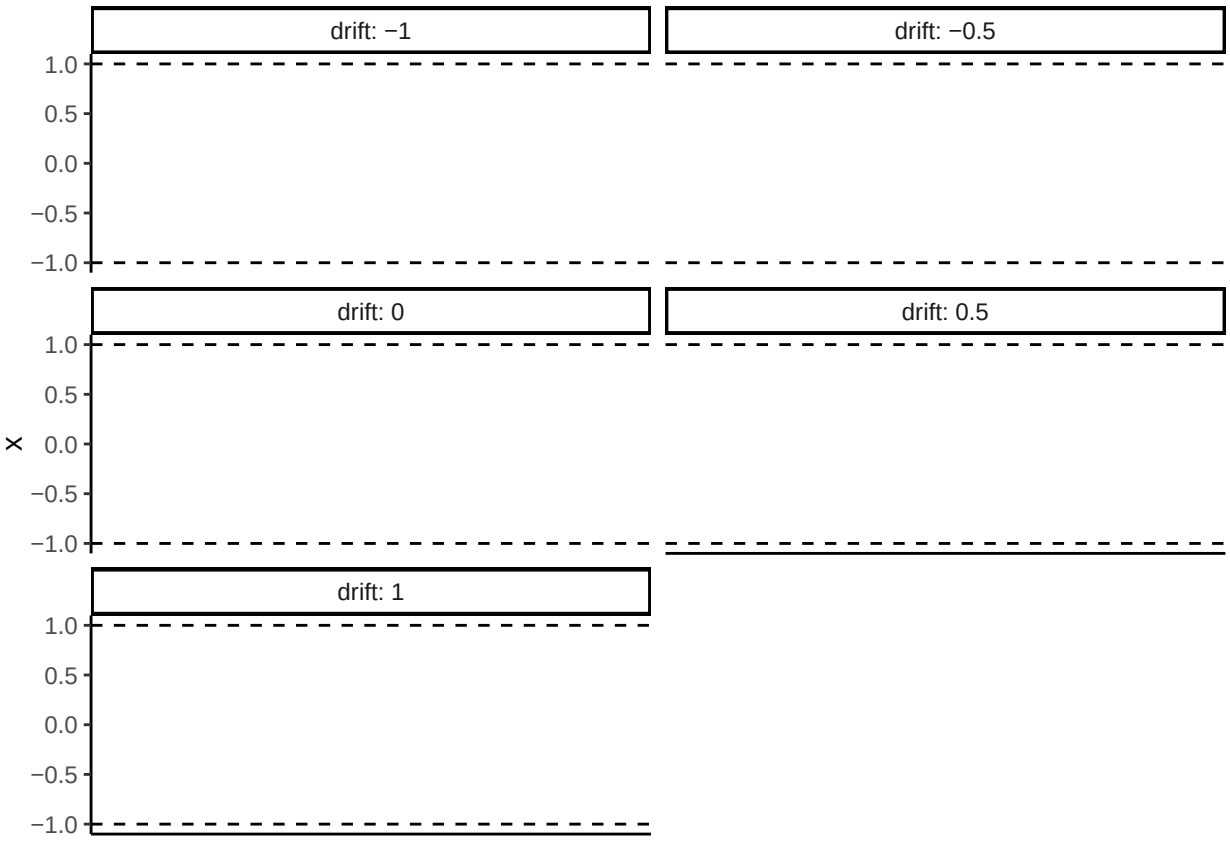
q = na.omit(data) %>%
  ggplot(aes(x = x, y = y, color = as.factor(col)))+
  xlab("Time")+
  ylab("x")+
  facet_wrap(~drift, nrow = 3, ncol = 2, labeller = label_both)+
  coord_cartesian(ylim = c(min(na.omit(data)$y),max(na.omit(data)$y)))+
  geom_line(linewidth=1)+
  theme_classic()+
  geom_hline(yintercept = bound, linetype = 2)+
  geom_hline(yintercept = -bound, linetype = 2)+
  theme(legend.position="none")+
  theme(axis.title.x=element_blank(),
        axis.text.x=element_blank(),
        axis.ticks.x=element_blank())+
  #transition_time(x)+
  #shadow_wake(wake_length = 0.1, alpha = FALSE)+
  #shadow_mark(alpha = 0.3, size = 0.5)+
  transition_reveal(x)

q
```

```
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?

