ITS simulation

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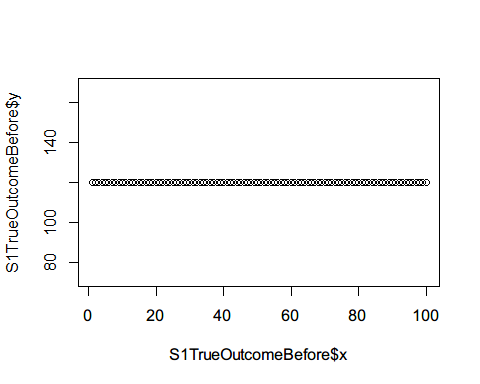
11/10/2021

# Simulating datasets

# Senario 1: No pre-exisiting trend, but has level change

Simulate a constant observed outcome before intervention.

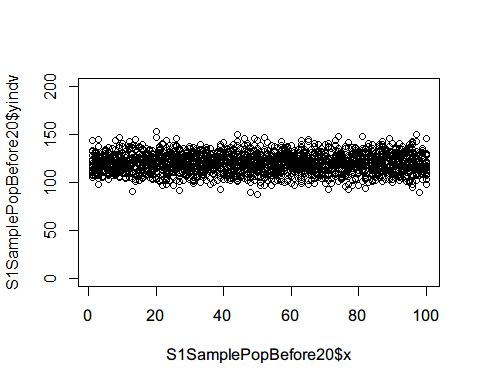
x=1:100  
S1TrueOutcomeBefore = data.frame(x, y=120)  
plot(S1TrueOutcomeBefore$x,S1TrueOutcomeBefore$y)



x=101:119  
S1CounterfactualBefore = data.frame(x, y=120)

Simulate sample of 20 from the observed population

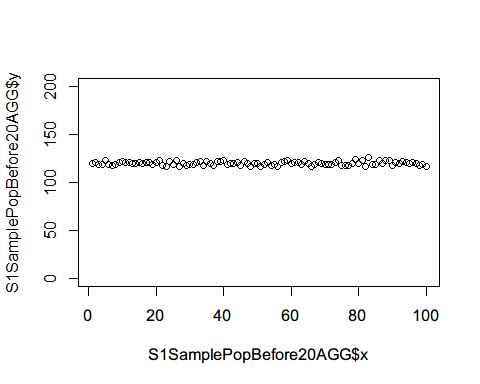
S1SamplePopBefore20=c()  
i=1  
temp=data.frame()  
set.seed(0)  
for(i in 1:length(S1TrueOutcomeBefore$y)){  
 x=rep(i,20)  
 Individual=1:20  
 yindv=rnorm(20,S1TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopBefore20=rbind(S1SamplePopBefore20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopBefore20$x,S1SamplePopBefore20$yindv,ylim=c(0,200))



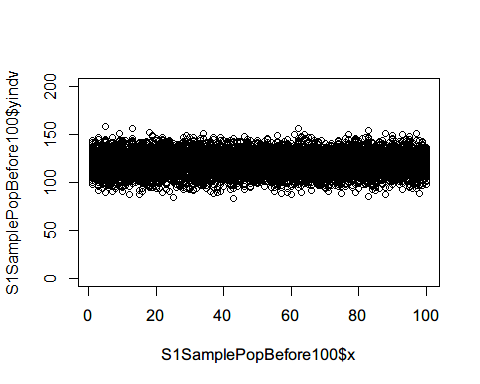
#Compute mean at each time point  
(S1SamplePopBefore20AGG<-S1SamplePopBefore20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 120.  
## 2 2 121.  
## 3 3 119.  
## 4 4 118.  
## 5 5 123.  
## 6 6 119.  
## 7 7 118.  
## 8 8 119.  
## 9 9 120.  
## 10 10 121.  
## # ... with 90 more rows

plot(S1SamplePopBefore20AGG$x,S1SamplePopBefore20AGG$y,ylim=c(0,200))

 Simulate sample of 100 from the observed population

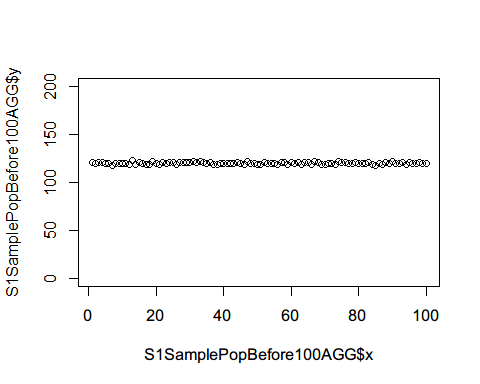
S1SamplePopBefore100=c()  
i=1  
temp=data.frame()  
set.seed(1)  
for(i in 1:length(S1TrueOutcomeBefore$y)){  
 x=rep(i,100)  
 Individual=1:100  
 yindv=rnorm(100,S1TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopBefore100=rbind(S1SamplePopBefore100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopBefore100$x,S1SamplePopBefore100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S1SamplePopBefore100AGG<-S1SamplePopBefore100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 121.  
## 2 2 120.  
## 3 3 120.  
## 4 4 121.  
## 5 5 120.  
## 6 6 120.  
## 7 7 118.  
## 8 8 120.  
## 9 9 120.  
## 10 10 120.  
## # ... with 90 more rows

plot(S1SamplePopBefore100AGG$x,S1SamplePopBefore100AGG$y,ylim=c(0,200))

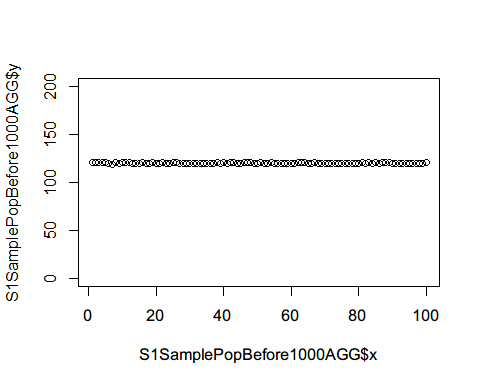


Simulate sample of 1000 from the observed population

S1SamplePopBefore1000=c()  
i=1  
temp=data.frame()  
set.seed(2)  
for(i in 1:length(S1TrueOutcomeBefore$y)){  
 x=rep(i,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S1TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopBefore1000=rbind(S1SamplePopBefore1000,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S1SamplePopBefore1000AGG<-S1SamplePopBefore1000 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 121.  
## 2 2 120.  
## 3 3 121.  
## 4 4 120.  
## 5 5 120.  
## 6 6 120.  
## 7 7 119.  
## 8 8 120.  
## 9 9 119.  
## 10 10 120.  
## # ... with 90 more rows

plot(S1SamplePopBefore1000AGG$x,S1SamplePopBefore1000AGG$y,ylim=c(0,200))

 Compare variation across each sample size

var(S1SamplePopBefore20AGG$y)

## [1] 3.630824

var(S1SamplePopBefore100AGG$y)

## [1] 0.9586764

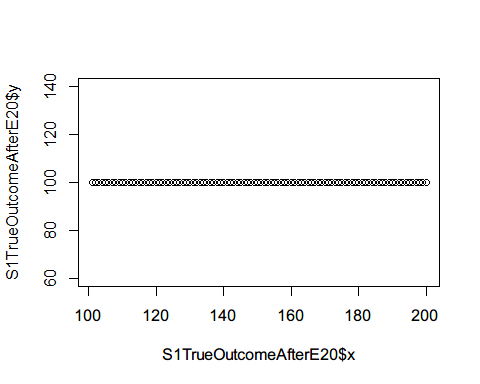
var(S1SamplePopBefore1000AGG$y)

## [1] 0.1307949

## Effect Size: 20

Simulate level changed time points after intervention.

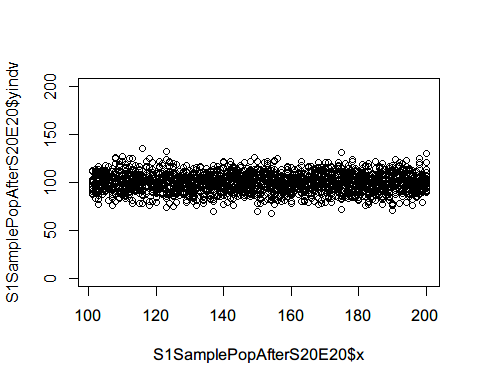
x=101:200  
S1TrueOutcomeAfterE20 = data.frame(x, y=100)  
plot(S1TrueOutcomeAfterE20$x,S1TrueOutcomeAfterE20$y)



S1CounterfactualAfterE20=subset(S1TrueOutcomeAfterE20,x<120&x>100)

Simulate sample of 20 from the observed population

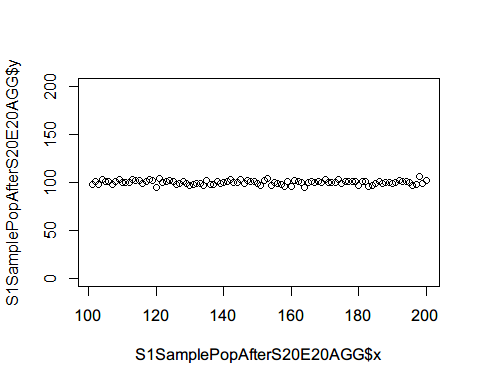
S1SamplePopAfterS20E20=c()  
i=1  
temp=data.frame()  
set.seed(3)  
for(i in 1:length(S1TrueOutcomeAfterE20$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S1TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS20E20=rbind(S1SamplePopAfterS20E20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopAfterS20E20$x,S1SamplePopAfterS20E20$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S1SamplePopAfterS20E20AGG<-S1SamplePopAfterS20E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

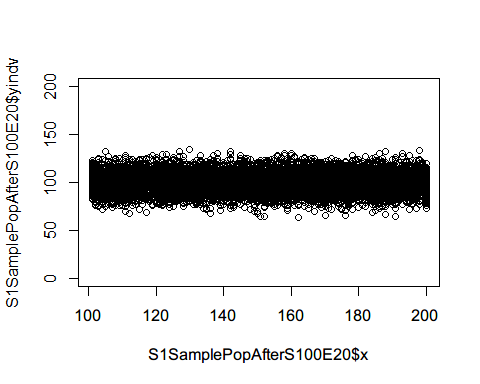
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 98.3  
## 2 102 101.   
## 3 103 98.1  
## 4 104 103.   
## 5 105 101.   
## 6 106 101.   
## 7 107 97.4  
## 8 108 101.   
## 9 109 103.   
## 10 110 99.4  
## # ... with 90 more rows

plot(S1SamplePopAfterS20E20AGG$x,S1SamplePopAfterS20E20AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

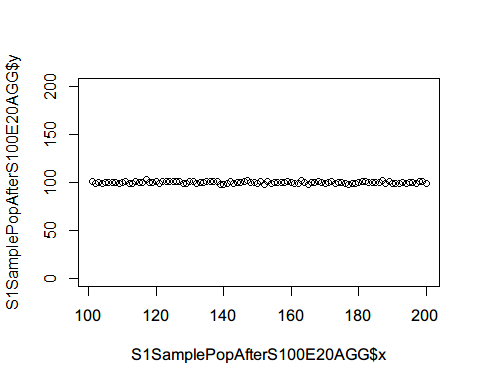
S1SamplePopAfterS100E20=c()  
i=1  
temp=data.frame()  
set.seed(4)  
for(i in 1:length(S1TrueOutcomeAfterE20$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S1TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS100E20=rbind(S1SamplePopAfterS100E20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopAfterS100E20$x,S1SamplePopAfterS100E20$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S1SamplePopAfterS100E20AGG<-S1SamplePopAfterS100E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 101.   
## 2 102 99.2  
## 3 103 99.6  
## 4 104 99.2  
## 5 105 99.5  
## 6 106 99.9  
## 7 107 99.6  
## 8 108 99.9  
## 9 109 99.3  
## 10 110 99.4  
## # ... with 90 more rows

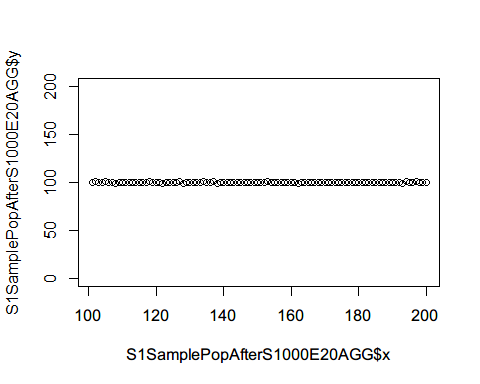
plot(S1SamplePopAfterS100E20AGG$x,S1SamplePopAfterS100E20AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S1SamplePopAfterS1000E20=c()  
i=1  
temp=data.frame()  
set.seed(5)  
for(i in 1:length(S1TrueOutcomeAfterE20$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S1TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS1000E20=rbind(S1SamplePopAfterS1000E20,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S1SamplePopAfterS1000E20AGG<-S1SamplePopAfterS1000E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

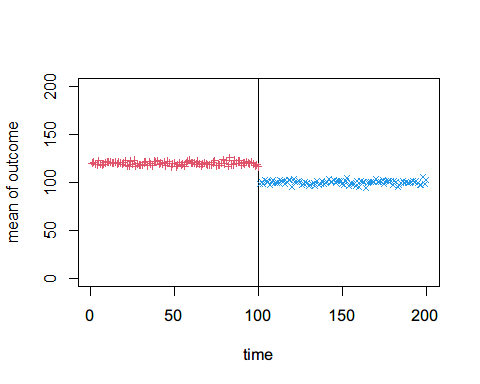
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 100.   
## 2 102 101.   
## 3 103 100.   
## 4 104 99.8  
## 5 105 100.   
## 6 106 99.8  
## 7 107 99.8  
## 8 108 99.4  
## 9 109 100.   
## 10 110 100.   
## # ... with 90 more rows

plot(S1SamplePopAfterS1000E20AGG$x,S1SamplePopAfterS1000E20AGG$y,ylim=c(0,200))