## Warning in formals(fun): argument is not a function

## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
## `geom_line()`: Each group consists of only one observation.
## i Do you need to adjust the group aesthetic?
```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drift: 1
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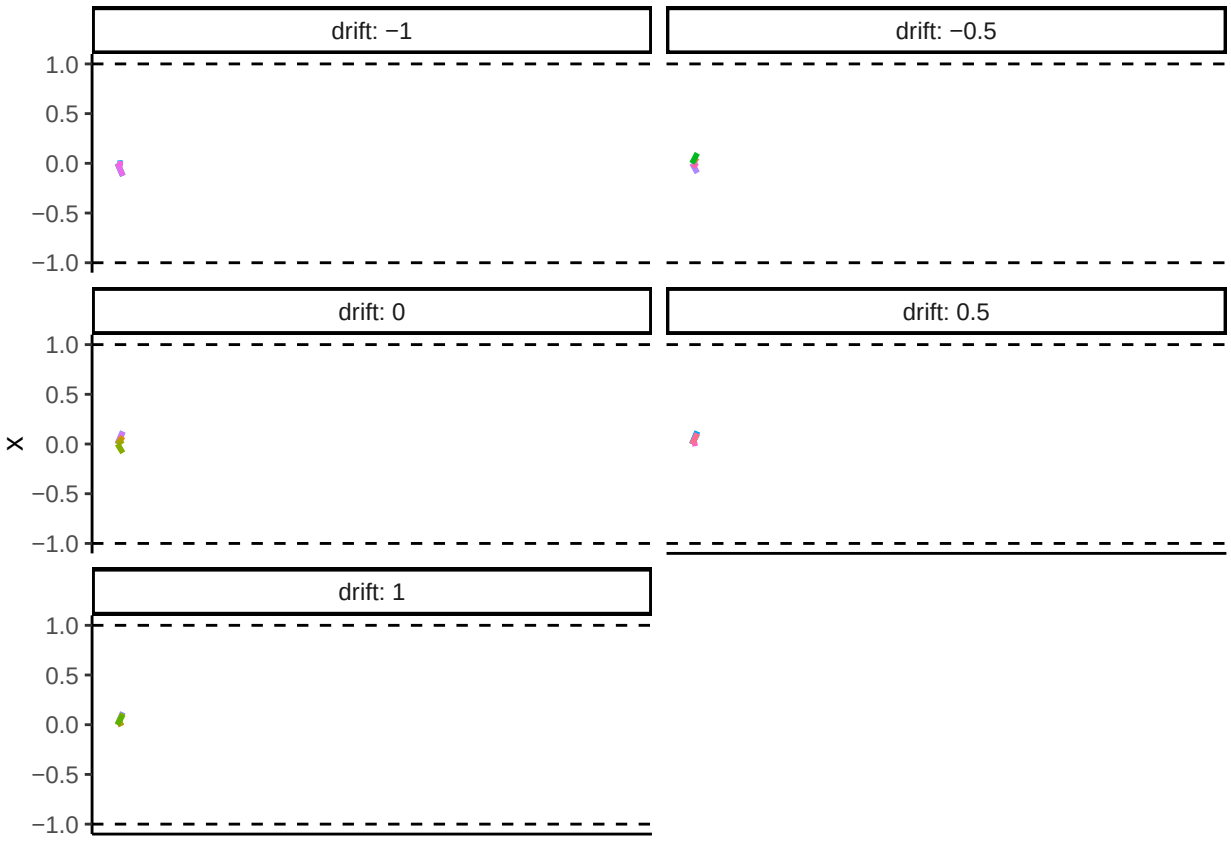
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x
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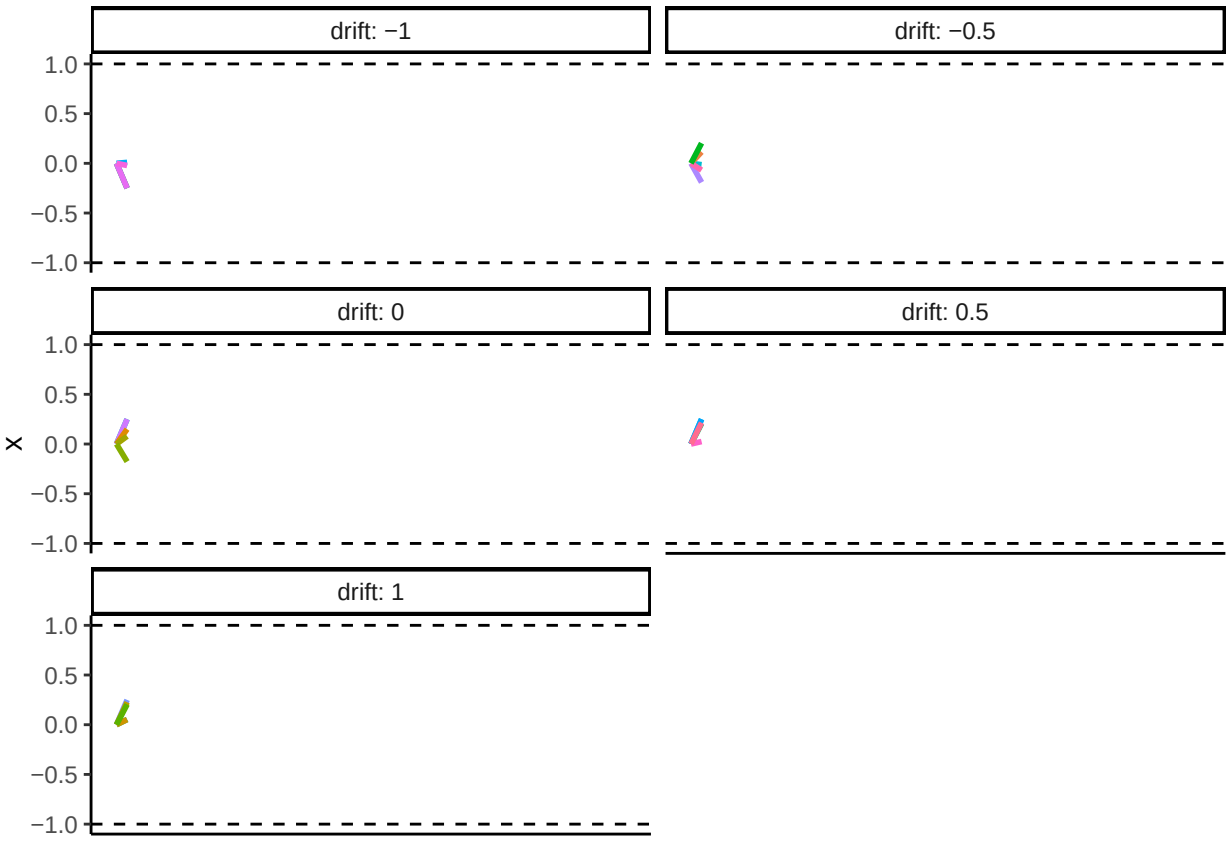
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x
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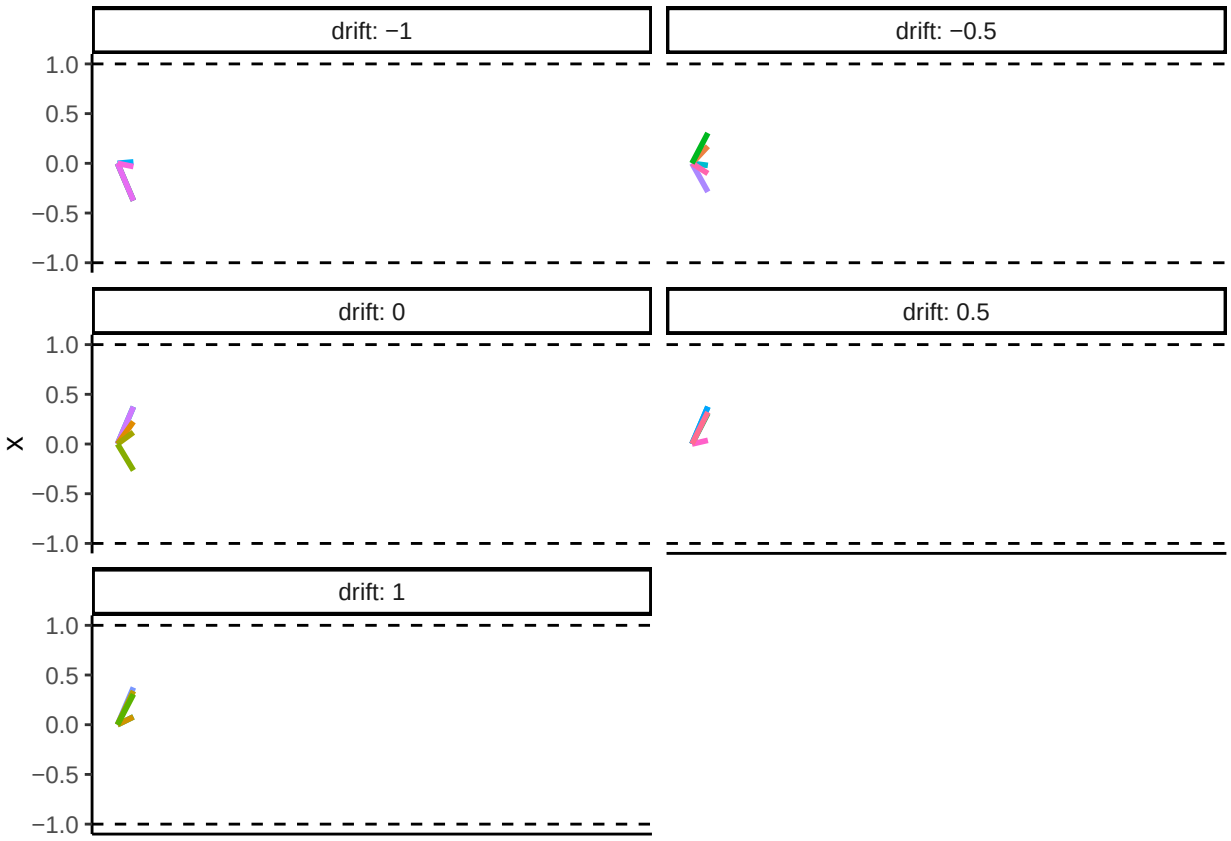
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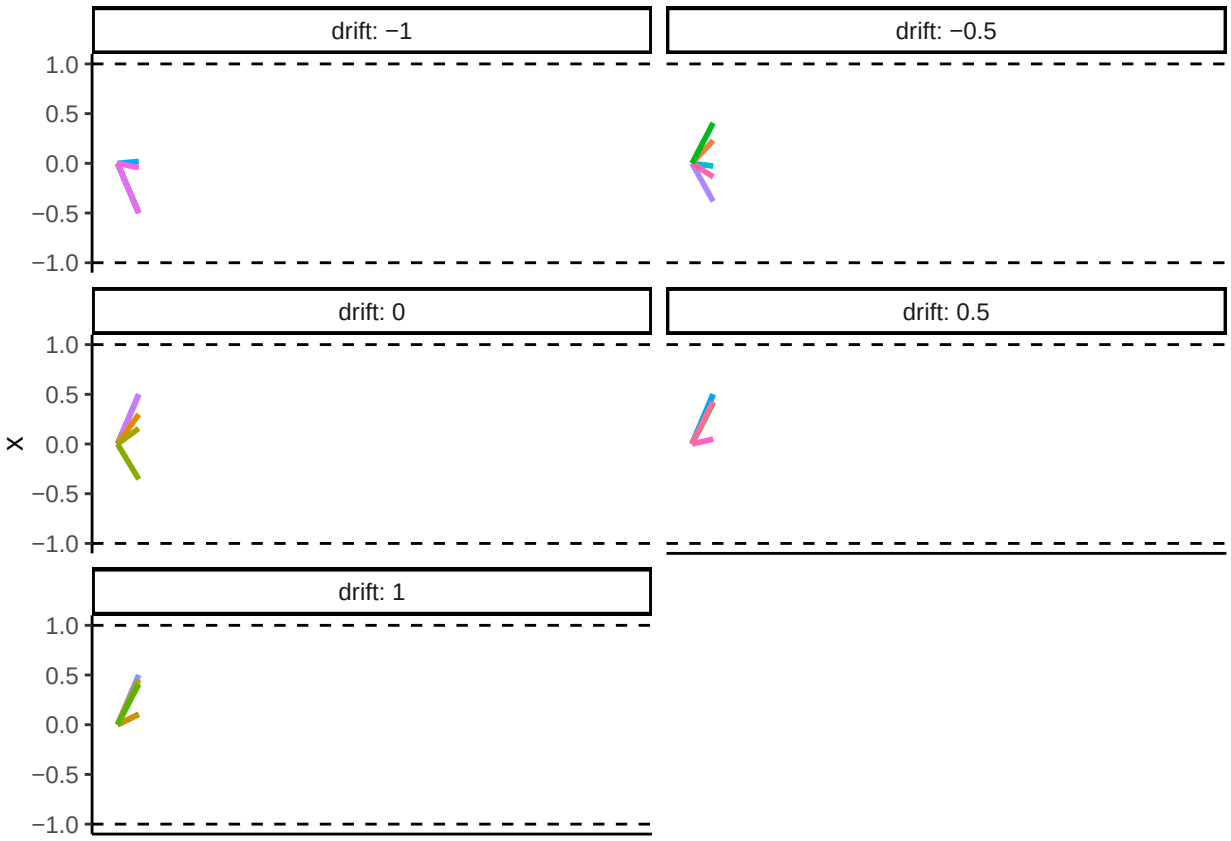
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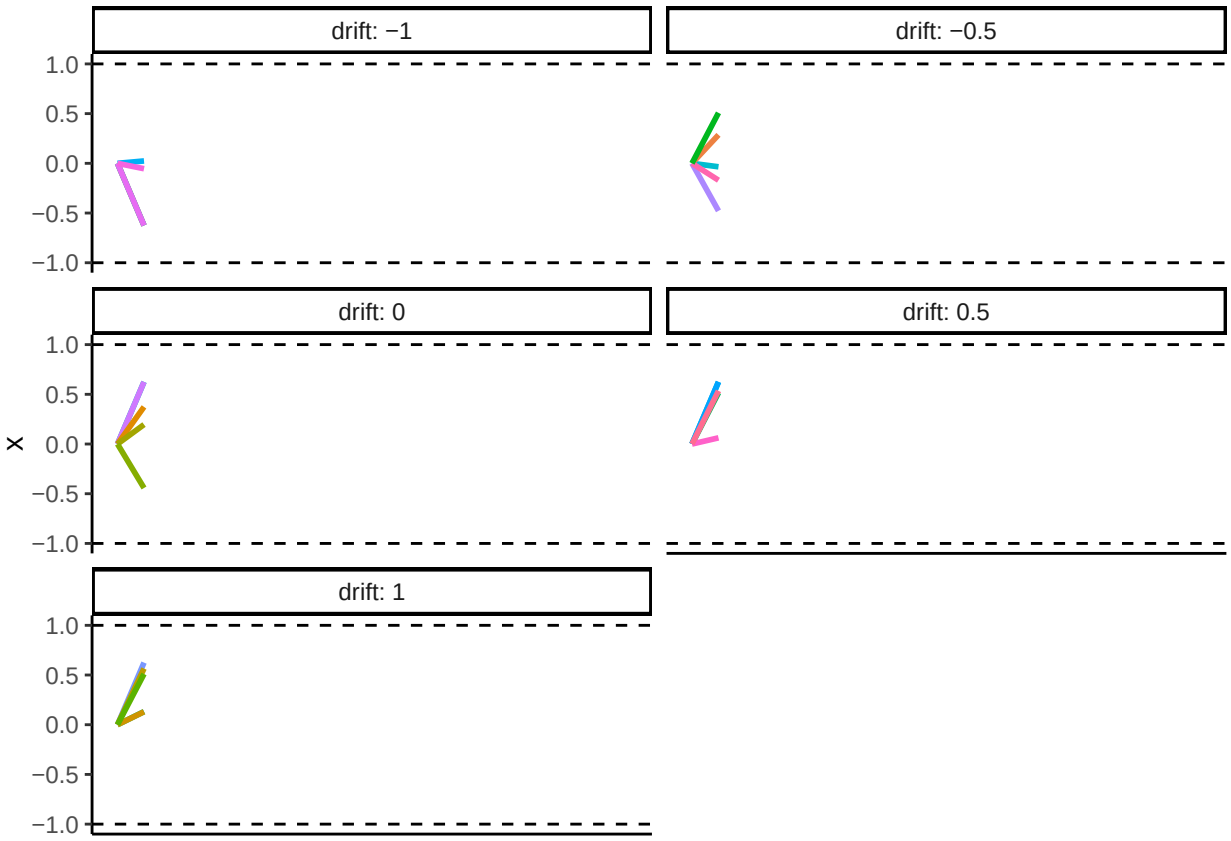
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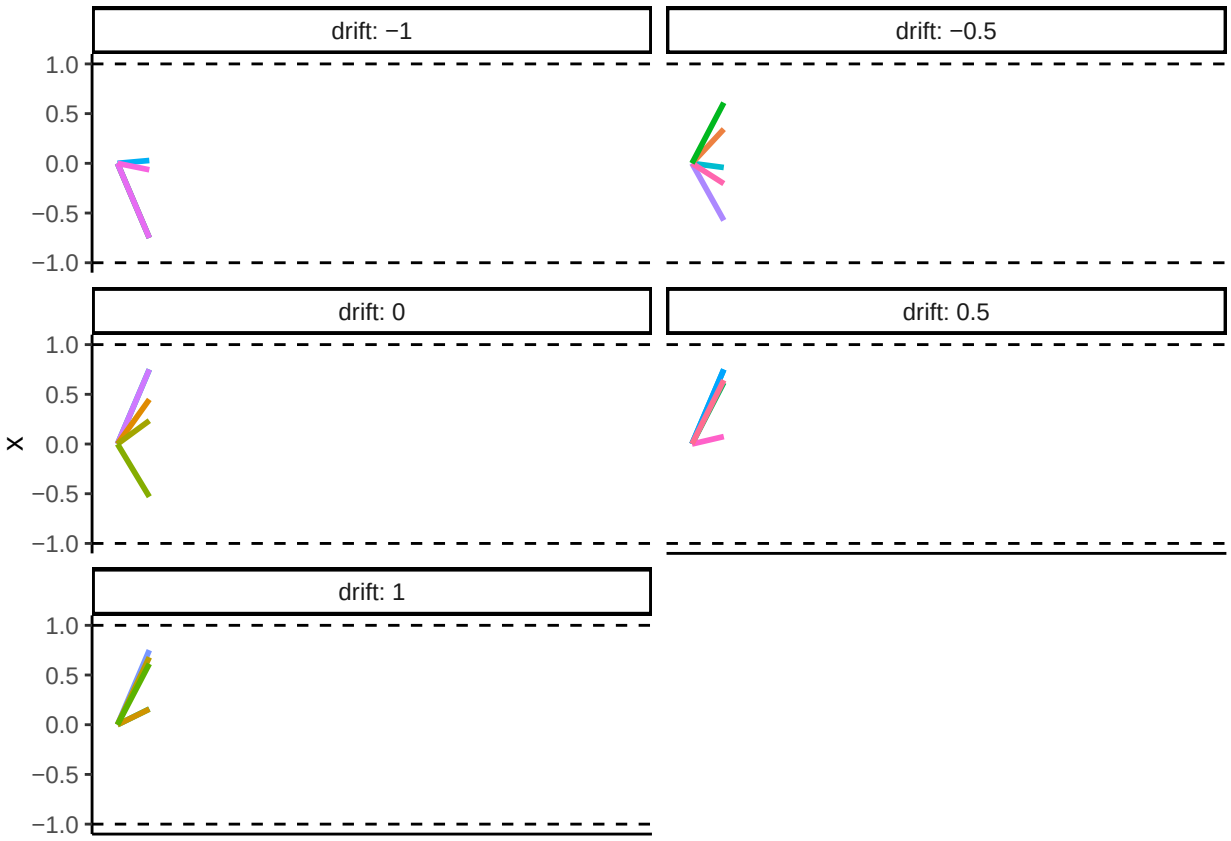
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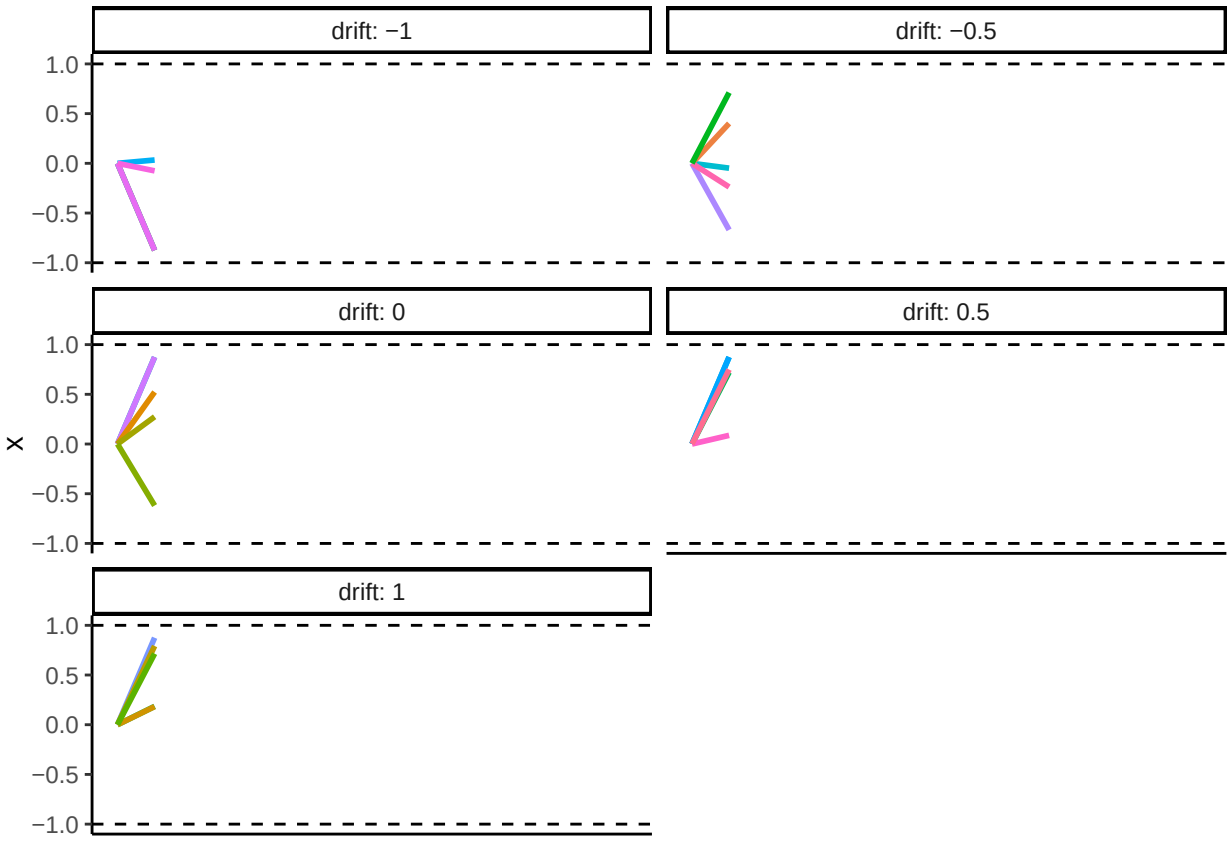
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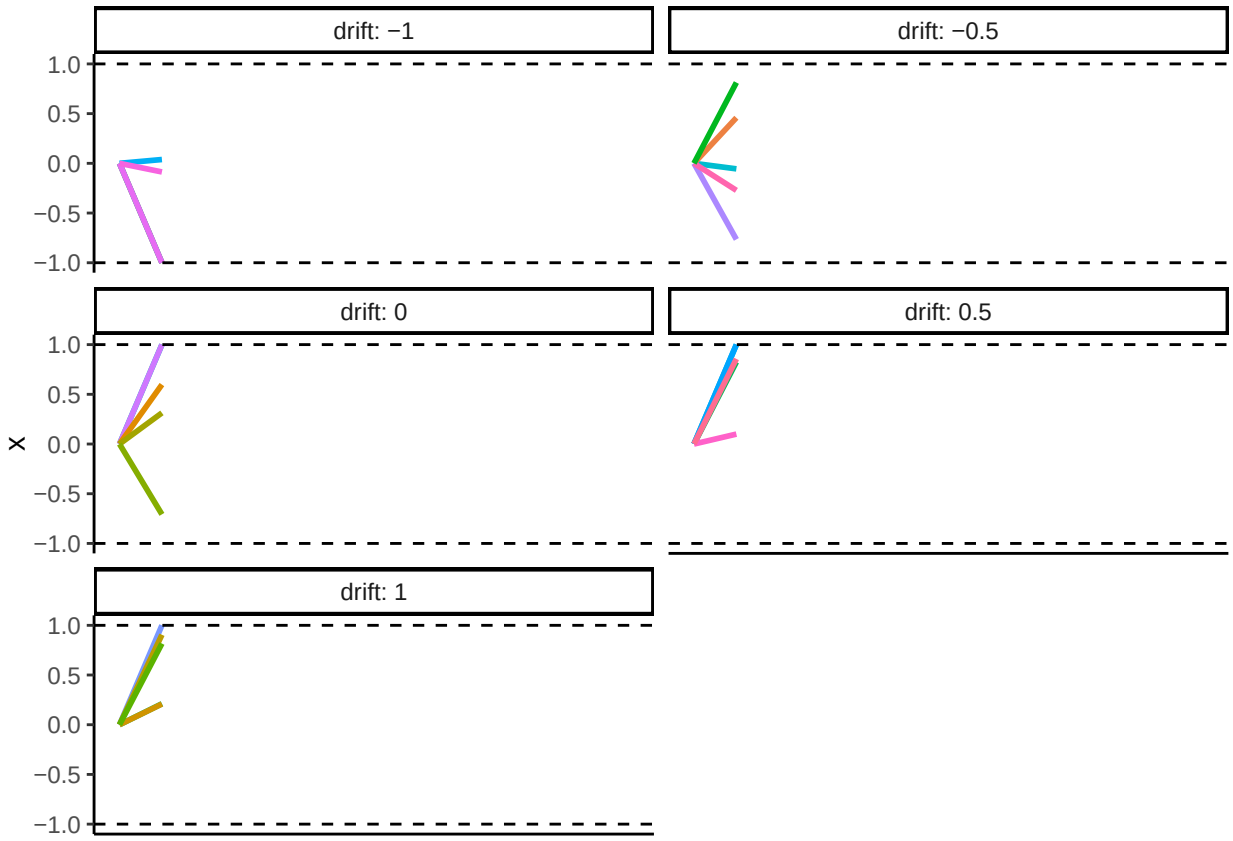
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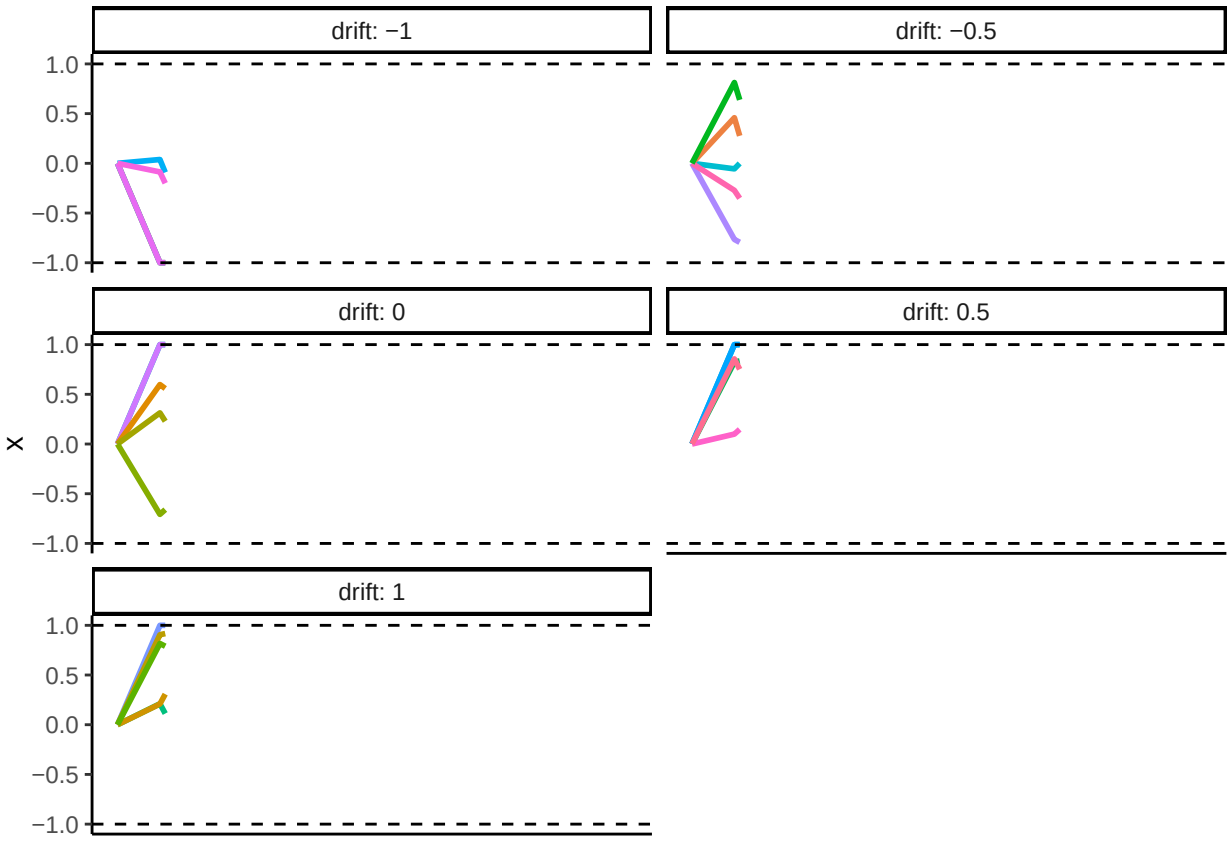
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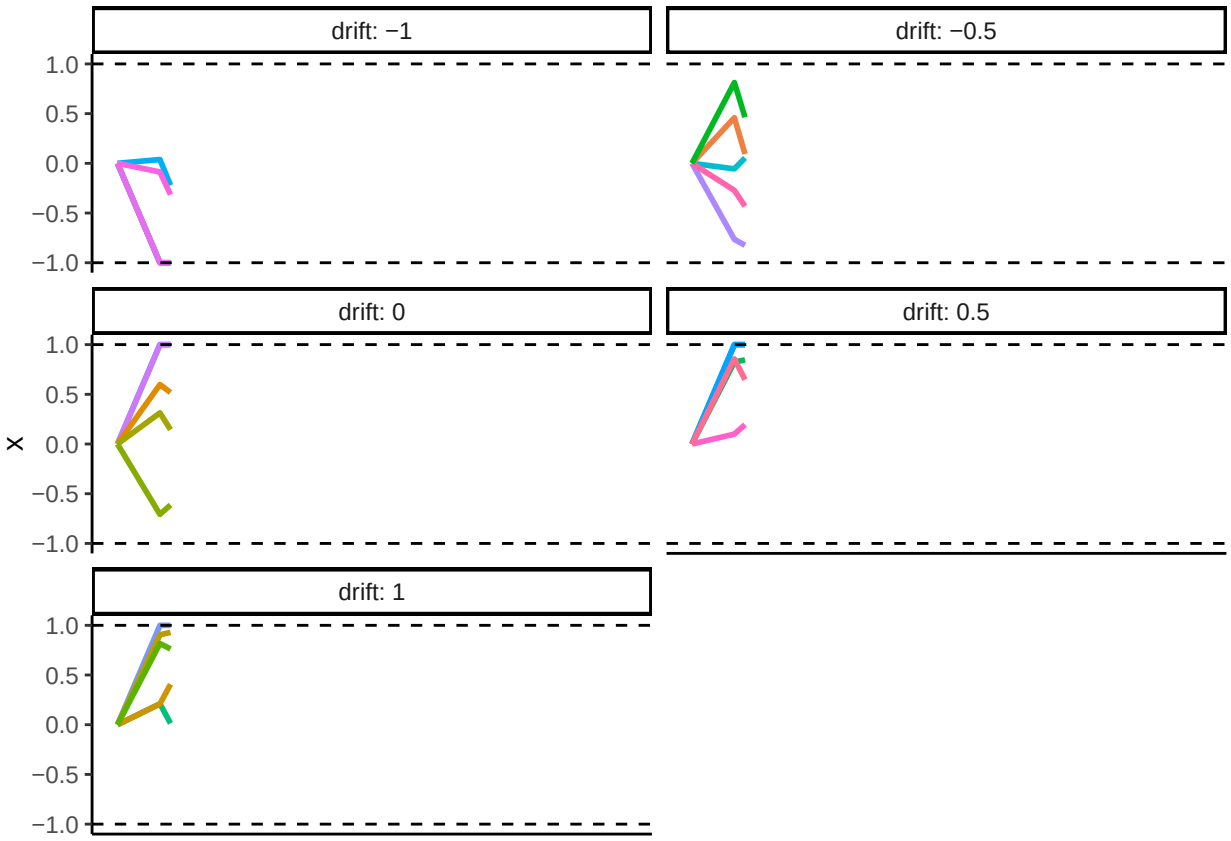
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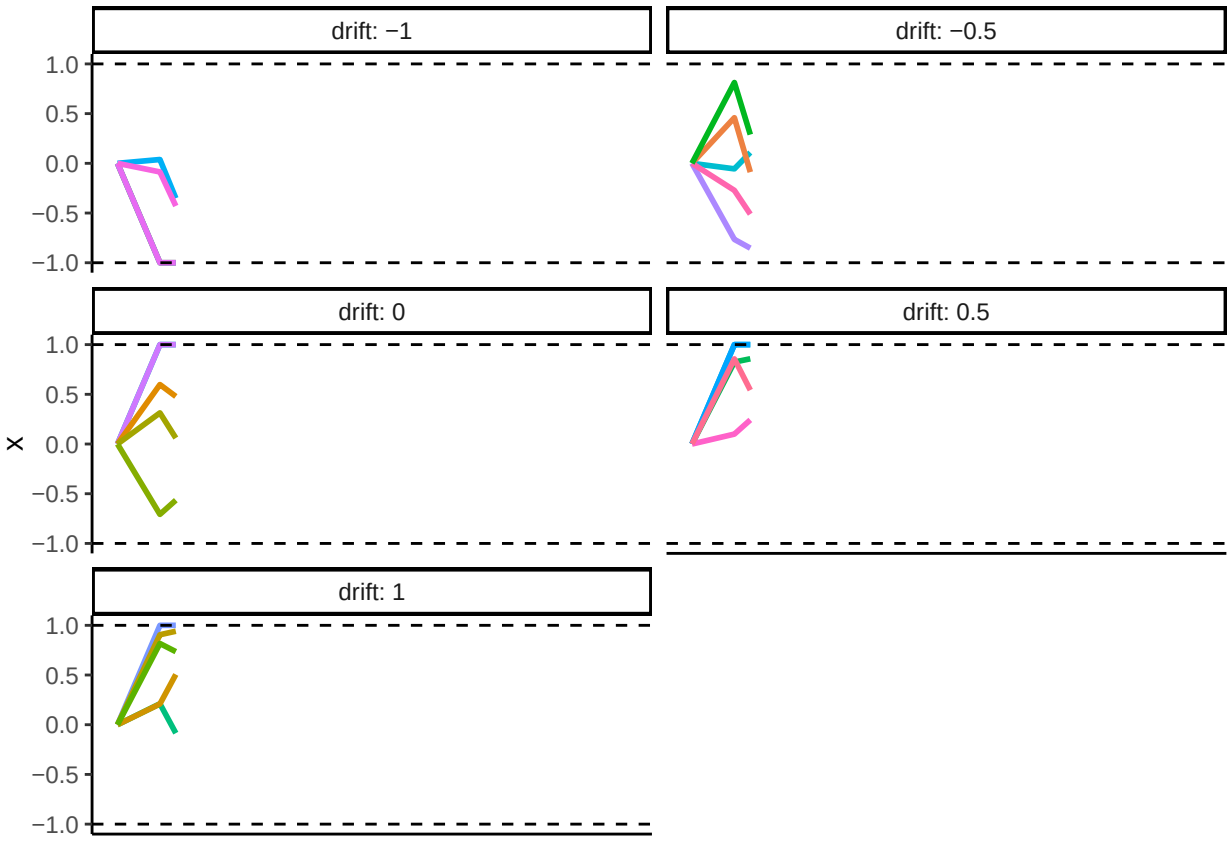
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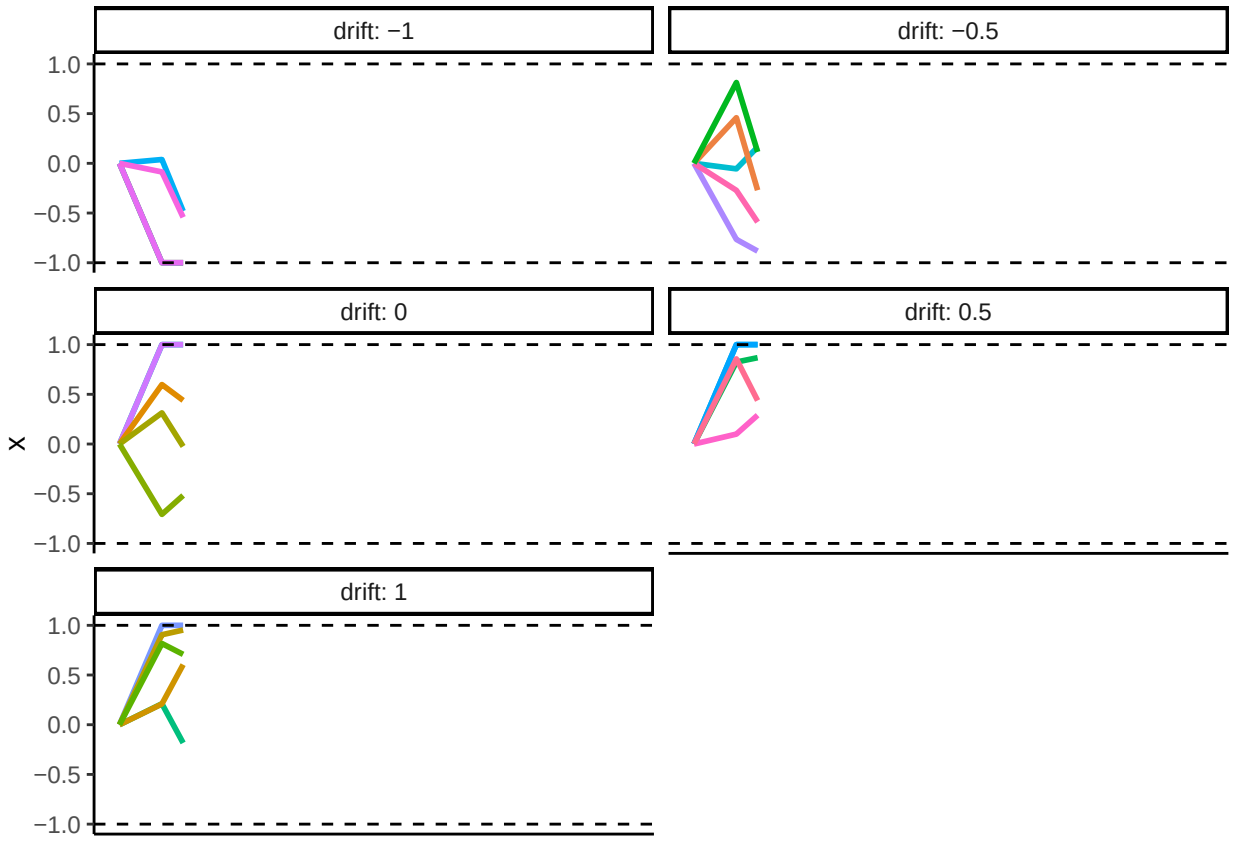
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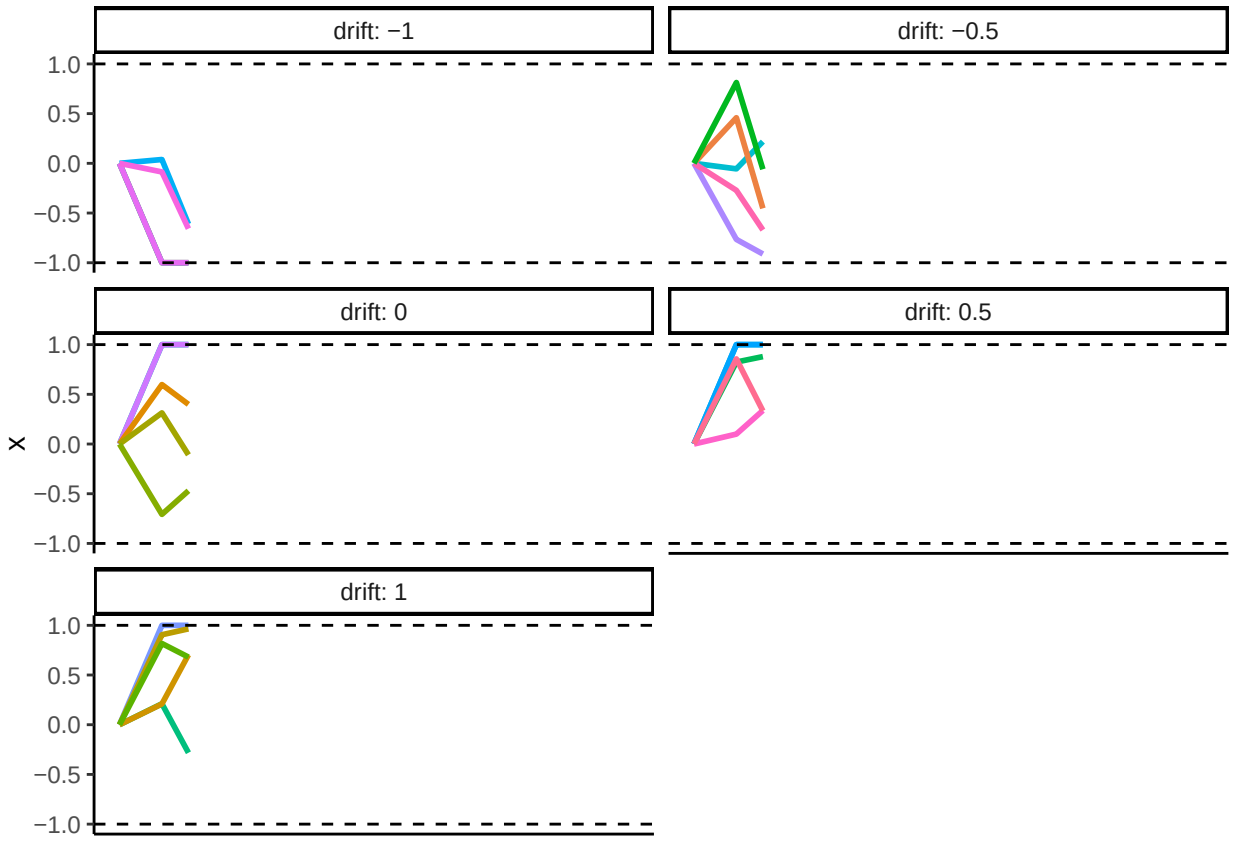