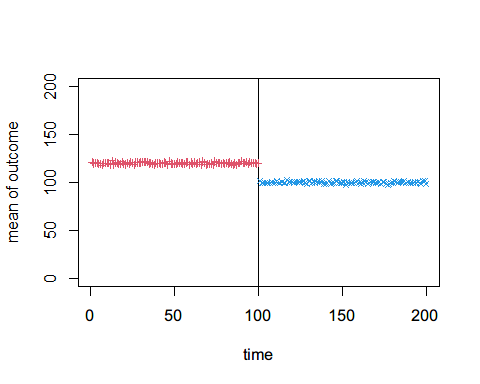


Combine before and after for size 20

S1SamplePopS20E20AGG<-rbind(S1SamplePopBefore20AGG,S1SamplePopAfterS20E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore20AGG$x, S1SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS20E20AGG$x, S1SamplePopAfterS20E20AGG$y, pch=4, col=4,cex=0.7)

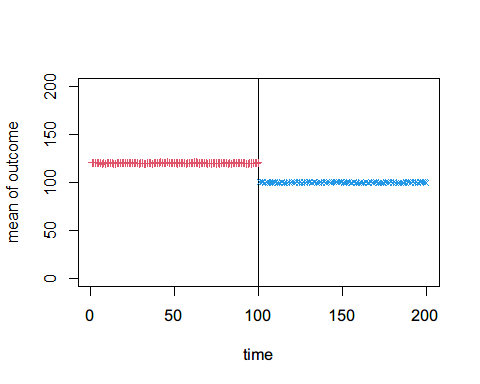
 Combine before and after for size 100

S1SamplePopS100E20AGG<-rbind(S1SamplePopBefore100AGG,S1SamplePopAfterS100E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore100AGG$x, S1SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS100E20AGG$x, S1SamplePopAfterS100E20AGG$y, pch=4, col=4,cex=0.7)



Combine before and after for size 1000

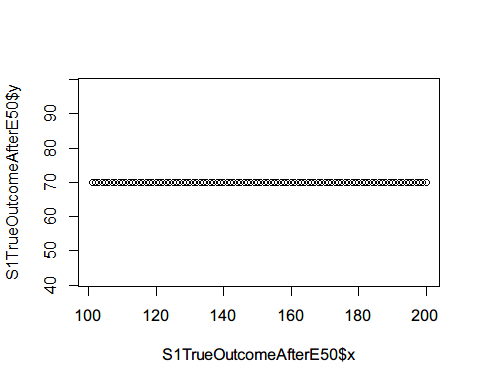
S1SamplePopS1000E20AGG<-rbind(S1SamplePopBefore100AGG,S1SamplePopAfterS1000E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore1000AGG$x, S1SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS1000E20AGG$x, S1SamplePopAfterS1000E20AGG$y, pch=4, col=4,cex=0.7)



## Effect Size: 50

Simulate level changed time points after intervention.

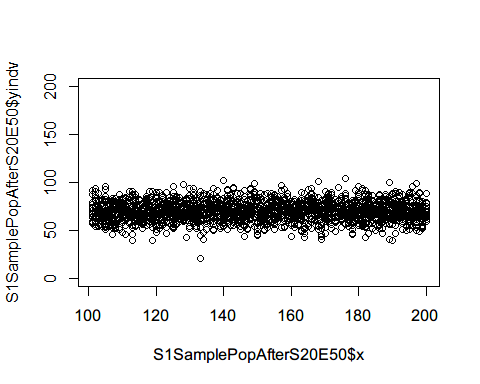
x=101:200  
S1TrueOutcomeAfterE50 = data.frame(x, y=70)  
plot(S1TrueOutcomeAfterE50$x,S1TrueOutcomeAfterE50$y)



S1CounterfactualAfterE50=subset(S1TrueOutcomeAfterE50,x<120&x>100)

Simulate sample of 20 from the observed population

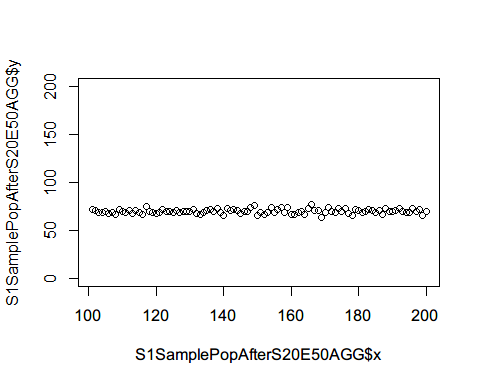
S1SamplePopAfterS20E50=c()  
i=1  
temp=data.frame()  
set.seed(6)  
for(i in 1:length(S1TrueOutcomeAfterE50$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S1TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS20E50=rbind(S1SamplePopAfterS20E50,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopAfterS20E50$x,S1SamplePopAfterS20E50$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S1SamplePopAfterS20E50AGG<-S1SamplePopAfterS20E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

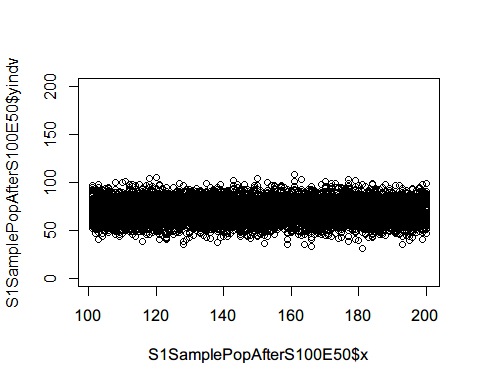
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 71.9  
## 2 102 70.6  
## 3 103 68.6  
## 4 104 68.6  
## 5 105 69.8  
## 6 106 67.8  
## 7 107 69.1  
## 8 108 66.9  
## 9 109 72.1  
## 10 110 69.6  
## # ... with 90 more rows

plot(S1SamplePopAfterS20E50AGG$x,S1SamplePopAfterS20E50AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

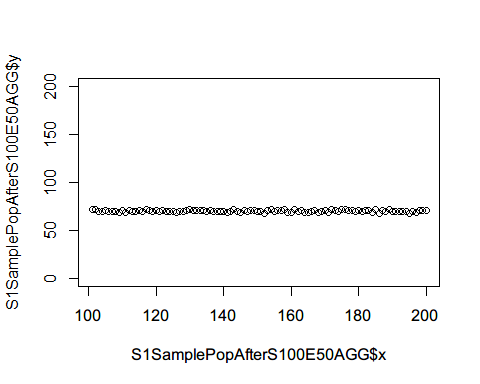
S1SamplePopAfterS100E50=c()  
i=1  
temp=data.frame()  
set.seed(7)  
for(i in 1:length(S1TrueOutcomeAfterE50$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S1TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS100E50=rbind(S1SamplePopAfterS100E50,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopAfterS100E50$x,S1SamplePopAfterS100E50$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S1SamplePopAfterS100E50AGG<-S1SamplePopAfterS100E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 71.4  
## 2 102 71.3  
## 3 103 69.6  
## 4 104 69.5  
## 5 105 70.4  
## 6 106 70.0  
## 7 107 69.2  
## 8 108 70.2  
## 9 109 68.3  
## 10 110 70.3  
## # ... with 90 more rows

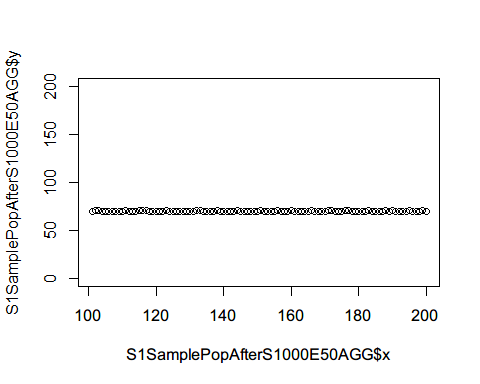
plot(S1SamplePopAfterS100E50AGG$x,S1SamplePopAfterS100E50AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S1SamplePopAfterS1000E50=c()  
i=1  
temp=data.frame()  
set.seed(8)  
for(i in 1:length(S1TrueOutcomeAfterE50$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S1TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS1000E50=rbind(S1SamplePopAfterS1000E50,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S1SamplePopAfterS1000E50AGG<-S1SamplePopAfterS1000E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

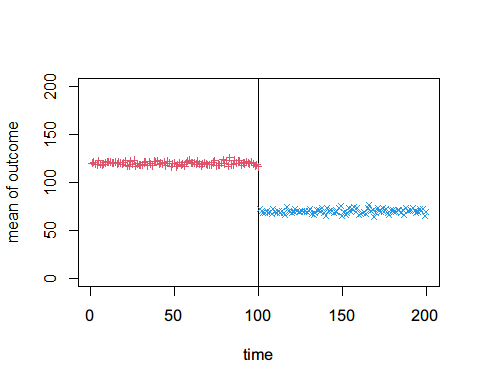
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 69.6  
## 2 102 70.2  
## 3 103 70.3  
## 4 104 70.2  
## 5 105 69.9  
## 6 106 70.1  
## 7 107 69.8  
## 8 108 70.1  
## 9 109 70.1  
## 10 110 70.1  
## # ... with 90 more rows

plot(S1SamplePopAfterS1000E50AGG$x,S1SamplePopAfterS1000E50AGG$y,ylim=c(0,200))

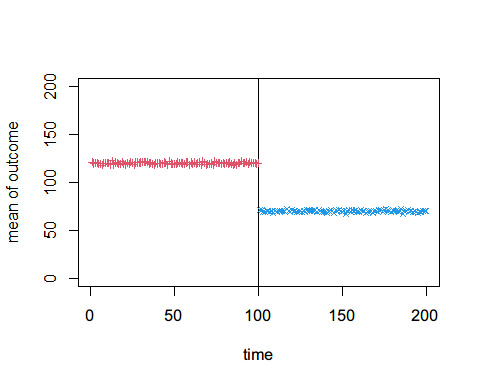


Combine before and after for size 20

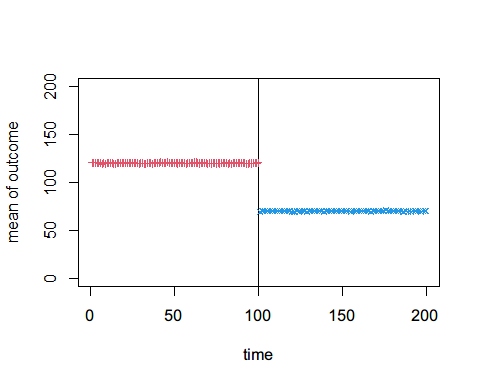
S1SamplePopS20E50AGG<-rbind(S1SamplePopBefore20AGG,S1SamplePopAfterS20E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore20AGG$x, S1SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS20E50AGG$x, S1SamplePopAfterS20E50AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 100

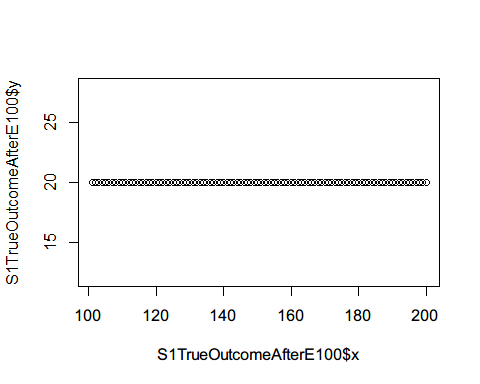
S1SamplePopS100E50AGG<-rbind(S1SamplePopBefore100AGG,S1SamplePopAfterS100E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore100AGG$x, S1SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS100E50AGG$x, S1SamplePopAfterS100E50AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 1000

S1SamplePopS1000E50AGG<-rbind(S1SamplePopBefore100AGG,S1SamplePopAfterS1000E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore1000AGG$x, S1SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS1000E50AGG$x, S1SamplePopAfterS1000E50AGG$y, pch=4, col=4,cex=0.7)

 ## Effect Size: 100  
Simulate level changed time points after intervention.

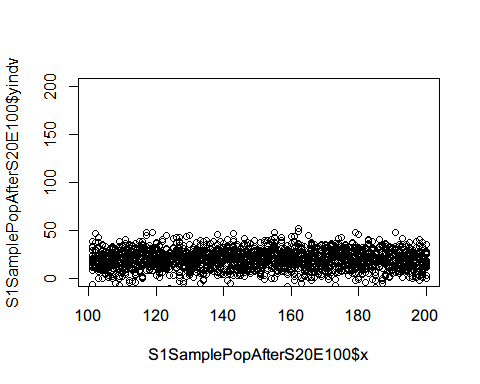
x=101:200  
S1TrueOutcomeAfterE100 = data.frame(x, y=20)  
plot(S1TrueOutcomeAfterE100$x,S1TrueOutcomeAfterE100$y)



S1CounterfactualAfterE100=subset(S1TrueOutcomeAfterE100,x<120&x>100)

Simulate sample of 20 from the observed population

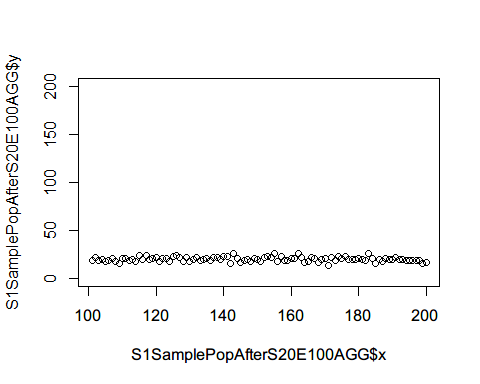
S1SamplePopAfterS20E100=c()  
i=1  
temp=data.frame()  
set.seed(9)  
for(i in 1:length(S1TrueOutcomeAfterE100$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S1TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS20E100=rbind(S1SamplePopAfterS20E100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopAfterS20E100$x,S1SamplePopAfterS20E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S1SamplePopAfterS20E100AGG<-S1SamplePopAfterS20E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

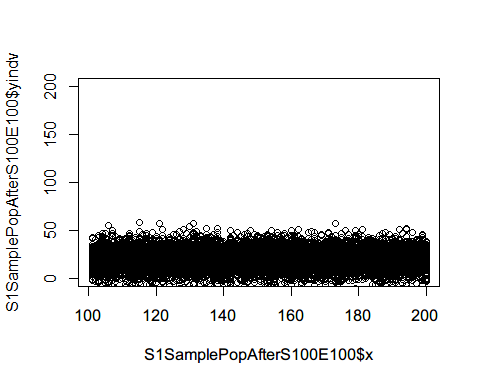
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 18.5  
## 2 102 22.0  
## 3 103 18.8  
## 4 104 20.1  
## 5 105 18.0  
## 6 106 18.3  
## 7 107 20.6  
## 8 108 18.0  
## 9 109 16.0  
## 10 110 20.3  
## # ... with 90 more rows

plot(S1SamplePopAfterS20E100AGG$x,S1SamplePopAfterS20E100AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

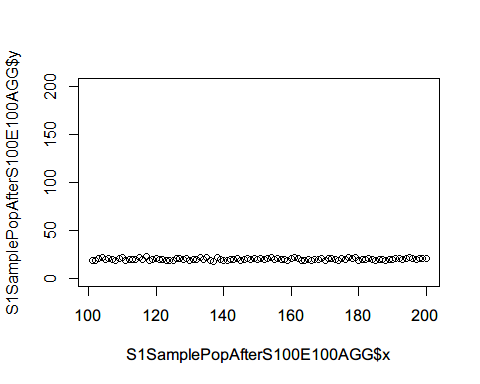
S1SamplePopAfterS100E100=c()  
i=1  
temp=data.frame()  
set.seed(10)  
for(i in 1:length(S1TrueOutcomeAfterE100$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S1TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS100E100=rbind(S1SamplePopAfterS100E100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S1SamplePopAfterS100E100$x,S1SamplePopAfterS100E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S1SamplePopAfterS100E100AGG<-S1SamplePopAfterS100E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 18.6  
## 2 102 19.1  
## 3 103 20.3  
## 4 104 22.0  
## 5 105 19.5  
## 6 106 20.7  
## 7 107 19.7  
## 8 108 18.7  
## 9 109 20.4  
## 10 110 22.2  
## # ... with 90 more rows

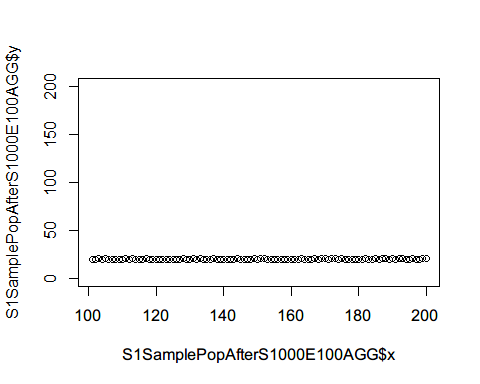
plot(S1SamplePopAfterS100E100AGG$x,S1SamplePopAfterS100E100AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S1SamplePopAfterS1000E100=c()  
i=1  
temp=data.frame()  
set.seed(11)  
for(i in 1:length(S1TrueOutcomeAfterE100$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S1TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S1SamplePopAfterS1000E100=rbind(S1SamplePopAfterS1000E100,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S1SamplePopAfterS1000E100AGG<-S1SamplePopAfterS1000E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

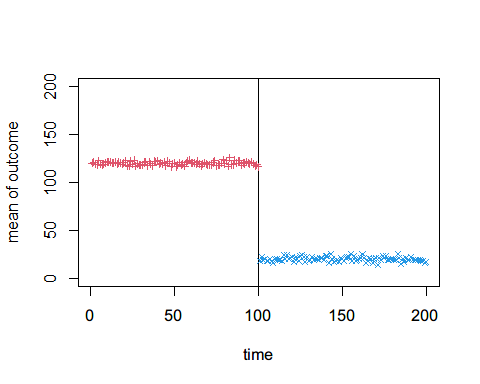
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 20.1  
## 2 102 20.0  
## 3 103 20.4  
## 4 104 20.0  
## 5 105 20.5  
## 6 106 19.9  
## 7 107 20.0  
## 8 108 20.0  
## 9 109 20.2  
## 10 110 20.0  
## # ... with 90 more rows

plot(S1SamplePopAfterS1000E100AGG$x,S1SamplePopAfterS1000E100AGG$y,ylim=c(0,200))

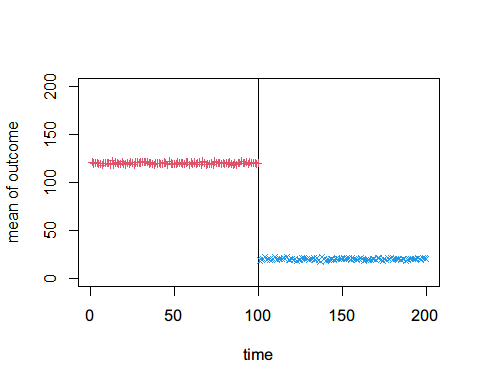


Combine before and after for size 20

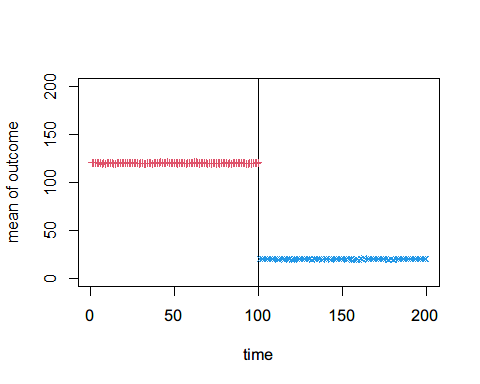
S1SamplePopS20E100AGG<-rbind(S1SamplePopBefore20AGG,S1SamplePopAfterS20E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore20AGG$x, S1SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS20E100AGG$x, S1SamplePopAfterS20E100AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 100

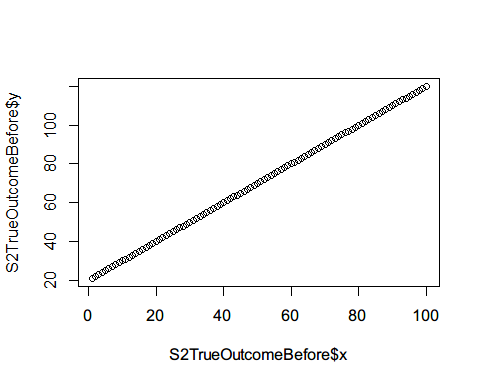
S1SamplePopS100E100AGG<-rbind(S1SamplePopBefore100AGG,S1SamplePopAfterS100E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore100AGG$x, S1SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS100E100AGG$x, S1SamplePopAfterS100E100AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 1000

S1SamplePopS1000E100AGG<-rbind(S1SamplePopBefore100AGG,S1SamplePopAfterS1000E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S1SamplePopBefore1000AGG$x, S1SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S1SamplePopAfterS1000E100AGG$x, S1SamplePopAfterS1000E100AGG$y, pch=4, col=4,cex=0.7)

 # Senario 2: with pre-exisiting trend, has level change but not slope change Simulate a constant observed outcome before intervention.

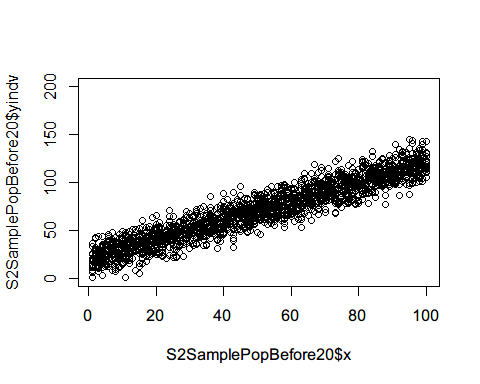
x=1:100  
S2TrueOutcomeBefore = data.frame(x, y=x+20)  
plot(S2TrueOutcomeBefore$x,S2TrueOutcomeBefore$y)



x=101:119  
S2CounterfactualBefore = data.frame(x, y=x+20)

Simulate sample of 20 from the observed population

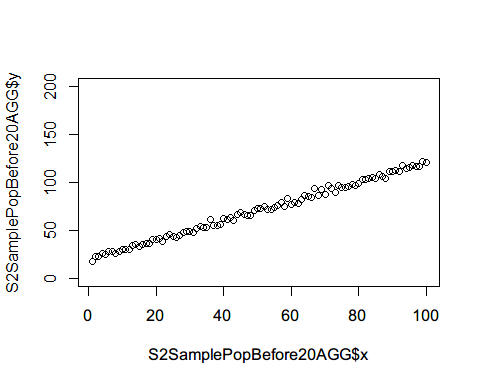
S2SamplePopBefore20=c()  
i=1  
temp=data.frame()  
set.seed(12)  
for(i in 1:length(S2TrueOutcomeBefore$y)){  
 x=rep(i,20)  
 Individual=1:20  
 yindv=rnorm(20,S2TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopBefore20=rbind(S2SamplePopBefore20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopBefore20$x,S2SamplePopBefore20$yindv,ylim=c(0,200))



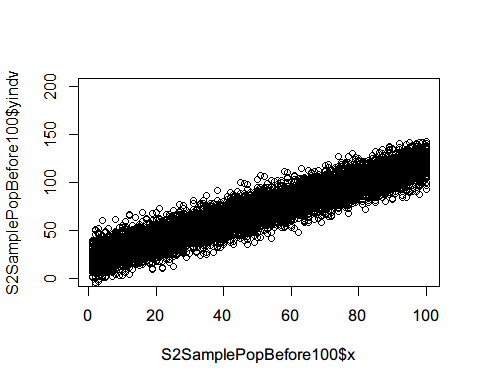
#Compute mean at each time point  
(S2SamplePopBefore20AGG<-S2SamplePopBefore20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 17.7  
## 2 2 23.0  
## 3 3 22.4  
## 4 4 25.6  
## 5 5 24.8  
## 6 6 27.5  
## 7 7 28.2  
## 8 8 26.4  
## 9 9 27.9  
## 10 10 30.5  
## # ... with 90 more rows

plot(S2SamplePopBefore20AGG$x,S2SamplePopBefore20AGG$y,ylim=c(0,200))

 Simulate sample of 100 from the observed population

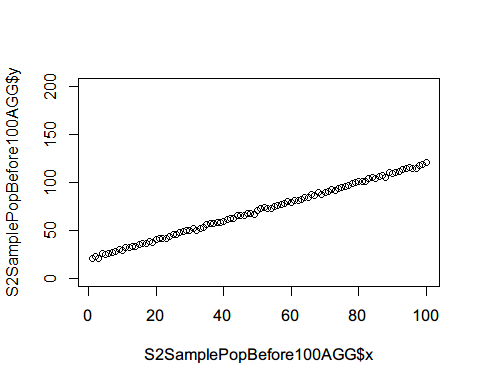
S2SamplePopBefore100=c()  
i=1  
temp=data.frame()  
set.seed(13)  
for(i in 1:length(S2TrueOutcomeBefore$y)){  
 x=rep(i,100)  
 Individual=1:100  
 yindv=rnorm(100,S2TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopBefore100=rbind(S2SamplePopBefore100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopBefore100$x,S2SamplePopBefore100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S2SamplePopBefore100AGG<-S2SamplePopBefore100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 20.4  
## 2 2 22.3  
## 3 3 21.2  
## 4 4 26.0  
## 5 5 25.3  
## 6 6 25.8  
## 7 7 26.7  
## 8 8 28.1  
## 9 9 30.0  
## 10 10 29.0  
## # ... with 90 more rows

plot(S2SamplePopBefore100AGG$x,S2SamplePopBefore100AGG$y,ylim=c(0,200))

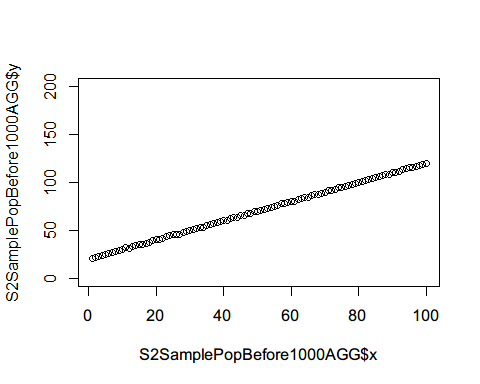


Simulate sample of 1000 from the observed population

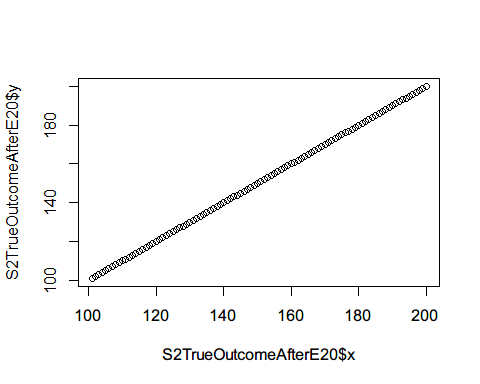
S2SamplePopBefore1000=c()  
i=1  
temp=data.frame()  
set.seed(14)  
for(i in 1:length(S2TrueOutcomeBefore$y)){  
 x=rep(i,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S2TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopBefore1000=rbind(S2SamplePopBefore1000,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S2SamplePopBefore1000AGG<-S2SamplePopBefore1000 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 20.7  
## 2 2 21.7  
## 3 3 23.1  
## 4 4 23.7  
## 5 5 25.1  
## 6 6 25.9  
## 7 7 27.3  
## 8 8 27.8  
## 9 9 28.9  
## 10 10 29.9  
## # ... with 90 more rows

plot(S2SamplePopBefore1000AGG$x,S2SamplePopBefore1000AGG$y,ylim=c(0,200))

 ## Effect Size: 20  
Simulate level changed time points after intervention.

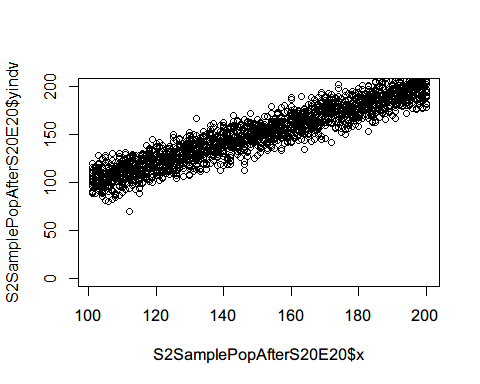
x=101:200  
S2TrueOutcomeAfterE20 = data.frame(x, y=x)  
plot(S2TrueOutcomeAfterE20$x,S2TrueOutcomeAfterE20$y)



S2CounterfactualAfterE20=subset(S2TrueOutcomeAfterE20,x<120&x>100)