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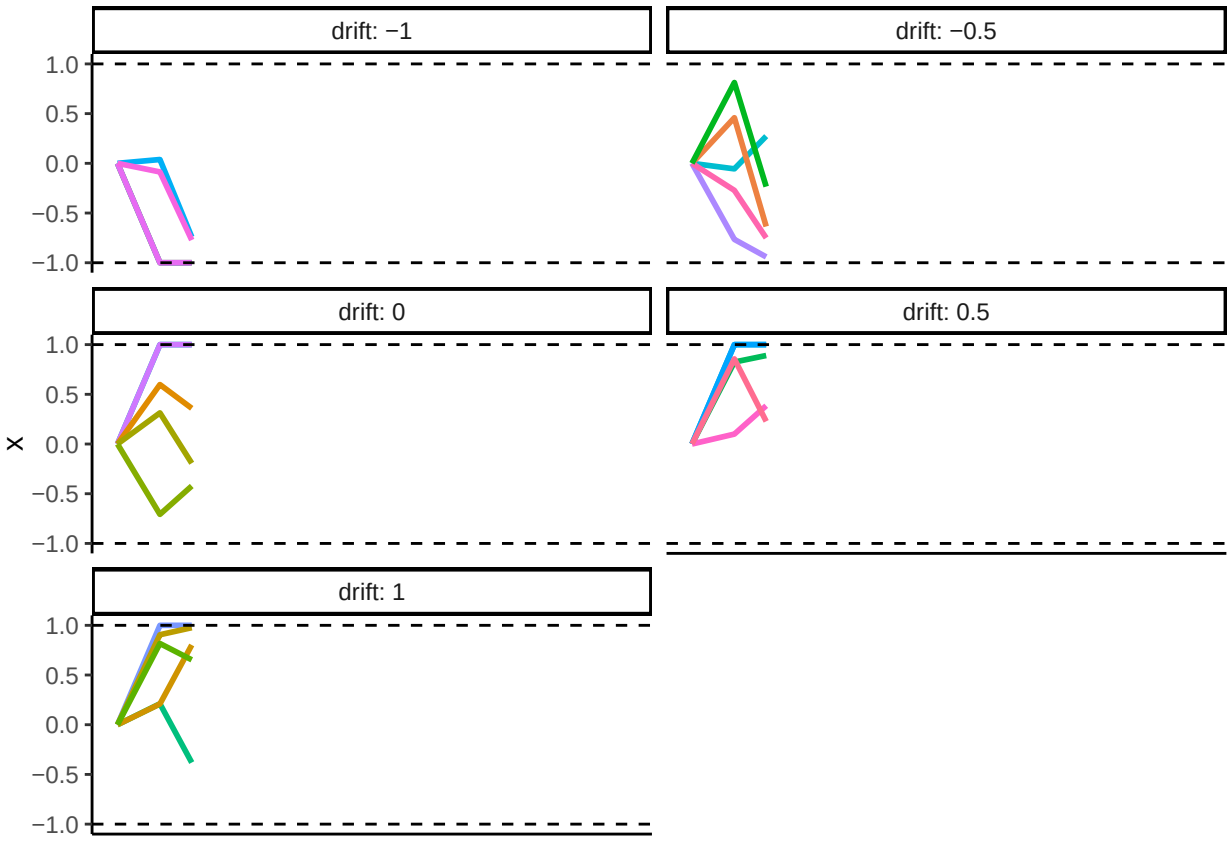
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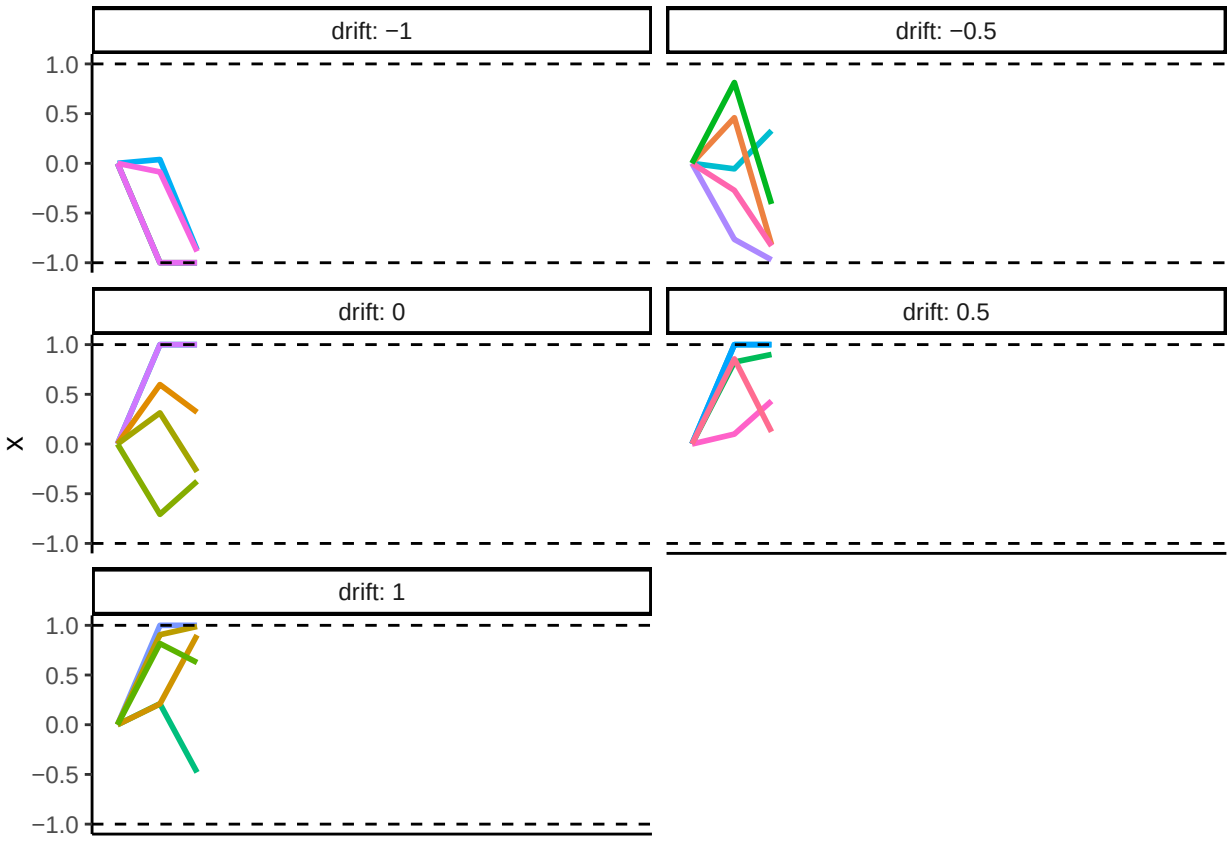
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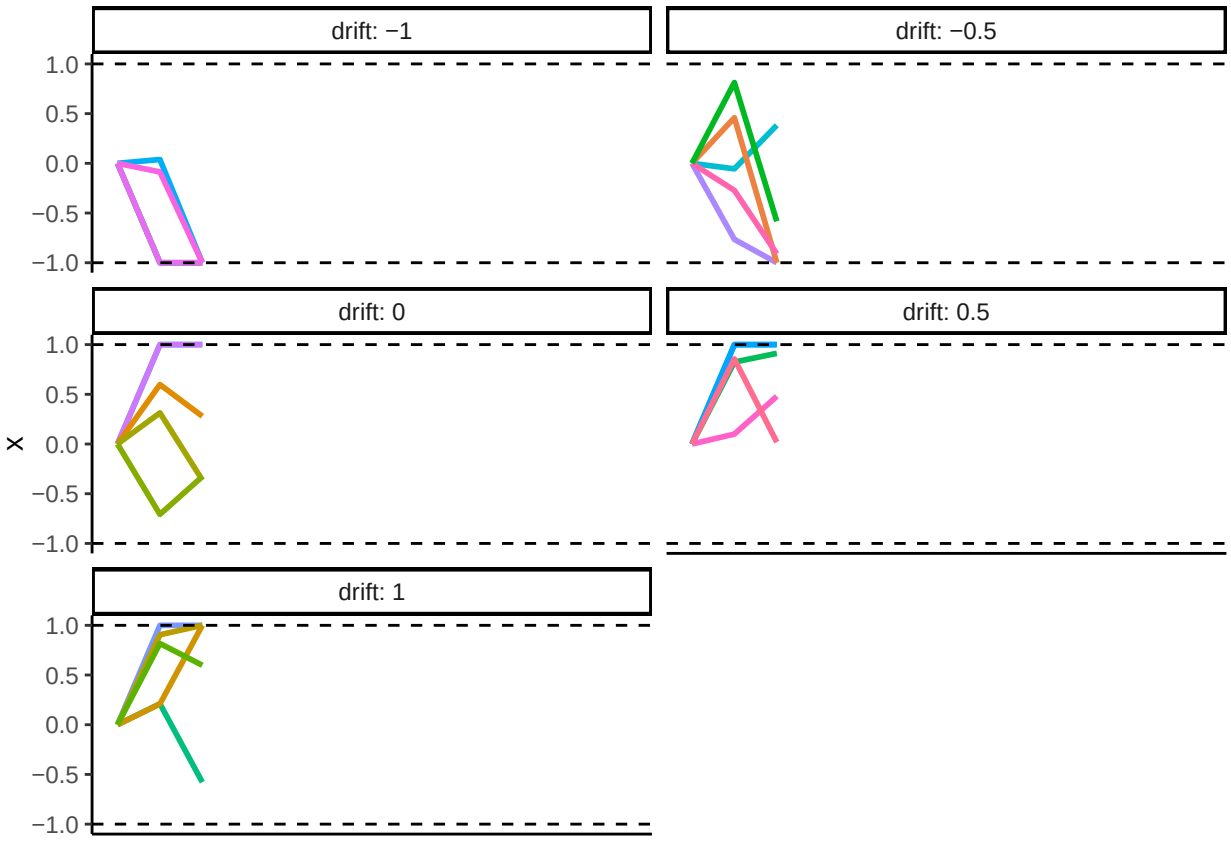
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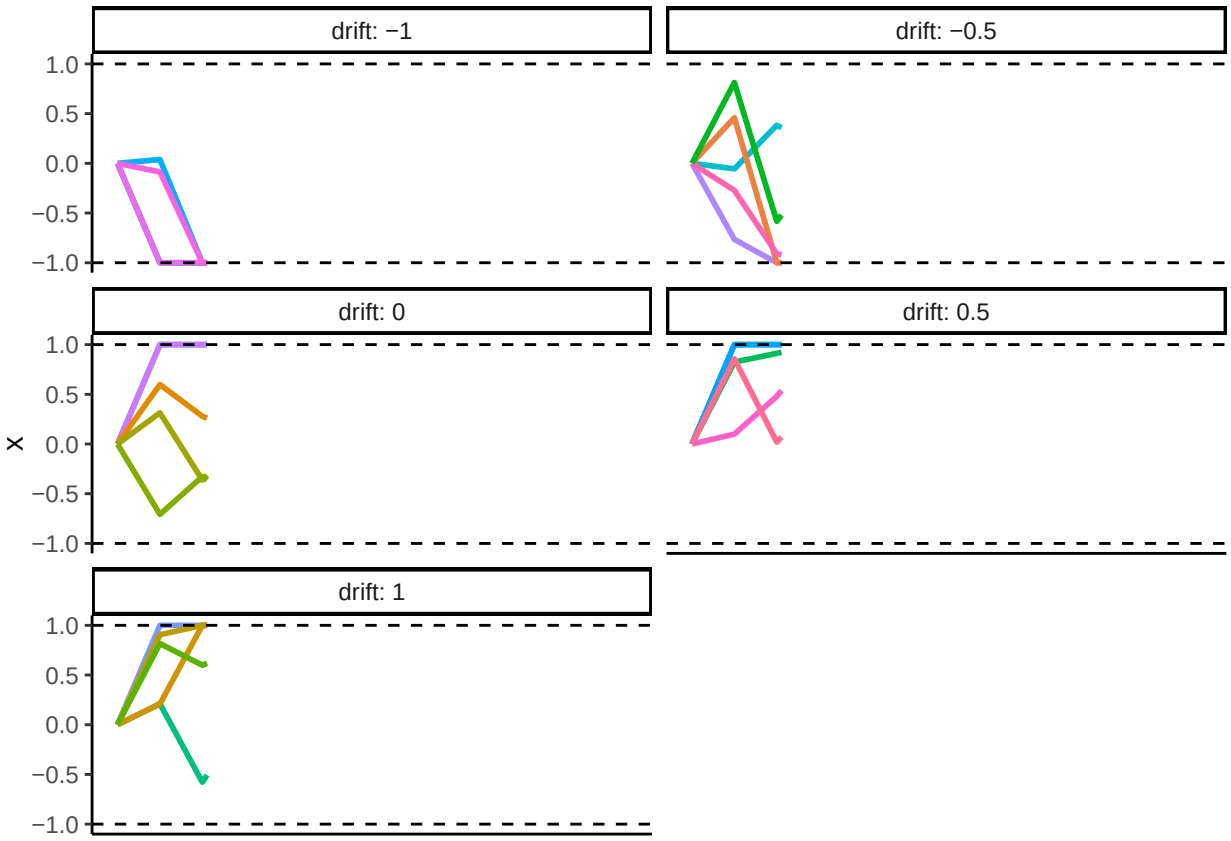
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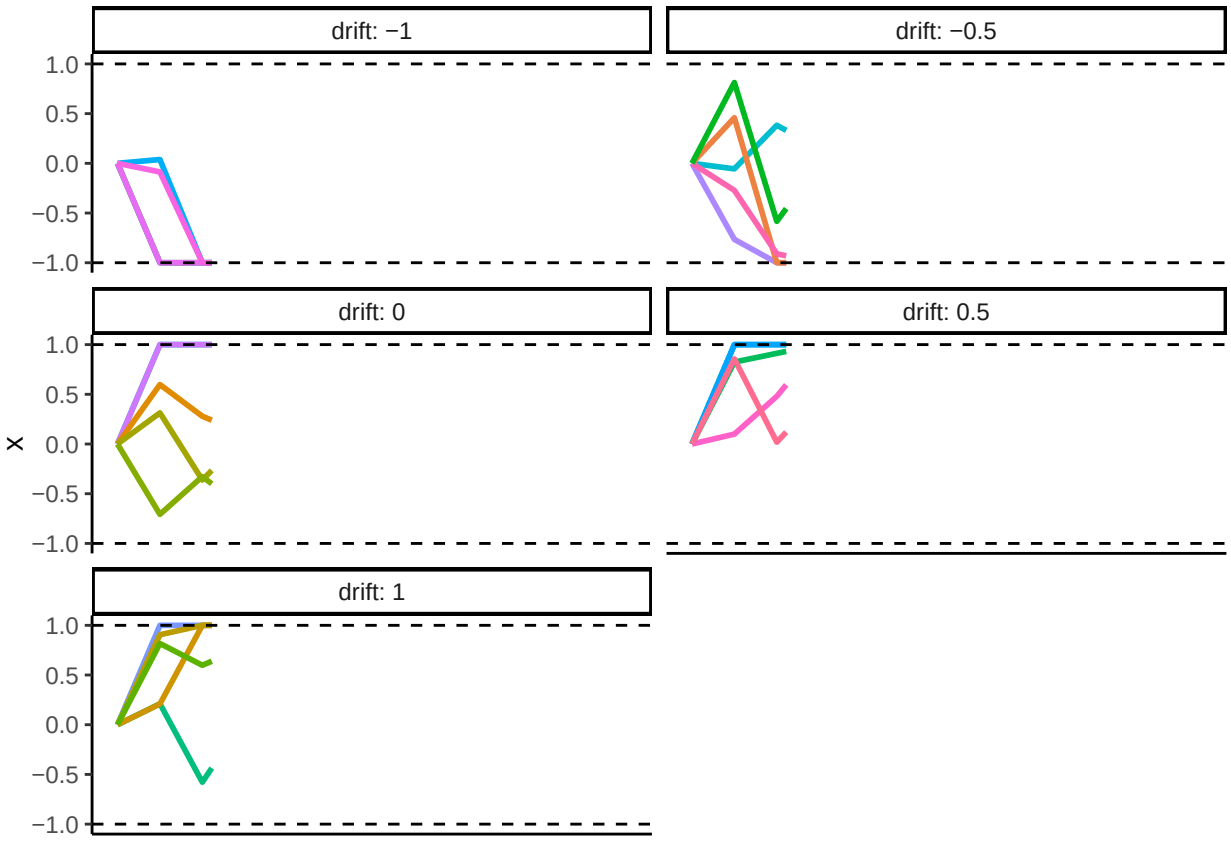
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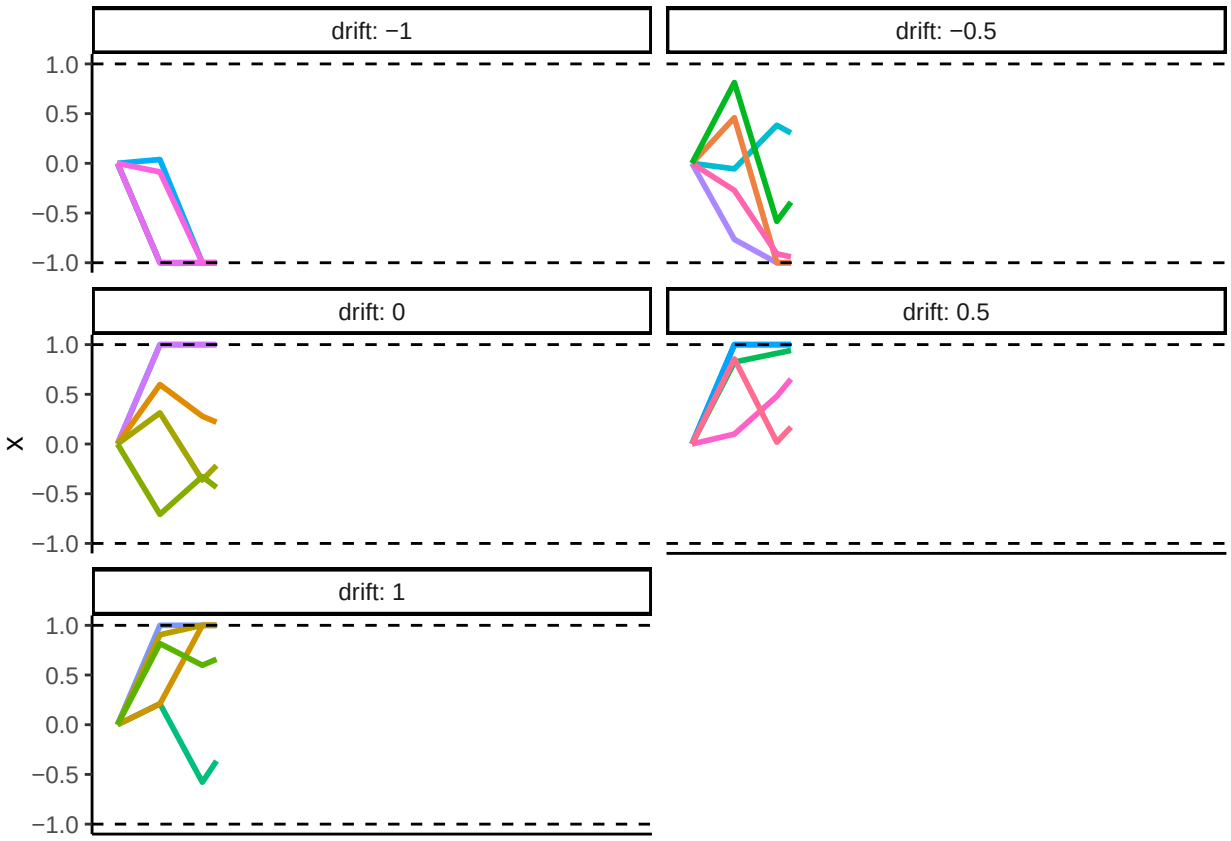
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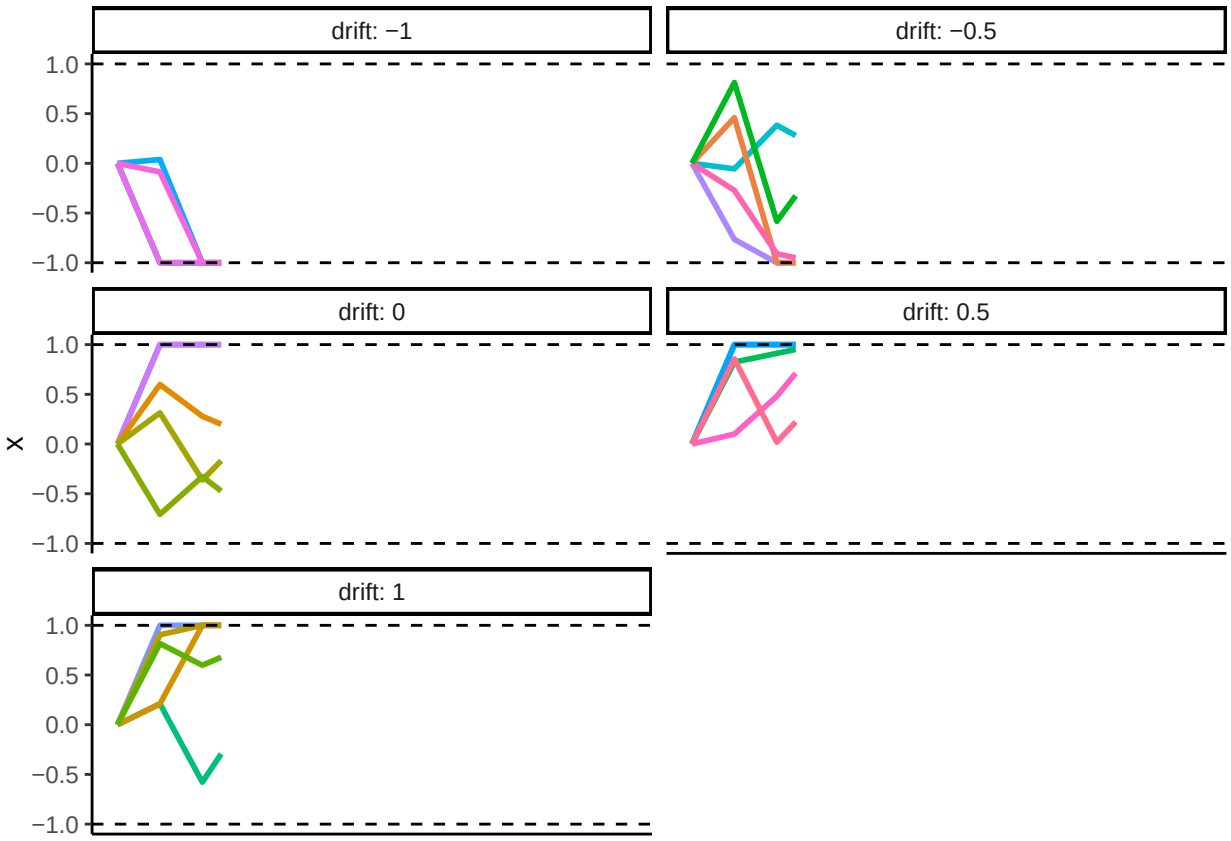
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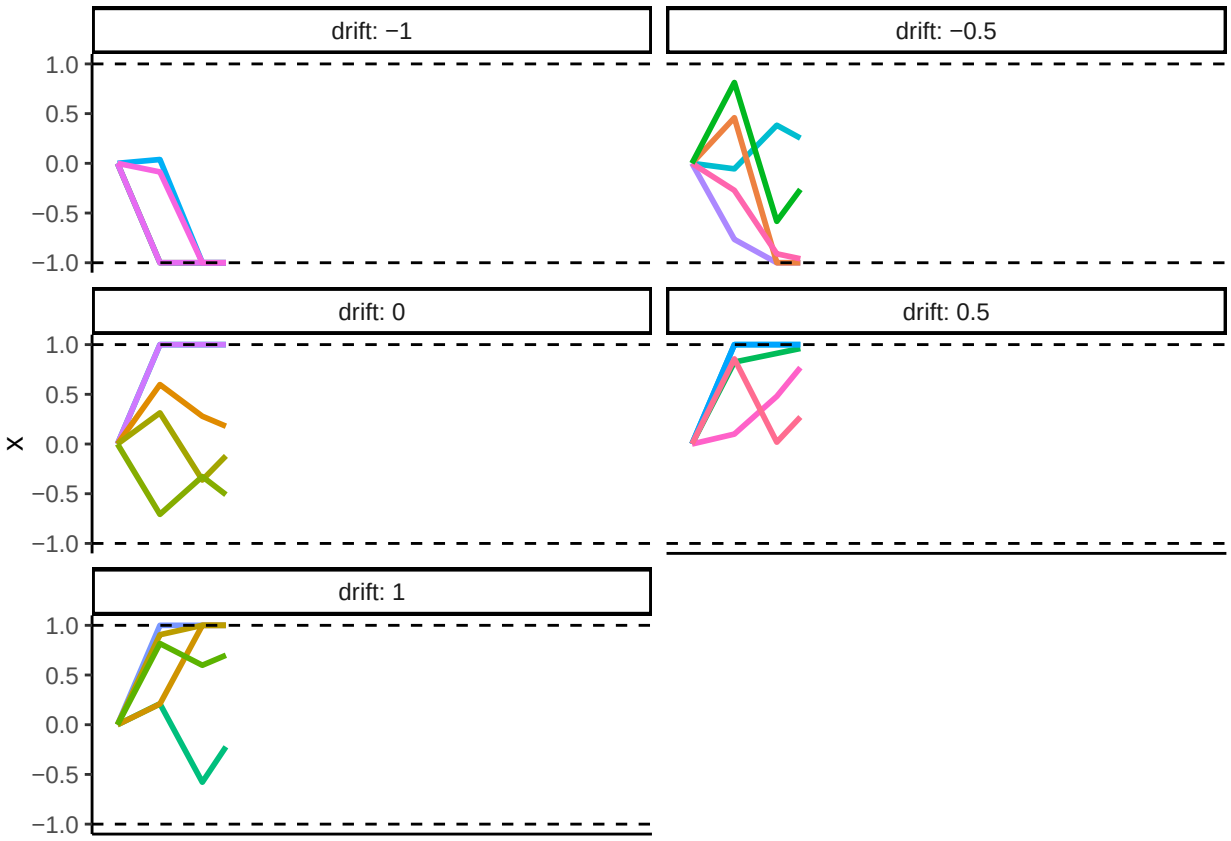
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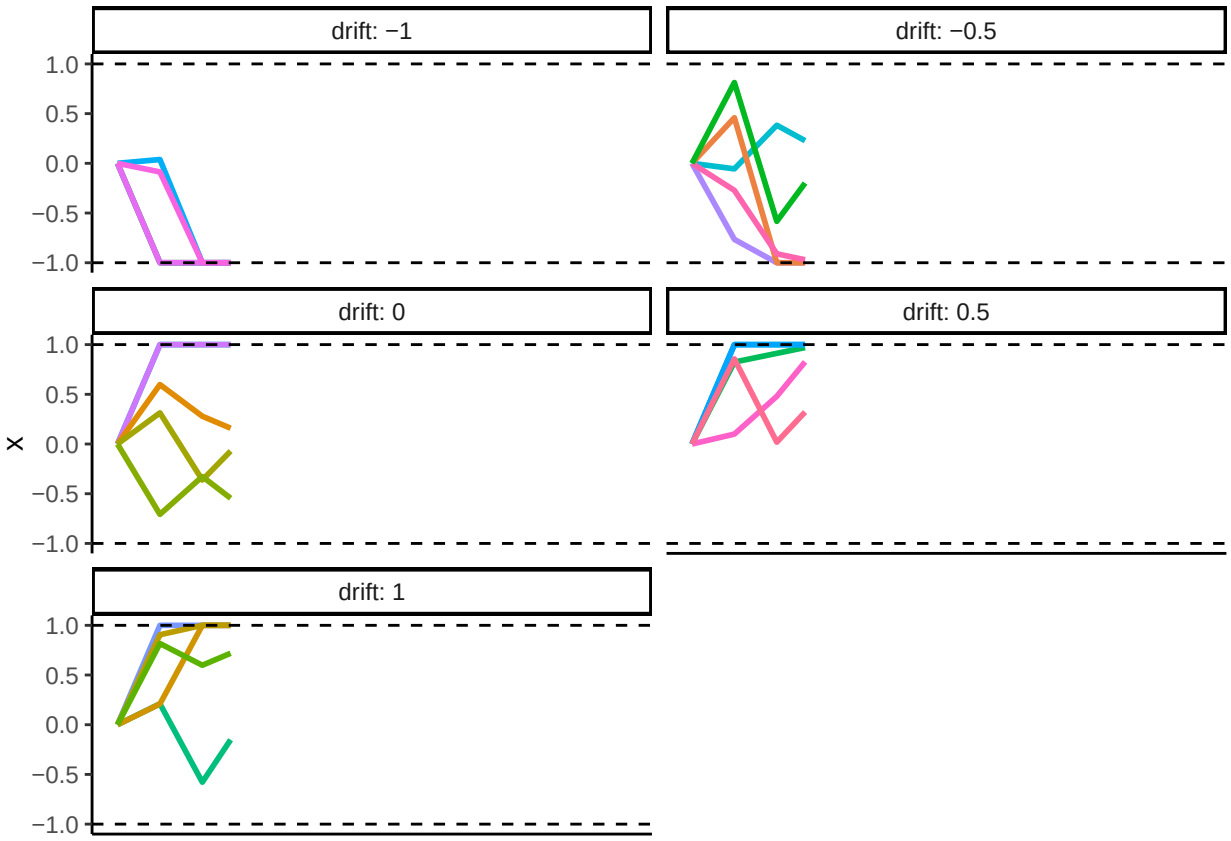
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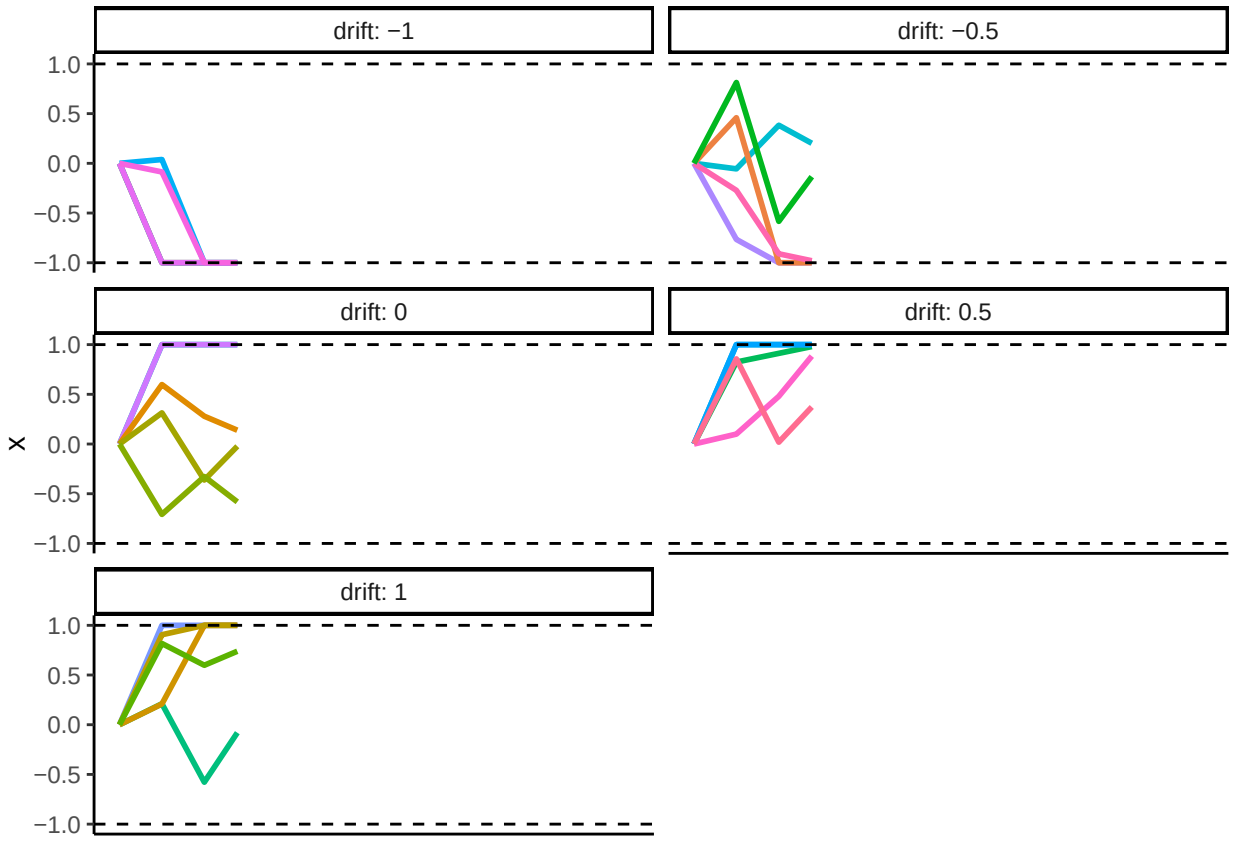
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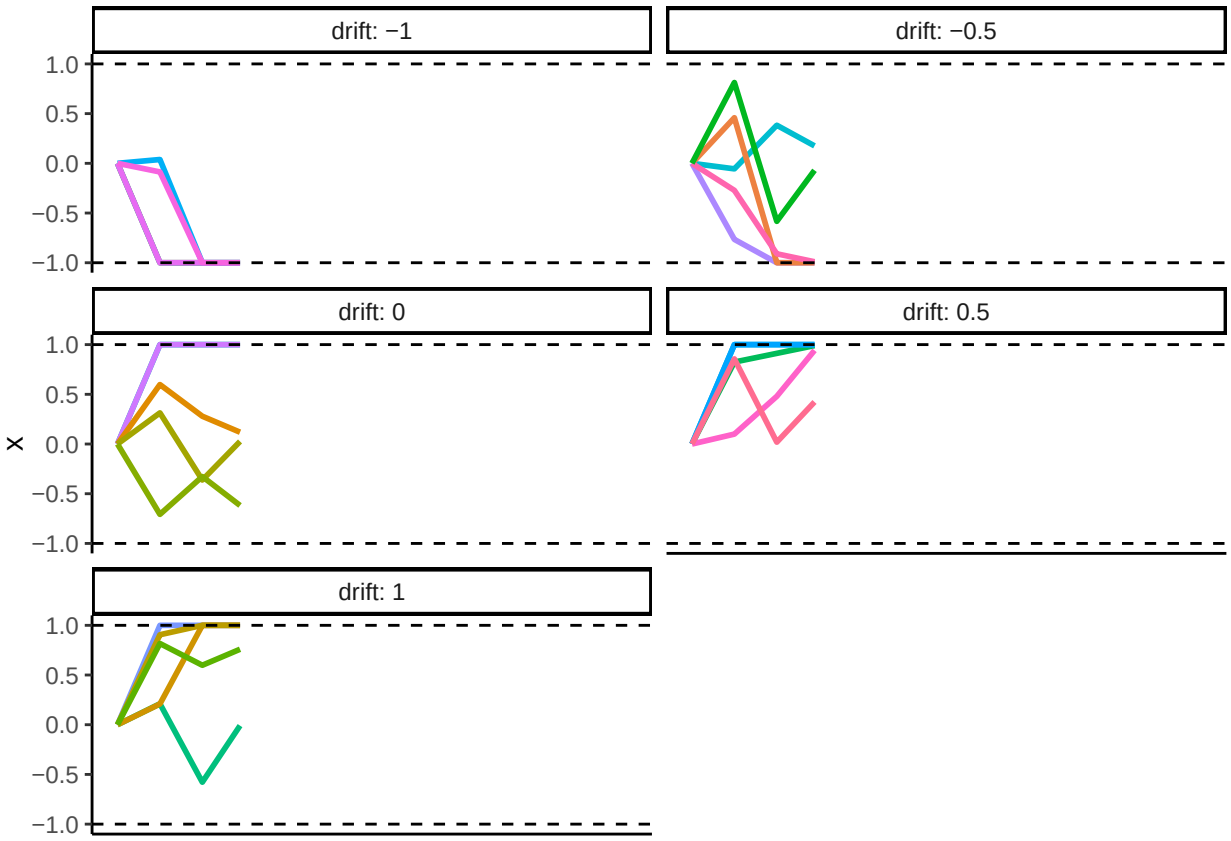
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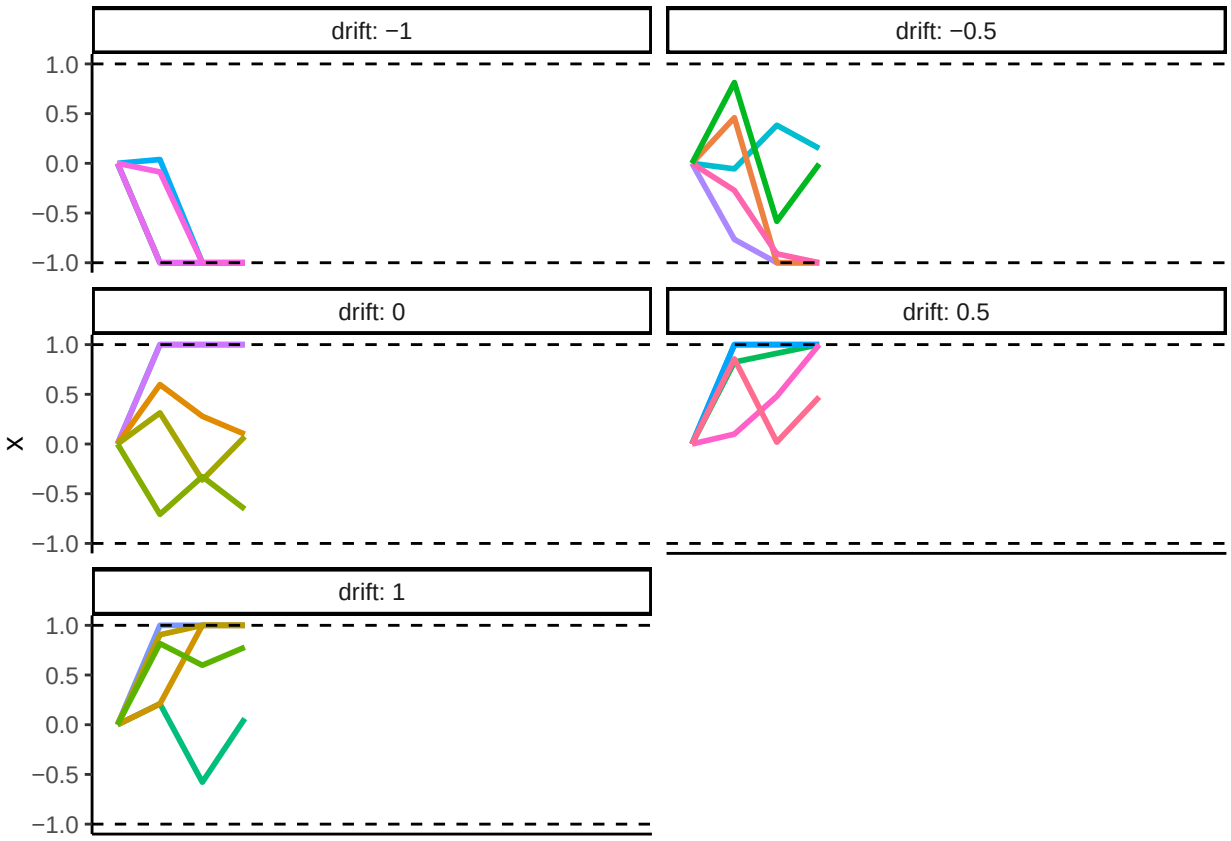
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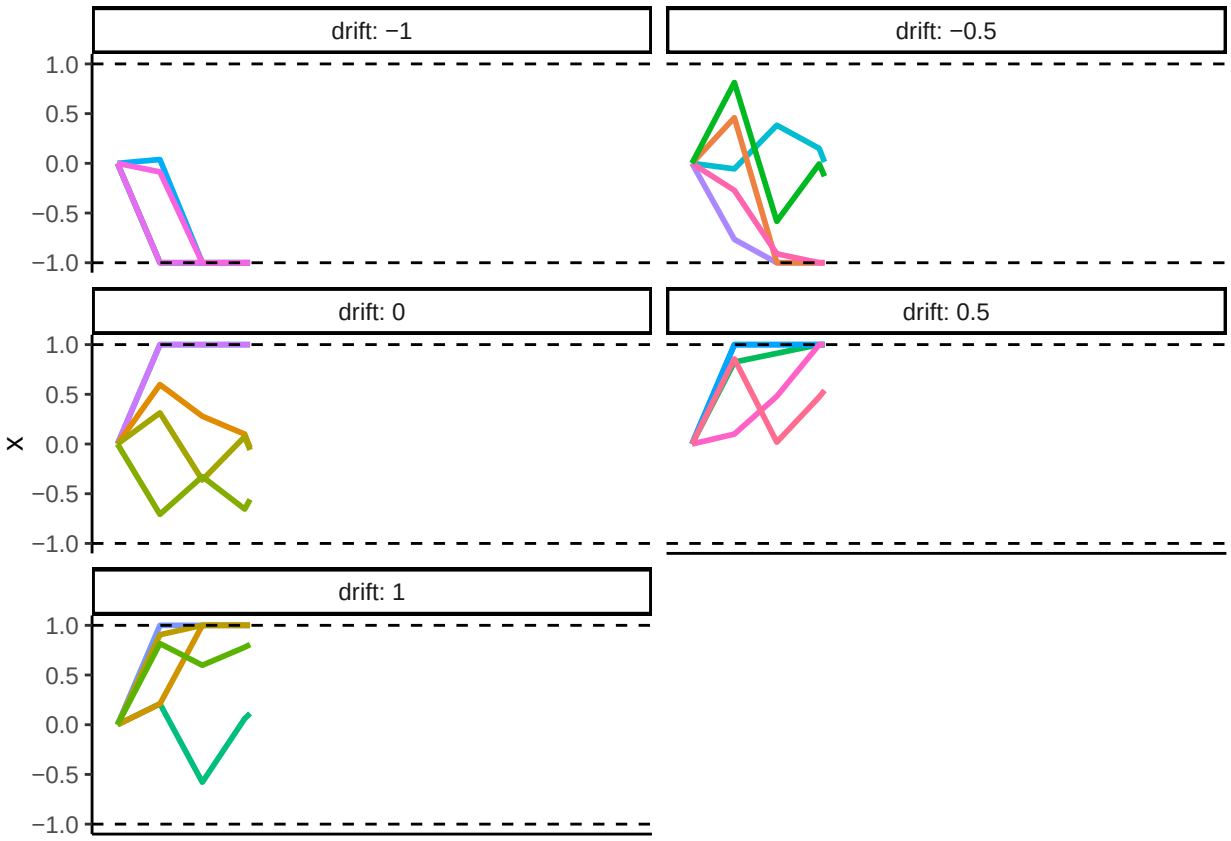
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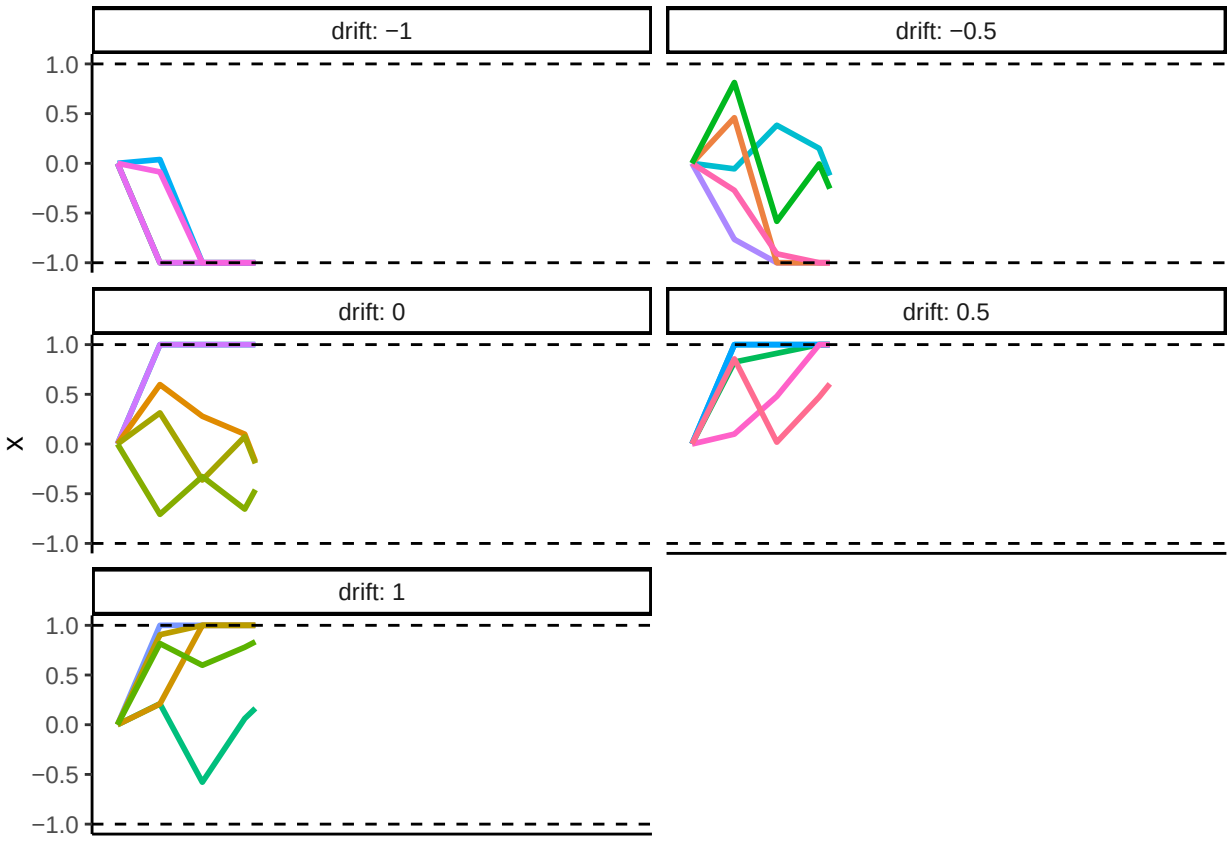
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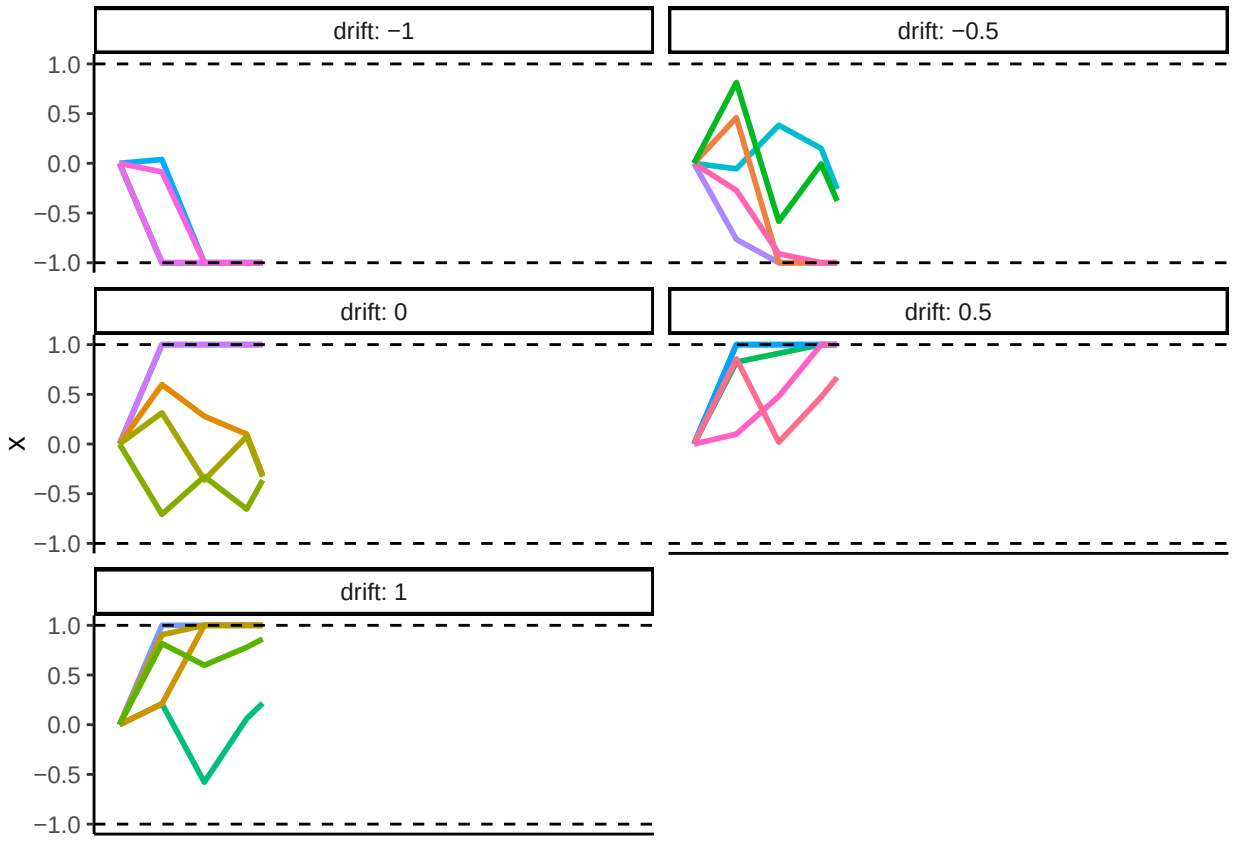
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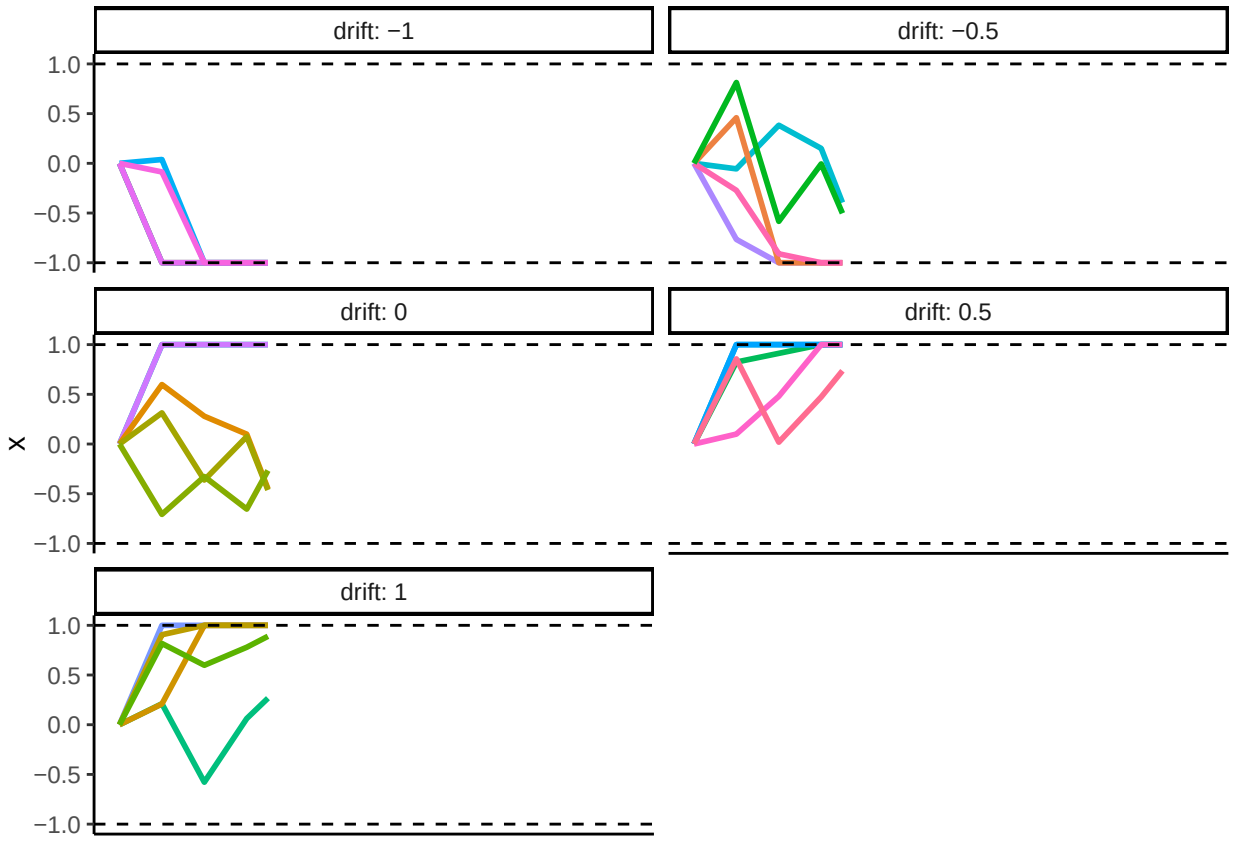
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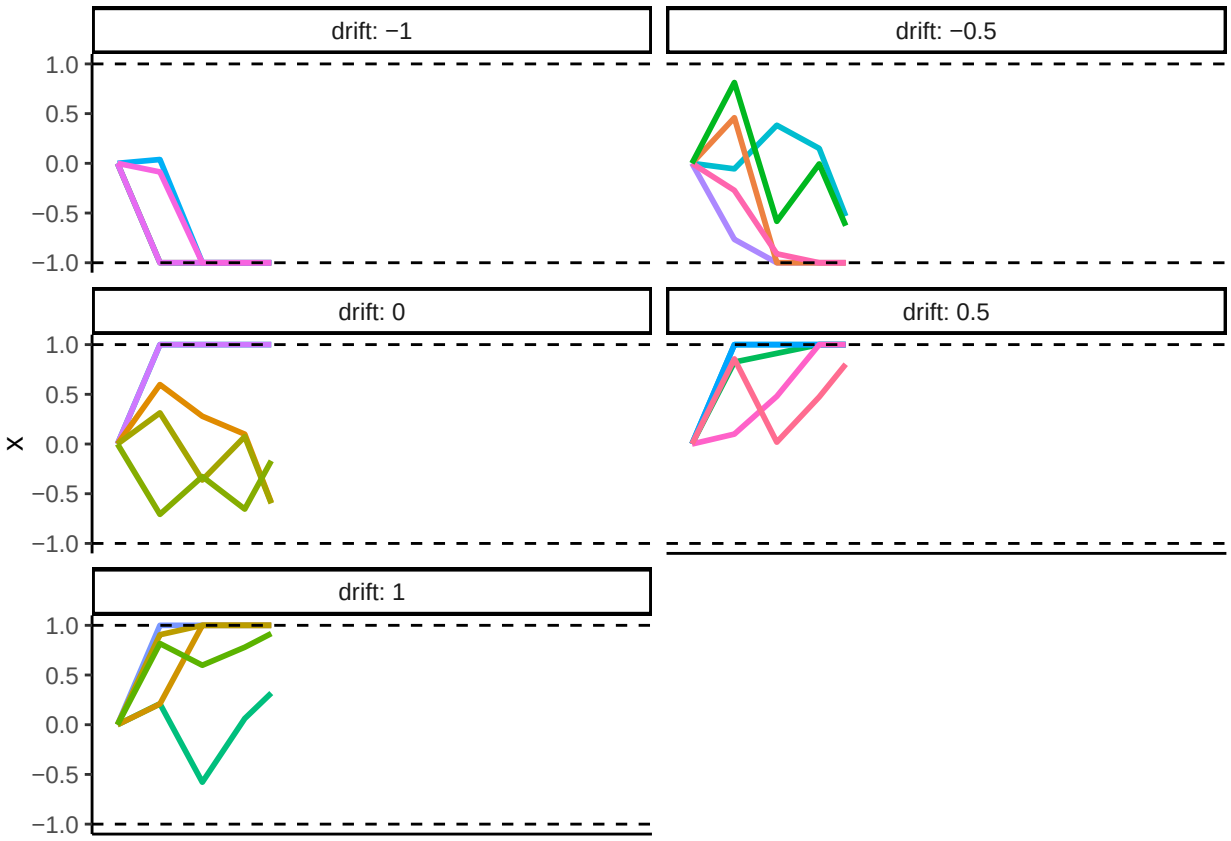
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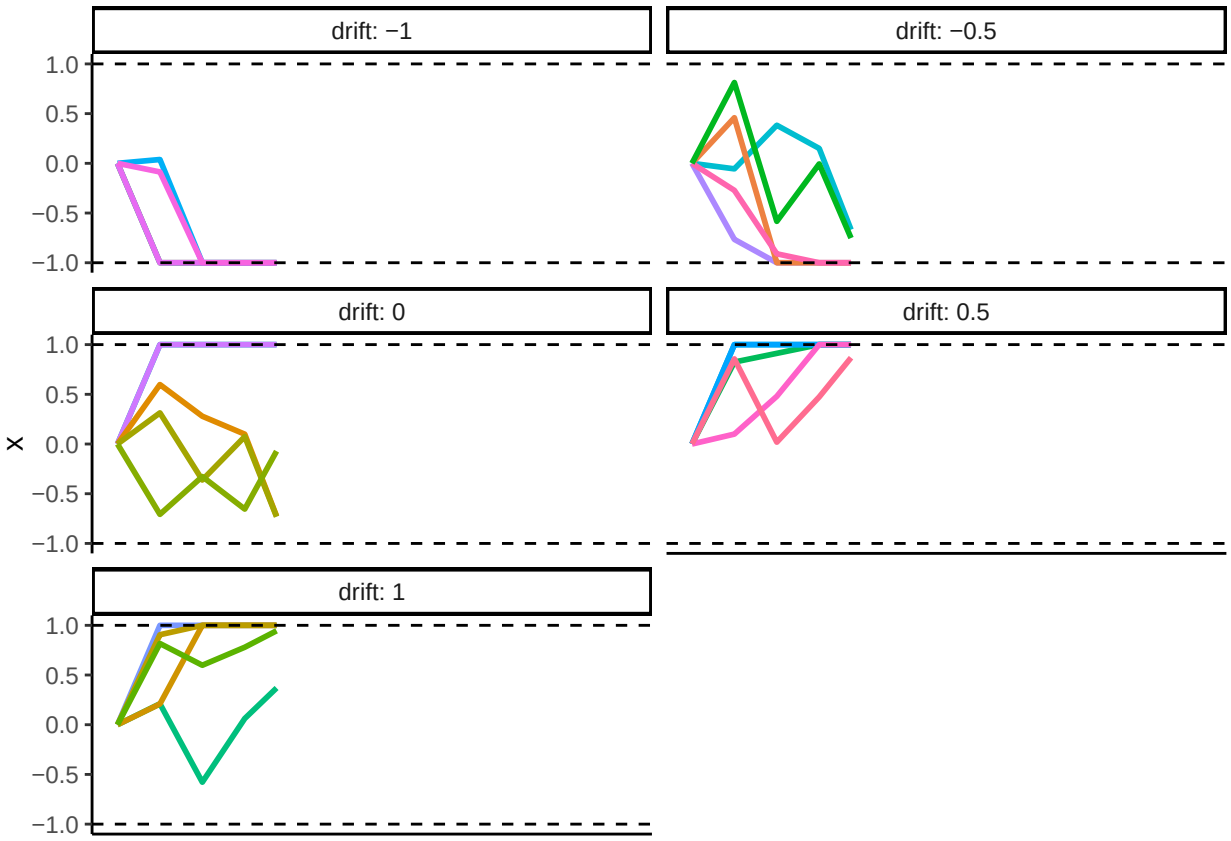