Simulate sample of 20 from the observed population

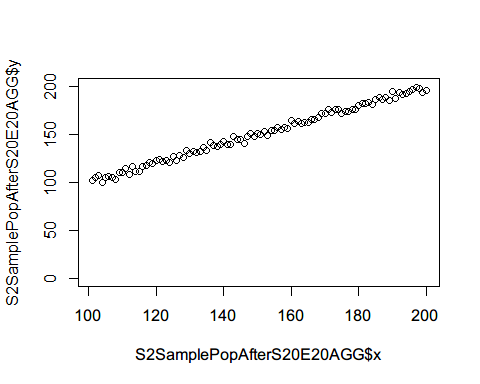
S2SamplePopAfterS20E20=c()  
i=1  
temp=data.frame()  
set.seed(15)  
for(i in 1:length(S2TrueOutcomeAfterE20$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S2TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS20E20=rbind(S2SamplePopAfterS20E20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopAfterS20E20$x,S2SamplePopAfterS20E20$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S2SamplePopAfterS20E20AGG<-S2SamplePopAfterS20E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

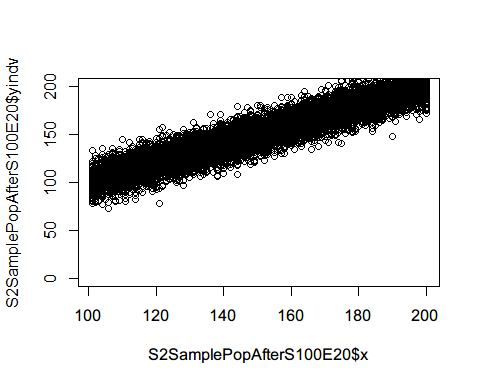
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 101.  
## 2 102 105.  
## 3 103 108.  
## 4 104 100.  
## 5 105 105.  
## 6 106 106.  
## 7 107 105.  
## 8 108 103.  
## 9 109 110.  
## 10 110 110.  
## # ... with 90 more rows

plot(S2SamplePopAfterS20E20AGG$x,S2SamplePopAfterS20E20AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

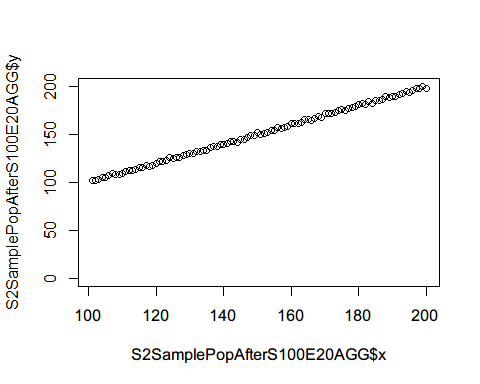
S2SamplePopAfterS100E20=c()  
i=1  
temp=data.frame()  
set.seed(16)  
for(i in 1:length(S2TrueOutcomeAfterE20$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S2TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS100E20=rbind(S2SamplePopAfterS100E20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopAfterS100E20$x,S2SamplePopAfterS100E20$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S2SamplePopAfterS100E20AGG<-S2SamplePopAfterS100E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 102.  
## 2 102 102.  
## 3 103 104.  
## 4 104 106.  
## 5 105 105.  
## 6 106 107.  
## 7 107 109.  
## 8 108 108.  
## 9 109 108.  
## 10 110 110.  
## # ... with 90 more rows

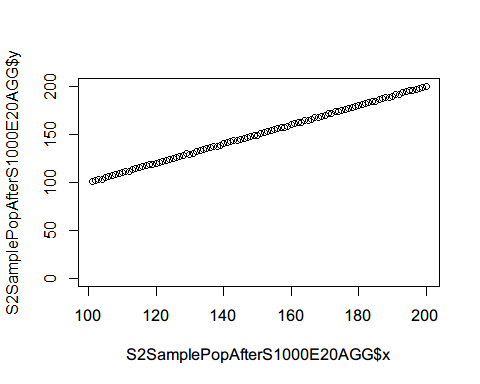
plot(S2SamplePopAfterS100E20AGG$x,S2SamplePopAfterS100E20AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S2SamplePopAfterS1000E20=c()  
i=1  
temp=data.frame()  
set.seed(17)  
for(i in 1:length(S2TrueOutcomeAfterE20$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S2TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS1000E20=rbind(S2SamplePopAfterS1000E20,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S2SamplePopAfterS1000E20AGG<-S2SamplePopAfterS1000E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

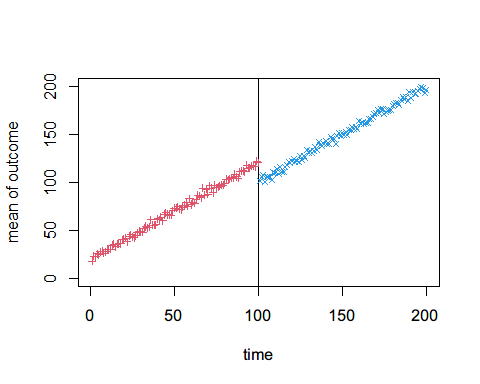
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 101.  
## 2 102 102.  
## 3 103 103.  
## 4 104 103.  
## 5 105 105.  
## 6 106 107.  
## 7 107 108.  
## 8 108 108.  
## 9 109 109.  
## 10 110 110.  
## # ... with 90 more rows

plot(S2SamplePopAfterS1000E20AGG$x,S2SamplePopAfterS1000E20AGG$y,ylim=c(0,200))

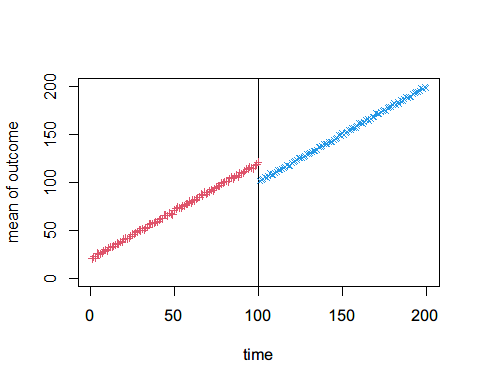


Combine before and after for size 20

S2SamplePopS20E20AGG<-rbind(S2SamplePopBefore20AGG,S2SamplePopAfterS20E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore20AGG$x, S2SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS20E20AGG$x, S2SamplePopAfterS20E20AGG$y, pch=4, col=4,cex=0.7)

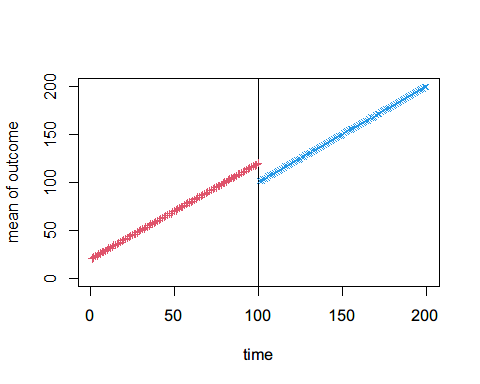
 Combine before and after for size 100

S2SamplePopS100E20AGG<-rbind(S2SamplePopBefore100AGG,S2SamplePopAfterS100E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore100AGG$x, S2SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS100E20AGG$x, S2SamplePopAfterS100E20AGG$y, pch=4, col=4,cex=0.7)



Combine before and after for size 1000

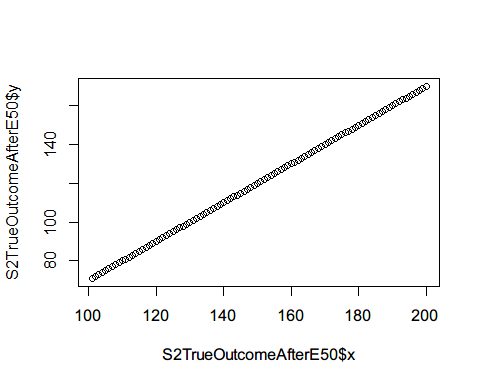
S2SamplePopS1000E20AGG<-rbind(S2SamplePopBefore100AGG,S2SamplePopAfterS1000E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore1000AGG$x, S2SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS1000E20AGG$x, S2SamplePopAfterS1000E20AGG$y, pch=4, col=4,cex=0.7)



## Effect Size: 50

Simulate level changed time points after intervention.

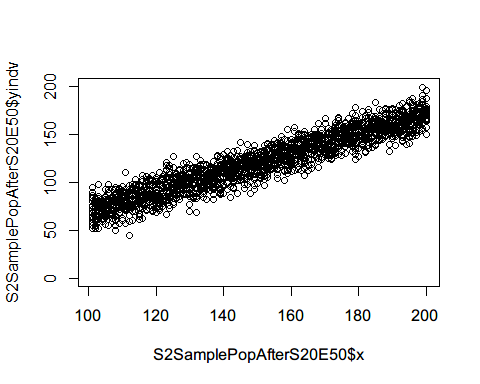
x=101:200  
S2TrueOutcomeAfterE50 = data.frame(x, y=x-30)  
plot(S2TrueOutcomeAfterE50$x,S2TrueOutcomeAfterE50$y)



S2CounterfactualAfterE50=subset(S2TrueOutcomeAfterE50,x<120&x>100)

Simulate sample of 20 from the observed population

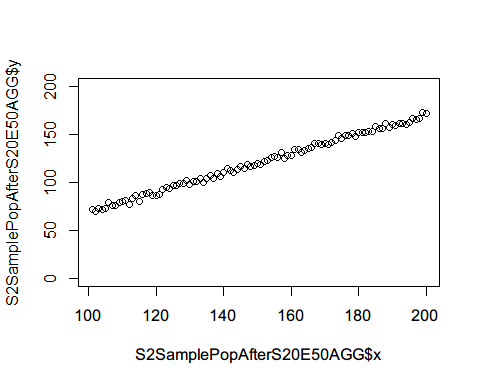
S2SamplePopAfterS20E50=c()  
i=1  
temp=data.frame()  
set.seed(18)  
for(i in 1:length(S2TrueOutcomeAfterE50$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S2TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS20E50=rbind(S2SamplePopAfterS20E50,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopAfterS20E50$x,S2SamplePopAfterS20E50$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S2SamplePopAfterS20E50AGG<-S2SamplePopAfterS20E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

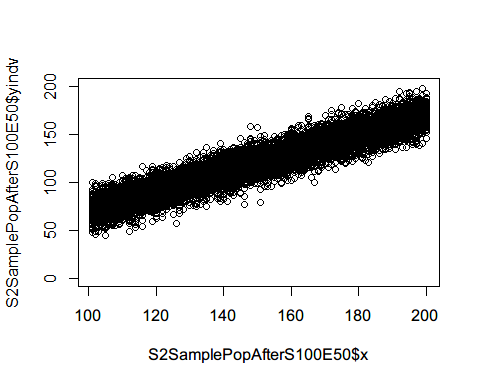
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 72.0  
## 2 102 69.3  
## 3 103 73.1  
## 4 104 71.3  
## 5 105 73.1  
## 6 106 78.8  
## 7 107 75.4  
## 8 108 76.4  
## 9 109 78.8  
## 10 110 80.6  
## # ... with 90 more rows

plot(S2SamplePopAfterS20E50AGG$x,S2SamplePopAfterS20E50AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

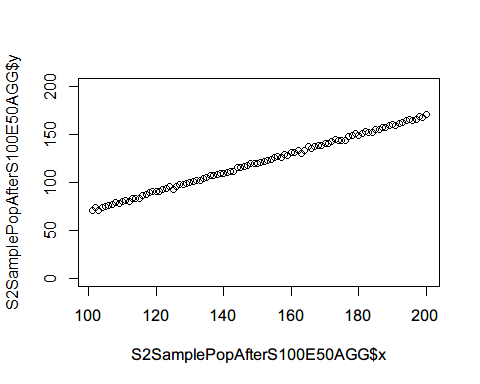
S2SamplePopAfterS100E50=c()  
i=1  
temp=data.frame()  
set.seed(19)  
for(i in 1:length(S2TrueOutcomeAfterE50$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S2TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS100E50=rbind(S2SamplePopAfterS100E50,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopAfterS100E50$x,S2SamplePopAfterS100E50$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S2SamplePopAfterS100E50AGG<-S2SamplePopAfterS100E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 71.1  
## 2 102 73.5  
## 3 103 71.2  
## 4 104 73.8  
## 5 105 74.7  
## 6 106 75.5  
## 7 107 76.8  
## 8 108 79.4  
## 9 109 78.5  
## 10 110 79.9  
## # ... with 90 more rows

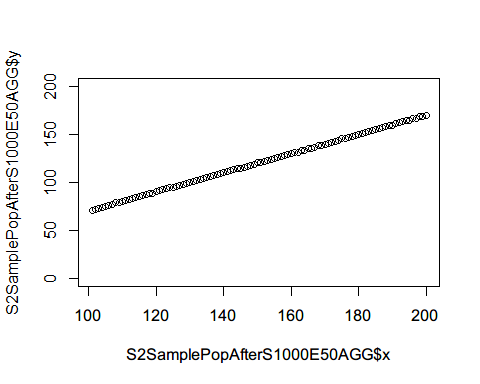
plot(S2SamplePopAfterS100E50AGG$x,S2SamplePopAfterS100E50AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S2SamplePopAfterS1000E50=c()  
i=1  
temp=data.frame()  
set.seed(20)  
for(i in 1:length(S2TrueOutcomeAfterE50$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S2TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS1000E50=rbind(S2SamplePopAfterS1000E50,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S2SamplePopAfterS1000E50AGG<-S2SamplePopAfterS1000E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

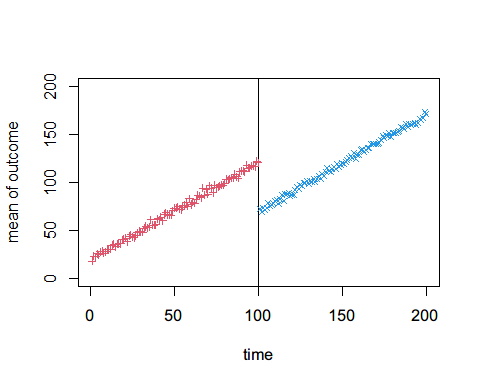
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 70.8  
## 2 102 71.7  
## 3 103 73.2  
## 4 104 74.0  
## 5 105 74.9  
## 6 106 75.5  
## 7 107 76.9  
## 8 108 78.6  
## 9 109 78.7  
## 10 110 79.9  
## # ... with 90 more rows

plot(S2SamplePopAfterS1000E50AGG$x,S2SamplePopAfterS1000E50AGG$y,ylim=c(0,200))

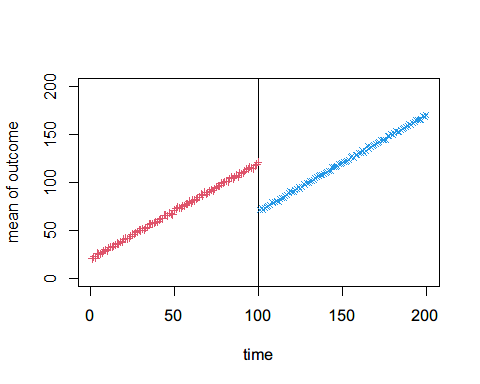


Combine before and after for size 20

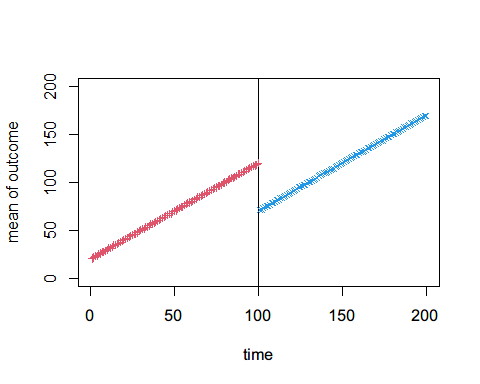
S2SamplePopS20E50AGG<-rbind(S2SamplePopBefore20AGG,S2SamplePopAfterS20E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore20AGG$x, S2SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS20E50AGG$x, S2SamplePopAfterS20E50AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 100

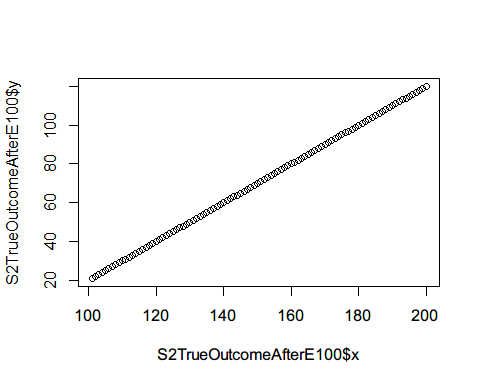
S2SamplePopS100E50AGG<-rbind(S2SamplePopBefore100AGG,S2SamplePopAfterS100E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore100AGG$x, S2SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS100E50AGG$x, S2SamplePopAfterS100E50AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 1000

S2SamplePopS1000E50AGG<-rbind(S2SamplePopBefore100AGG,S2SamplePopAfterS1000E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore1000AGG$x, S2SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS1000E50AGG$x, S2SamplePopAfterS1000E50AGG$y, pch=4, col=4,cex=0.7)

 ## Effect Size: 100  
Simulate level changed time points after intervention.

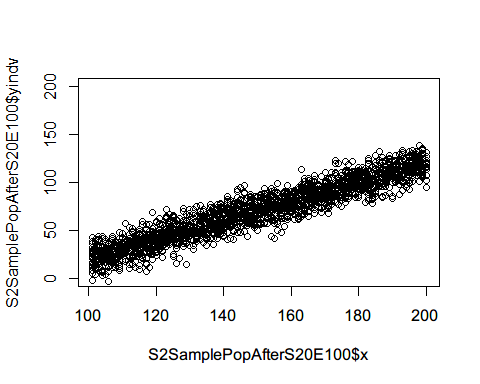
x=101:200  
S2TrueOutcomeAfterE100 = data.frame(x, y=x-80)  
plot(S2TrueOutcomeAfterE100$x,S2TrueOutcomeAfterE100$y)



S2CounterfactualAfterE100=subset(S2TrueOutcomeAfterE100,x<120&x>100)

Simulate sample of 20 from the observed population

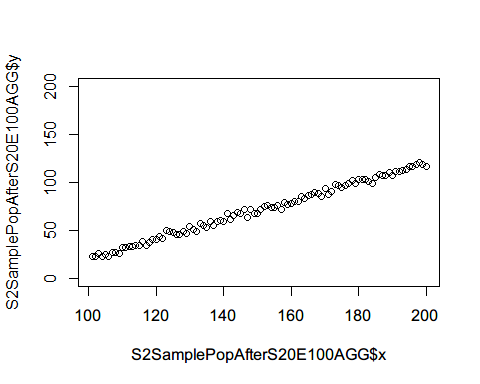
S2SamplePopAfterS20E100=c()  
i=1  
temp=data.frame()  
set.seed(21)  
for(i in 1:length(S2TrueOutcomeAfterE100$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S2TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS20E100=rbind(S2SamplePopAfterS20E100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopAfterS20E100$x,S2SamplePopAfterS20E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S2SamplePopAfterS20E100AGG<-S2SamplePopAfterS20E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

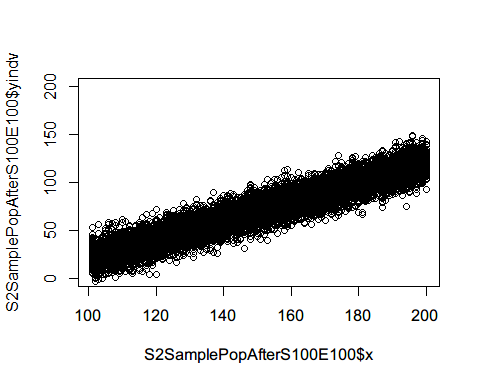
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 22.4  
## 2 102 22.8  
## 3 103 25.6  
## 4 104 22.9  
## 5 105 24.9  
## 6 106 23.0  
## 7 107 27.4  
## 8 108 26.7  
## 9 109 26.2  
## 10 110 31.7  
## # ... with 90 more rows

plot(S2SamplePopAfterS20E100AGG$x,S2SamplePopAfterS20E100AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

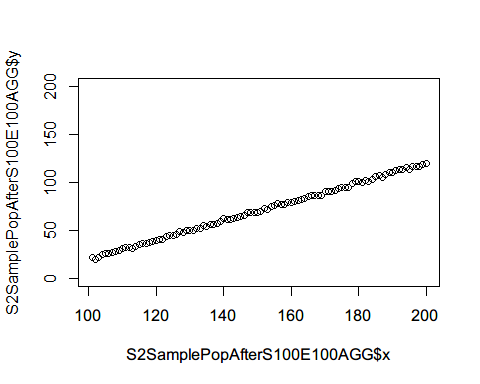
S2SamplePopAfterS100E100=c()  
i=1  
temp=data.frame()  
set.seed(22)  
for(i in 1:length(S2TrueOutcomeAfterE100$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S2TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS100E100=rbind(S2SamplePopAfterS100E100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S2SamplePopAfterS100E100$x,S2SamplePopAfterS100E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S2SamplePopAfterS100E100AGG<-S2SamplePopAfterS100E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 21.8  
## 2 102 19.8  
## 3 103 21.4  
## 4 104 24.6  
## 5 105 25.7  
## 6 106 26.2  
## 7 107 26.8  
## 8 108 28.3  
## 9 109 28.6  
## 10 110 31.0  
## # ... with 90 more rows

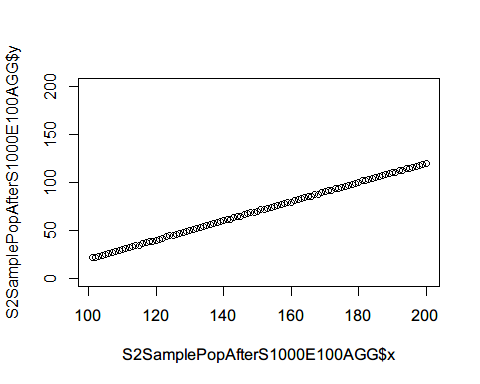
plot(S2SamplePopAfterS100E100AGG$x,S2SamplePopAfterS100E100AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S2SamplePopAfterS1000E100=c()  
i=1  
temp=data.frame()  
set.seed(23)  
for(i in 1:length(S2TrueOutcomeAfterE100$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S2TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S2SamplePopAfterS1000E100=rbind(S2SamplePopAfterS1000E100,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S2SamplePopAfterS1000E100AGG<-S2SamplePopAfterS1000E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

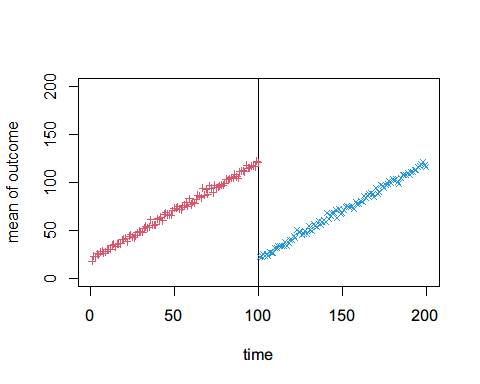
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 21.4  
## 2 102 21.8  
## 3 103 23.3  
## 4 104 24.2  
## 5 105 25.1  
## 6 106 26.2  
## 7 107 26.5  
## 8 108 28.0  
## 9 109 28.8  
## 10 110 30.3  
## # ... with 90 more rows

plot(S2SamplePopAfterS1000E100AGG$x,S2SamplePopAfterS1000E100AGG$y,ylim=c(0,200))

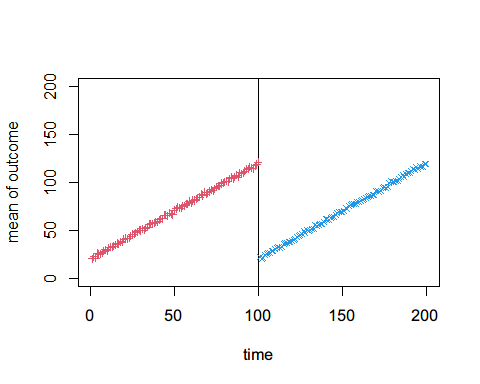


Combine before and after for size 20

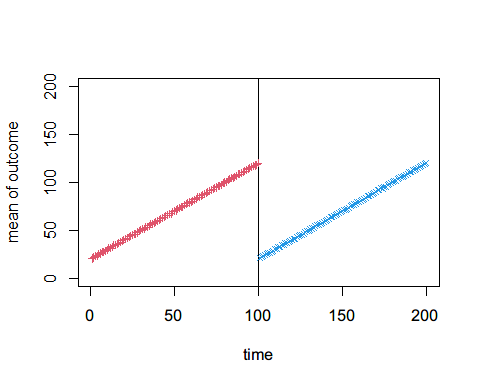
S2SamplePopS20E100AGG<-rbind(S2SamplePopBefore20AGG,S2SamplePopAfterS20E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore20AGG$x, S2SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS20E100AGG$x, S2SamplePopAfterS20E100AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 100

S2SamplePopS100E100AGG<-rbind(S2SamplePopBefore100AGG,S2SamplePopAfterS100E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore100AGG$x, S2SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS100E100AGG$x, S2SamplePopAfterS100E100AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 1000

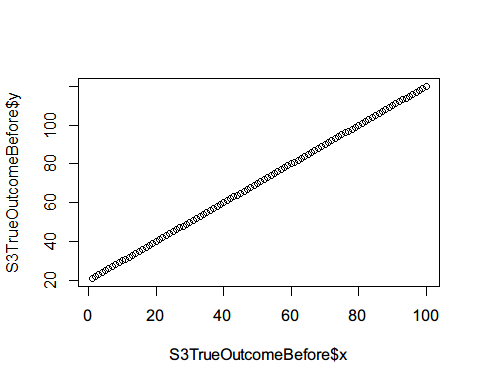
S2SamplePopS1000E100AGG<-rbind(S2SamplePopBefore100AGG,S2SamplePopAfterS1000E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S2SamplePopBefore1000AGG$x, S2SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S2SamplePopAfterS1000E100AGG$x, S2SamplePopAfterS1000E100AGG$y, pch=4, col=4,cex=0.7)



# Senario 3: with pre-exisiting trend, has level change and slope change.

Simulate a constant observed outcome before intervention.

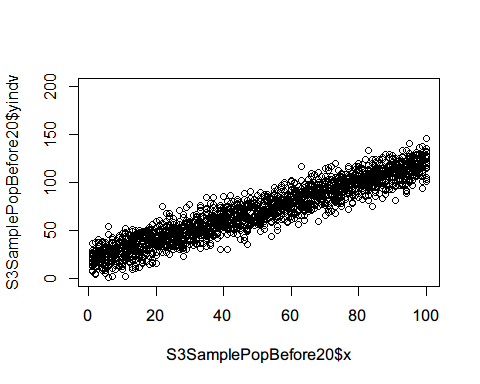
x=1:100  
S3TrueOutcomeBefore = data.frame(x, y=x+20)  
plot(S3TrueOutcomeBefore$x,S3TrueOutcomeBefore$y)



x=101:119  
S3CounterfactualBefore = data.frame(x, y=x+20)

Simulate sample of 20 from the observed population

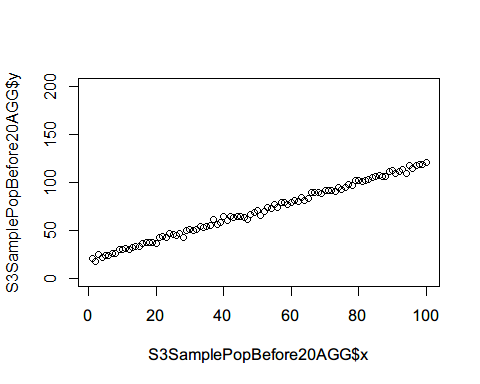
S3SamplePopBefore20=c()  
i=1  
temp=data.frame()  
set.seed(24)  
for(i in 1:length(S3TrueOutcomeBefore$y)){  
 x=rep(i,20)  
 Individual=1:20  
 yindv=rnorm(20,S3TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopBefore20=rbind(S3SamplePopBefore20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopBefore20$x,S3SamplePopBefore20$yindv,ylim=c(0,200))



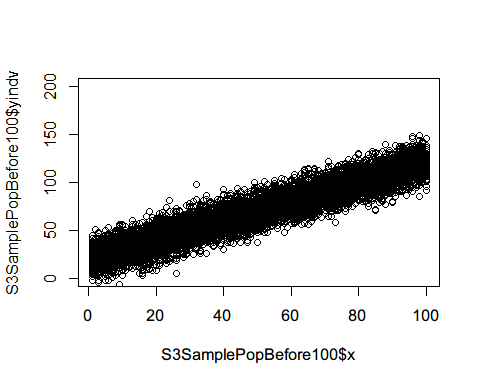
#Compute mean at each time point  
(S3SamplePopBefore20AGG<-S3SamplePopBefore20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 20.7  
## 2 2 17.5  
## 3 3 25.0  
## 4 4 22.1  
## 5 5 23.5  
## 6 6 23.9  
## 7 7 25.8  
## 8 8 26.1  
## 9 9 29.7  
## 10 10 29.7  
## # ... with 90 more rows

plot(S3SamplePopBefore20AGG$x,S3SamplePopBefore20AGG$y,ylim=c(0,200))