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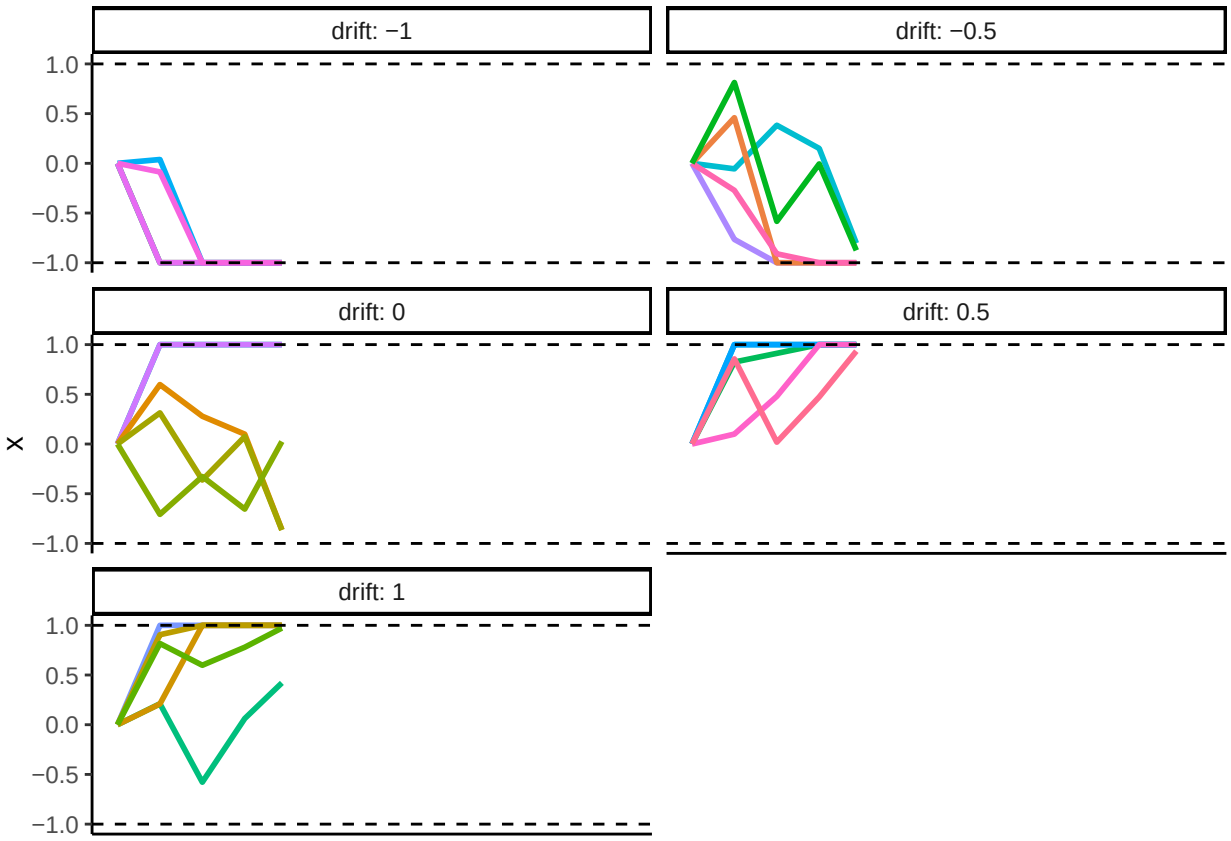
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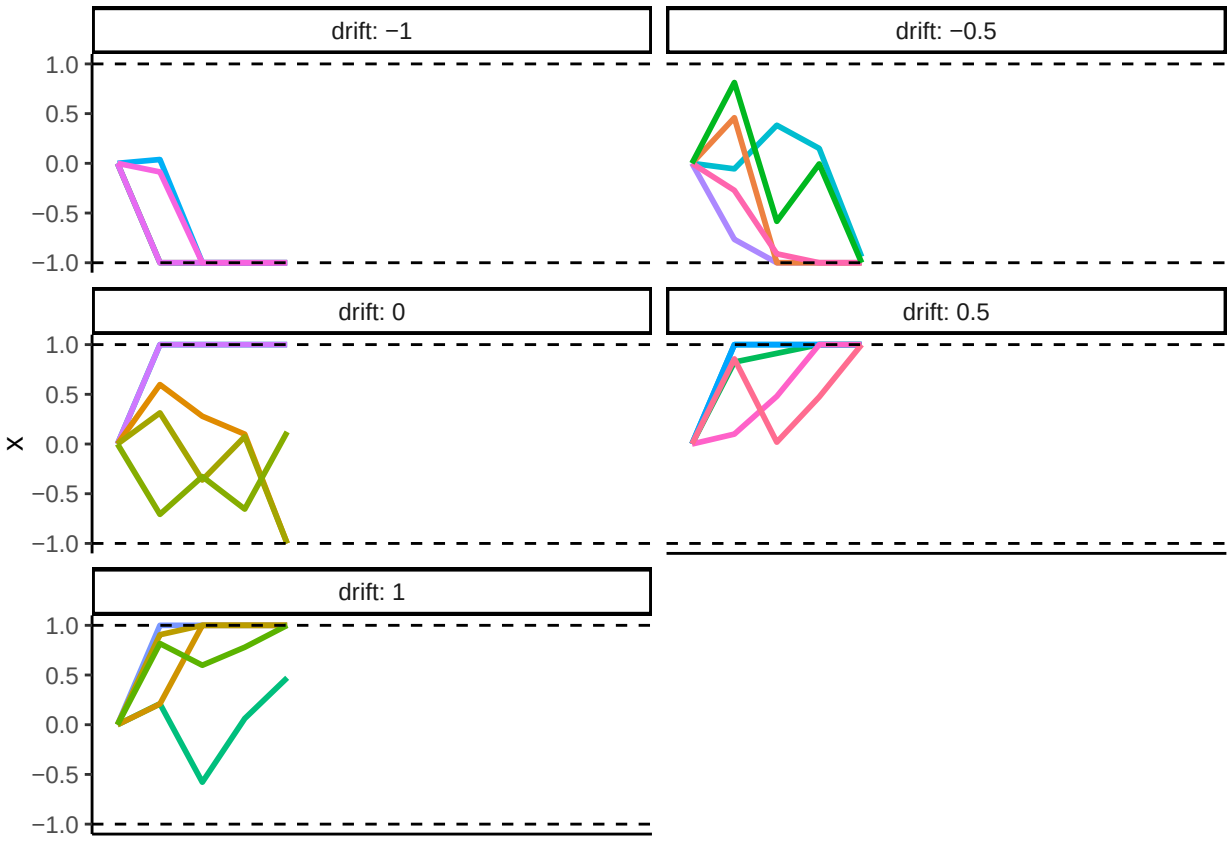
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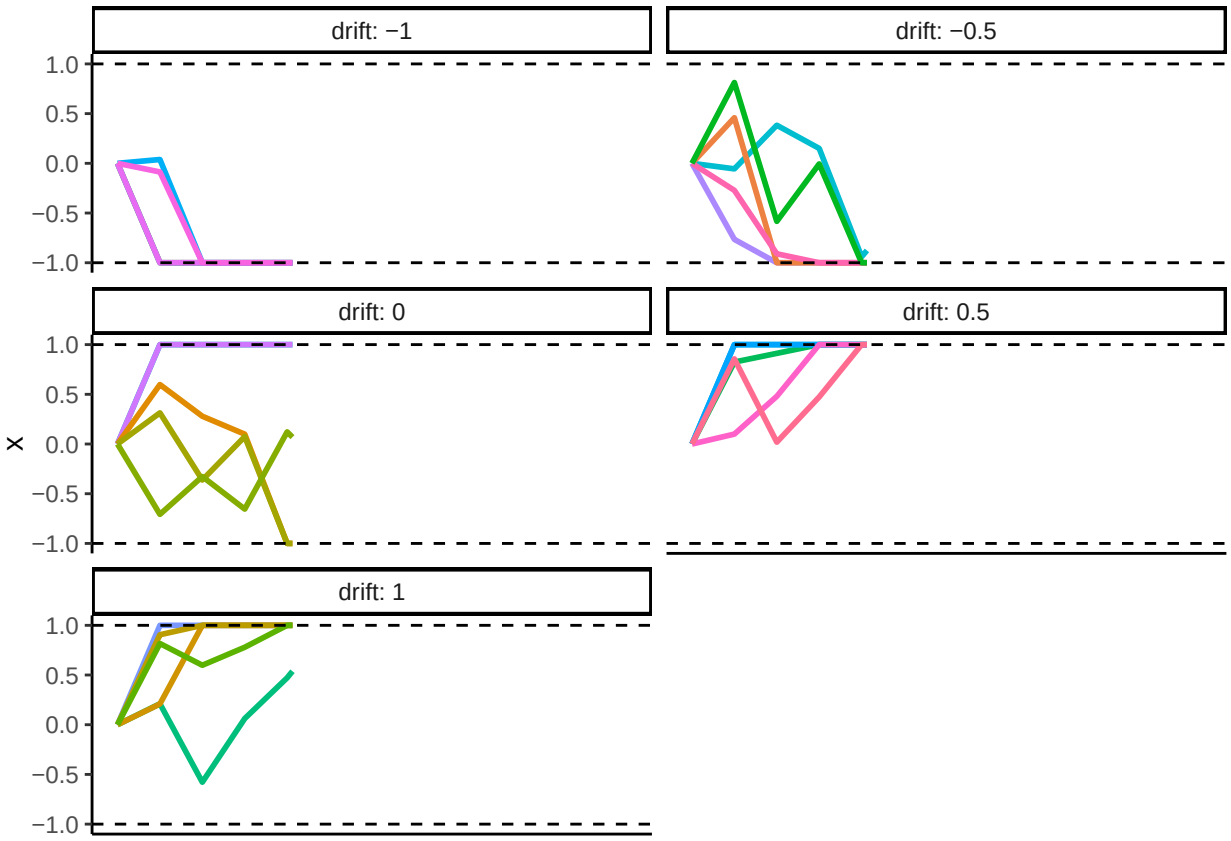
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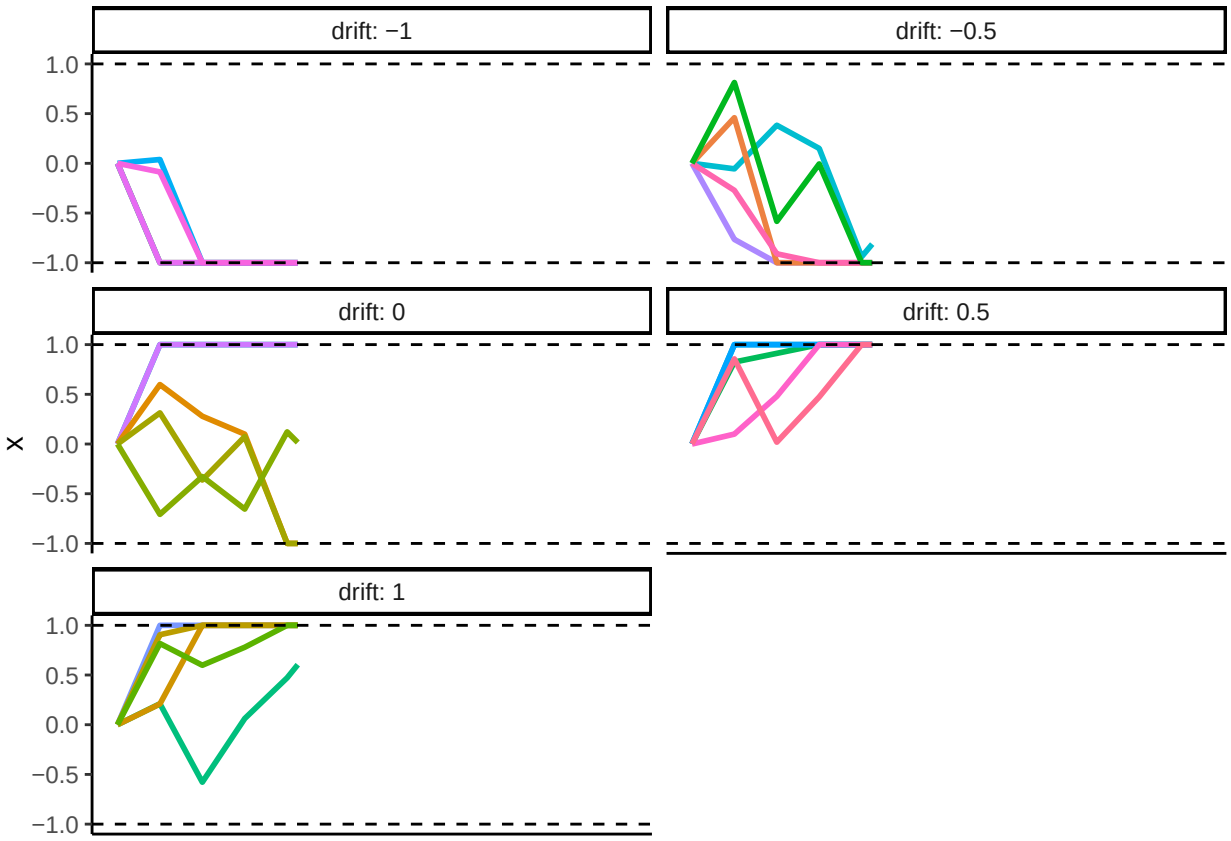
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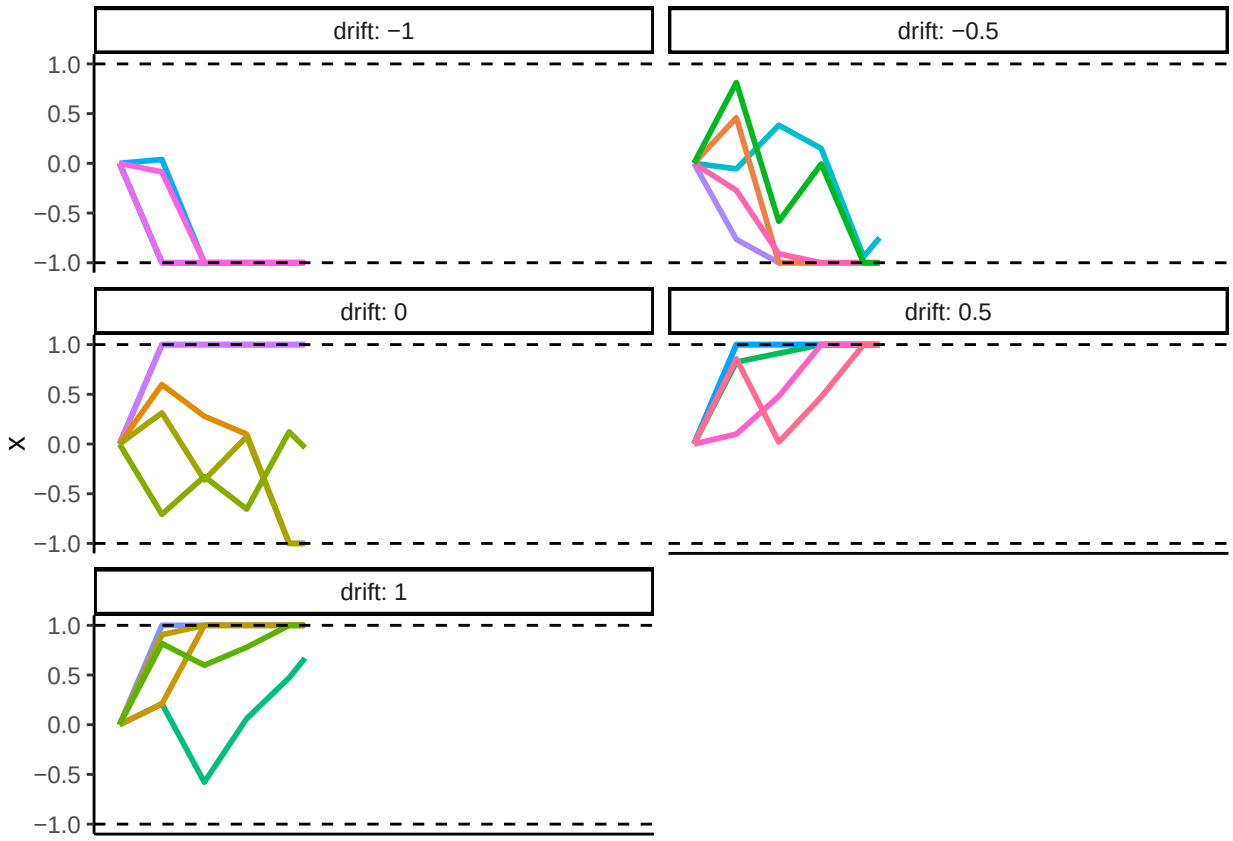
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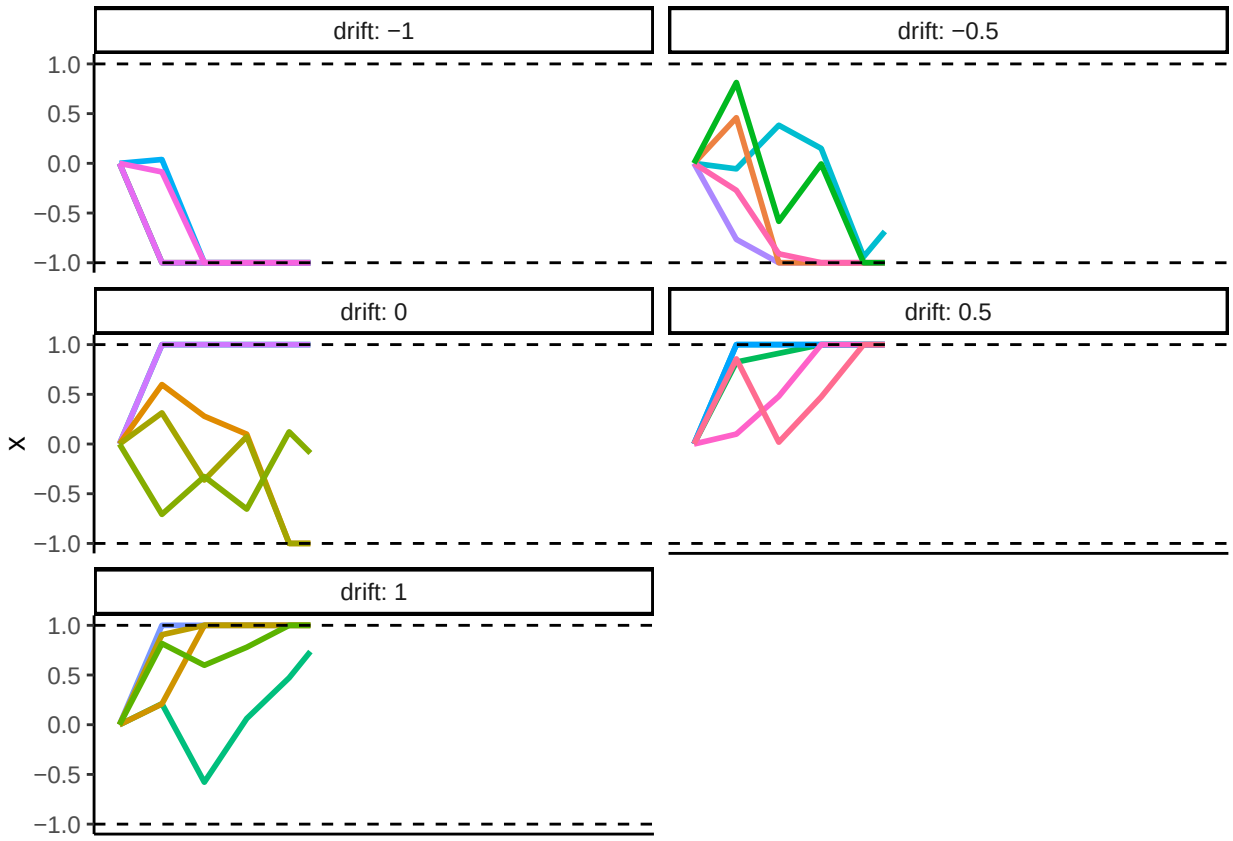
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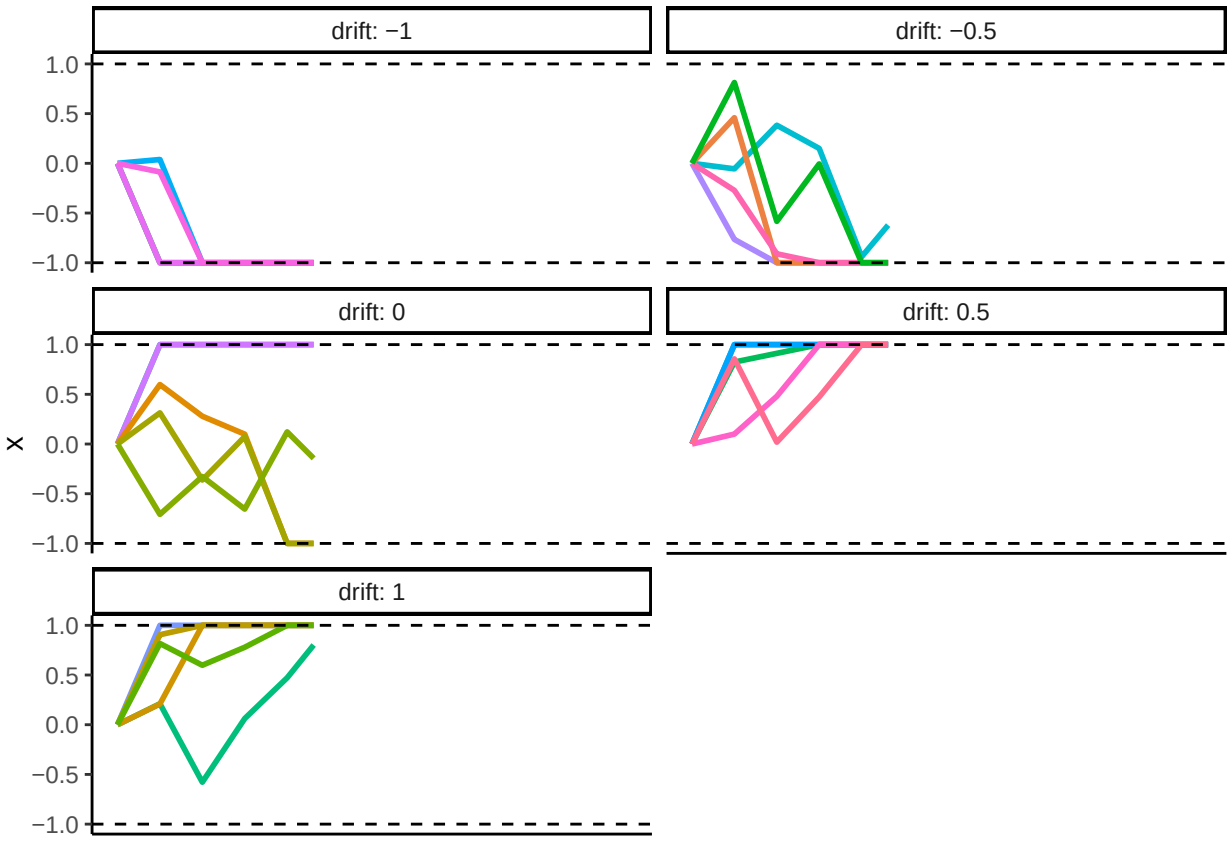
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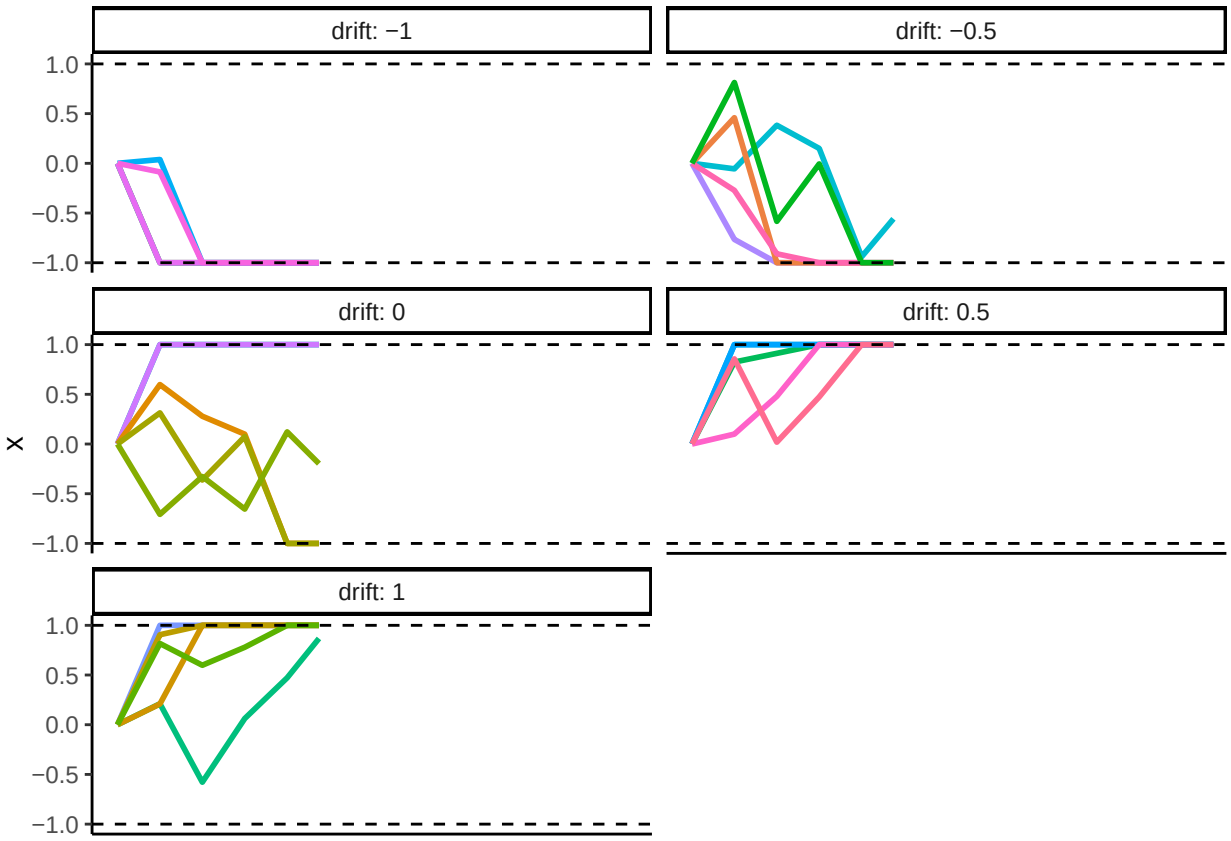
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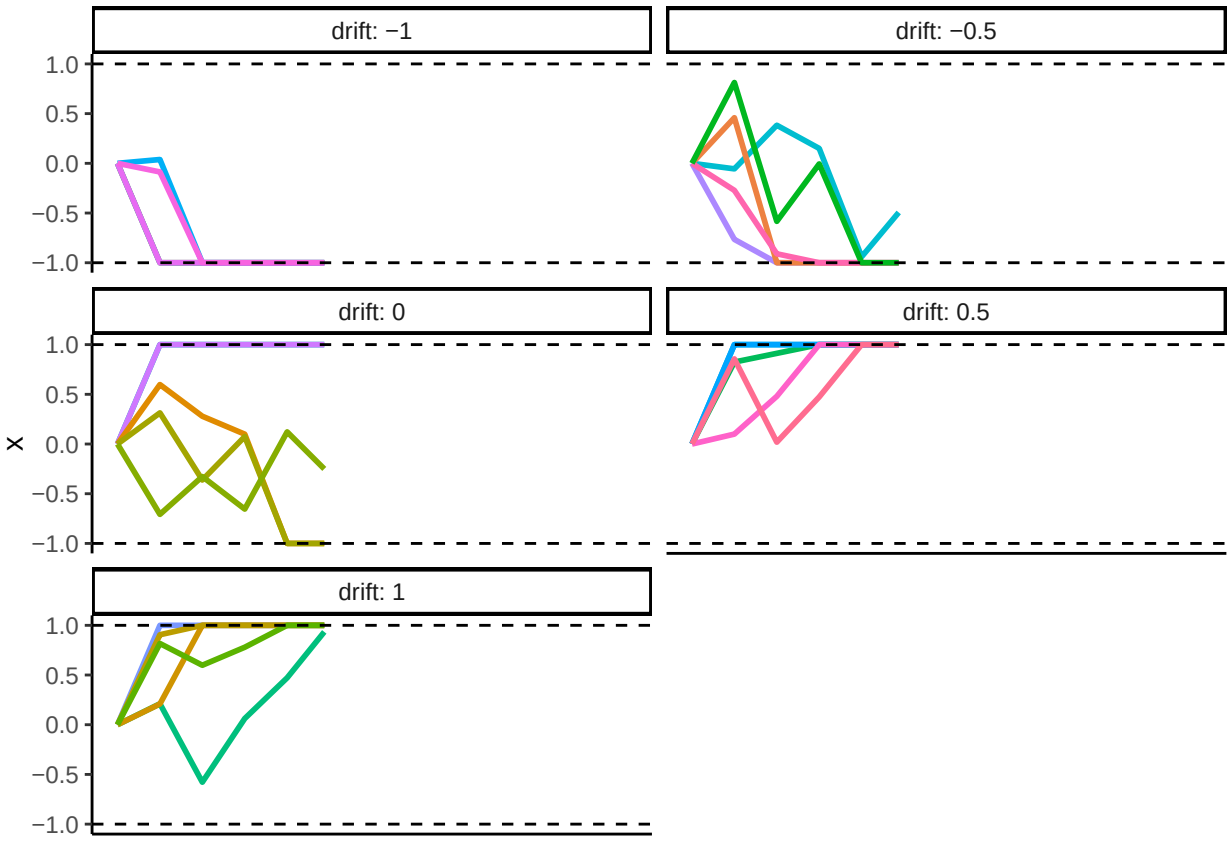
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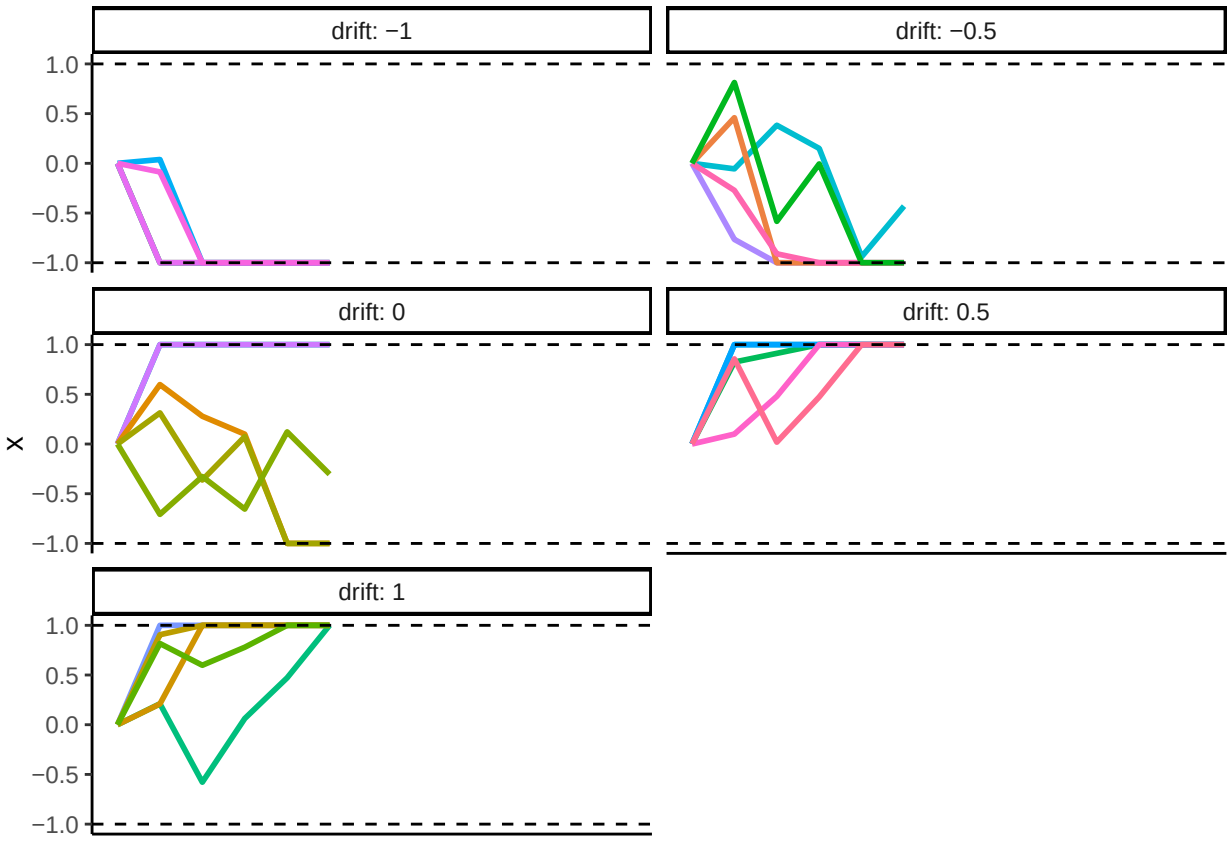
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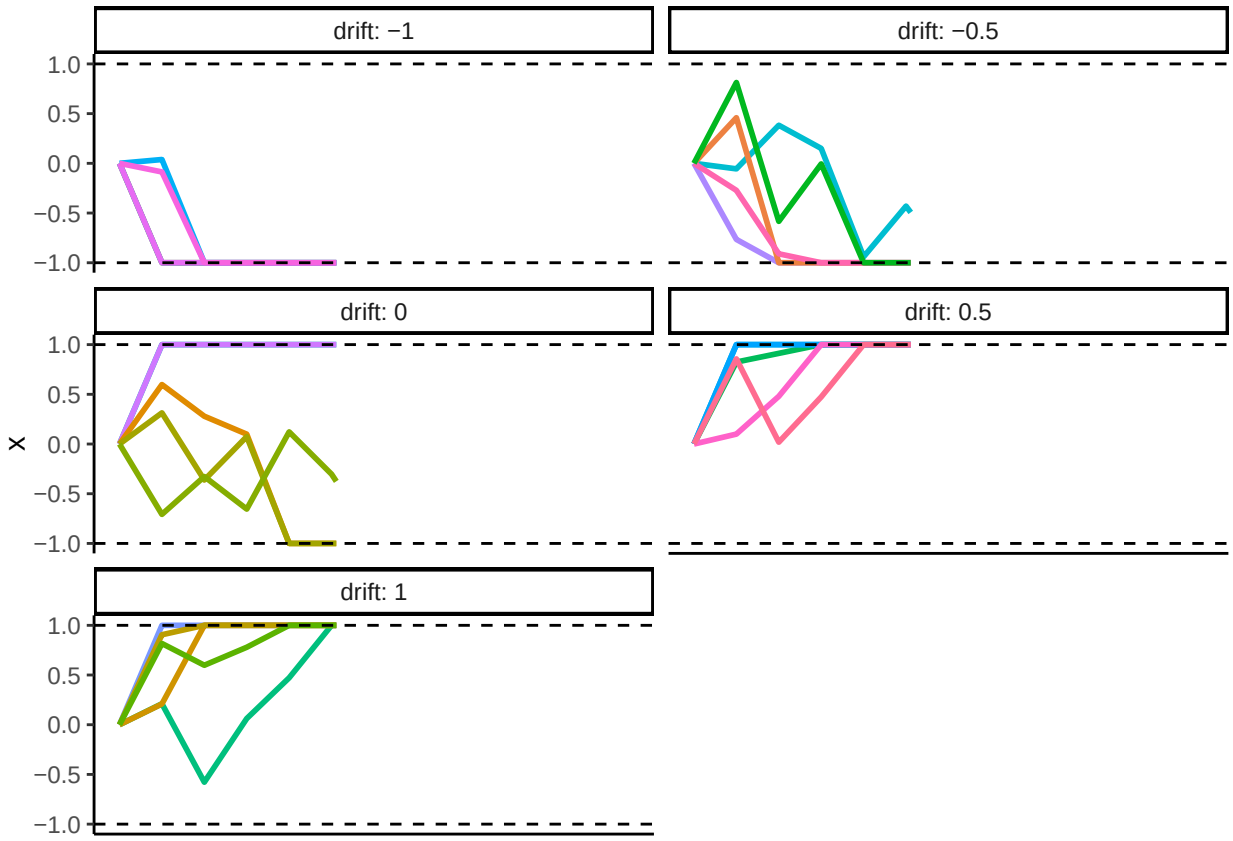
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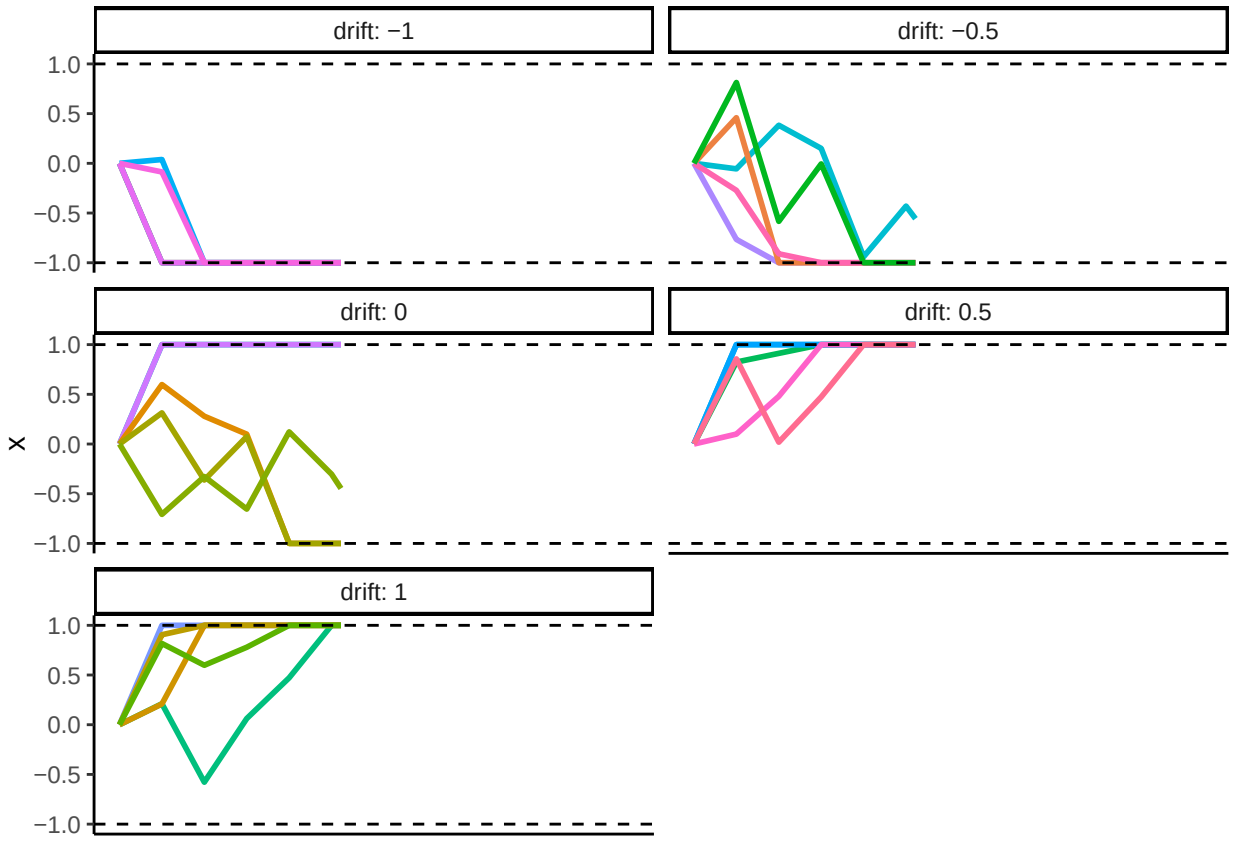
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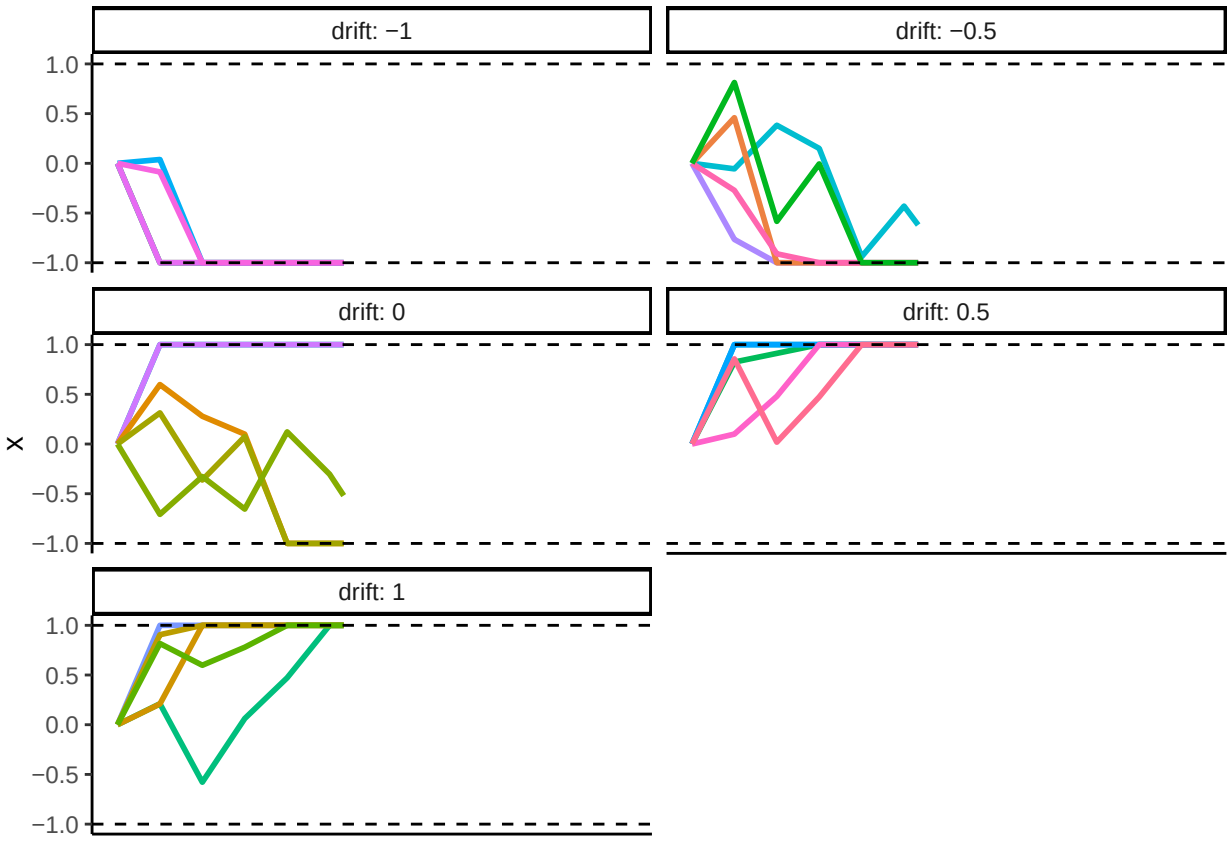
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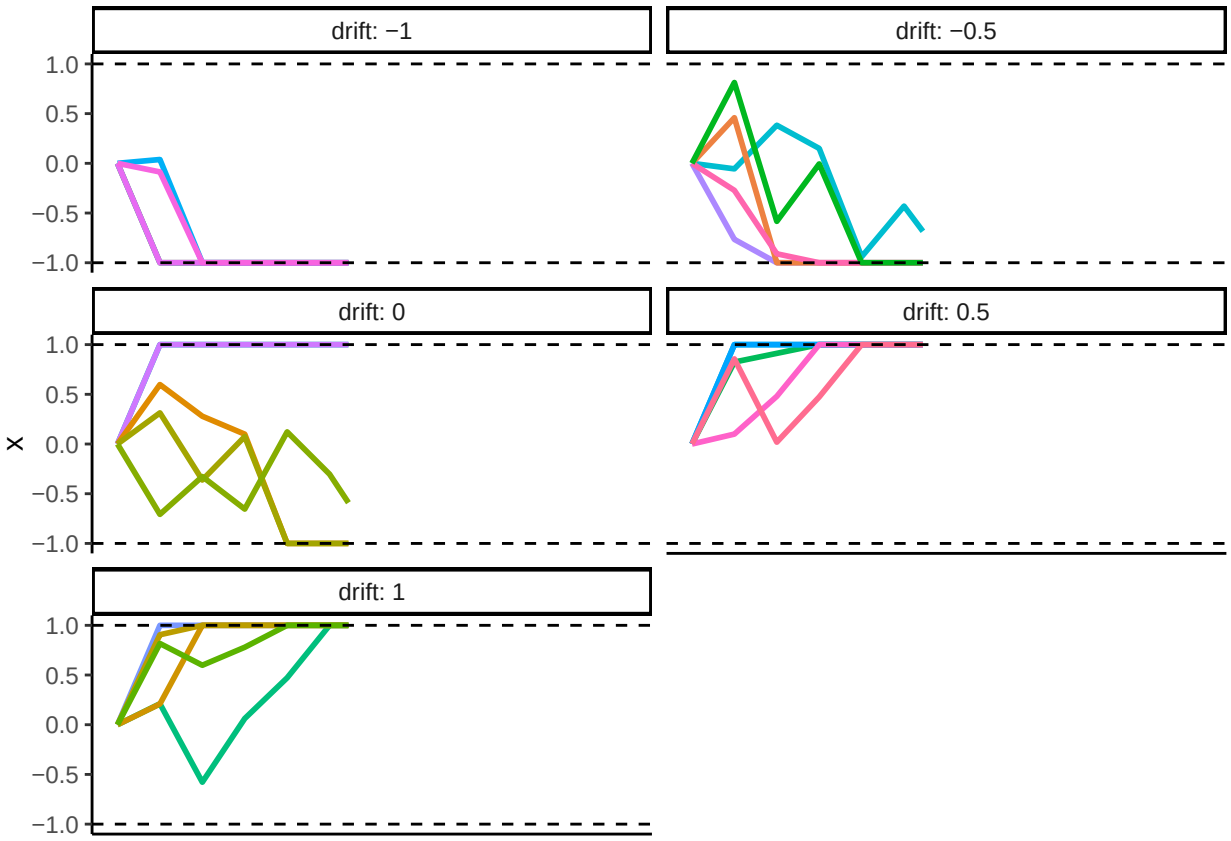
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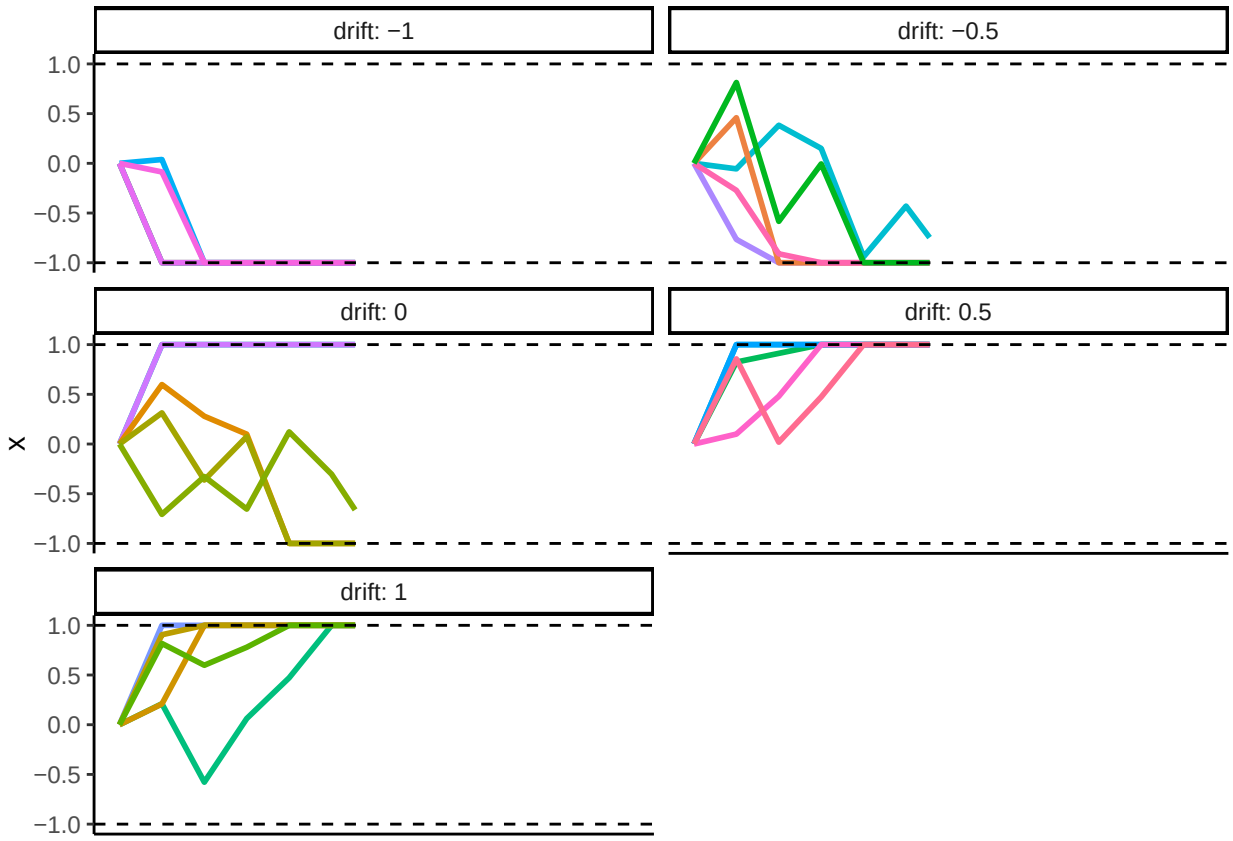
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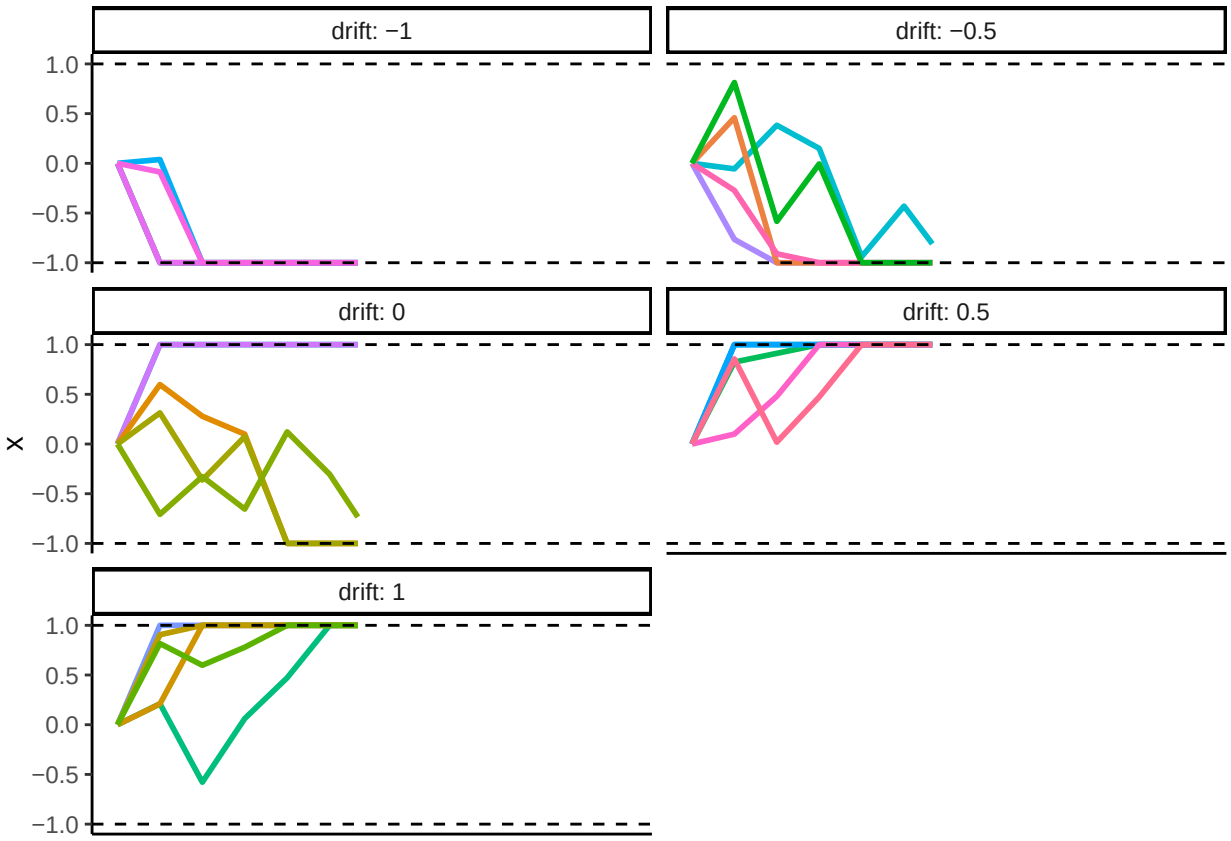
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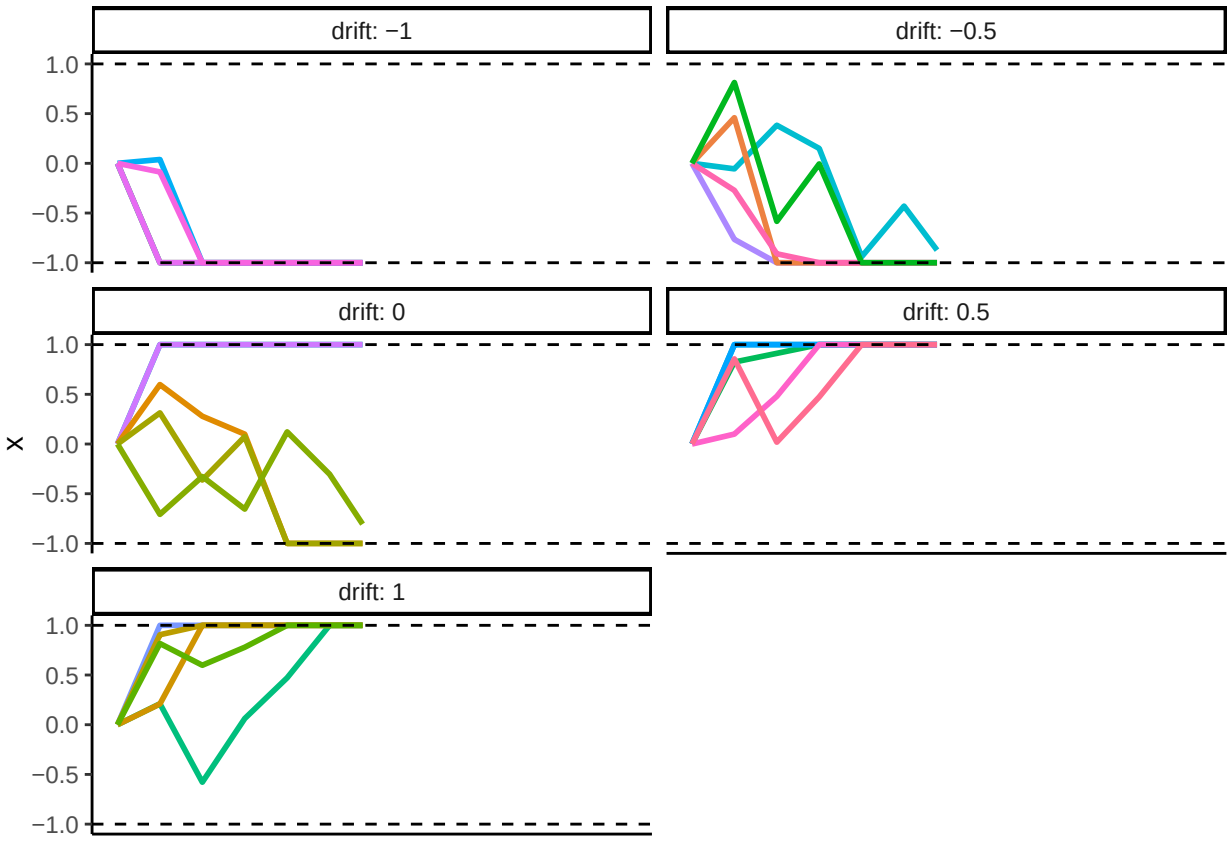