 Simulate sample of 100 from the observed population

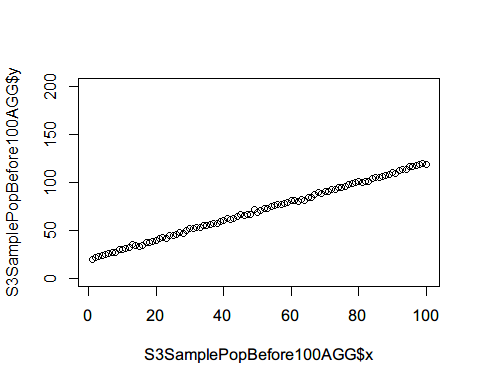
S3SamplePopBefore100=c()  
i=1  
temp=data.frame()  
set.seed(25)  
for(i in 1:length(S3TrueOutcomeBefore$y)){  
 x=rep(i,100)  
 Individual=1:100  
 yindv=rnorm(100,S3TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopBefore100=rbind(S3SamplePopBefore100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopBefore100$x,S3SamplePopBefore100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S3SamplePopBefore100AGG<-S3SamplePopBefore100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 19.2  
## 2 2 22.0  
## 3 3 23.2  
## 4 4 24.3  
## 5 5 25.4  
## 6 6 26.1  
## 7 7 27.4  
## 8 8 27.3  
## 9 9 30.4  
## 10 10 30.1  
## # ... with 90 more rows

plot(S3SamplePopBefore100AGG$x,S3SamplePopBefore100AGG$y,ylim=c(0,200))

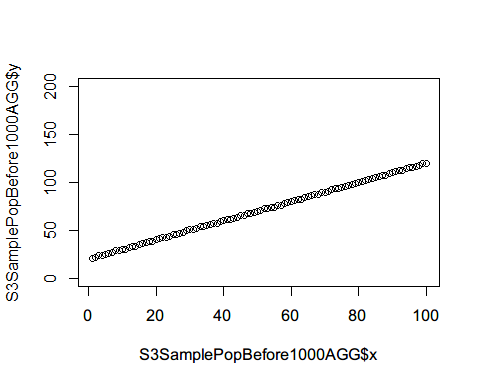


Simulate sample of 1000 from the observed population

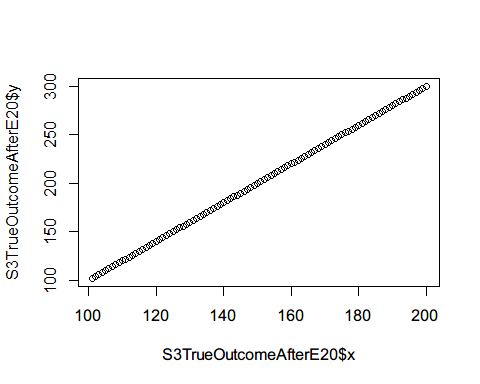
S3SamplePopBefore1000=c()  
i=1  
temp=data.frame()  
set.seed(26)  
for(i in 1:length(S3TrueOutcomeBefore$y)){  
 x=rep(i,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S3TrueOutcomeBefore$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopBefore1000=rbind(S3SamplePopBefore1000,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S3SamplePopBefore1000AGG<-S3SamplePopBefore1000 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 1 20.9  
## 2 2 21.5  
## 3 3 23.5  
## 4 4 24.2  
## 5 5 24.8  
## 6 6 25.6  
## 7 7 26.8  
## 8 8 28.7  
## 9 9 29.3  
## 10 10 30.5  
## # ... with 90 more rows

plot(S3SamplePopBefore1000AGG$x,S3SamplePopBefore1000AGG$y,ylim=c(0,200))

 ## Effect Size: 20  
Simulate level changed time points after intervention.

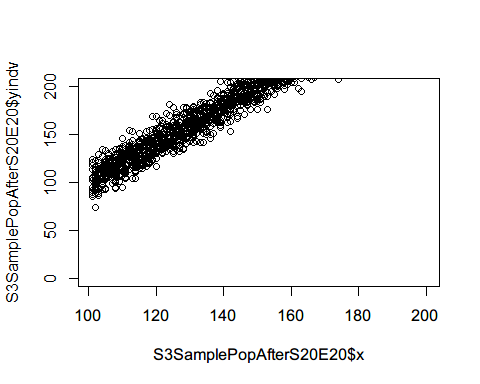
x=101:200  
S3TrueOutcomeAfterE20 = data.frame(x, y=2\*x-100)  
plot(S3TrueOutcomeAfterE20$x,S3TrueOutcomeAfterE20$y)



S3CounterfactualAfterE20=subset(S3TrueOutcomeAfterE20,x<120&x>100)

Simulate sample of 20 from the observed population

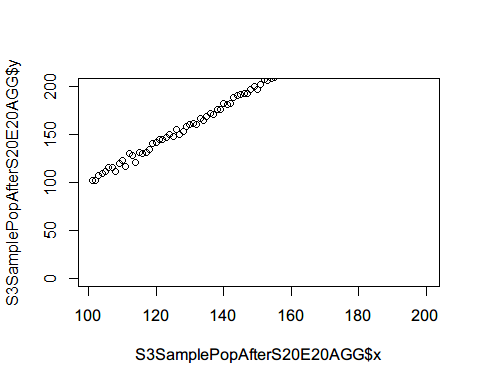
S3SamplePopAfterS20E20=c()  
i=1  
temp=data.frame()  
set.seed(27)  
for(i in 1:length(S3TrueOutcomeAfterE20$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S3TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS20E20=rbind(S3SamplePopAfterS20E20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopAfterS20E20$x,S3SamplePopAfterS20E20$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S3SamplePopAfterS20E20AGG<-S3SamplePopAfterS20E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

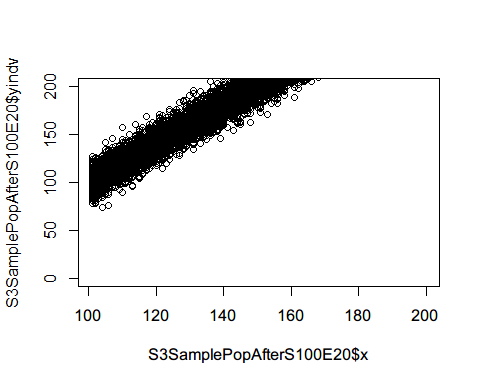
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 102.  
## 2 102 102.  
## 3 103 107.  
## 4 104 109.  
## 5 105 111.  
## 6 106 116.  
## 7 107 116.  
## 8 108 112.  
## 9 109 120.  
## 10 110 123.  
## # ... with 90 more rows

plot(S3SamplePopAfterS20E20AGG$x,S3SamplePopAfterS20E20AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

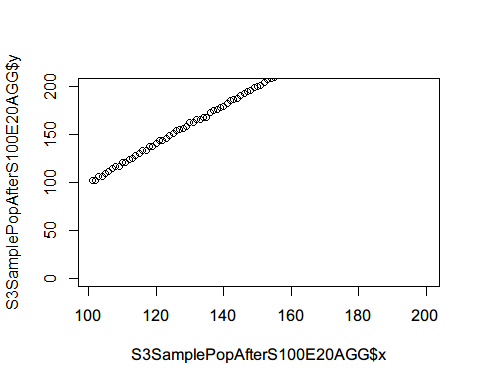
S3SamplePopAfterS100E20=c()  
i=1  
temp=data.frame()  
set.seed(28)  
for(i in 1:length(S3TrueOutcomeAfterE20$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S3TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS100E20=rbind(S3SamplePopAfterS100E20,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopAfterS100E20$x,S3SamplePopAfterS100E20$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S3SamplePopAfterS100E20AGG<-S3SamplePopAfterS100E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 102.  
## 2 102 102.  
## 3 103 106.  
## 4 104 106.  
## 5 105 109.  
## 6 106 112.  
## 7 107 114.  
## 8 108 116.  
## 9 109 117.  
## 10 110 121.  
## # ... with 90 more rows

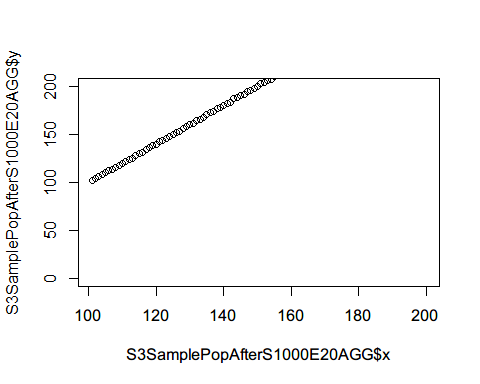
plot(S3SamplePopAfterS100E20AGG$x,S3SamplePopAfterS100E20AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S3SamplePopAfterS1000E20=c()  
i=1  
temp=data.frame()  
set.seed(29)  
for(i in 1:length(S3TrueOutcomeAfterE20$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S3TrueOutcomeAfterE20$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS1000E20=rbind(S3SamplePopAfterS1000E20,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S3SamplePopAfterS1000E20AGG<-S3SamplePopAfterS1000E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

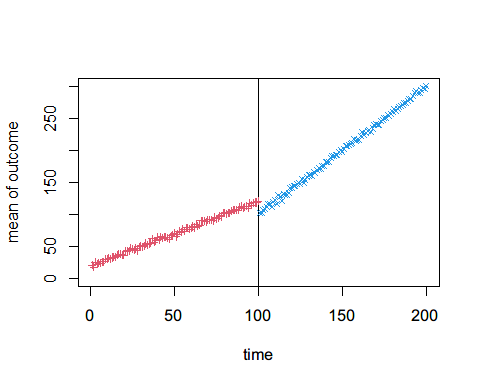
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 102.  
## 2 102 104.  
## 3 103 106.  
## 4 104 108.  
## 5 105 110.  
## 6 106 112.  
## 7 107 114.  
## 8 108 116.  
## 9 109 118.  
## 10 110 120.  
## # ... with 90 more rows

plot(S3SamplePopAfterS1000E20AGG$x,S3SamplePopAfterS1000E20AGG$y,ylim=c(0,200))

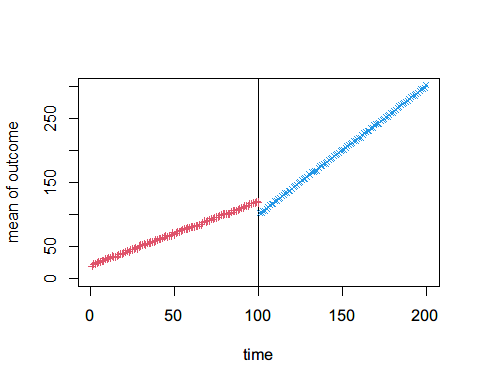


Combine before and after for size 20

S3SamplePopS20E20AGG<-rbind(S3SamplePopBefore20AGG,S3SamplePopAfterS20E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,300),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore20AGG$x, S3SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS20E20AGG$x, S3SamplePopAfterS20E20AGG$y, pch=4, col=4,cex=0.7)

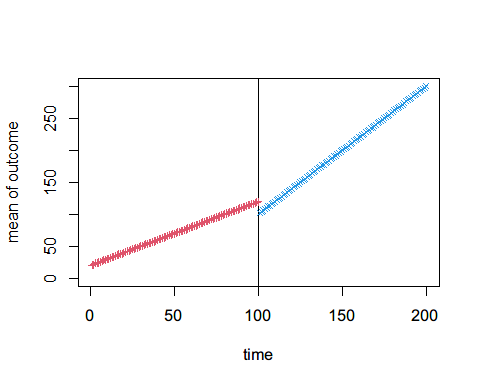
 Combine before and after for size 100

S3SamplePopS100E20AGG<-rbind(S3SamplePopBefore100AGG,S3SamplePopAfterS100E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,300),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore100AGG$x, S3SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS100E20AGG$x, S3SamplePopAfterS100E20AGG$y, pch=4, col=4,cex=0.7)



Combine before and after for size 1000

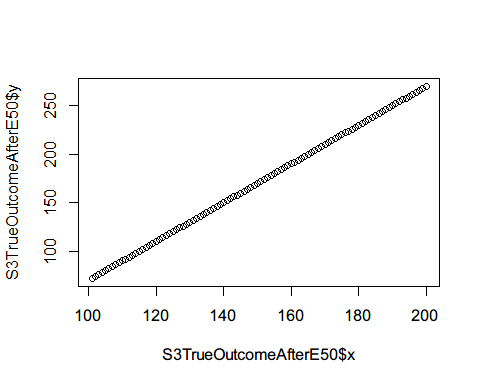
S3SamplePopS1000E20AGG<-rbind(S3SamplePopBefore100AGG,S3SamplePopAfterS1000E20AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,300),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore1000AGG$x, S3SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS1000E20AGG$x, S3SamplePopAfterS1000E20AGG$y, pch=4, col=4,cex=0.7)



## Effect Size: 50

Simulate level changed time points after intervention.