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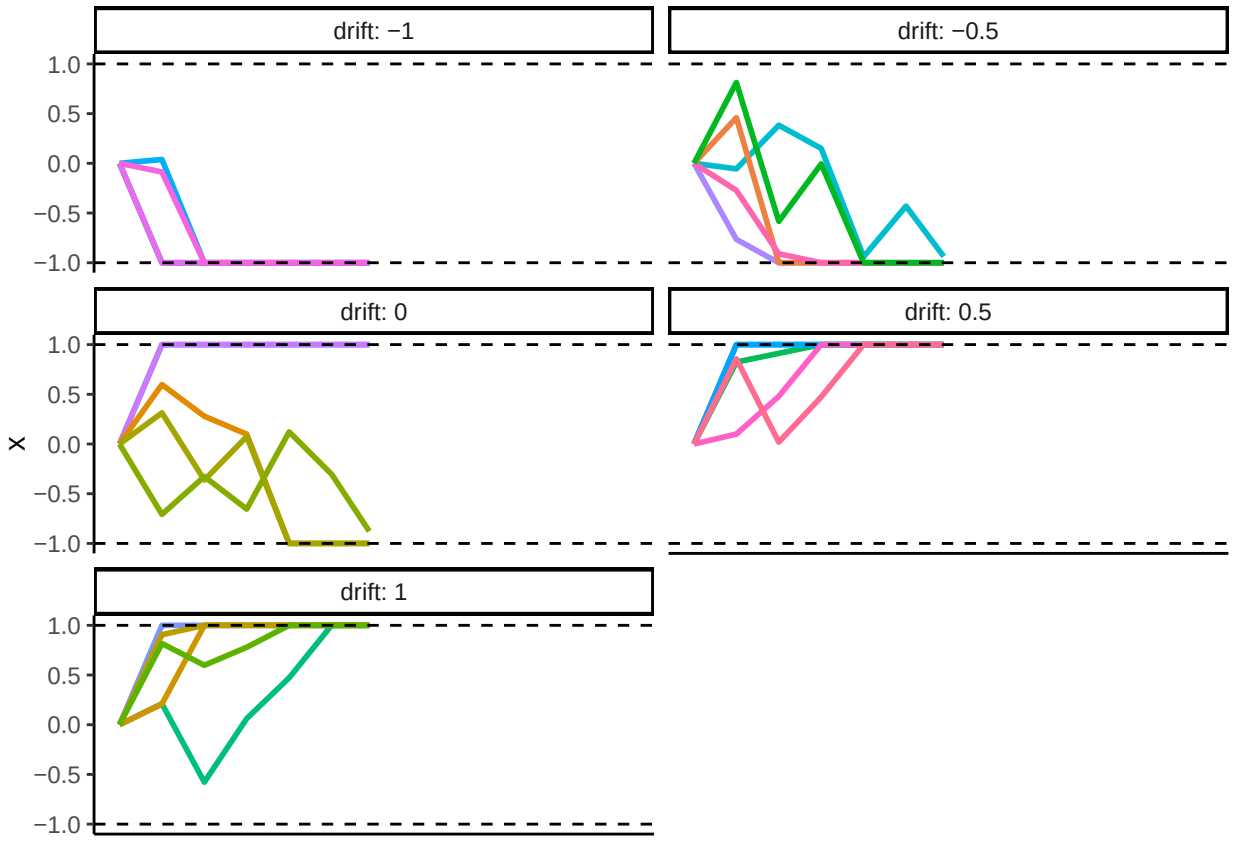
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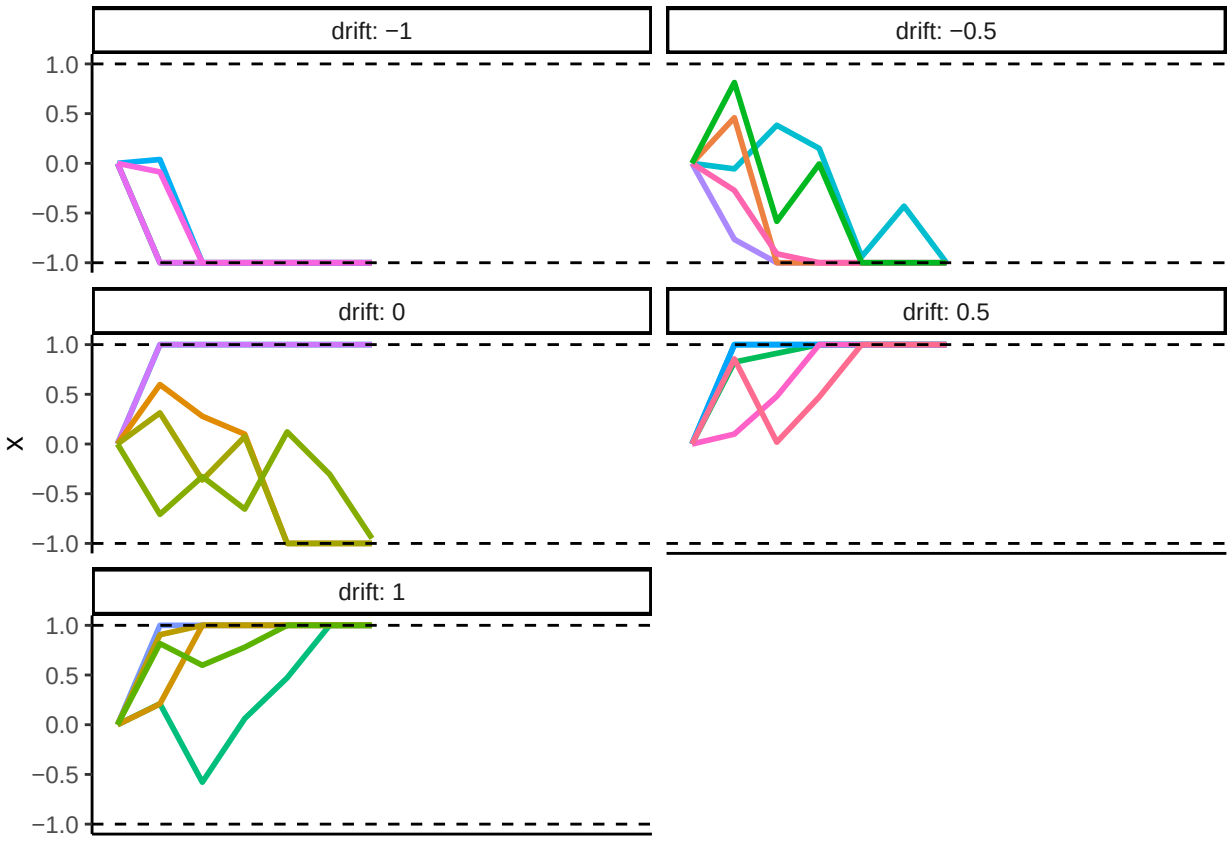
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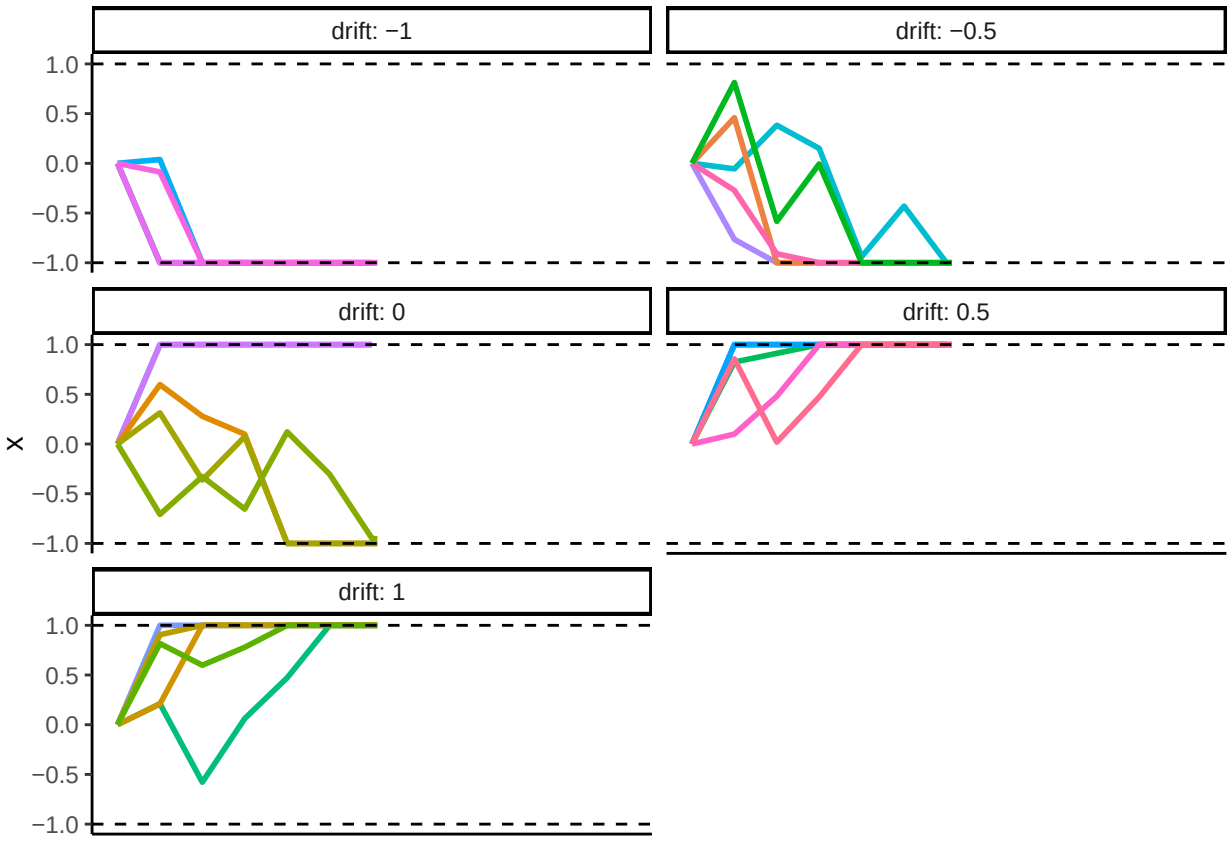
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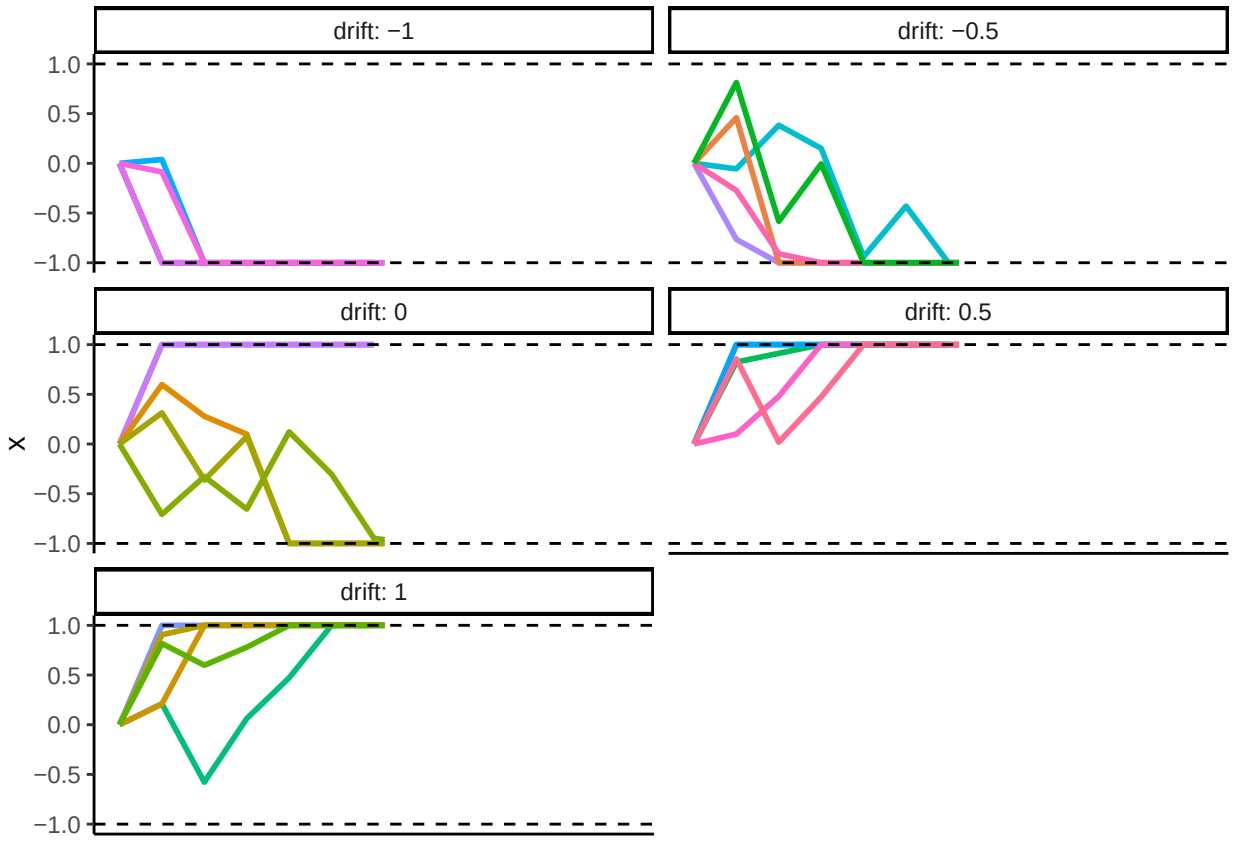
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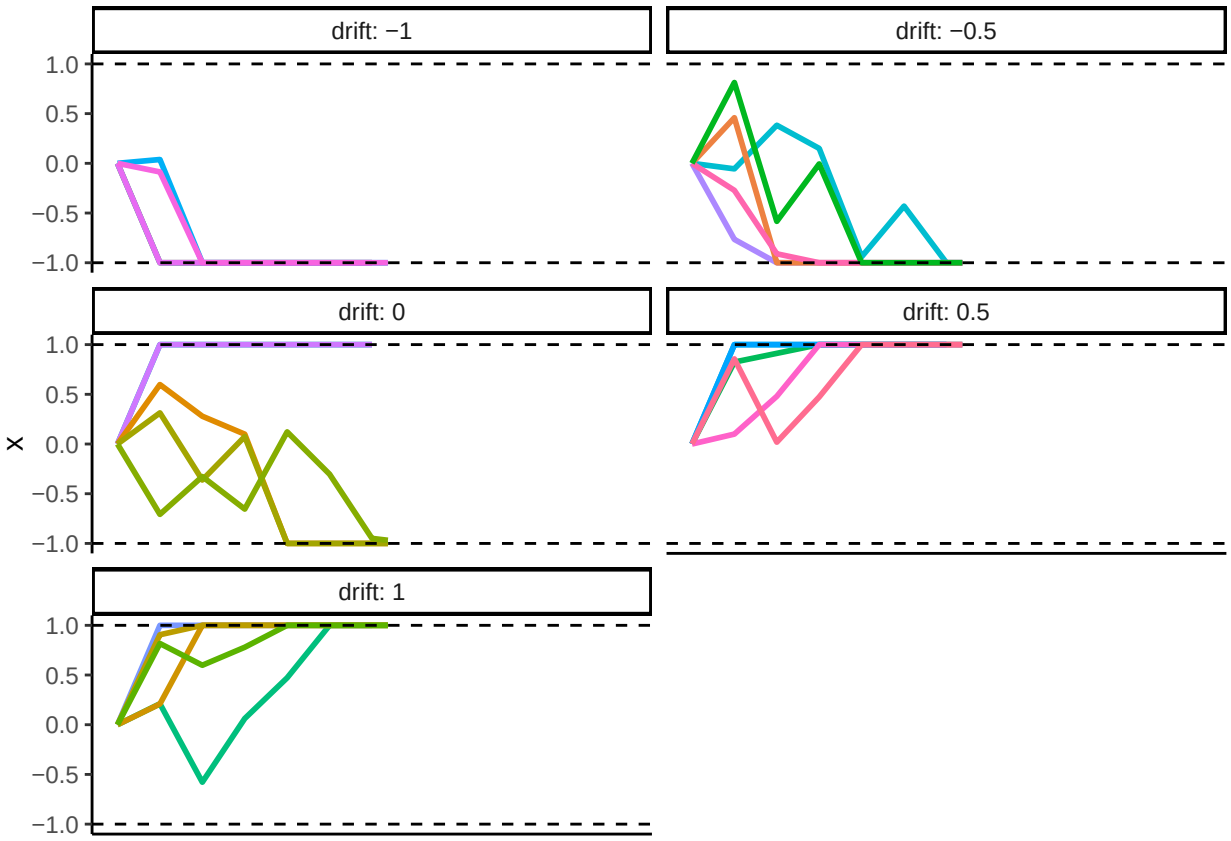
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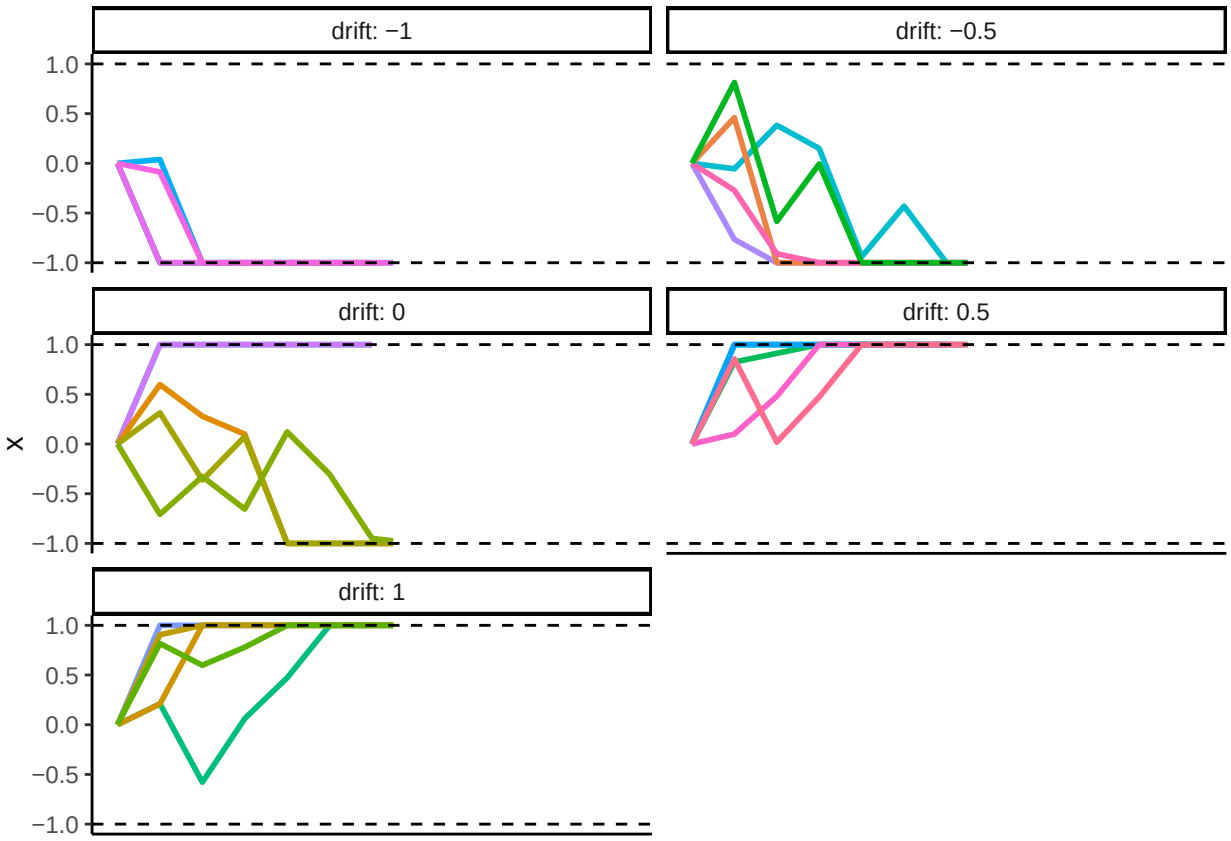
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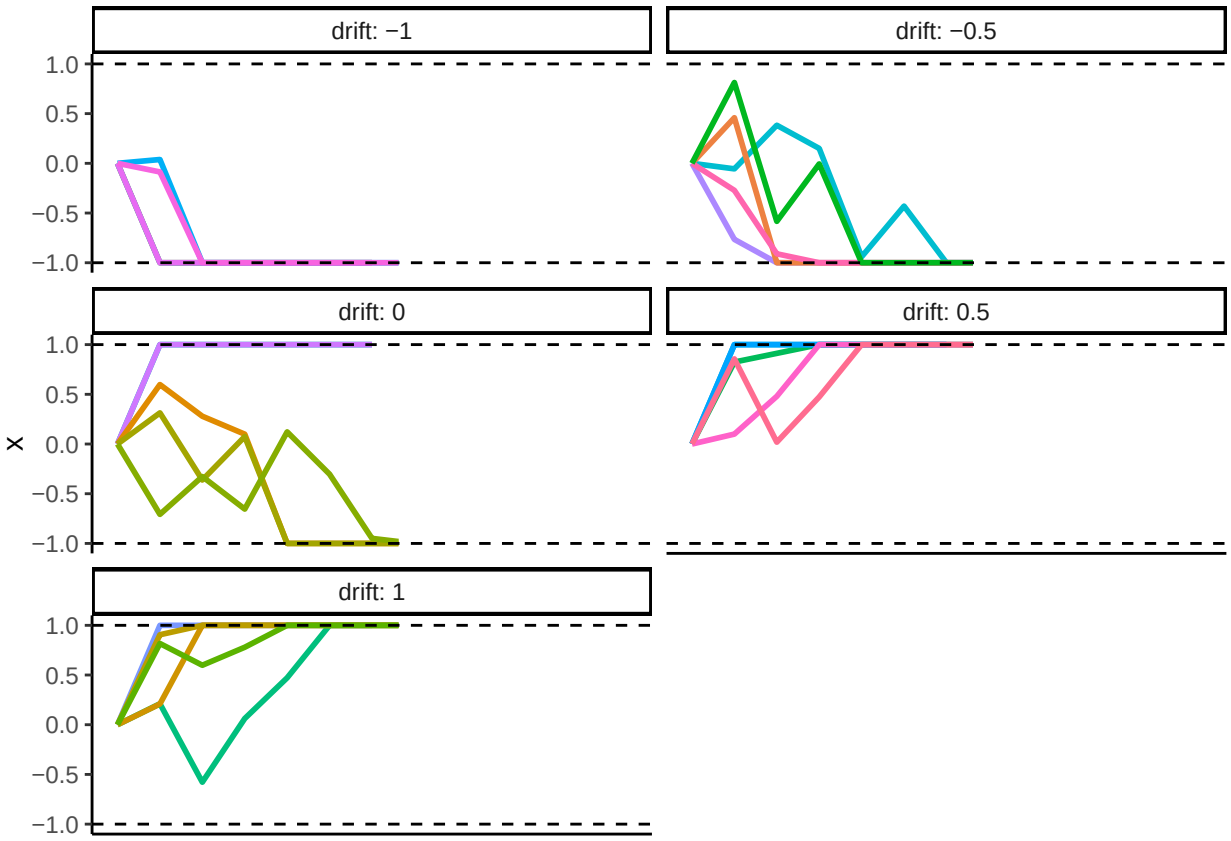
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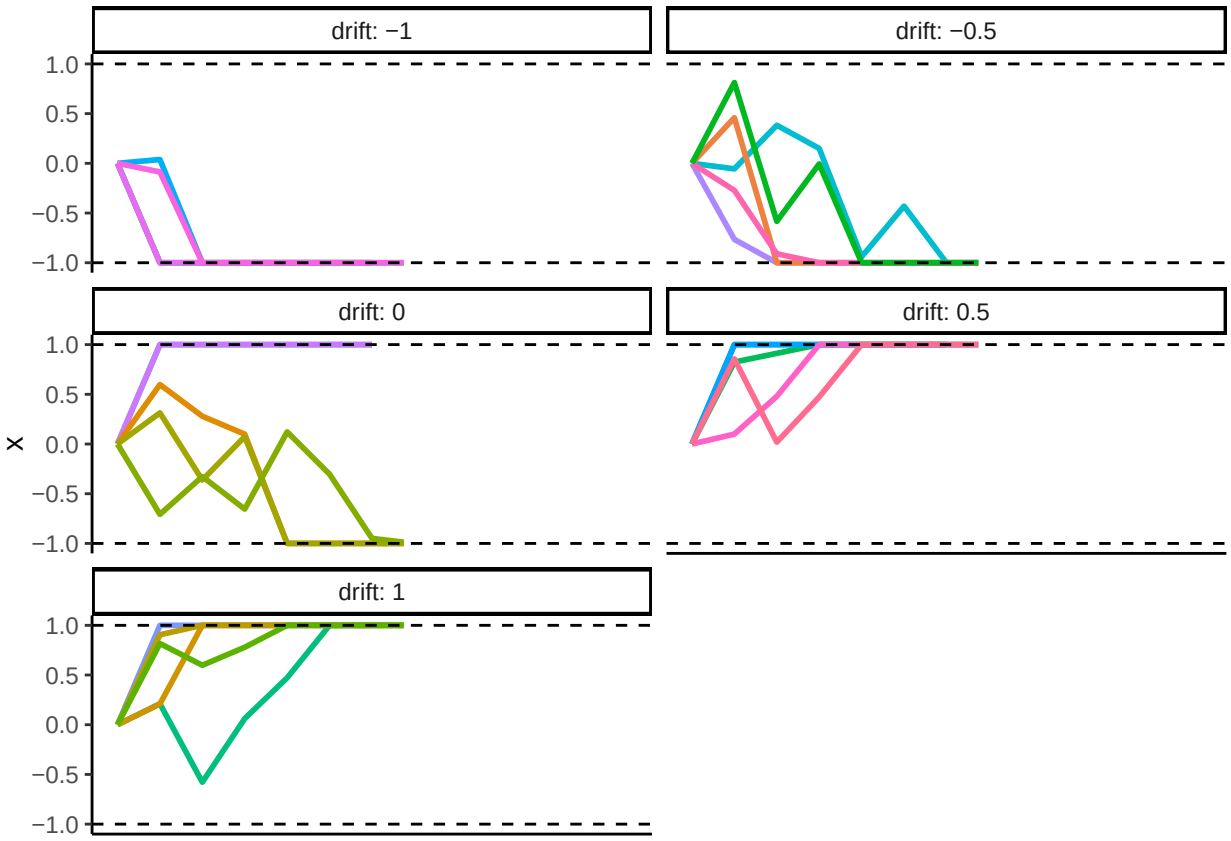
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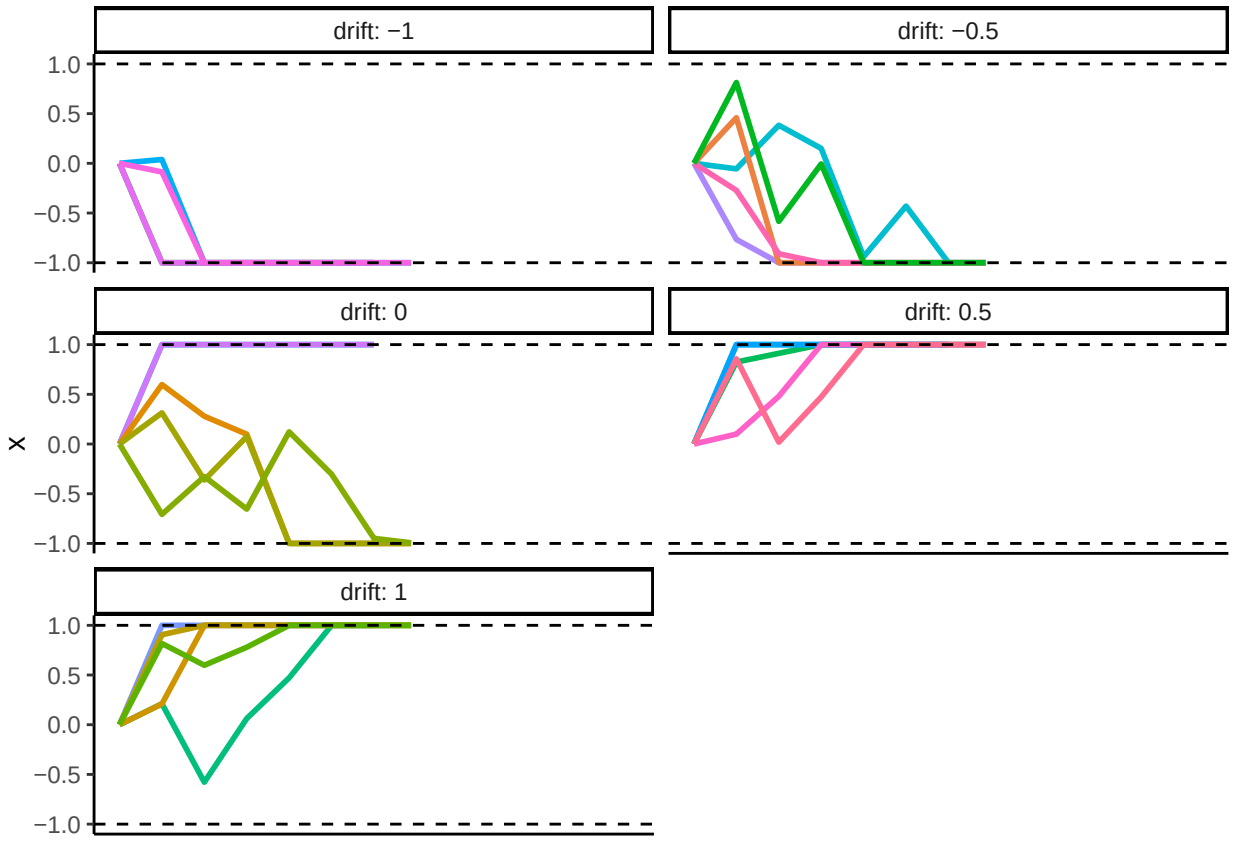
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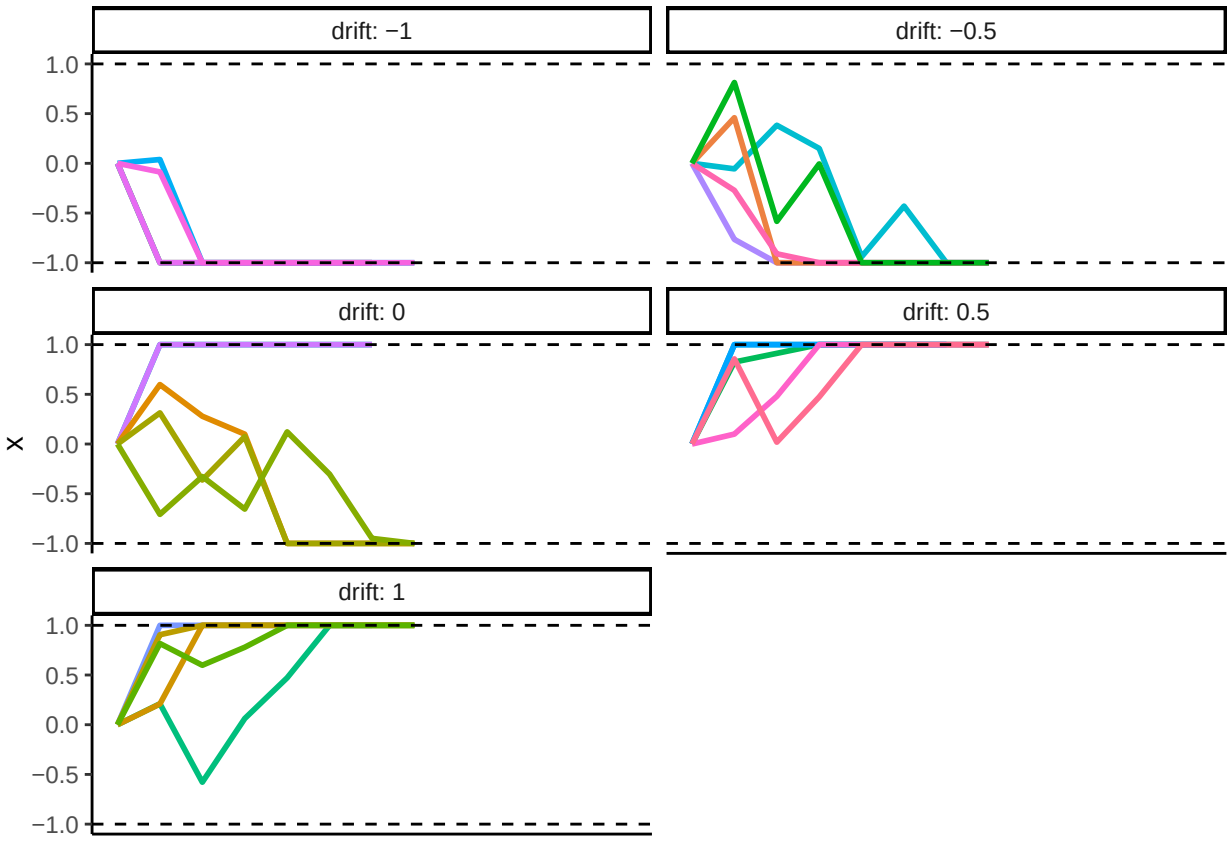
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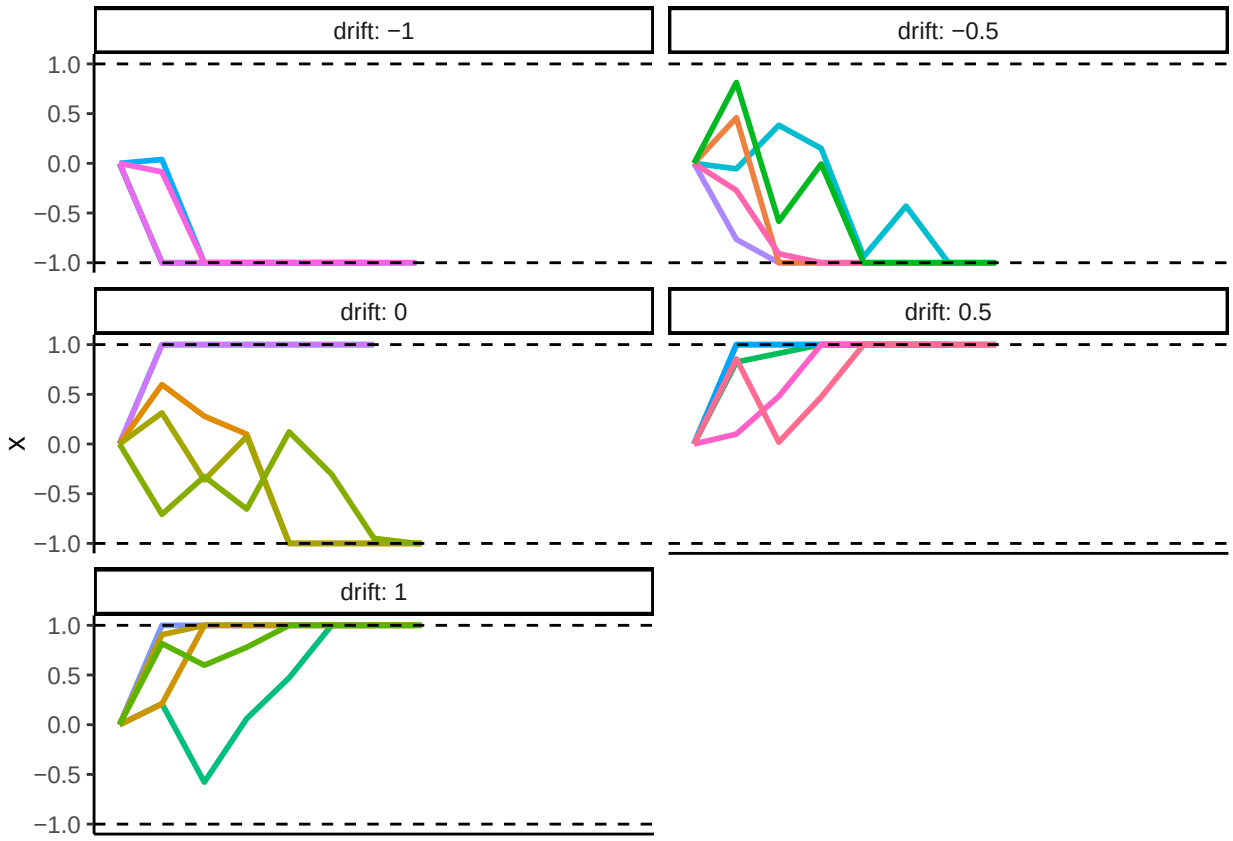
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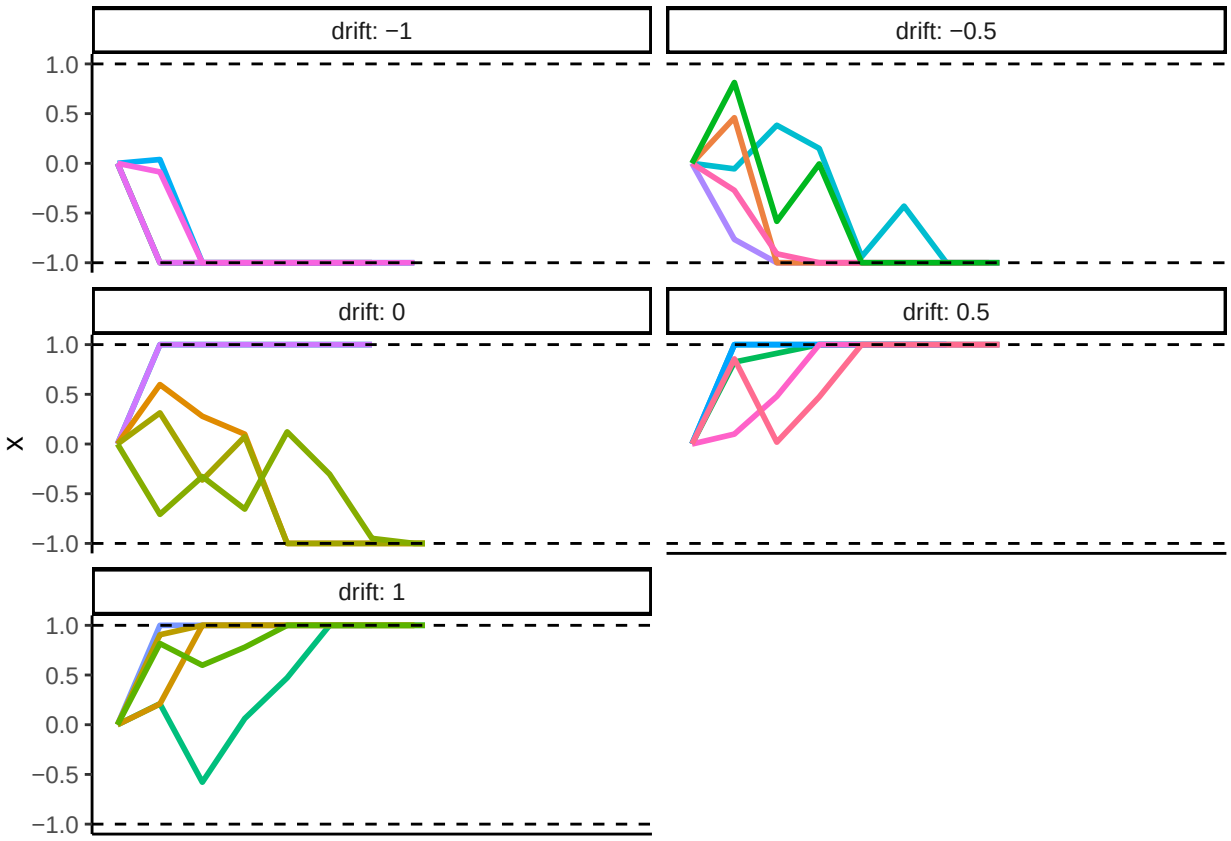
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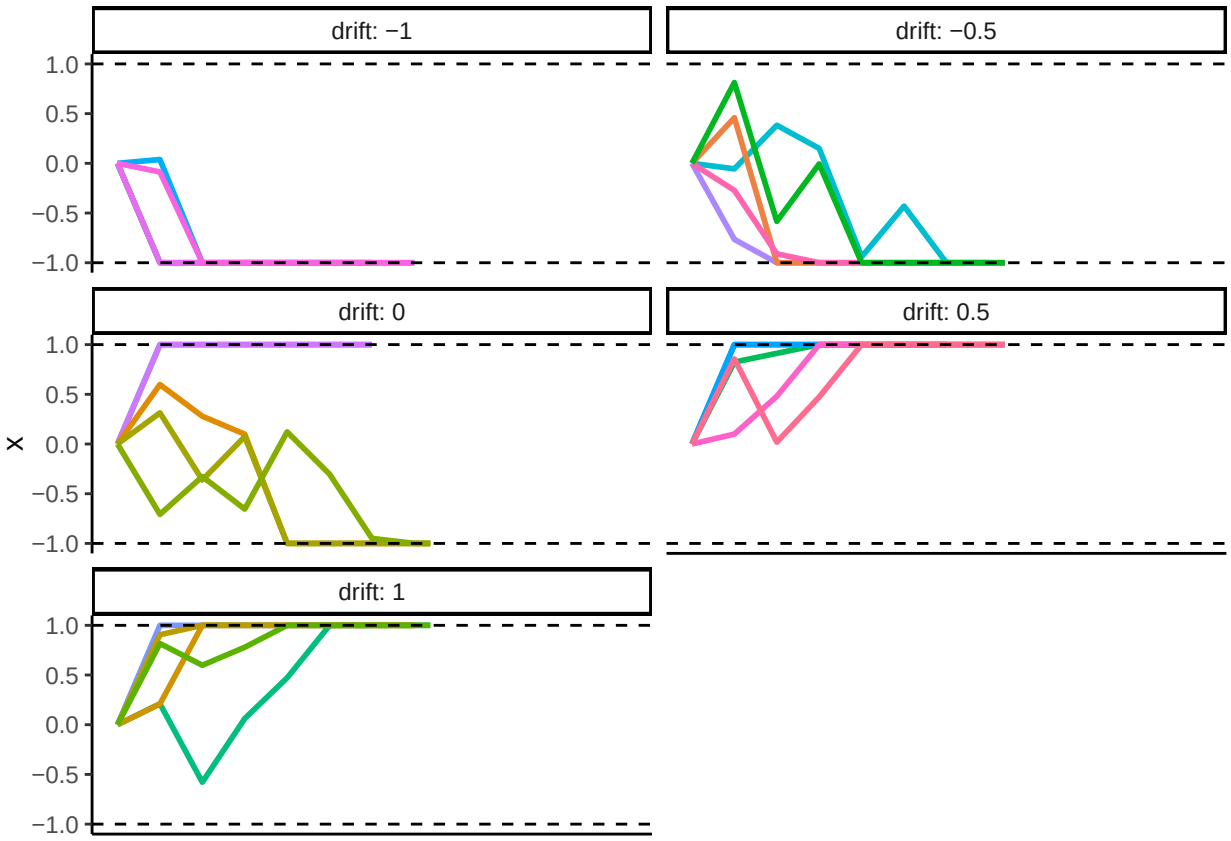
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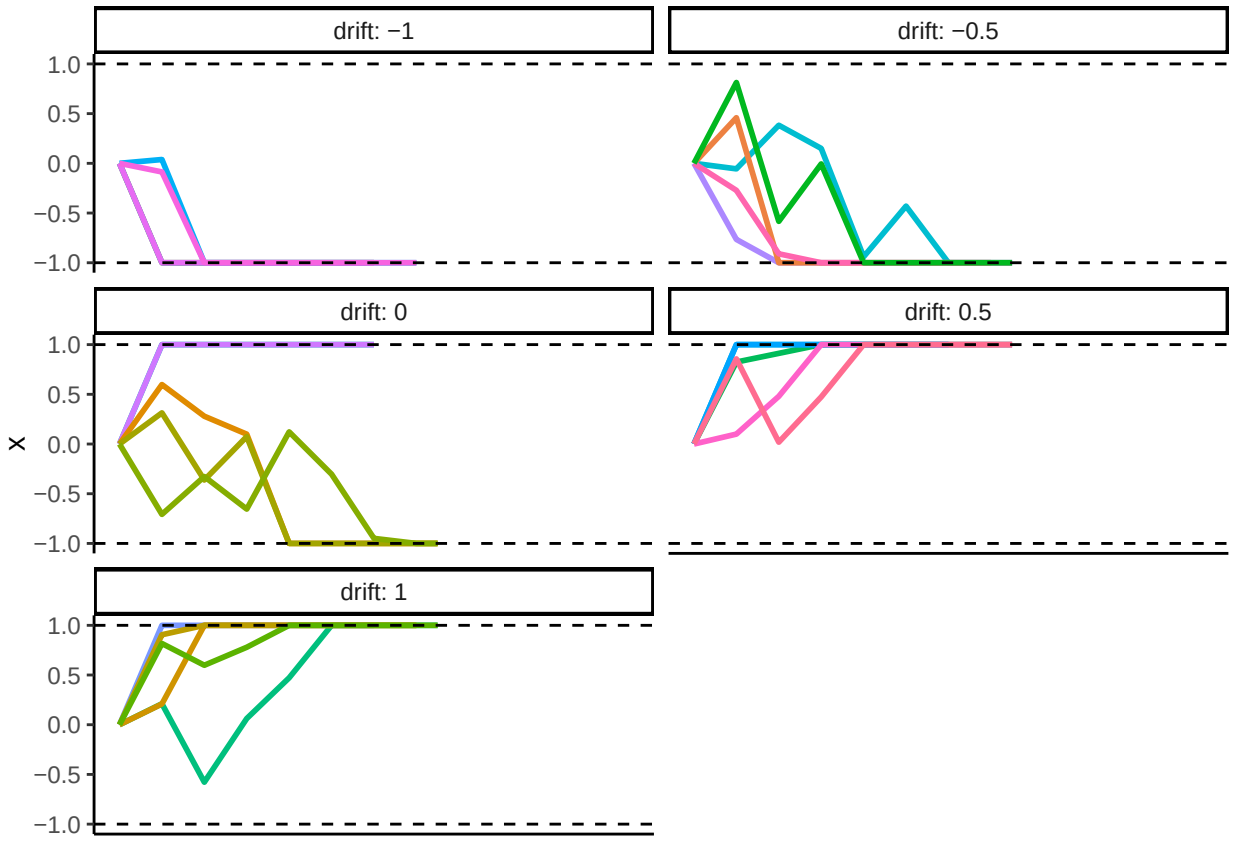
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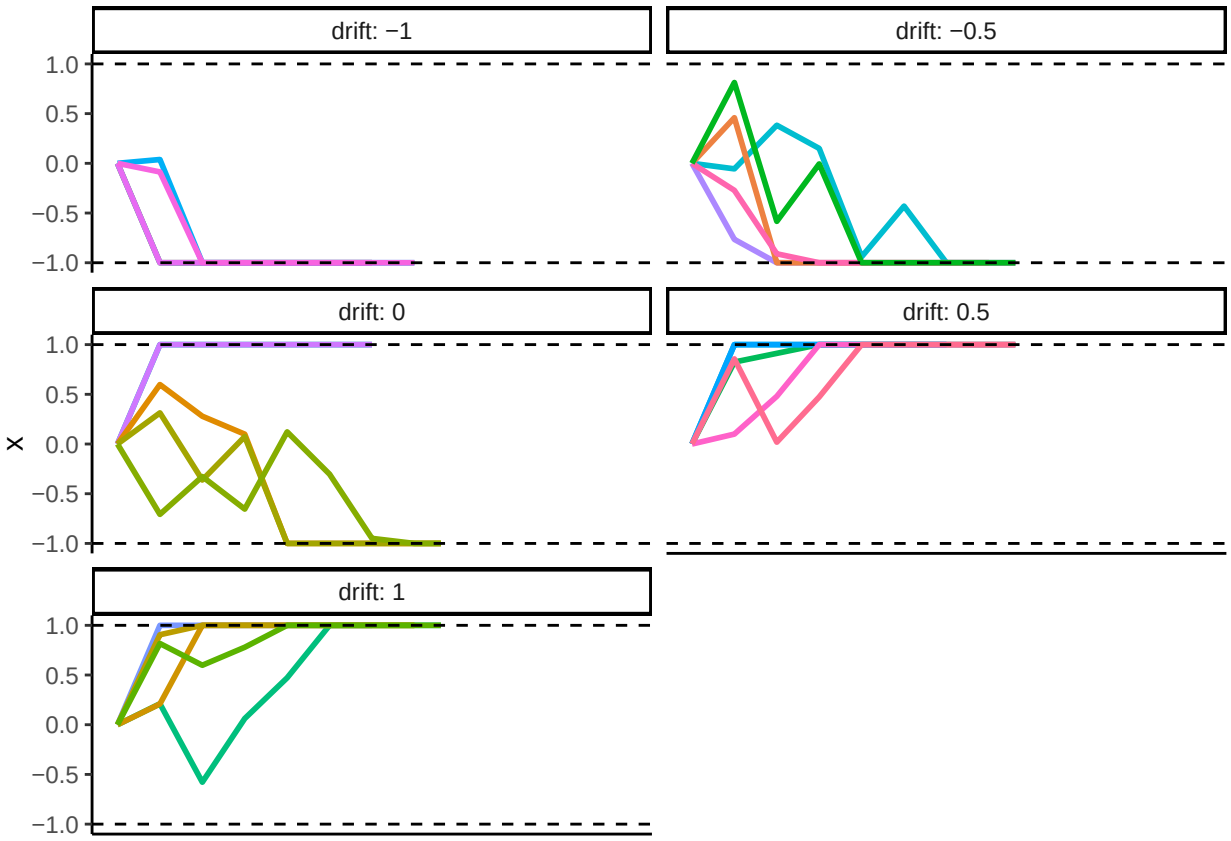
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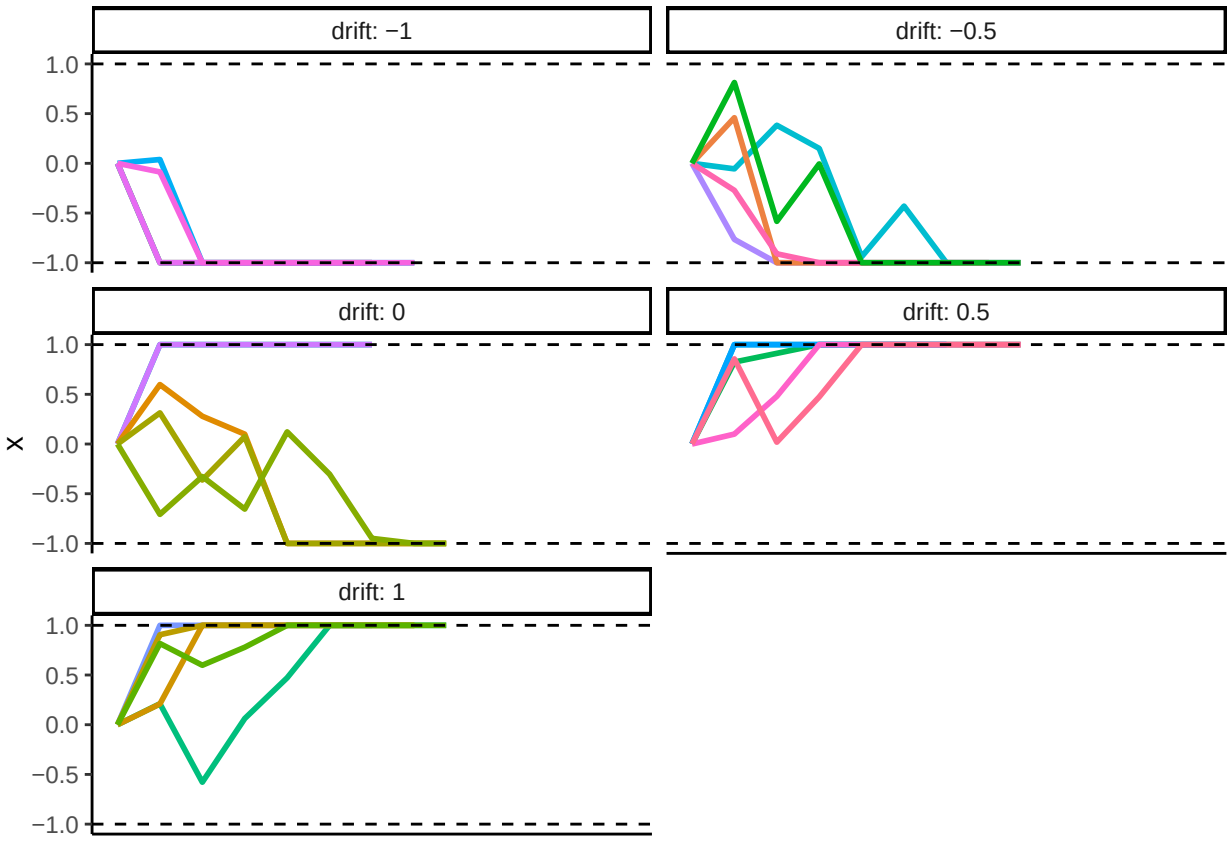
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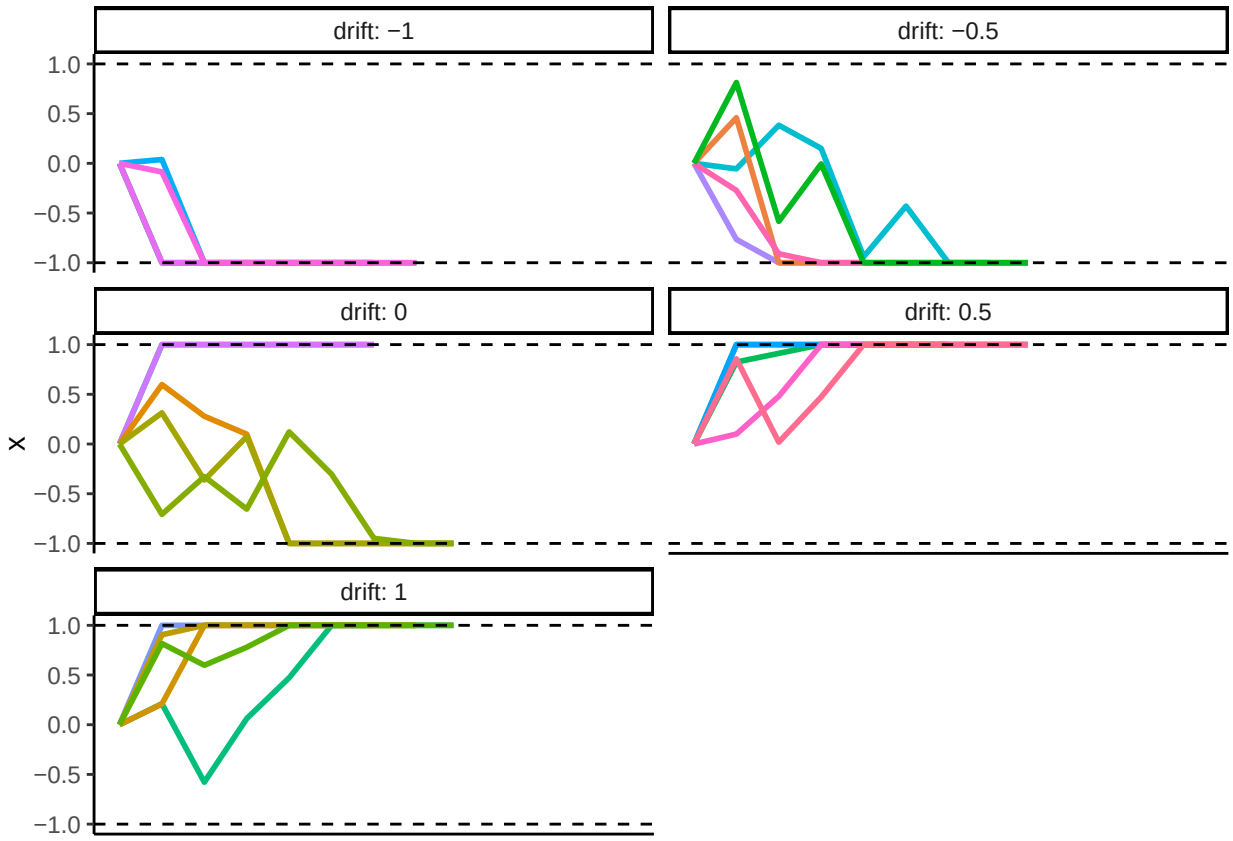
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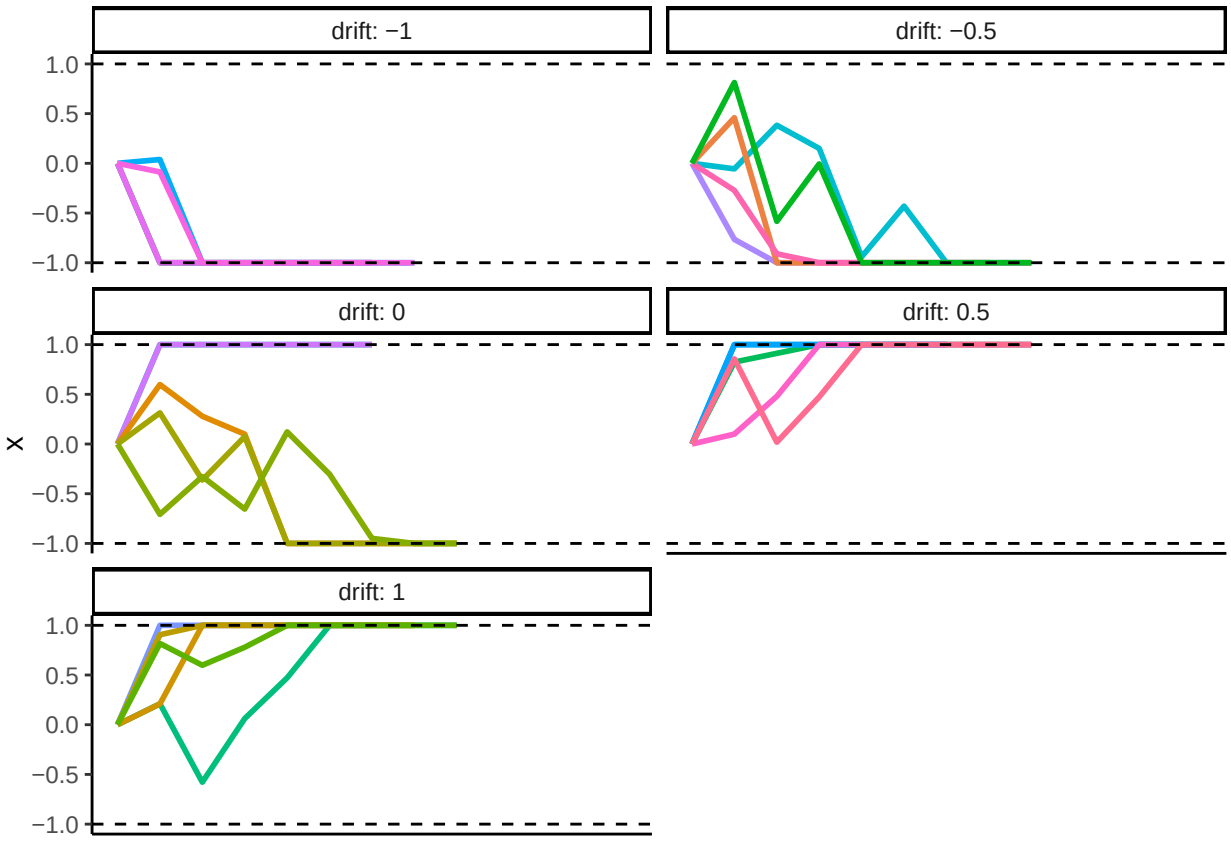