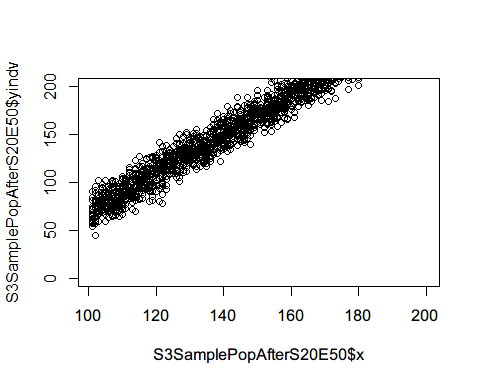
x=101:200  
S3TrueOutcomeAfterE50 = data.frame(x, y=2\*x-130)  
plot(S3TrueOutcomeAfterE50$x,S3TrueOutcomeAfterE50$y)



S3CounterfactualAfterE50=subset(S3TrueOutcomeAfterE50,x<120&x>100)

Simulate sample of 20 from the observed population

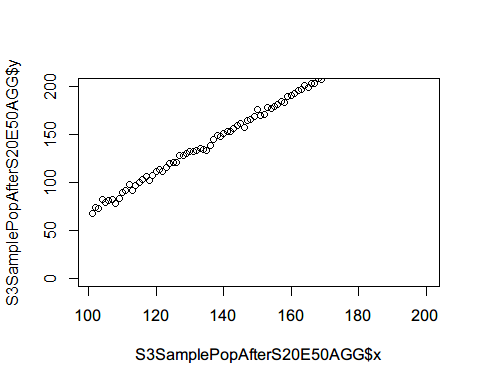
S3SamplePopAfterS20E50=c()  
i=1  
temp=data.frame()  
set.seed(30)  
for(i in 1:length(S3TrueOutcomeAfterE50$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S3TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS20E50=rbind(S3SamplePopAfterS20E50,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopAfterS20E50$x,S3SamplePopAfterS20E50$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S3SamplePopAfterS20E50AGG<-S3SamplePopAfterS20E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

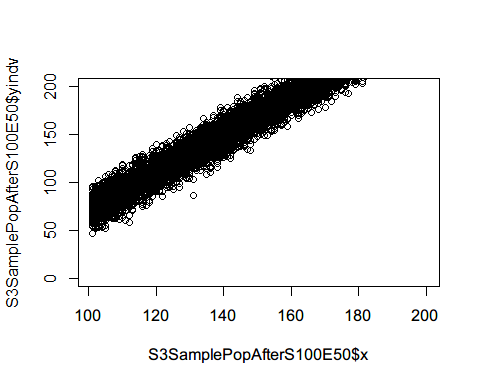
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 68.1  
## 2 102 73.7  
## 3 103 73.2  
## 4 104 81.8  
## 5 105 79.4  
## 6 106 81.4  
## 7 107 82.6  
## 8 108 77.8  
## 9 109 83.7  
## 10 110 89.1  
## # ... with 90 more rows

plot(S3SamplePopAfterS20E50AGG$x,S3SamplePopAfterS20E50AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

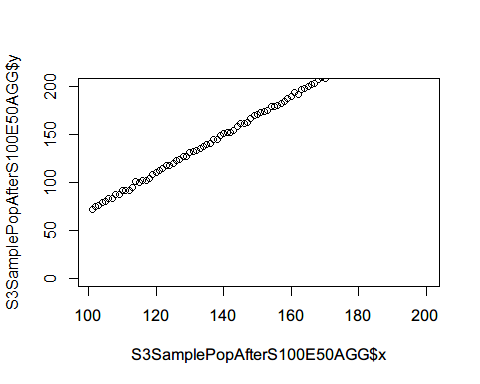
S3SamplePopAfterS100E50=c()  
i=1  
temp=data.frame()  
set.seed(31)  
for(i in 1:length(S3TrueOutcomeAfterE50$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S3TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS100E50=rbind(S3SamplePopAfterS100E50,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopAfterS100E50$x,S3SamplePopAfterS100E50$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S3SamplePopAfterS100E50AGG<-S3SamplePopAfterS100E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 71.8  
## 2 102 74.6  
## 3 103 75.7  
## 4 104 79.1  
## 5 105 79.7  
## 6 106 83.3  
## 7 107 83.7  
## 8 108 86.9  
## 9 109 87.0  
## 10 110 91.3  
## # ... with 90 more rows

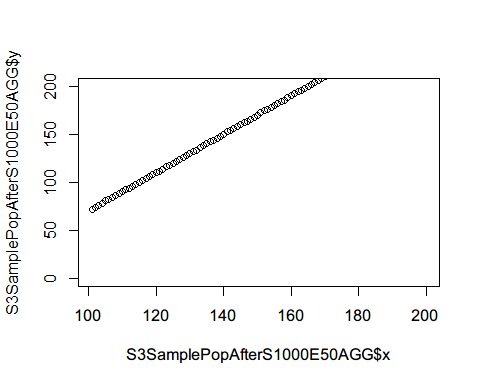
plot(S3SamplePopAfterS100E50AGG$x,S3SamplePopAfterS100E50AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S3SamplePopAfterS1000E50=c()  
i=1  
temp=data.frame()  
set.seed(32)  
for(i in 1:length(S3TrueOutcomeAfterE50$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S3TrueOutcomeAfterE50$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS1000E50=rbind(S3SamplePopAfterS1000E50,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S3SamplePopAfterS1000E50AGG<-S3SamplePopAfterS1000E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

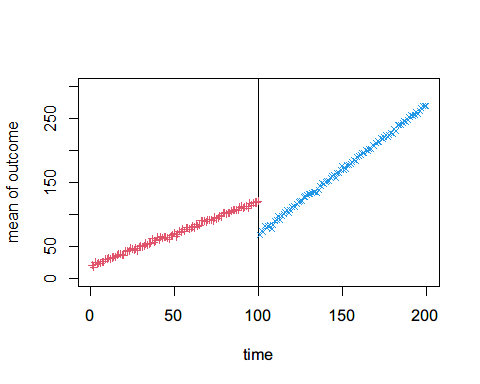
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 72.0  
## 2 102 73.5  
## 3 103 75.9  
## 4 104 78.1  
## 5 105 80.7  
## 6 106 82.4  
## 7 107 84.6  
## 8 108 86.2  
## 9 109 88.1  
## 10 110 90.3  
## # ... with 90 more rows

plot(S3SamplePopAfterS1000E50AGG$x,S3SamplePopAfterS1000E50AGG$y,ylim=c(0,200))

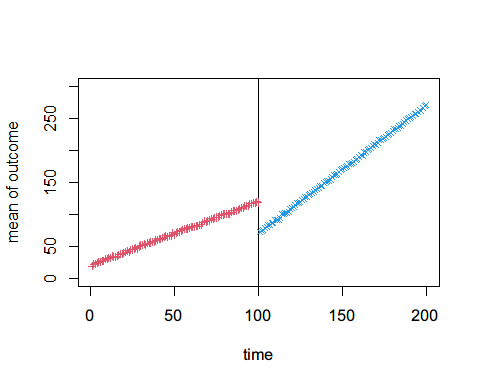


Combine before and after for size 20

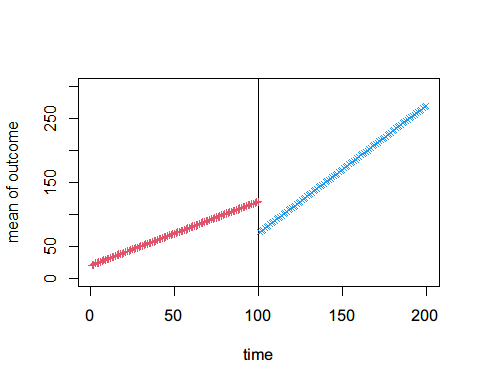
S3SamplePopS20E50AGG<-rbind(S3SamplePopBefore20AGG,S3SamplePopAfterS20E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,300),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore20AGG$x, S3SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS20E50AGG$x, S3SamplePopAfterS20E50AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 100

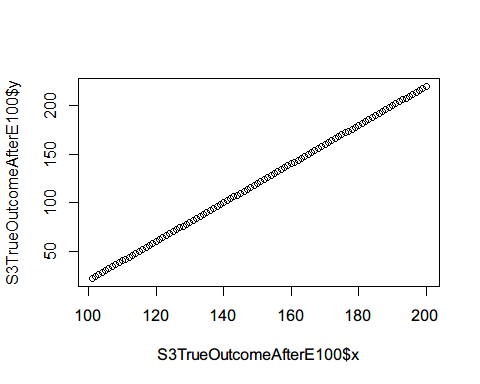
S3SamplePopS100E50AGG<-rbind(S3SamplePopBefore100AGG,S3SamplePopAfterS100E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,300),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore100AGG$x, S3SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS100E50AGG$x, S3SamplePopAfterS100E50AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 1000

S3SamplePopS1000E50AGG<-rbind(S3SamplePopBefore100AGG,S3SamplePopAfterS1000E50AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,300),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore1000AGG$x, S3SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS1000E50AGG$x, S3SamplePopAfterS1000E50AGG$y, pch=4, col=4,cex=0.7)

 ## Effect Size: 100  
Simulate level changed time points after intervention.

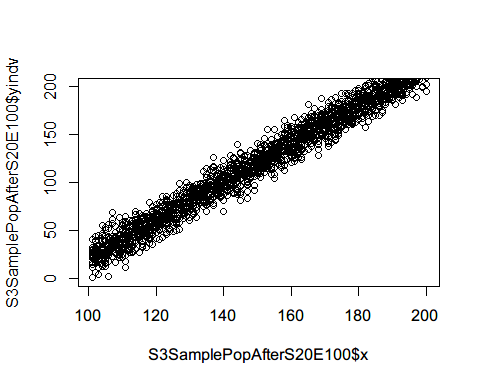
x=101:200  
S3TrueOutcomeAfterE100 = data.frame(x, y=2\*x-180)  
plot(S3TrueOutcomeAfterE100$x,S3TrueOutcomeAfterE100$y)



S3CounterfactualAfterE100=subset(S3TrueOutcomeAfterE100,x<120&x>100)

Simulate sample of 20 from the observed population

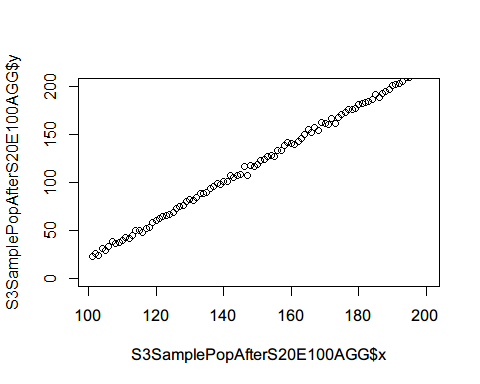
S3SamplePopAfterS20E100=c()  
i=1  
temp=data.frame()  
set.seed(33)  
for(i in 1:length(S3TrueOutcomeAfterE100$y)){  
 x=rep(i+100,20)  
 Individual=1:20  
 yindv=rnorm(20,S3TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS20E100=rbind(S3SamplePopAfterS20E100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopAfterS20E100$x,S3SamplePopAfterS20E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S3SamplePopAfterS20E100AGG<-S3SamplePopAfterS20E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

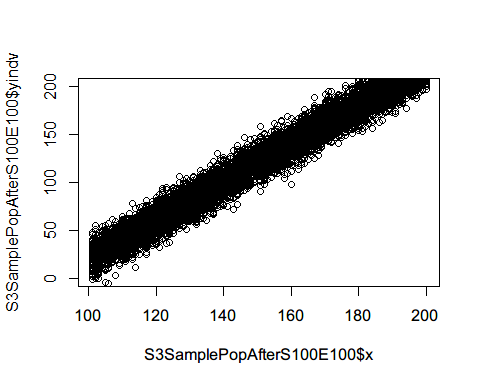
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 22.7  
## 2 102 25.8  
## 3 103 23.9  
## 4 104 31.4  
## 5 105 29.1  
## 6 106 33.6  
## 7 107 38.9  
## 8 108 36.6  
## 9 109 36.9  
## 10 110 39.8  
## # ... with 90 more rows

plot(S3SamplePopAfterS20E100AGG$x,S3SamplePopAfterS20E100AGG$y,ylim=c(0,200))



Simulate sample of 100 from the observed population

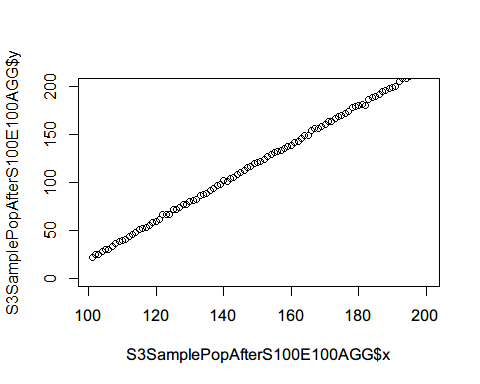
S3SamplePopAfterS100E100=c()  
i=1  
temp=data.frame()  
set.seed(34)  
for(i in 1:length(S3TrueOutcomeAfterE100$y)){  
 x=rep(i+100,100)  
 Individual=1:100  
 yindv=rnorm(100,S3TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS100E100=rbind(S3SamplePopAfterS100E100,temp)  
 i=i+1  
}  
#Individual level variation  
plot(S3SamplePopAfterS100E100$x,S3SamplePopAfterS100E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
(S3SamplePopAfterS100E100AGG<-S3SamplePopAfterS100E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 21.9  
## 2 102 25.3  
## 3 103 25.0  
## 4 104 27.7  
## 5 105 30.3  
## 6 106 30.6  
## 7 107 33.4  
## 8 108 36.1  
## 9 109 38.2  
## 10 110 39.4  
## # ... with 90 more rows

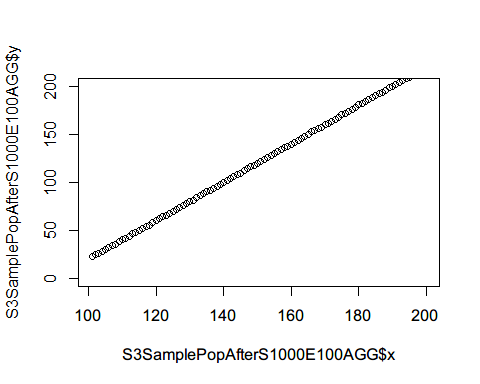
plot(S3SamplePopAfterS100E100AGG$x,S3SamplePopAfterS100E100AGG$y,ylim=c(0,200))

 Simulate sample of 1000 from the observed population

S3SamplePopAfterS1000E100=c()  
i=1  
temp=data.frame()  
set.seed(35)  
for(i in 1:length(S3TrueOutcomeAfterE100$y)){  
 x=rep(i+100,1000)  
 Individual=1:1000  
 yindv=rnorm(1000,S3TrueOutcomeAfterE100$y[i],10)  
 temp=data.frame(cbind(x,Individual,yindv))  
 S3SamplePopAfterS1000E100=rbind(S3SamplePopAfterS1000E100,temp)  
 i=i+1  
}  
#Compute mean at each time point  
(S3SamplePopAfterS1000E100AGG<-S3SamplePopAfterS1000E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv)))