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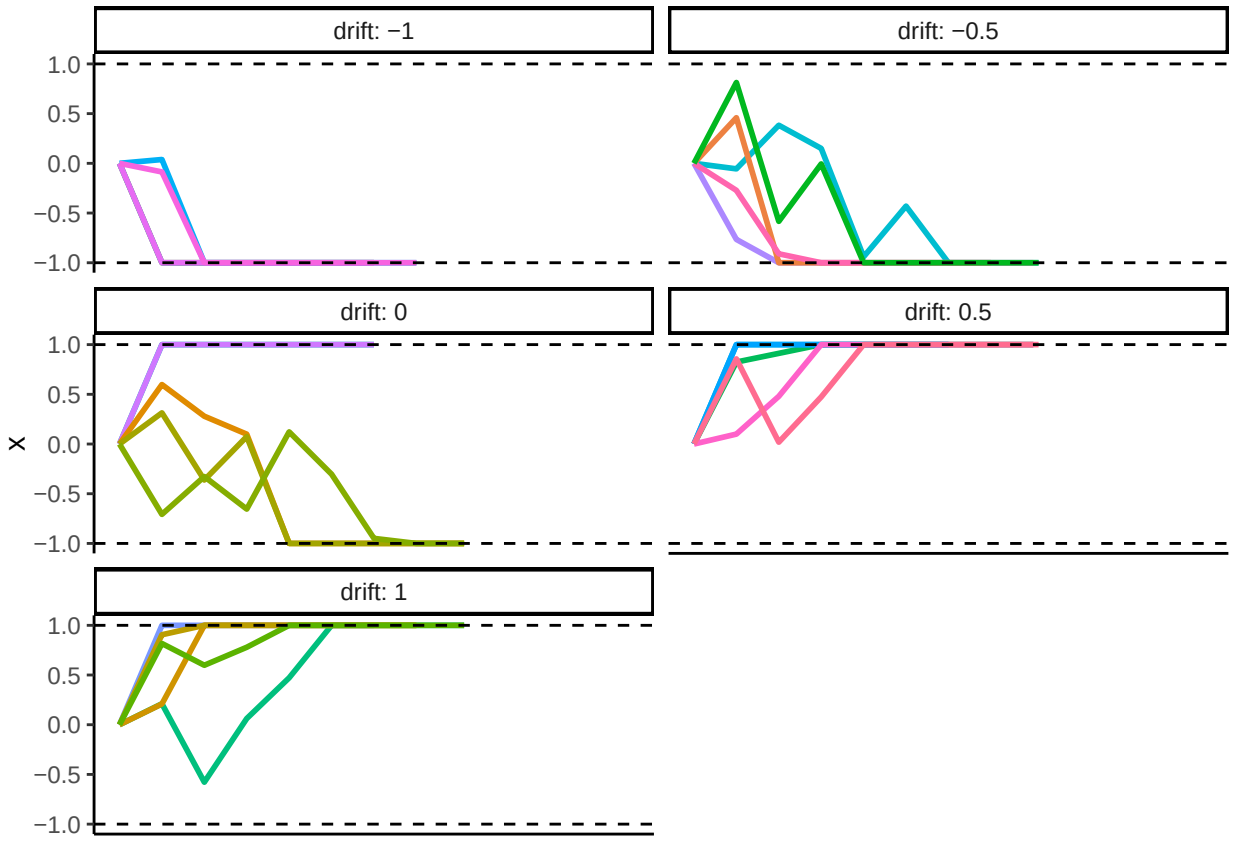
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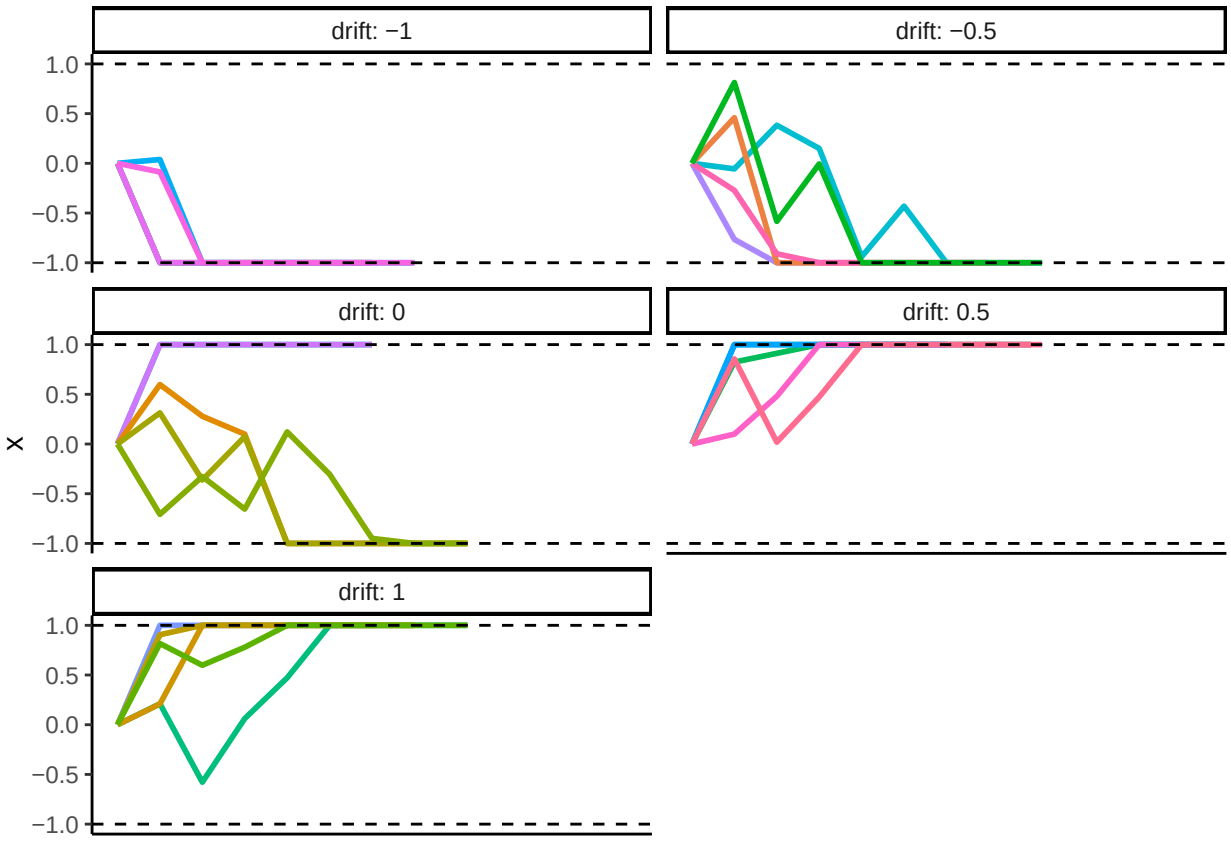
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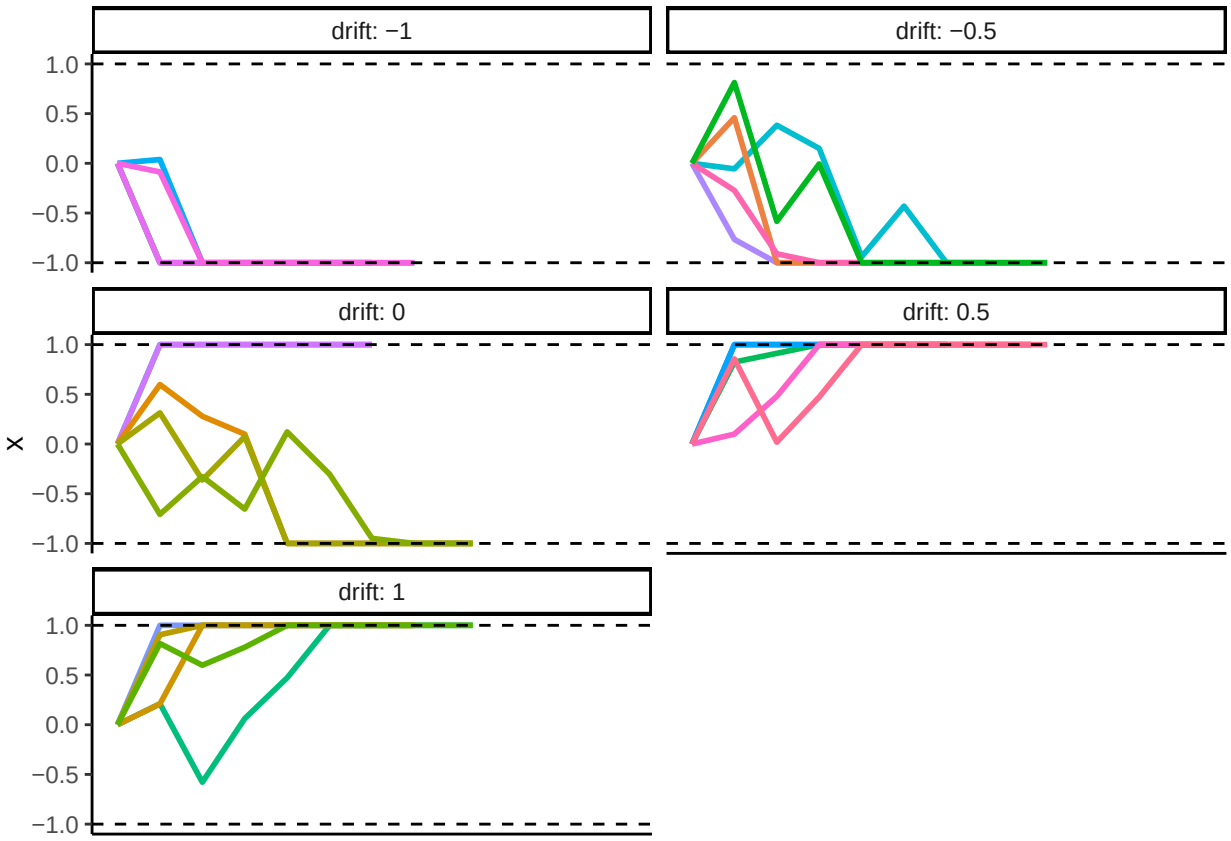
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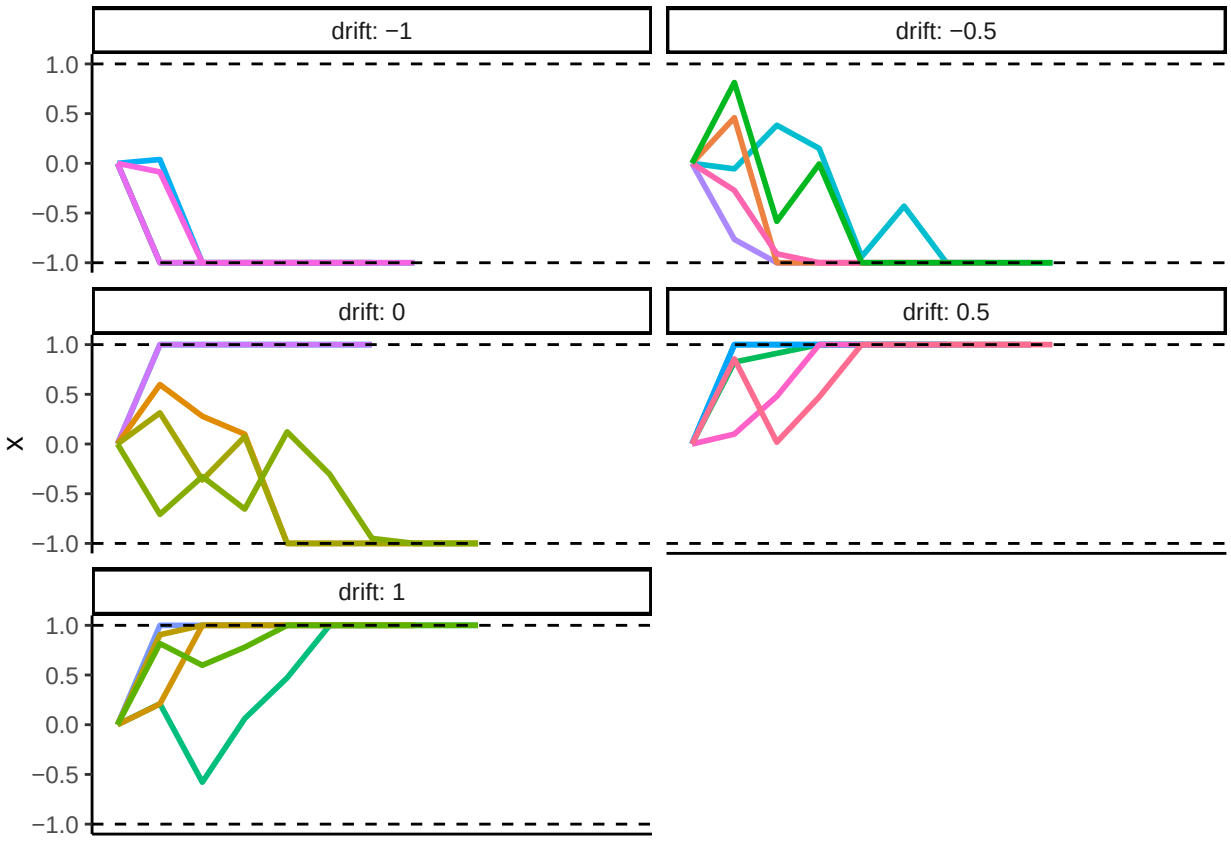
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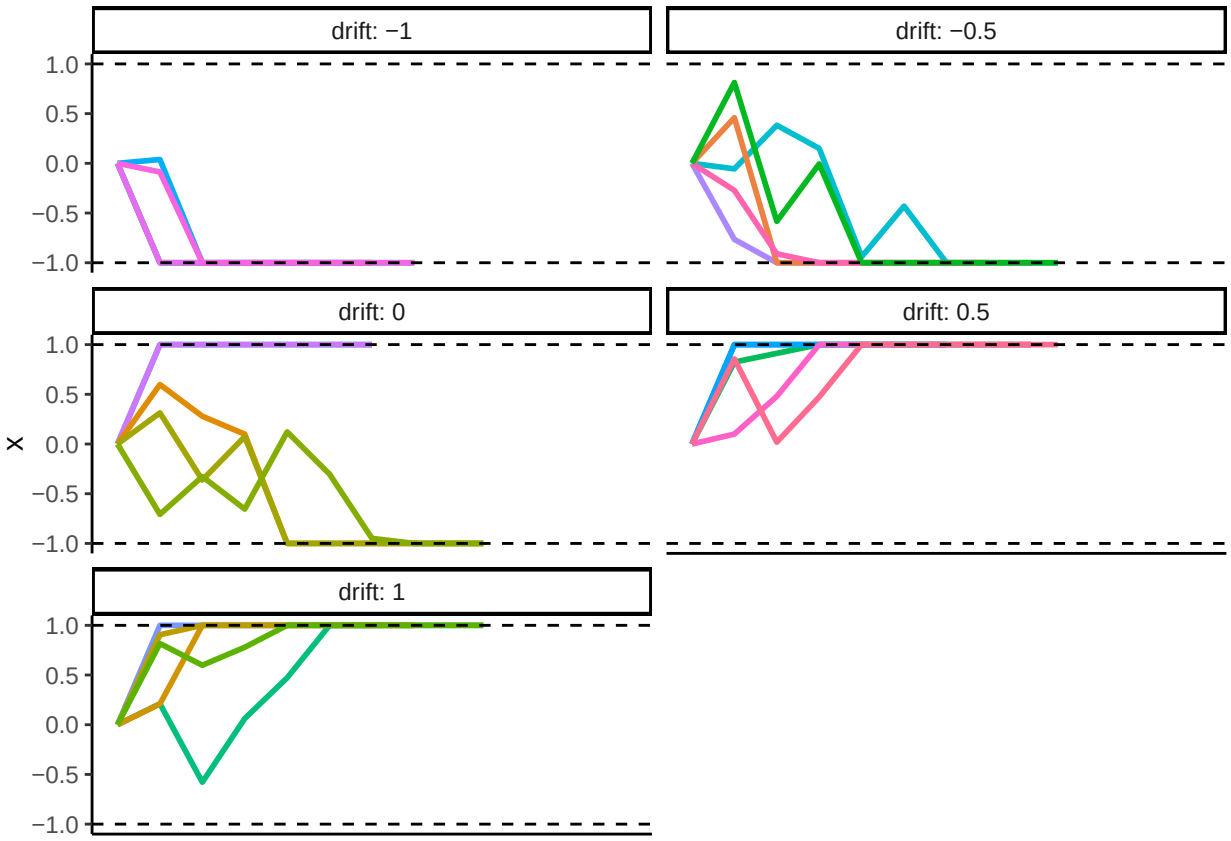
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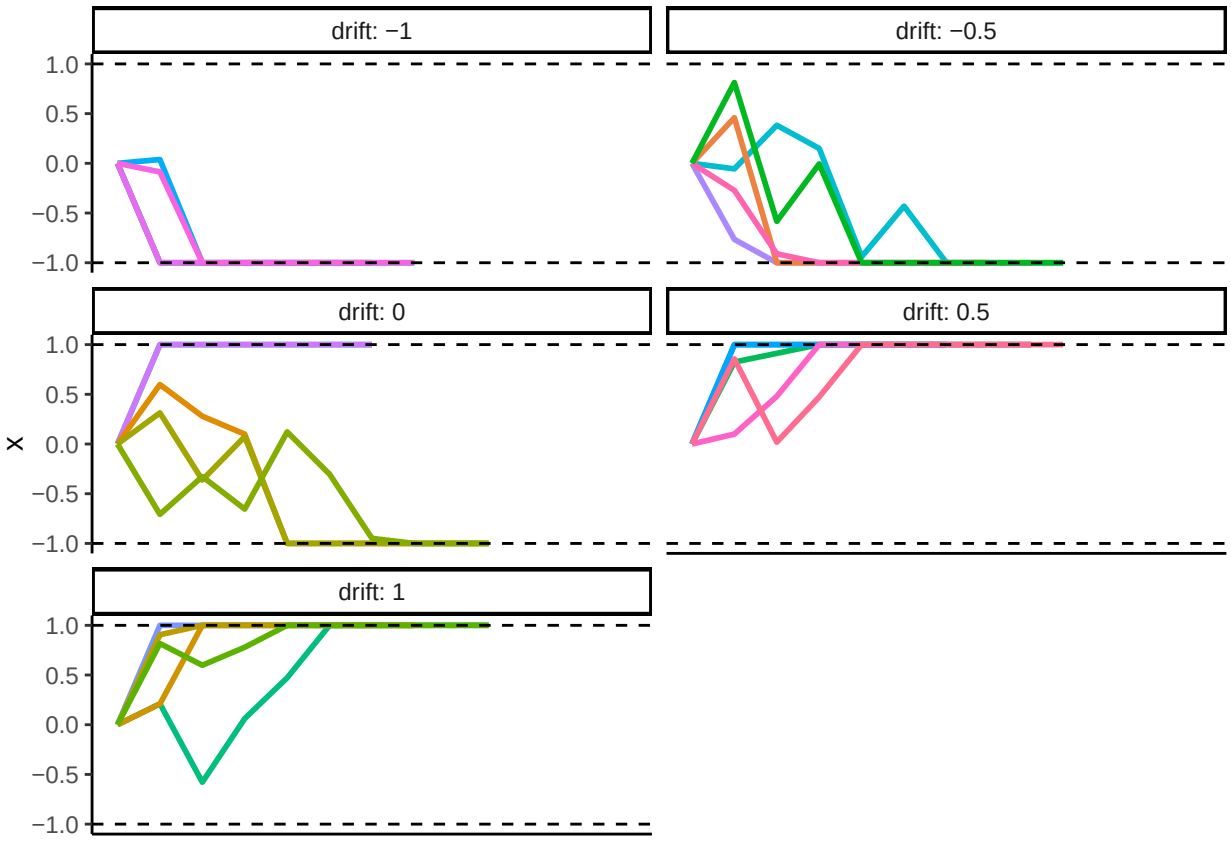
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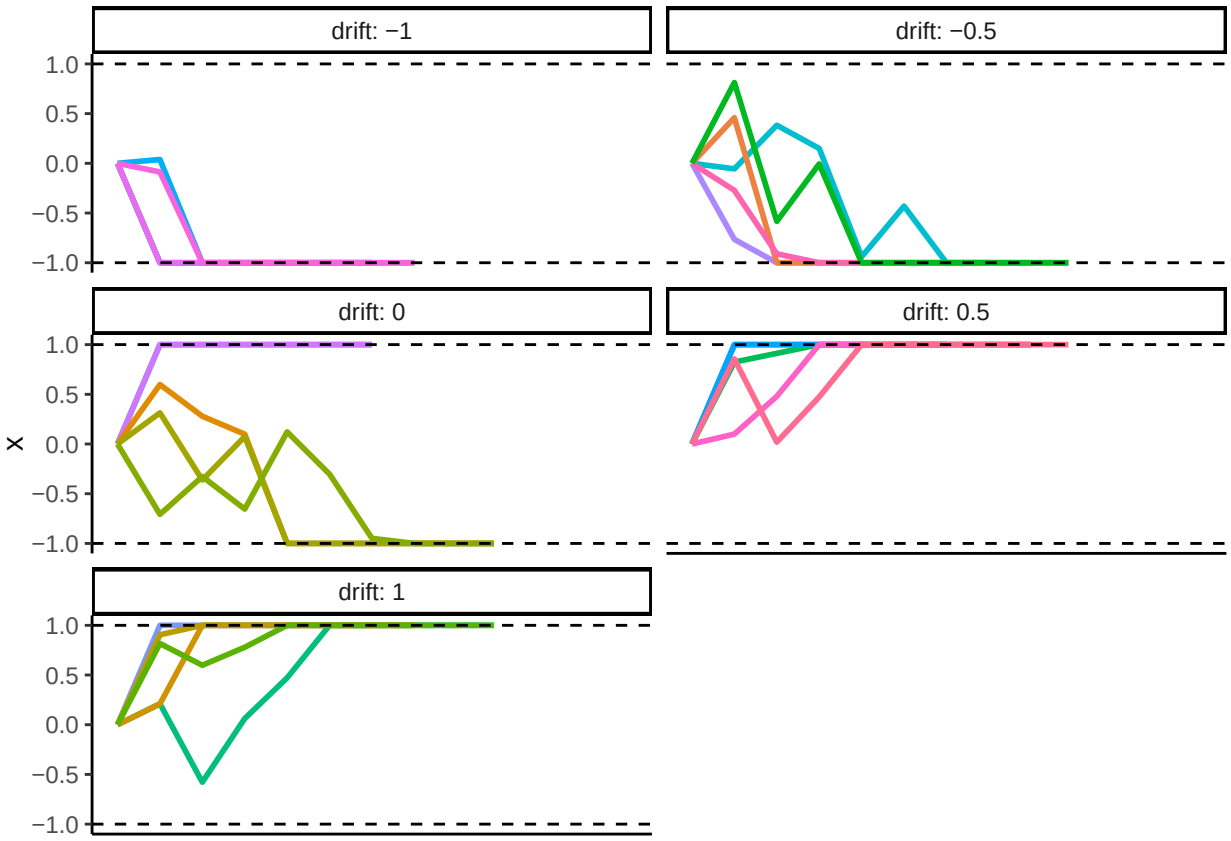
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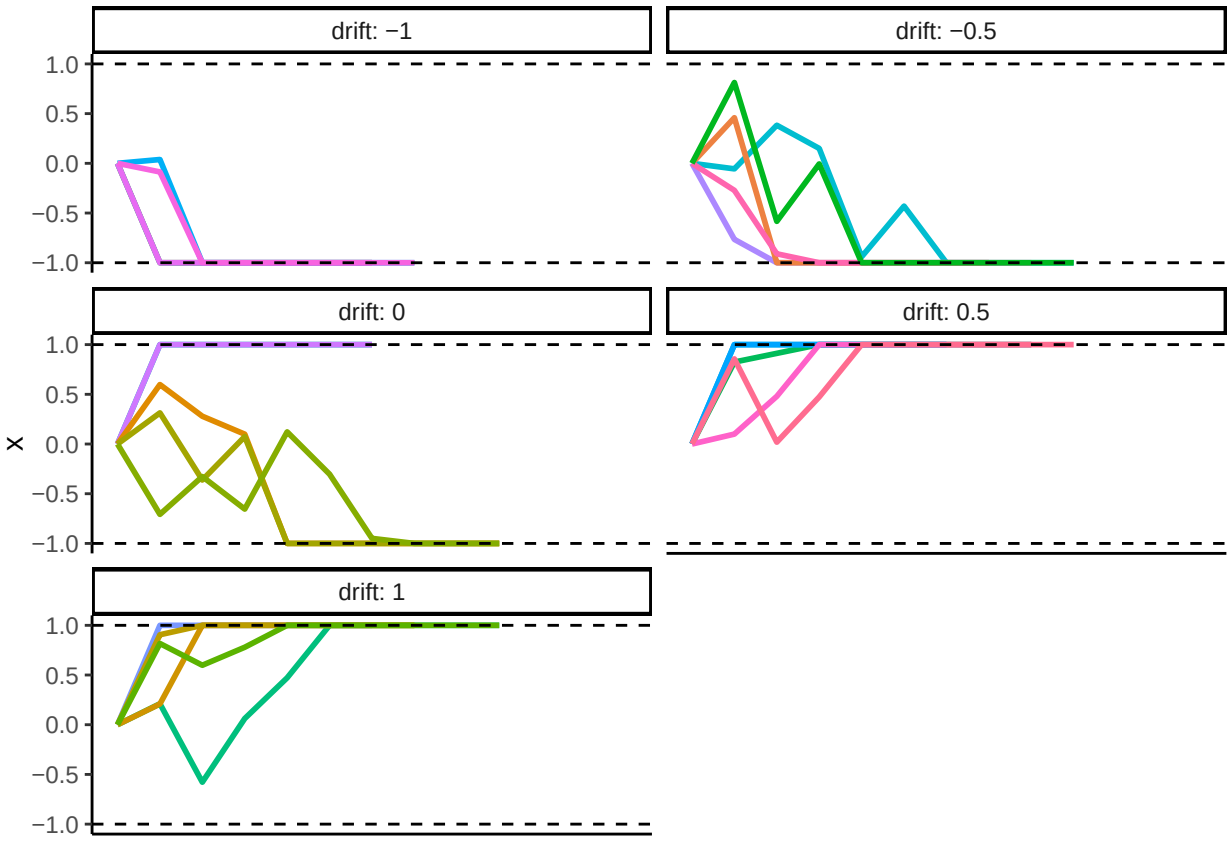
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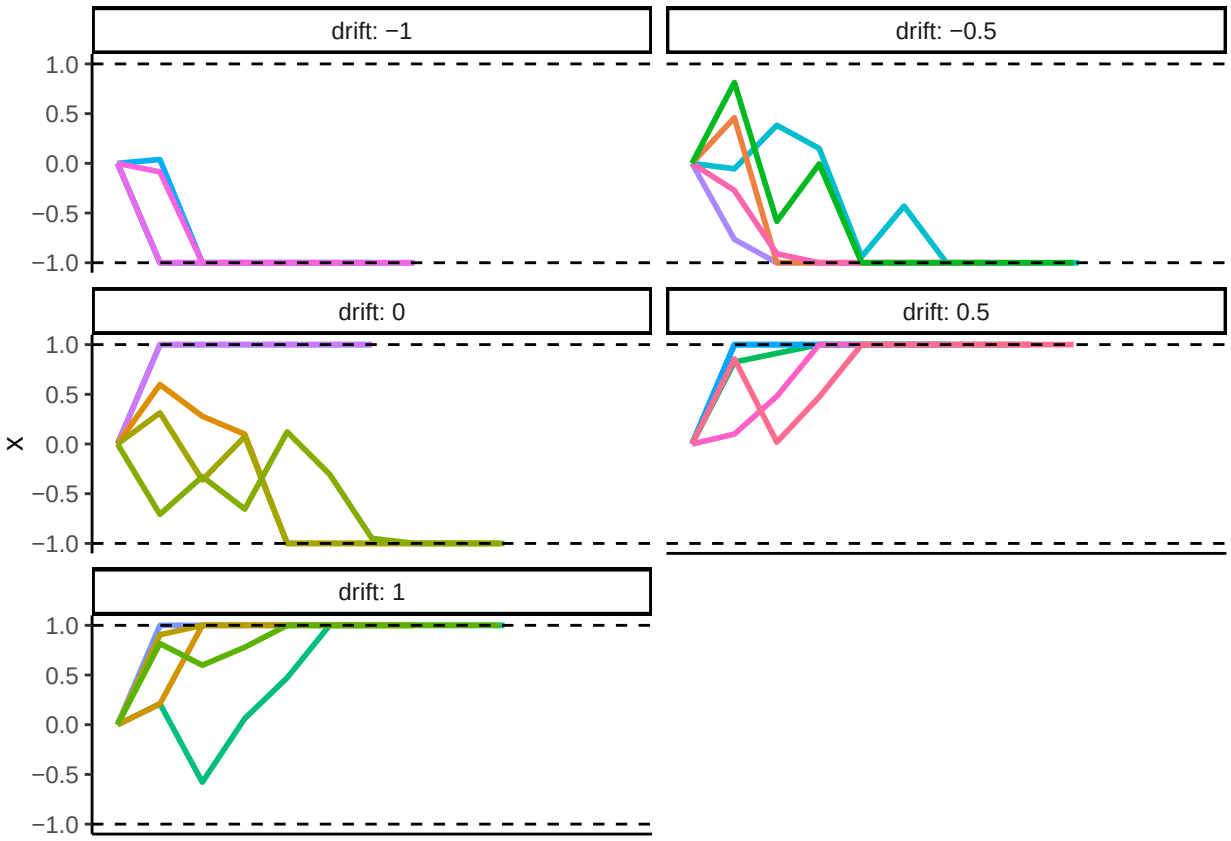
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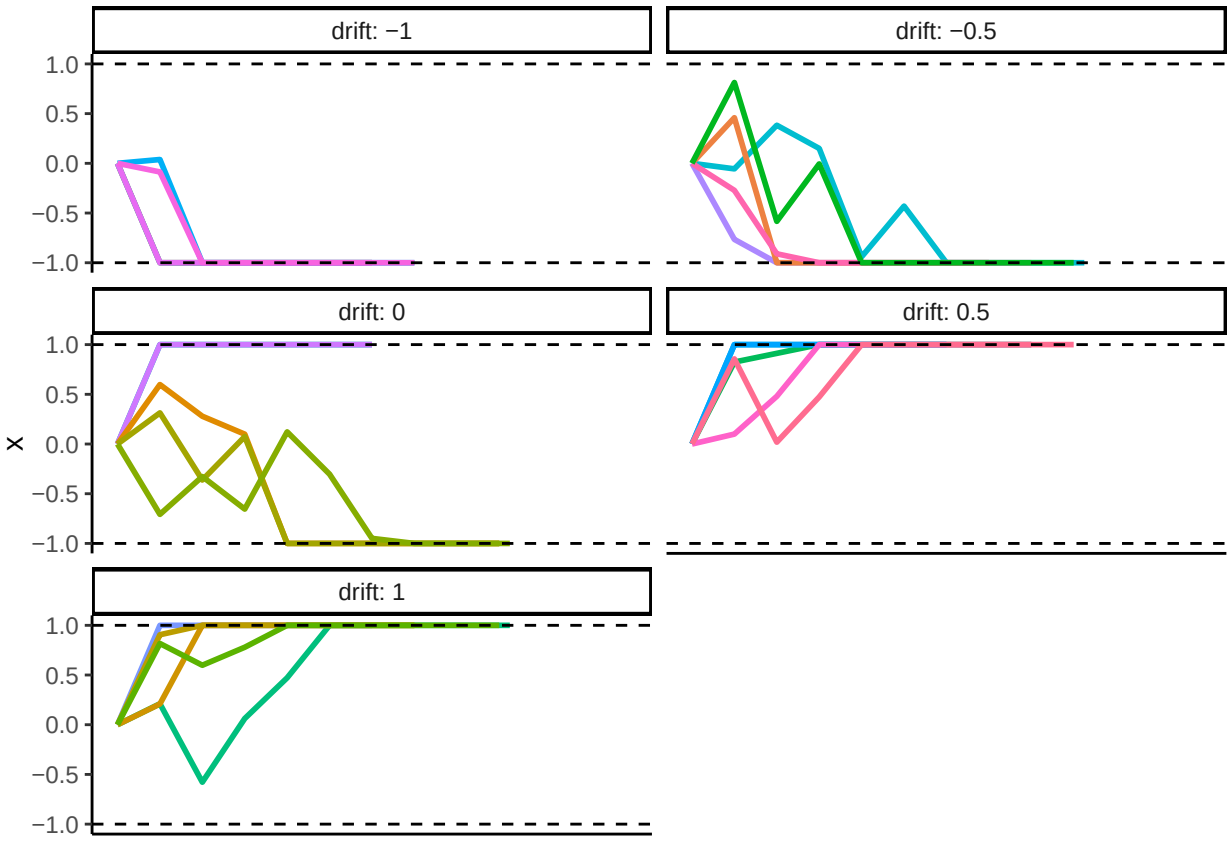
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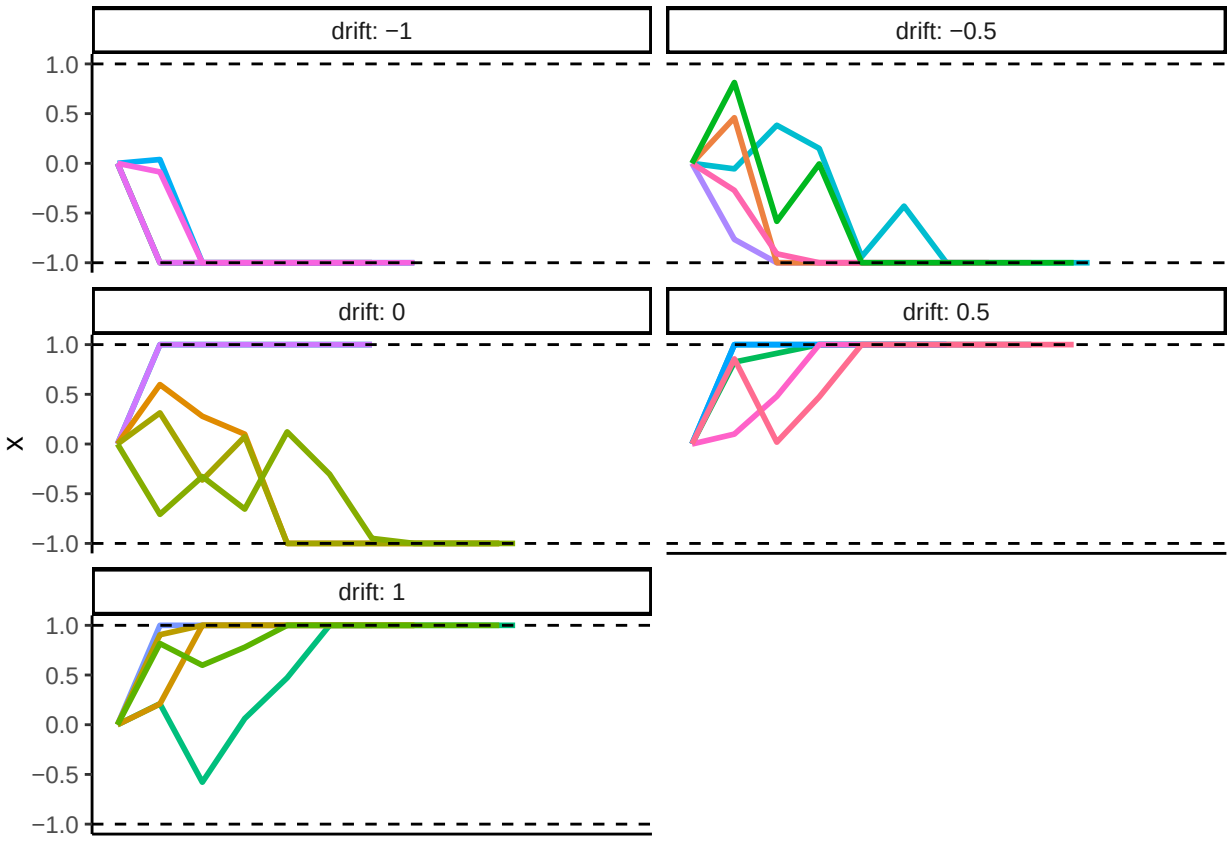
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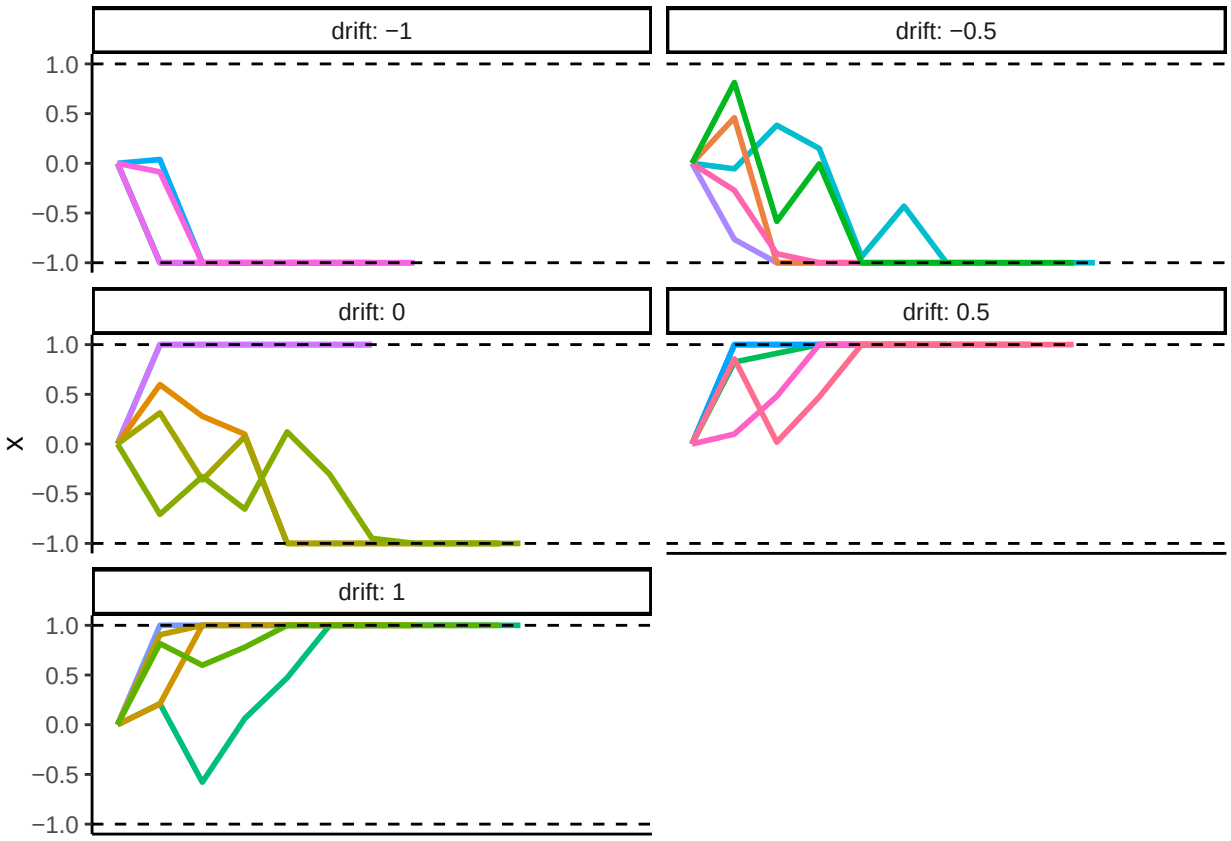
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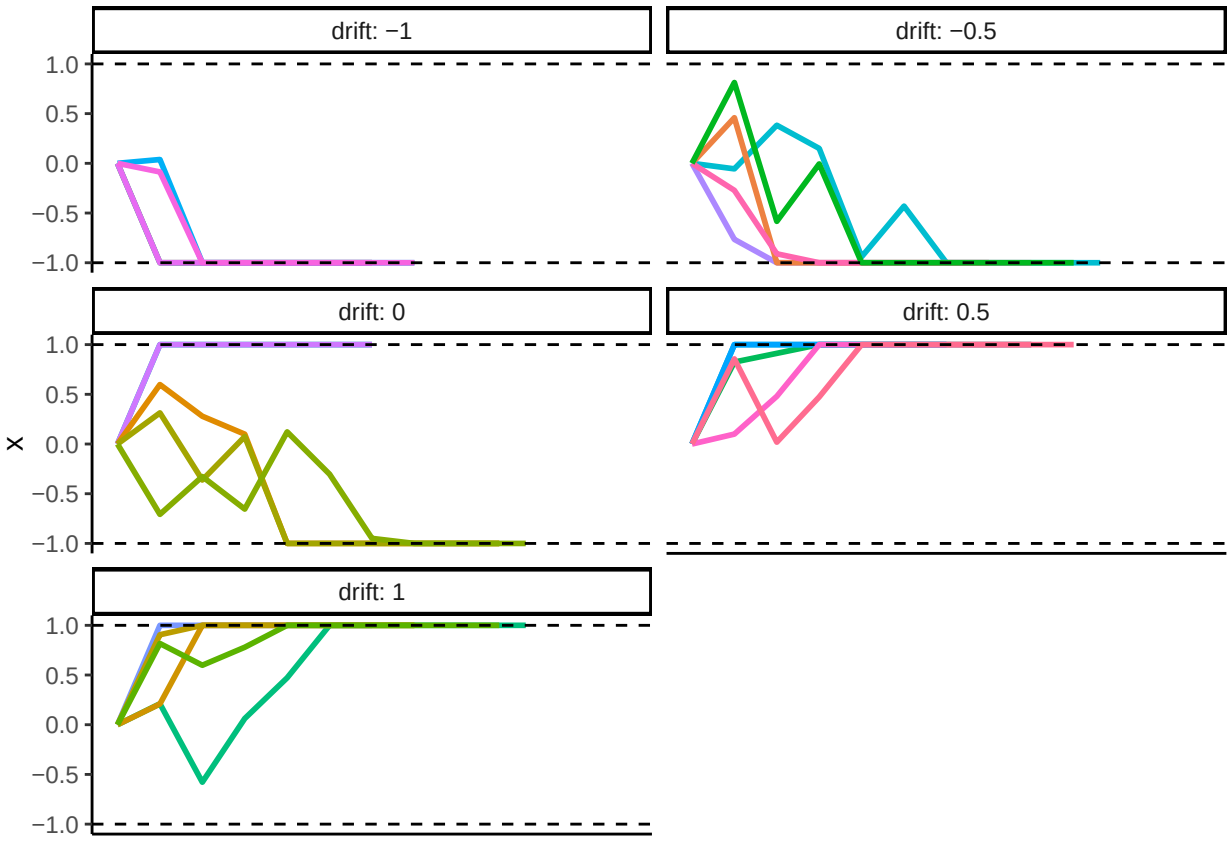
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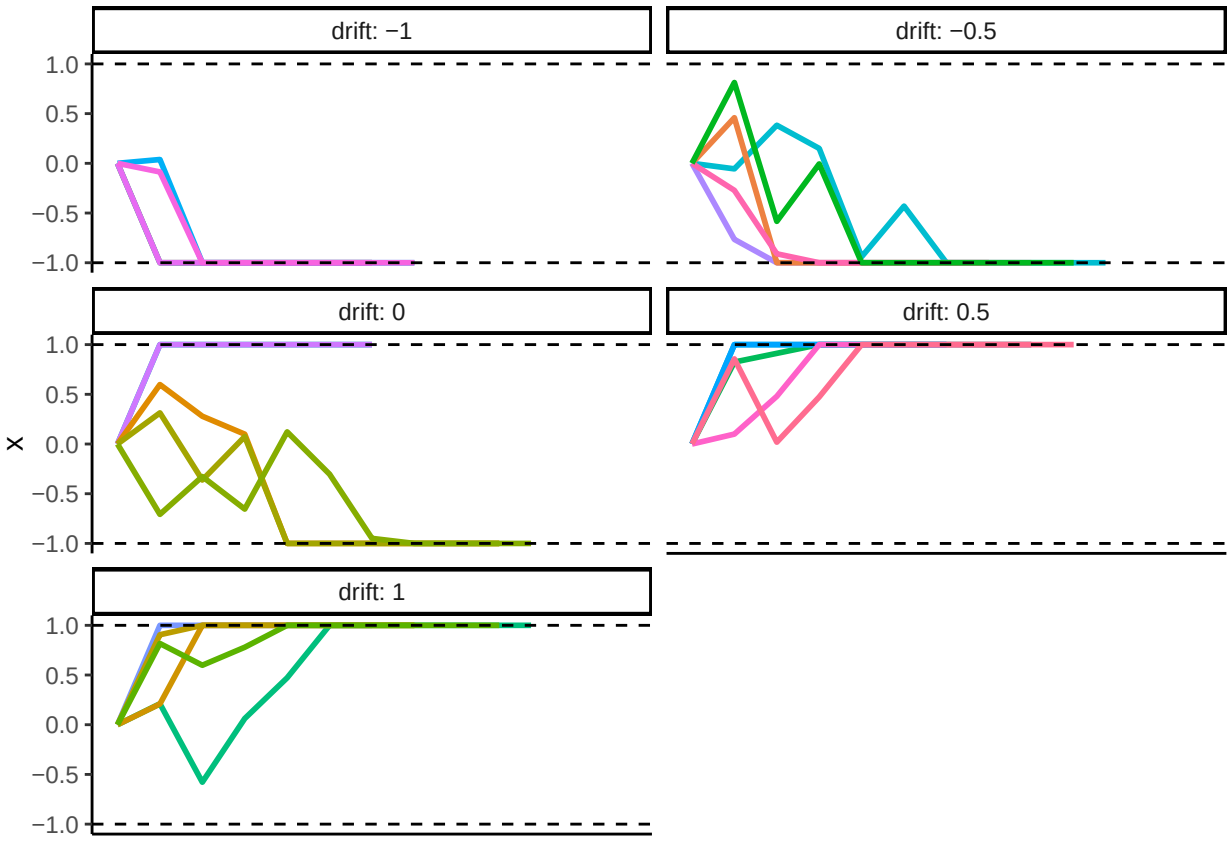
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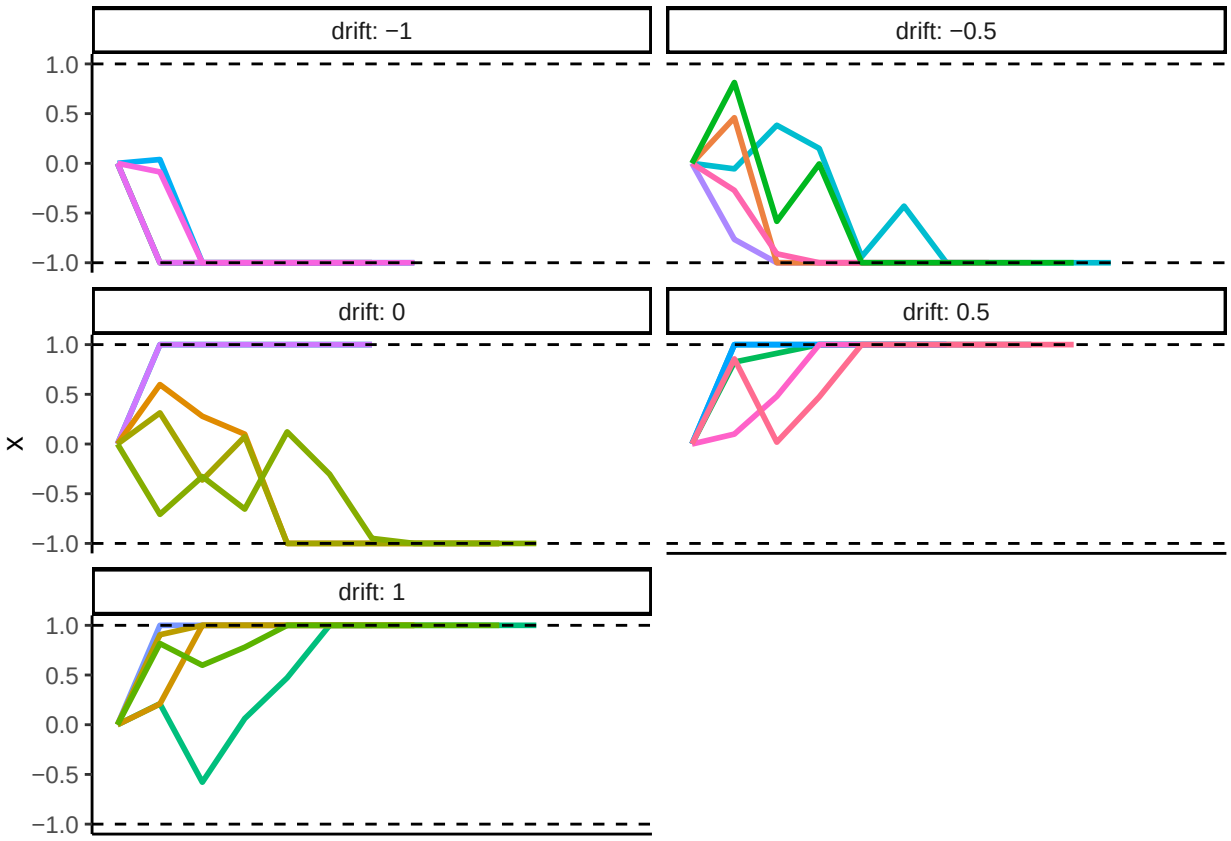
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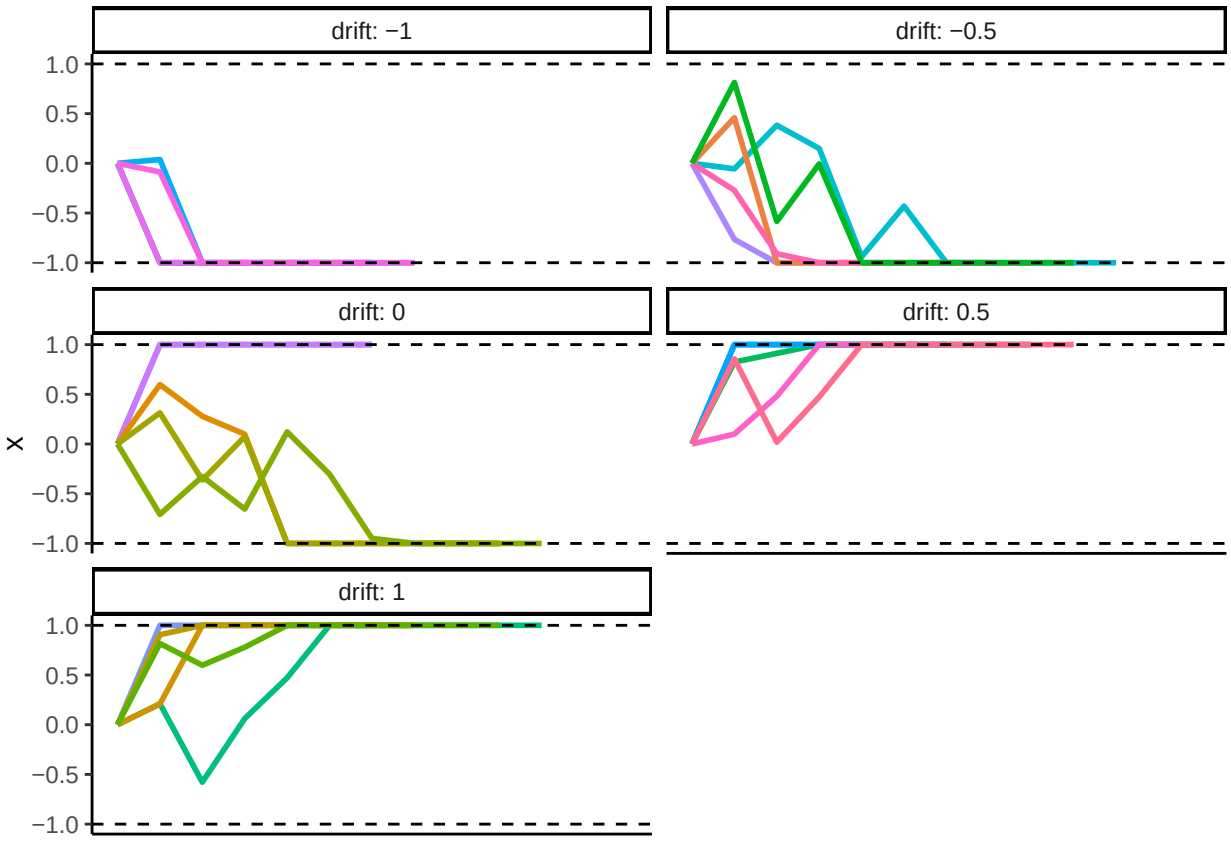
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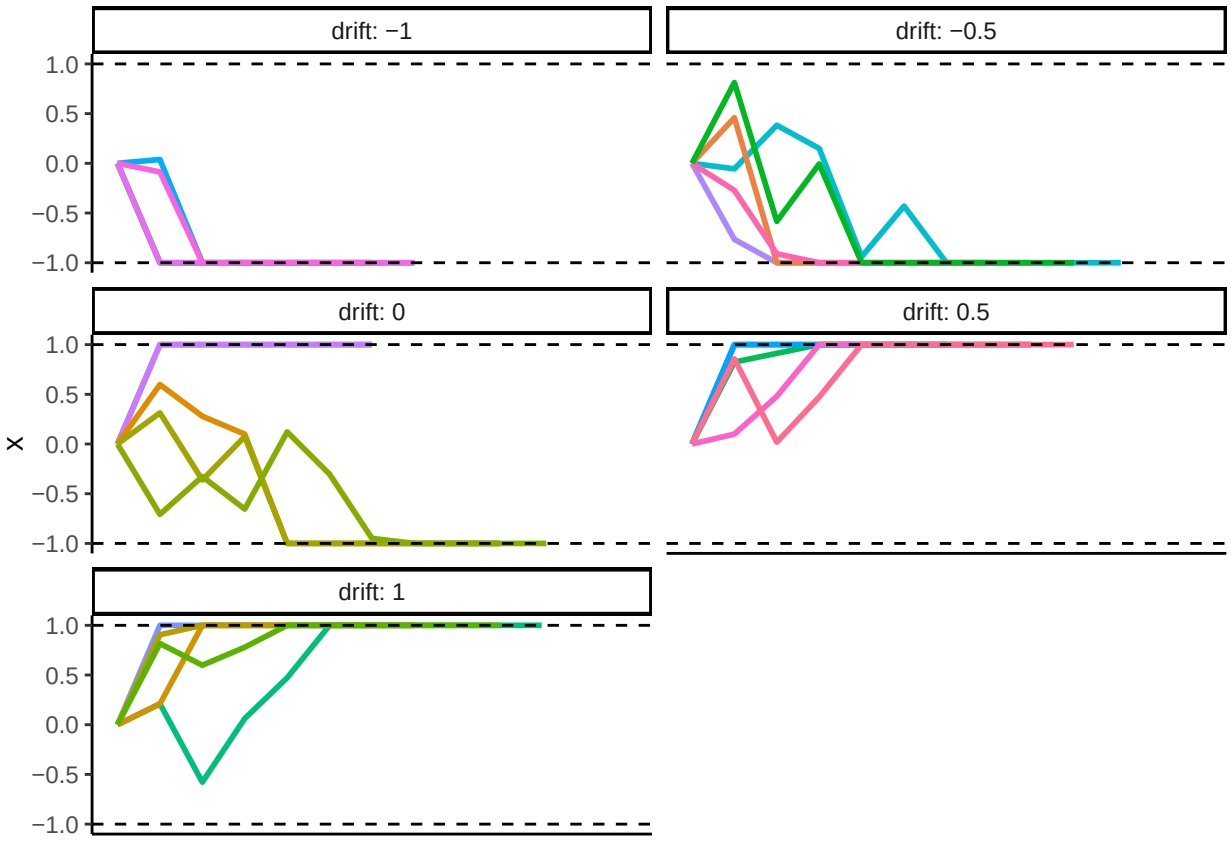
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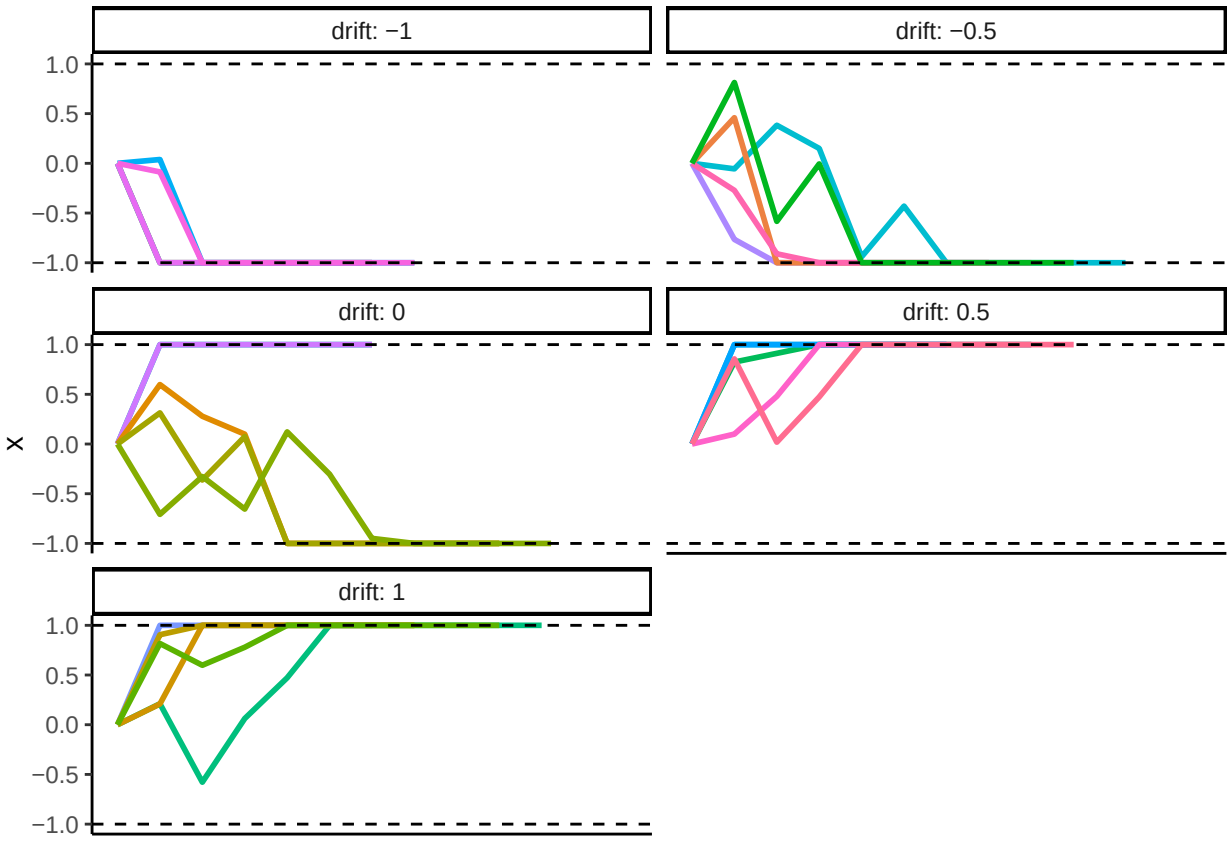
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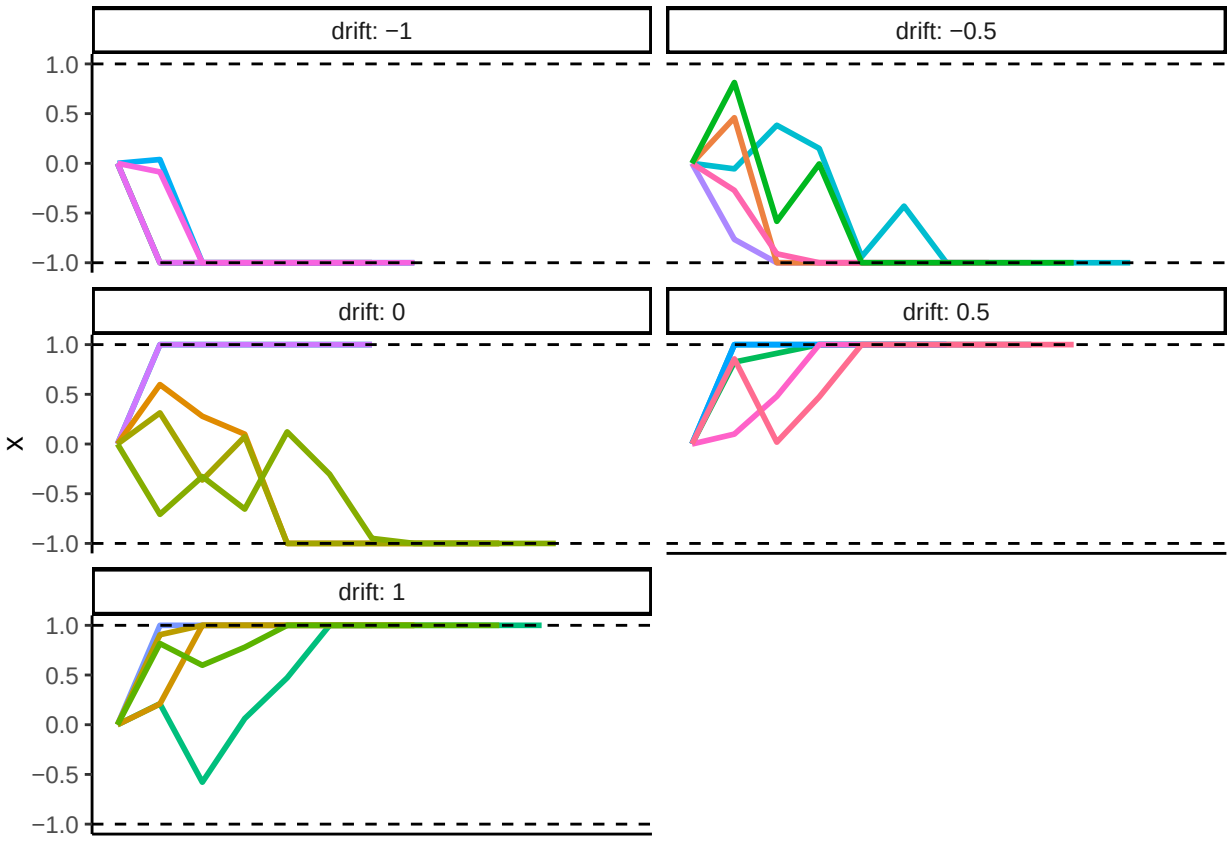
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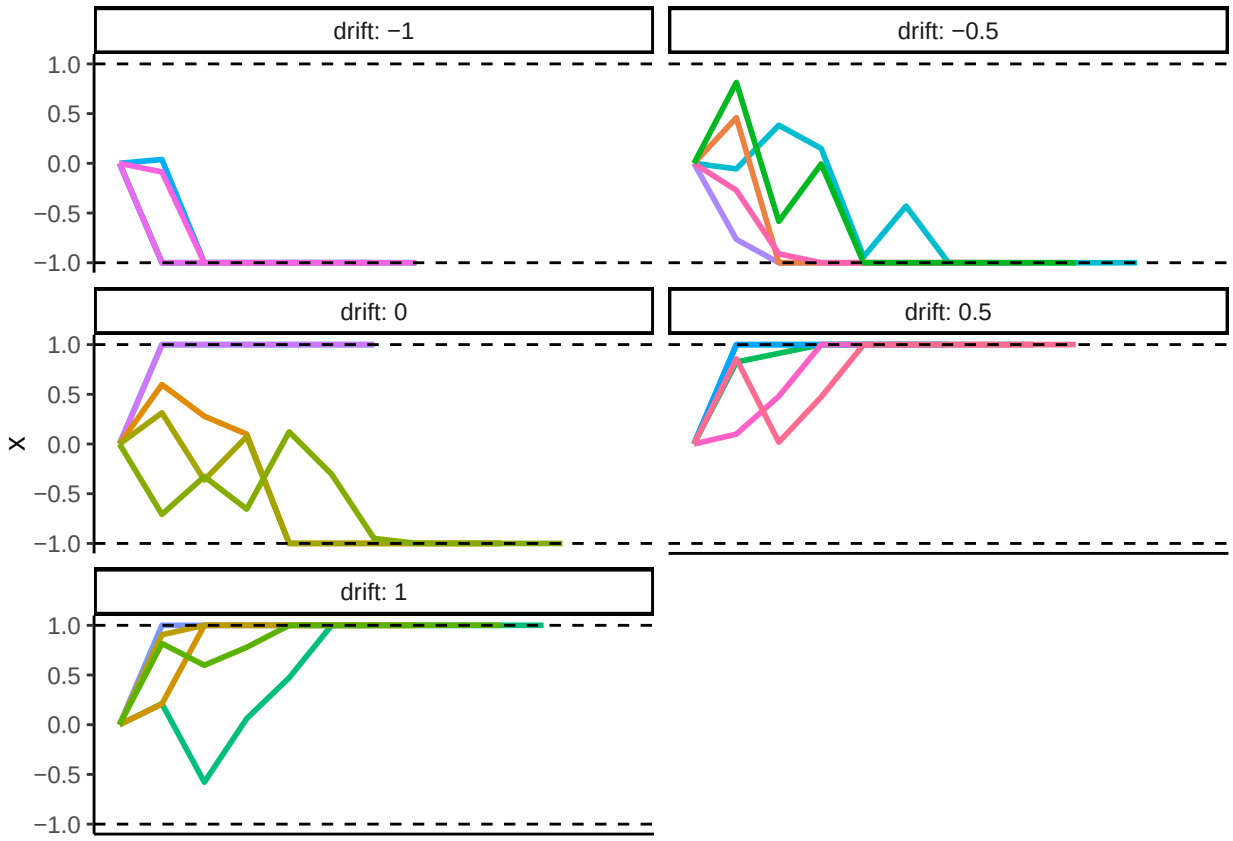
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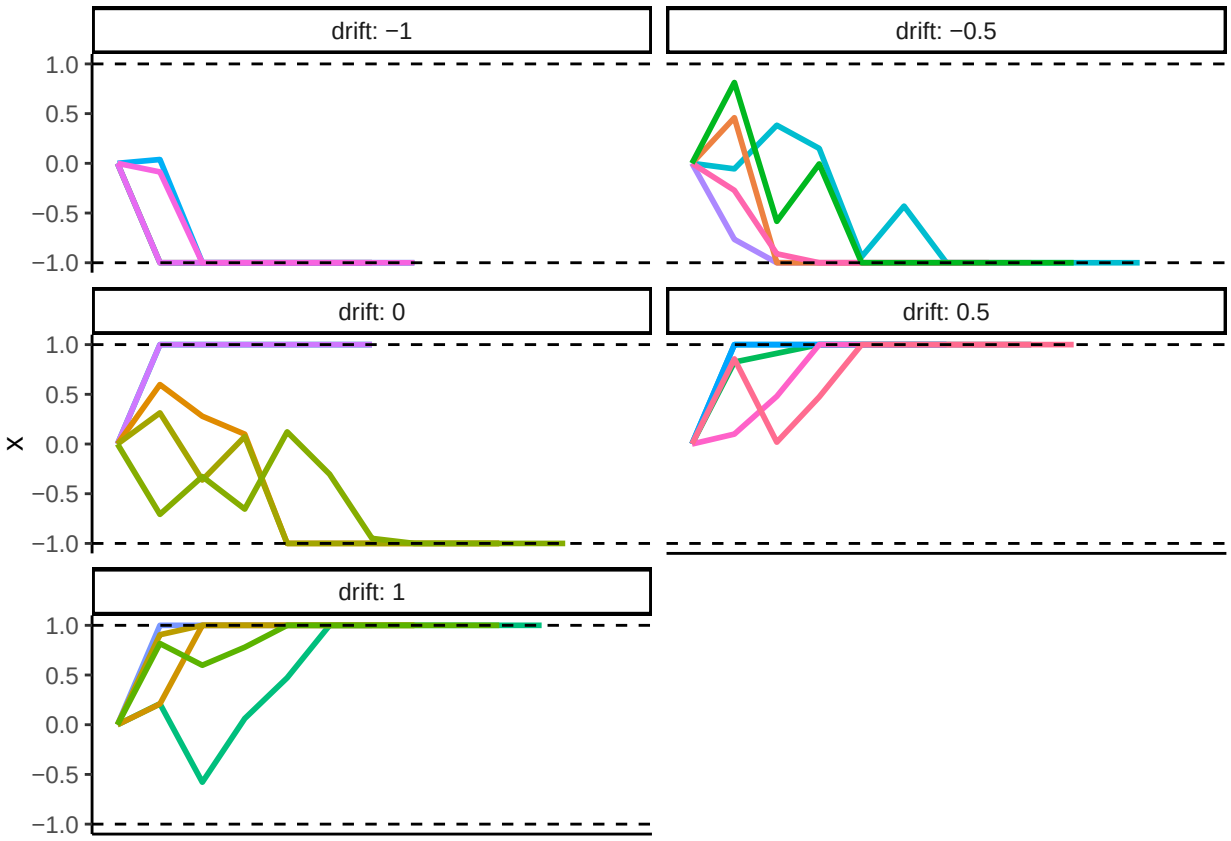
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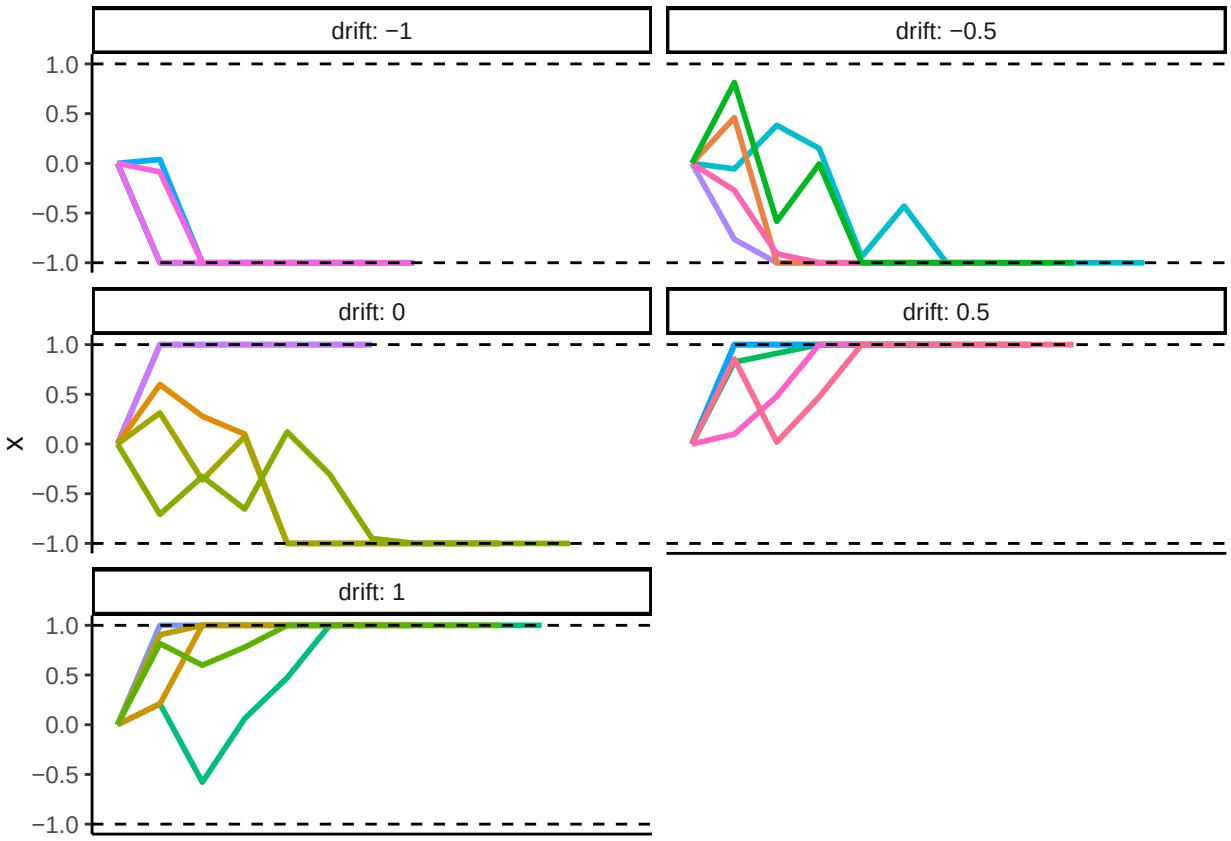
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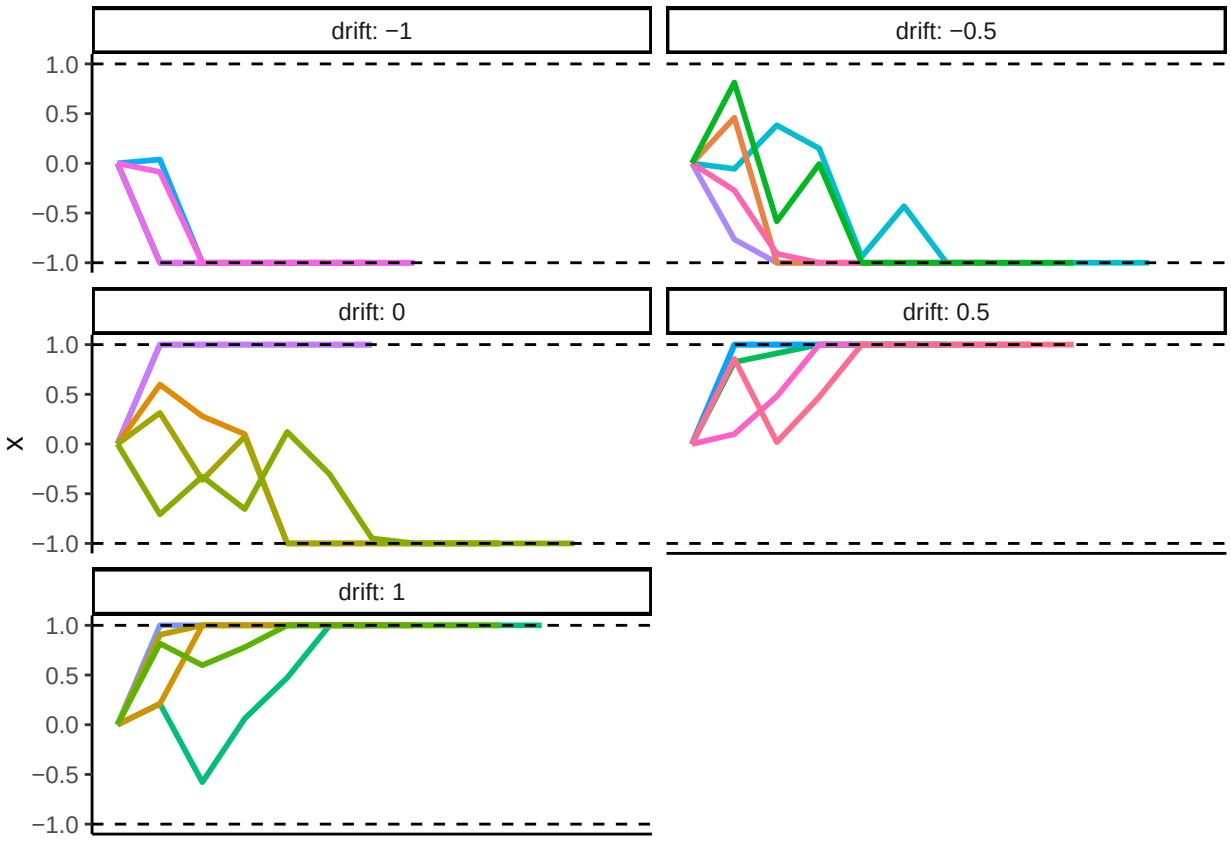
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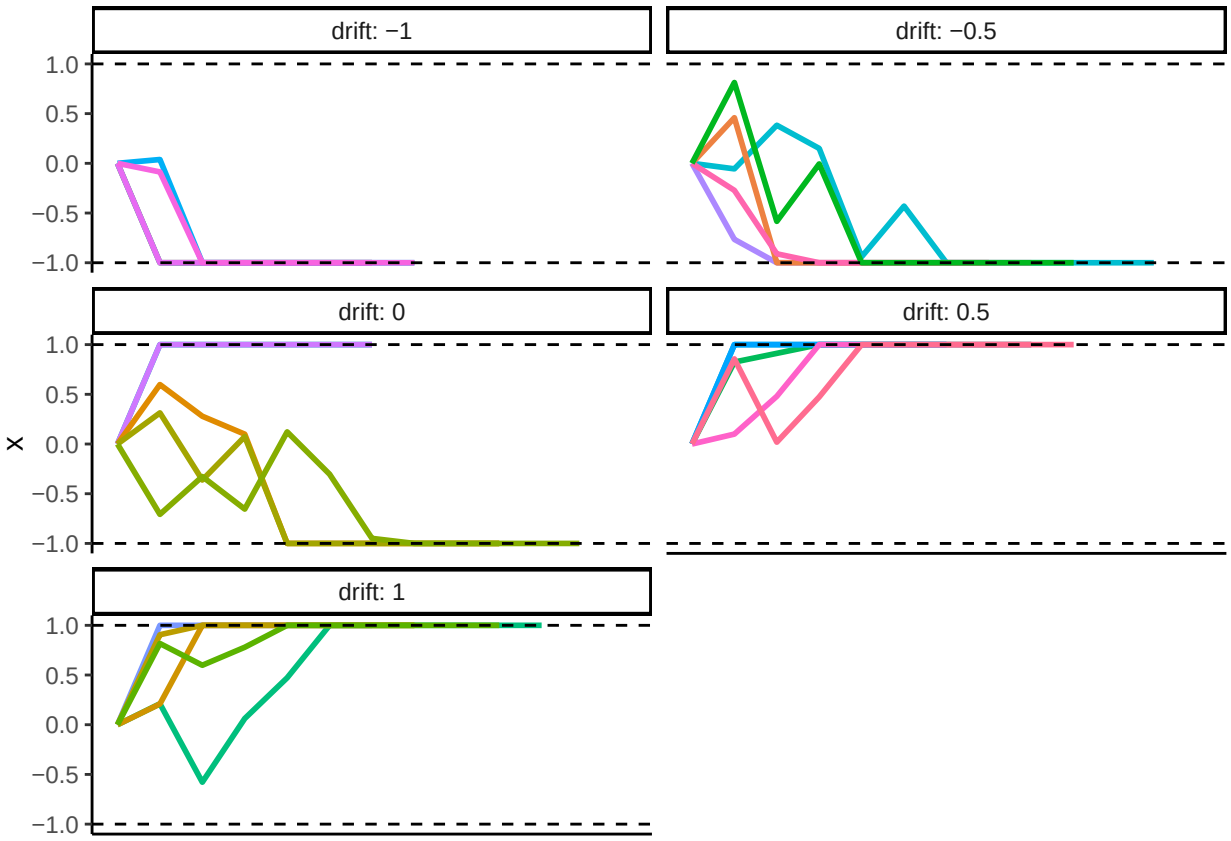
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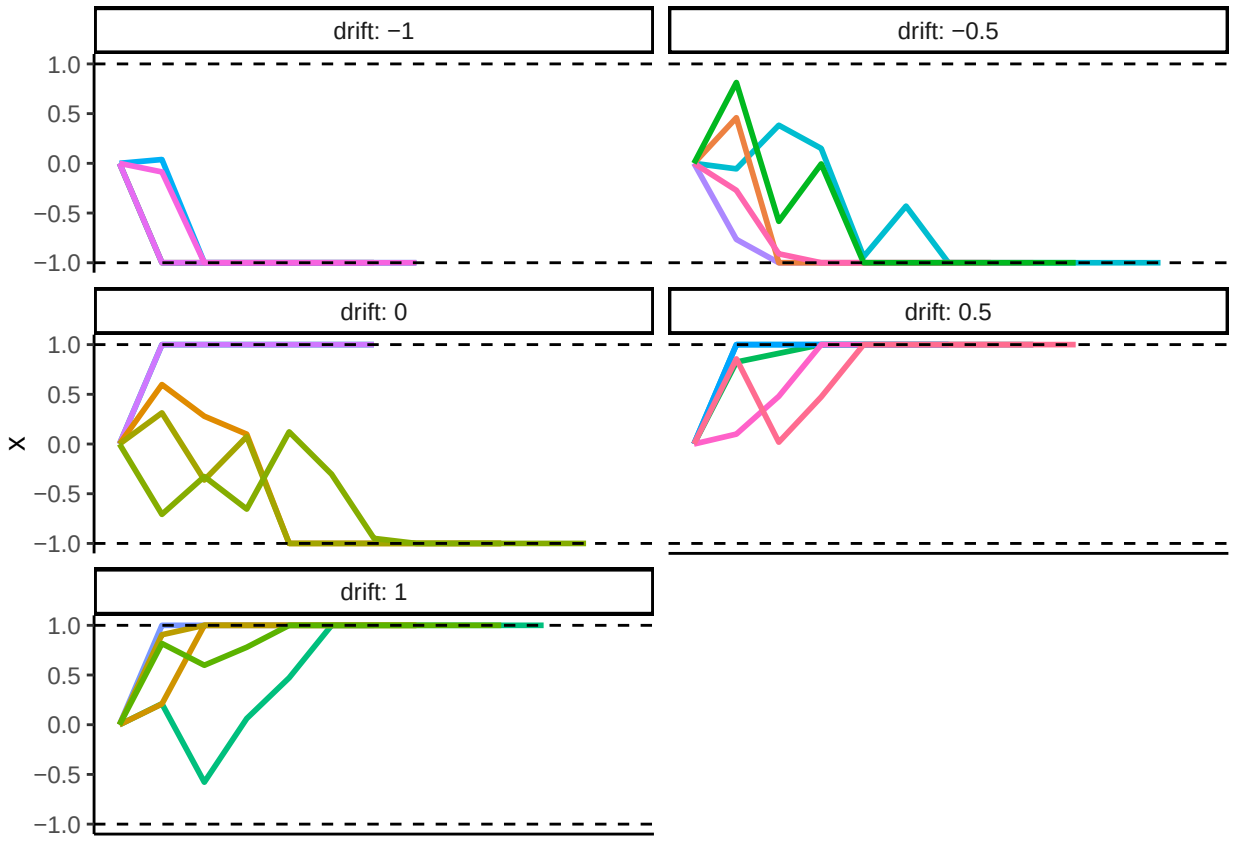
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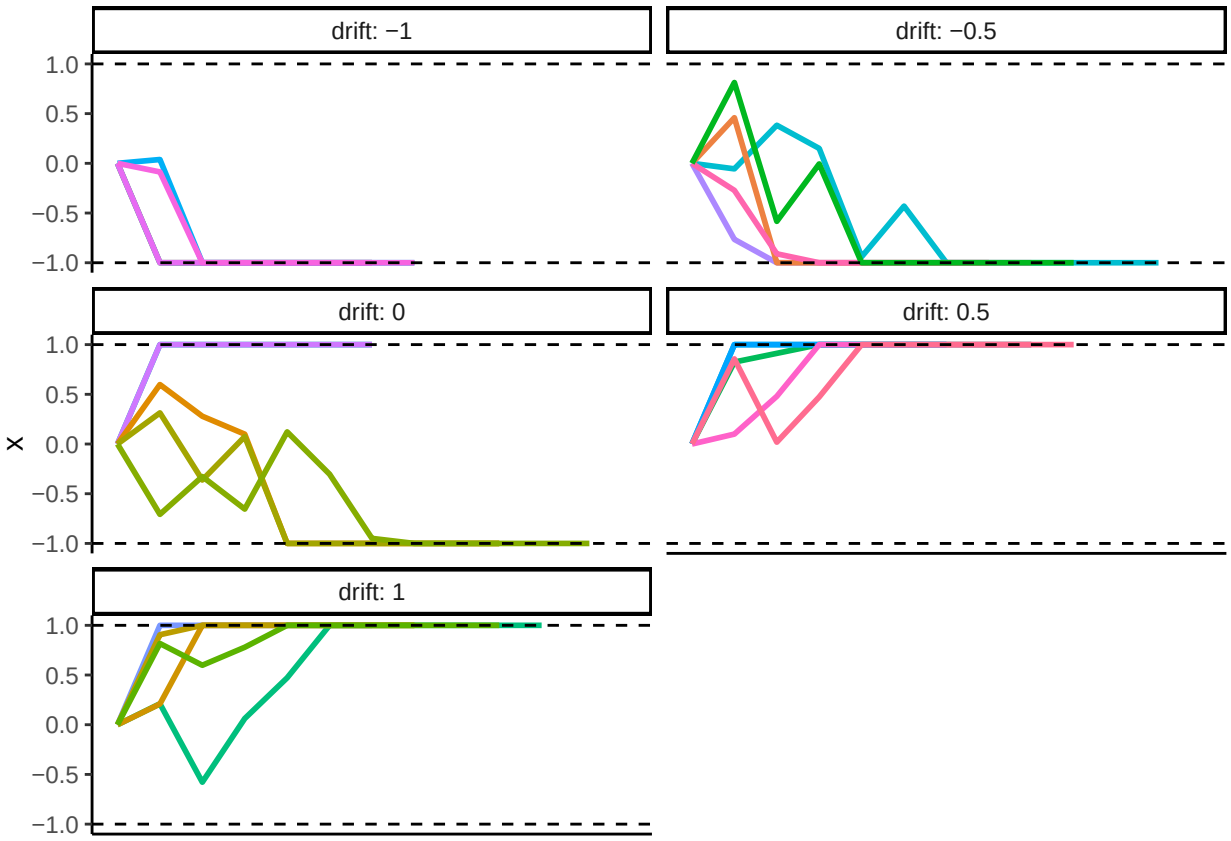
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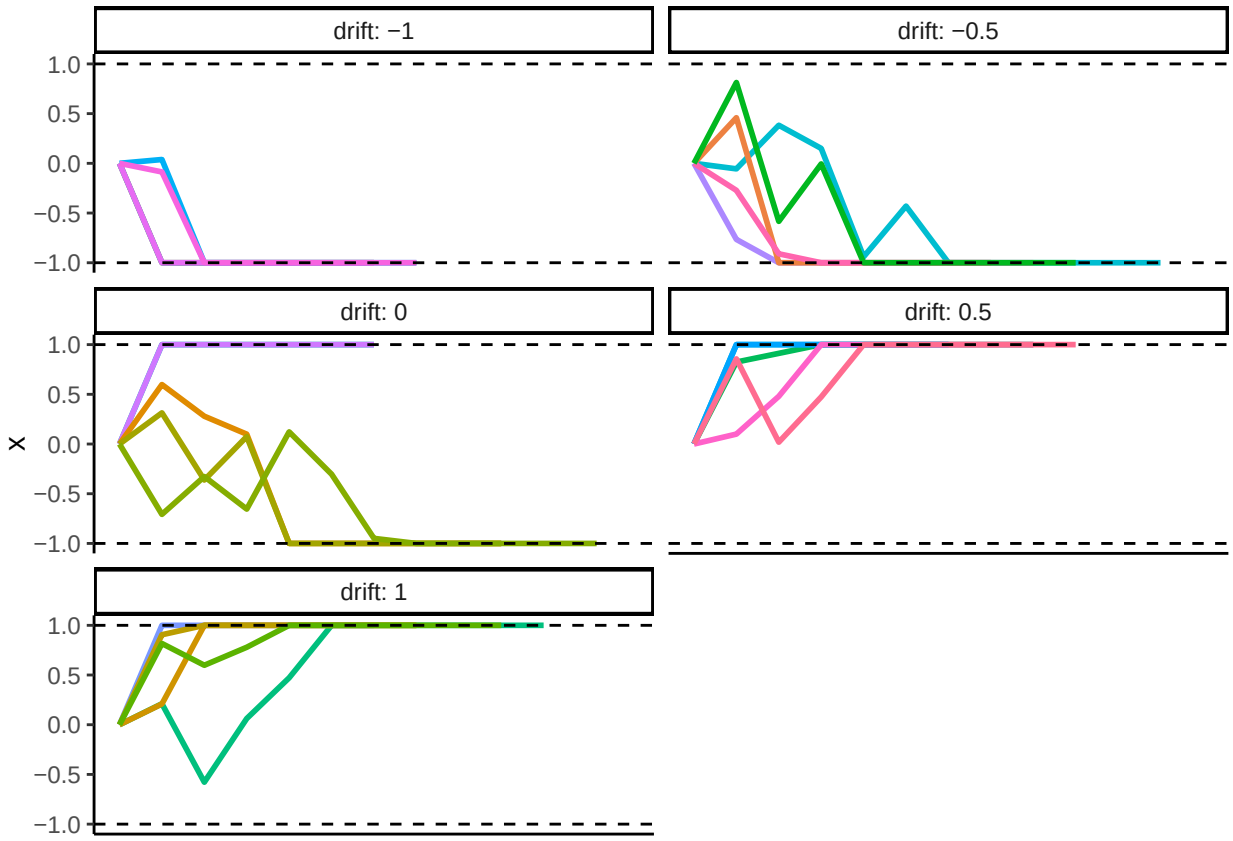
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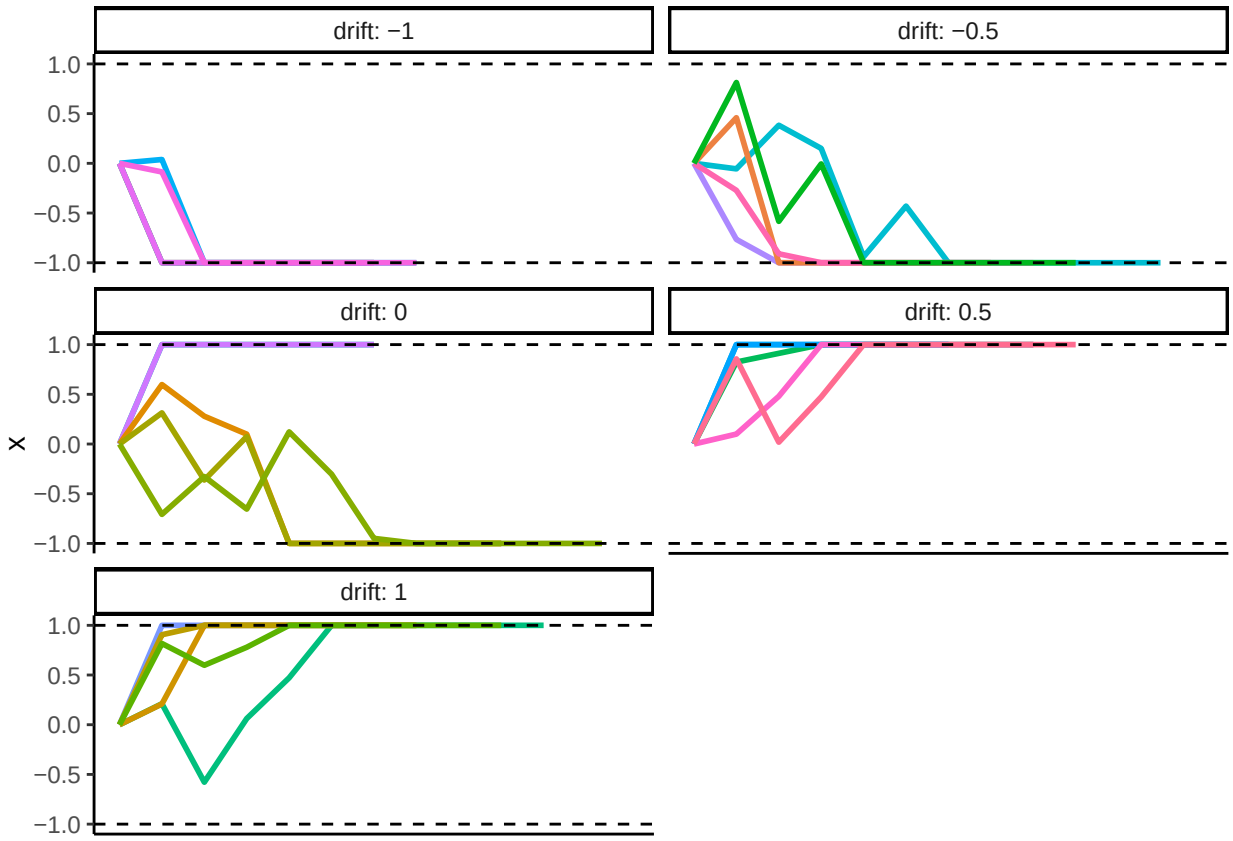
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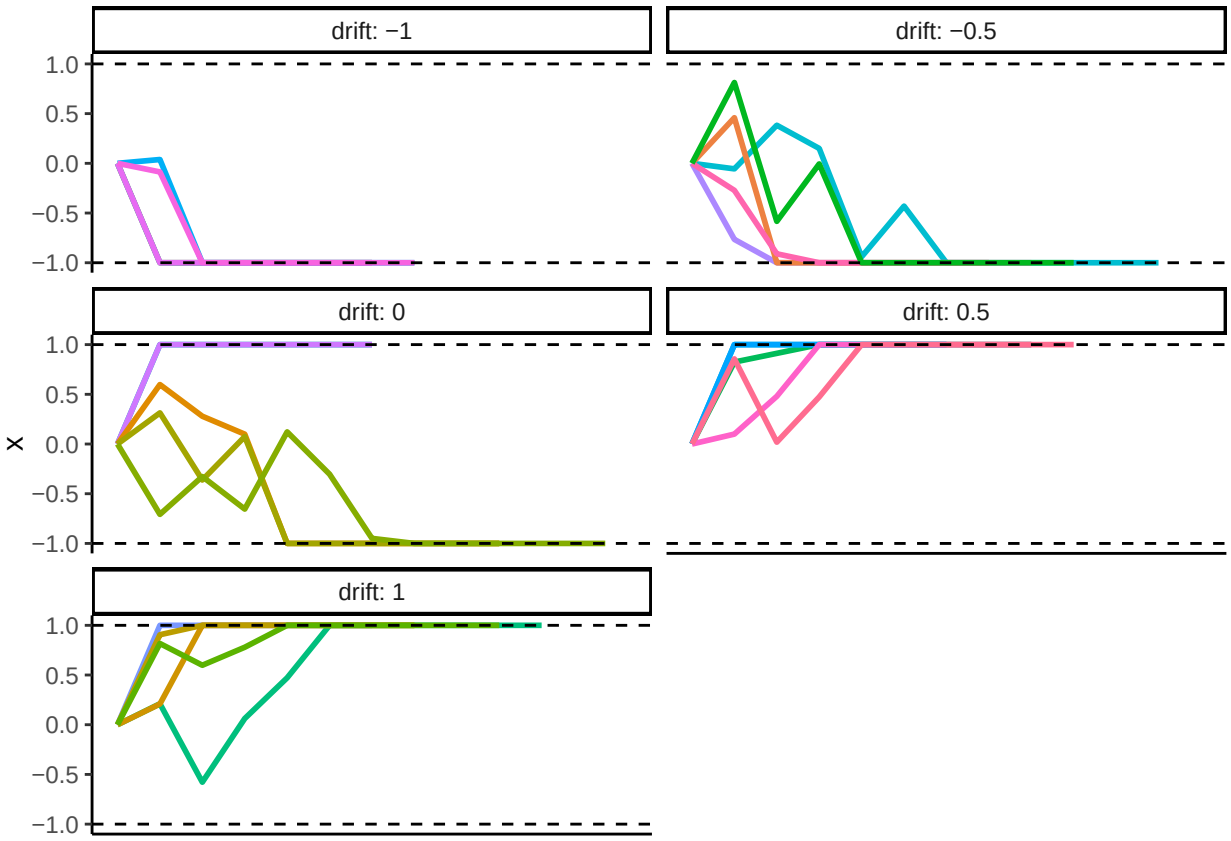
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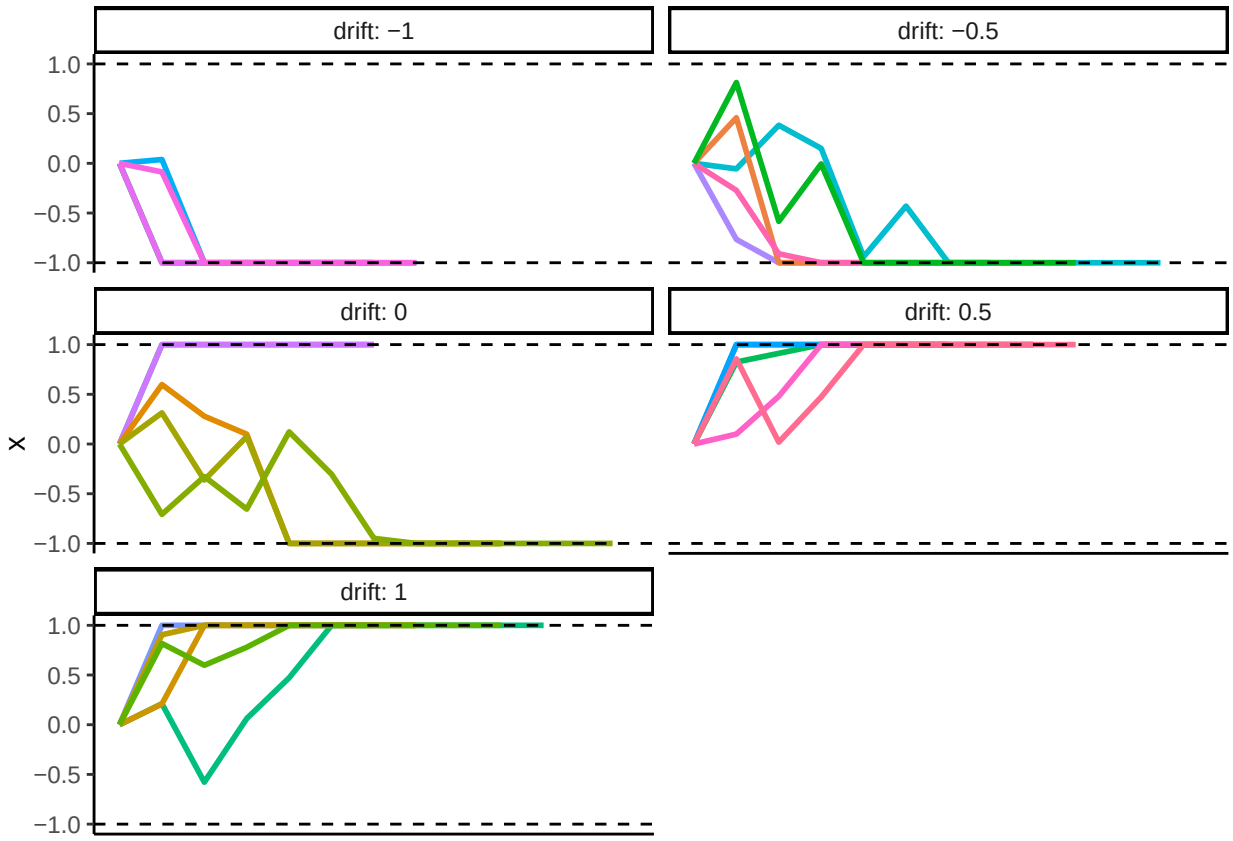
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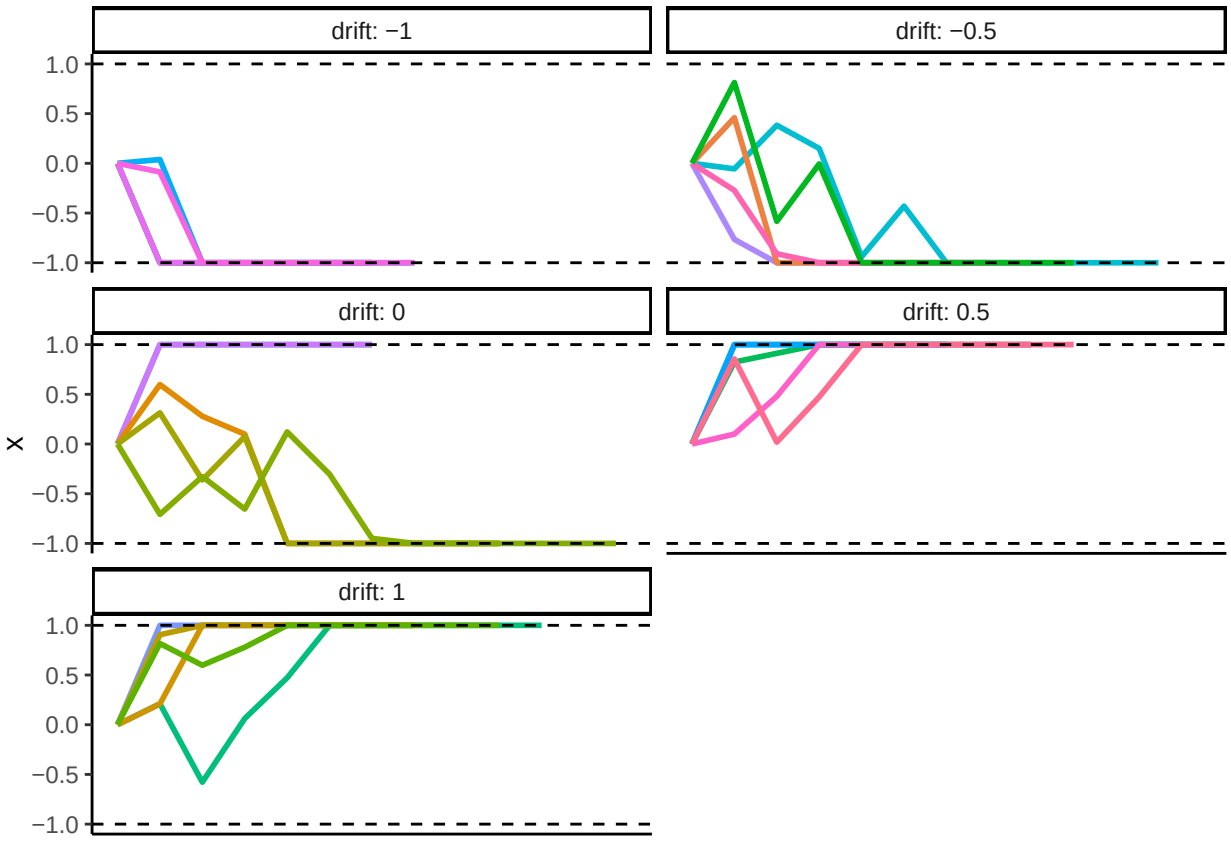
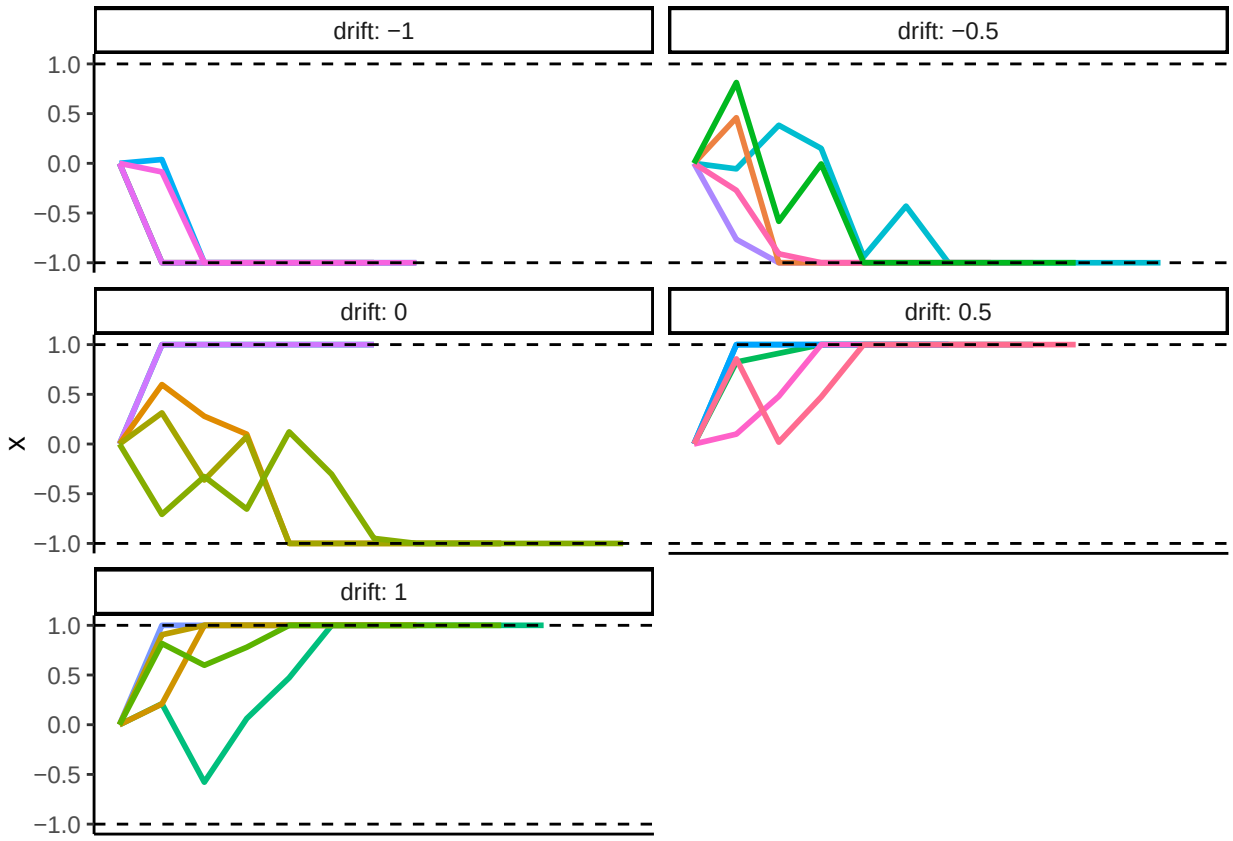
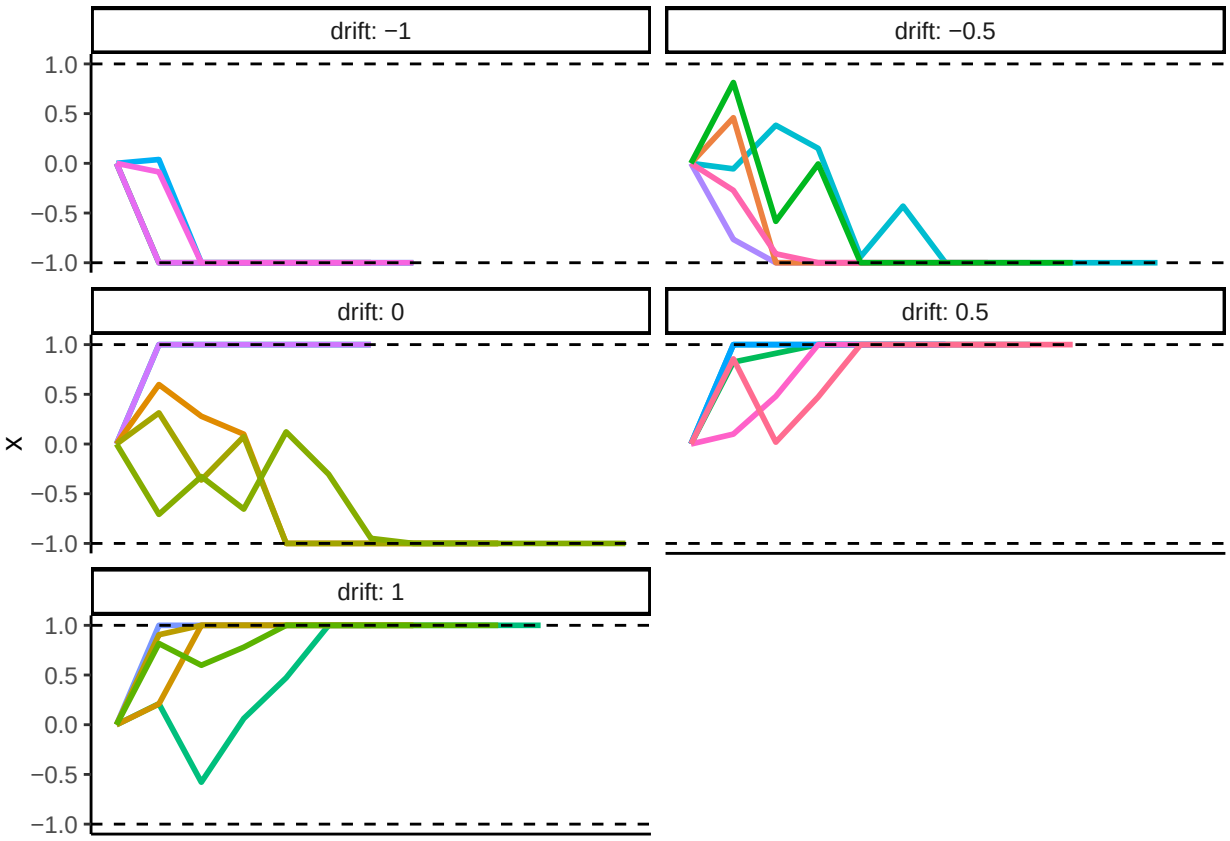
−0.5
−1.0


drift: −1
drift: −0.5
drift: 0
drift: 0.5
drift: 1
x
1.0
0.5
0.0
−0.5
−1.0


drift: −1
drift: −0.5
drift: 0
drift: 0.5
drift: 1
x
1.0
0.5
0.0
−0.5
−1.0



Lastly we can look at the RT distribution for both lower and upper bound hits for different drift rates:

```
max_time = seq(500,length.out = 1)

bias = seq(0.5,length.out = 1)

sd = seq(1,length.out = 1)

bound = seq(1,2,length.out = 1)

drift = seq(-1,1,length.out = 5)

replicate = 1:100


params = expand.grid(max_time = max_time,
                     bias = bias,
                     sd = sd,
                     bound = bound,
                     drift = drift,
                     replicate = replicate) %>%
  mutate(id = 1:nrow(.))

data_list <- split(params, params$id)
```

```
plan(multisession, workers = 3)
weiners = future_map(data_list, ~make_weiner(.x), .progress = TRUE, .options = furrr_options(seed = TRU

data = map_dfr(weiners,1)

data %>% na.omit(data) %>% group_by(col,drift) %>% summarize(last(resp))
```

```
## `summarise()` has grouped output by 'col'. You can override using the `.groups`
## argument.
```

```
## # A tibble: 492 x 3
## # Groups:   col [462]
##      col drift `last(resp)`
##    <dbl> <dbl> <chr>
##  1 -2728  -1   lower
##  2 -2359  -0.5 lower
##  3 -2218   0   lower
##  4 -2131  -1   lower
##  5 -2125  -0.5 lower
##  6 -2072   0.5 upper
##  7 -2059  -1   upper
##  8 -2010   0   lower
##  9 -2004  -0.5 upper
## 10 -1987   0   lower
## # i 482 more rows
```

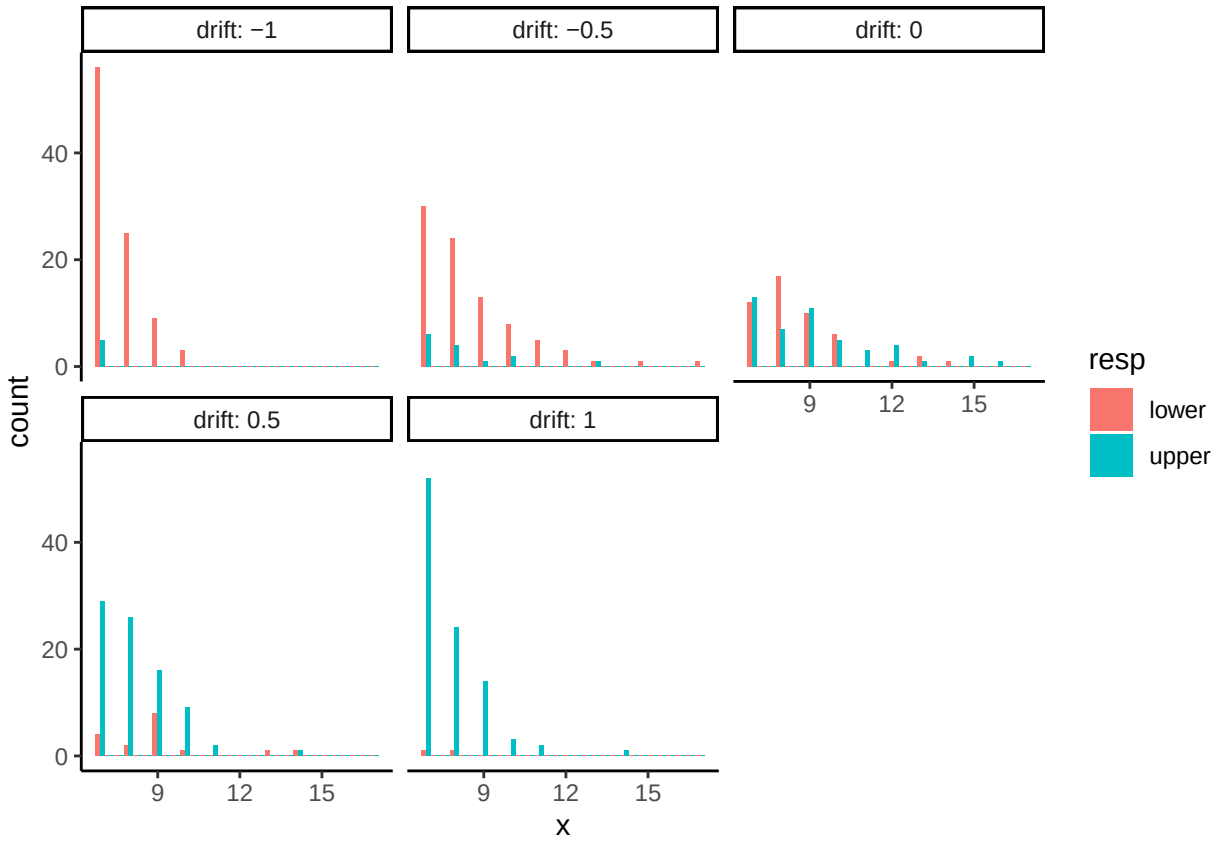
```
qq = na.omit(data) %>% group_by(col,drift) %>% summarize(x = max(x), resp = last(resp))  %>% ungroup() %
  ggplot(aes(x = x)) +
  geom_histogram(aes(fill = resp,bins = 30), position = position_dodge())+
  theme_classic()+
  facet_wrap(~drift, labeller = label_both)
```

```
## `summarise()` has grouped output by 'col'. You can override using the `.groups`
## argument.
```

```
## Warning in geom_histogram(aes(fill = resp, bins = 30), position =
## position_dodge()): Ignoring unknown aesthetics: bins
```

```
qq
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



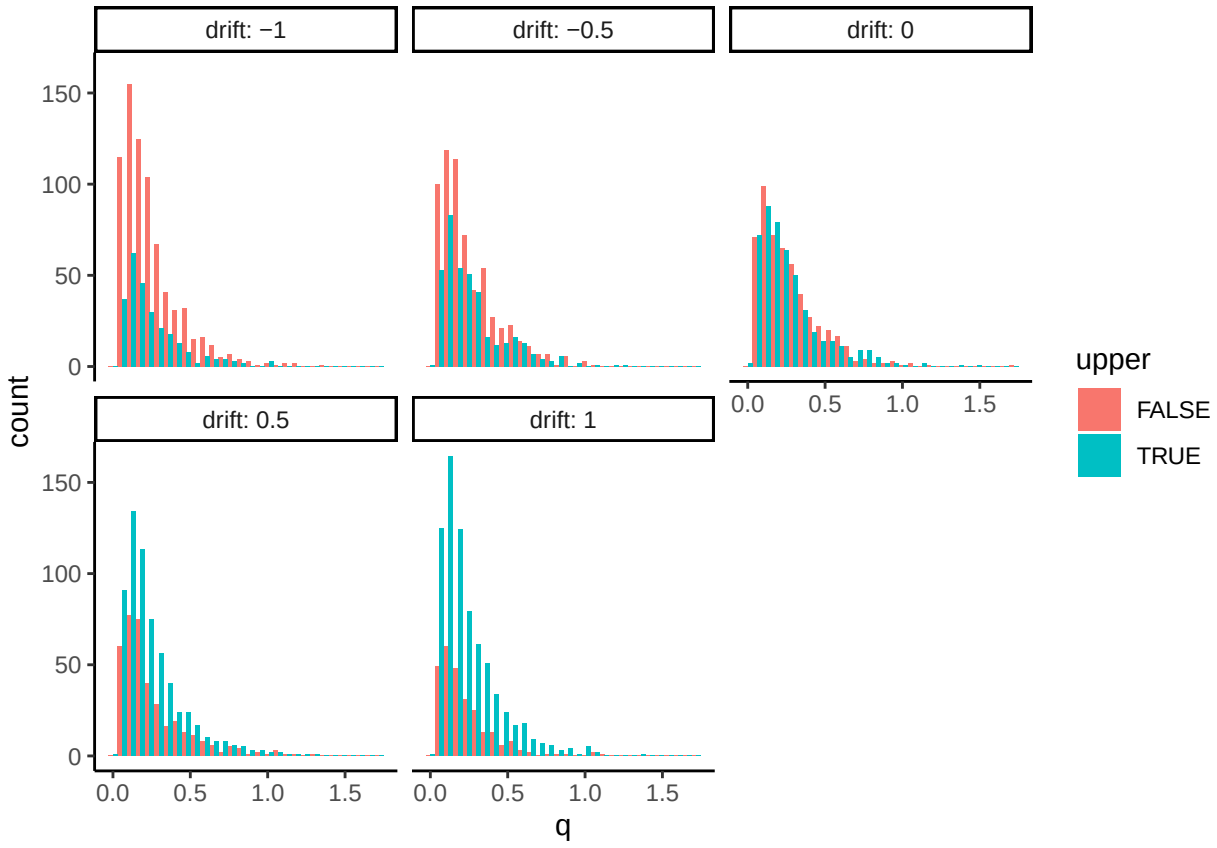

```
df = data.frame()
for(d in drift){
  df = rbind(df,RWiener::rwiener(1000,alpha = bound,tau = 0.01, beta = bias, delta = d)%>% mutate(drift
}


qq = na.omit(df) %>%
  mutate(upper = ifelse(resp == "upper", T,F)) %>%
  ggplot(aes(x = q)) +
  geom_histogram(aes(fill = upper,bins = 30), position = position_dodge())+
  theme_classic()+
  facet_wrap(~drift, labeller = label_both)
```

```
## Warning in geom_histogram(aes(fill = upper, bins = 30), position =
## position_dodge()): Ignoring unknown aesthetics: bins
```

```
qq
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



There does seem to be a difference in how the RWeiner function uses the driftrate and how i use it? Why??