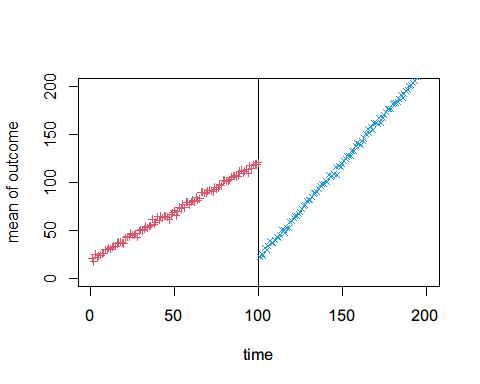
## # A tibble: 100 x 2  
## x y  
## <dbl> <dbl>  
## 1 101 22.9  
## 2 102 24.5  
## 3 103 25.9  
## 4 104 28.5  
## 5 105 29.9  
## 6 106 31.9  
## 7 107 34.2  
## 8 108 35.8  
## 9 109 38.3  
## 10 110 40.0  
## # ... with 90 more rows

plot(S3SamplePopAfterS1000E100AGG$x,S3SamplePopAfterS1000E100AGG$y,ylim=c(0,200))

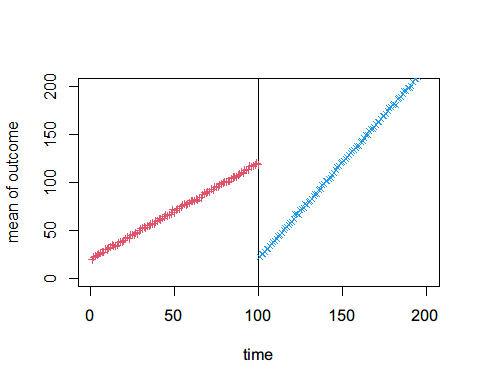


Combine before and after for size 20

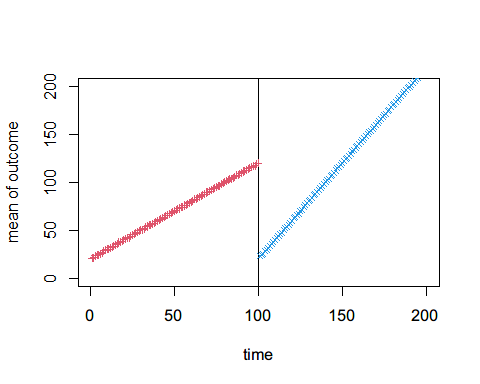
S3SamplePopS20E100AGG<-rbind(S3SamplePopBefore20AGG,S3SamplePopAfterS20E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore20AGG$x, S3SamplePopBefore20AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS20E100AGG$x, S3SamplePopAfterS20E100AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 100

S3SamplePopS100E100AGG<-rbind(S3SamplePopBefore100AGG,S3SamplePopAfterS100E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore100AGG$x, S3SamplePopBefore100AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS100E100AGG$x, S3SamplePopAfterS100E100AGG$y, pch=4, col=4,cex=0.7)

 Combine before and after for size 1000

S3SamplePopS1000E100AGG<-rbind(S3SamplePopBefore100AGG,S3SamplePopAfterS1000E100AGG)  
plot(x=1:200, y=rep(1,200), type="n", ylim=c(0,200),   
 xlab="time", ylab="mean of outcome")  
abline(v=100)  
points(S3SamplePopBefore1000AGG$x, S3SamplePopBefore1000AGG$y, pch=3, col=2,cex=0.7)  
points(S3SamplePopAfterS1000E100AGG$x, S3SamplePopAfterS1000E100AGG$y, pch=4, col=4,cex=0.7)

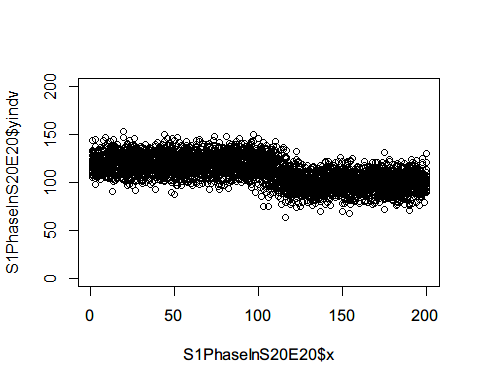
 # Simulating Phase-in period

# Senario 1

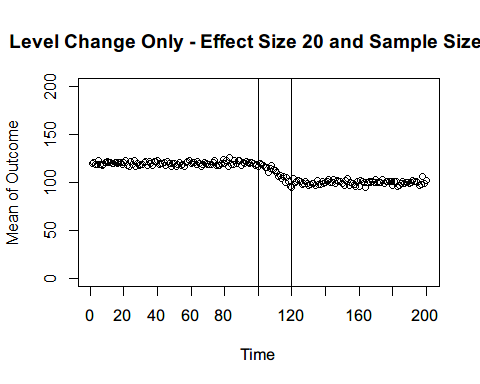
## Effect Size: 20

### Sample size: 20

S1SamplePopBefore20$Int<-FALSE  
S1SamplePopAfterS20E20Delay<-subset(S1SamplePopAfterS20E20,x>=120)  
S1SamplePopAfterS20E20Delay$Int<-TRUE  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(36)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS20E20Delay=rbind(S1SamplePopAfterS20E20Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S1CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS20E20Delay=rbind(S1SamplePopAfterS20E20Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS20E20=rbind(S1SamplePopBefore20,S1SamplePopAfterS20E20Delay)  
#Individual level variation  
plot(S1PhaseInS20E20$x,S1PhaseInS20E20$yindv,ylim=c(0,200))

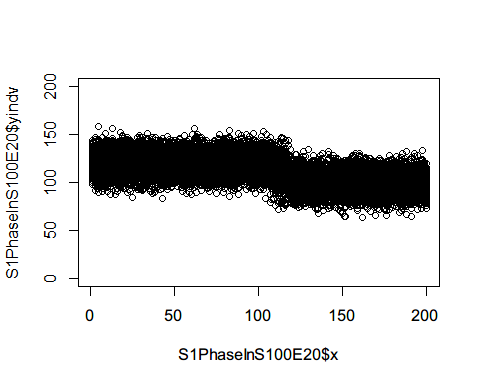


#Compute mean at each time point  
S1PhaseInS20E20AGG<-S1PhaseInS20E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS20E20AGG$x,S1PhaseInS20E20AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only - Effect Size 20 and Sample Size 20")  
abline(v=100)  
abline(v=120)

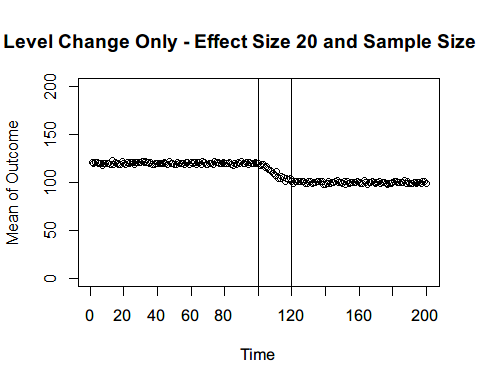


### Sample size: 100

S1SamplePopBefore100$Int<-FALSE  
S1SamplePopAfterS100E20Delay<-subset(S1SamplePopAfterS100E20,x>=120)  
S1SamplePopAfterS100E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(37)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS100E20Delay=rbind(S1SamplePopAfterS100E20Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S1CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS100E20Delay=rbind(S1SamplePopAfterS100E20Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS100E20=rbind(S1SamplePopBefore100,S1SamplePopAfterS100E20Delay)  
#Individual level variation  
plot(S1PhaseInS100E20$x,S1PhaseInS100E20$yindv,ylim=c(0,200))

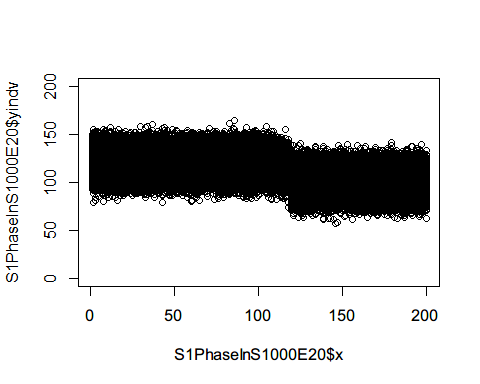


#Compute mean at each time point  
S1PhaseInS100E20AGG<-S1PhaseInS100E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS100E20AGG$x,S1PhaseInS100E20AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only - Effect Size 20 and Sample Size 100")  
abline(v=100)  
abline(v=120)

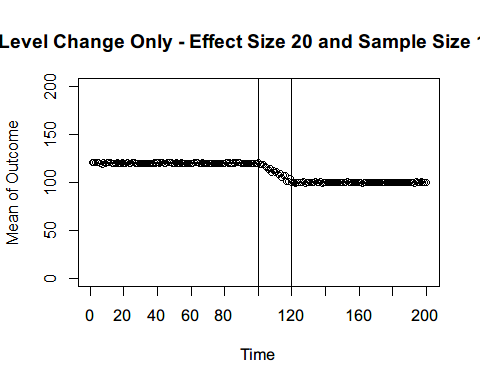


### Sample size: 1000

S1SamplePopBefore1000$Int<-FALSE  
S1SamplePopAfterS1000E20Delay<-subset(S1SamplePopAfterS1000E20,x>=120)  
S1SamplePopAfterS1000E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(38)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS1000E20Delay=rbind(S1SamplePopAfterS1000E20Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S1CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS1000E20Delay=rbind(S1SamplePopAfterS1000E20Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS1000E20=rbind(S1SamplePopBefore1000,S1SamplePopAfterS1000E20Delay)  
#Individual level variation  
plot(S1PhaseInS1000E20$x,S1PhaseInS1000E20$yindv,ylim=c(0,200))



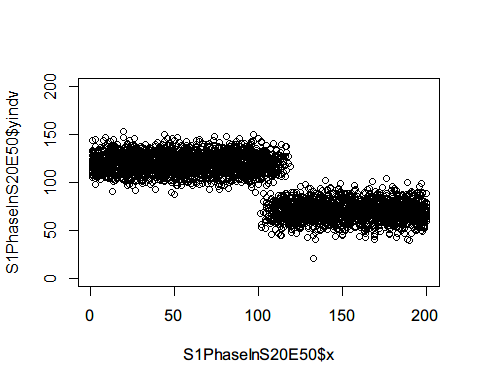
#Compute mean at each time point  
S1PhaseInS1000E20AGG<-S1PhaseInS1000E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS1000E20AGG$x,S1PhaseInS1000E20AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only - Effect Size 20 and Sample Size 1000")  
abline(v=100)  
abline(v=120)



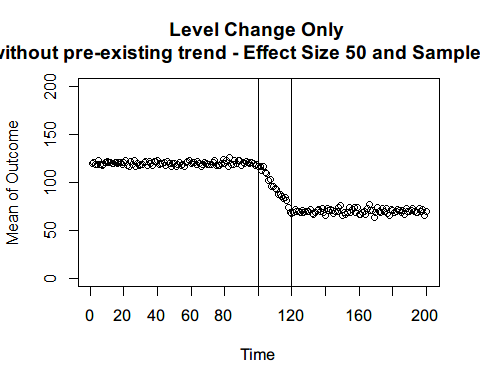
## Effect Size: 50

### Sample size: 20

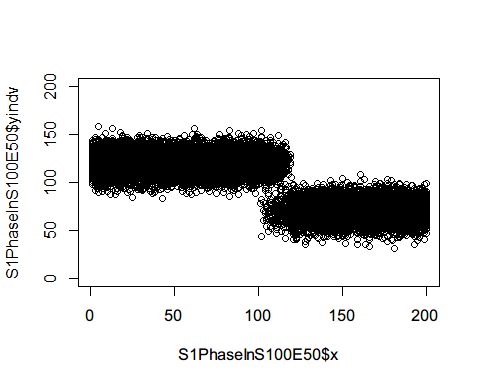
S1SamplePopAfterS20E50Delay<-subset(S1SamplePopAfterS20E50,x>=120)  
S1SamplePopAfterS20E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(39)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS20E50Delay=rbind(S1SamplePopAfterS20E50Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S1CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS20E50Delay=rbind(S1SamplePopAfterS20E50Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS20E50=rbind(S1SamplePopBefore20,S1SamplePopAfterS20E50Delay)  
#Individual level variation  
plot(S1PhaseInS20E50$x,S1PhaseInS20E50$yindv,ylim=c(0,200))



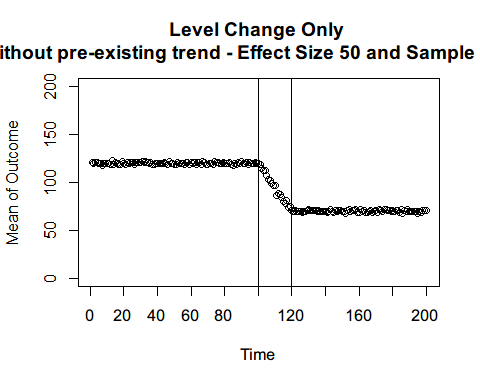
#Compute mean at each time point  
S1PhaseInS20E50AGG<-S1PhaseInS20E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS20E50AGG$x,S1PhaseInS20E50AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 without pre-existing trend - Effect Size 50 and Sample Size 20")  
abline(v=100)  
abline(v=120)

 ### Sample size: 100

S1SamplePopAfterS100E50Delay<-subset(S1SamplePopAfterS100E50,x>=120)  
S1SamplePopAfterS100E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(40)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS100E50Delay=rbind(S1SamplePopAfterS100E50Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S1CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS100E50Delay=rbind(S1SamplePopAfterS100E50Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS100E50=rbind(S1SamplePopBefore100,S1SamplePopAfterS100E50Delay)  
#Individual level variation  
plot(S1PhaseInS100E50$x,S1PhaseInS100E50$yindv,ylim=c(0,200))

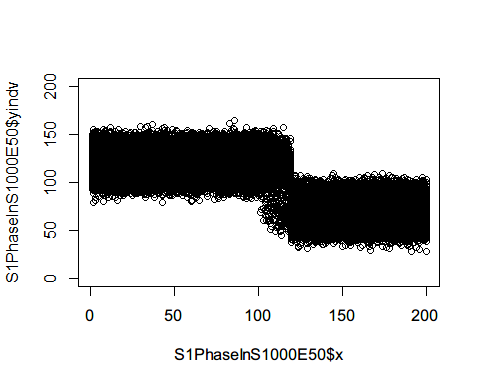


#Compute mean at each time point  
S1PhaseInS100E50AGG<-S1PhaseInS100E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS100E50AGG$x,S1PhaseInS100E50AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 without pre-existing trend - Effect Size 50 and Sample Size 100")  
abline(v=100)  
abline(v=120)

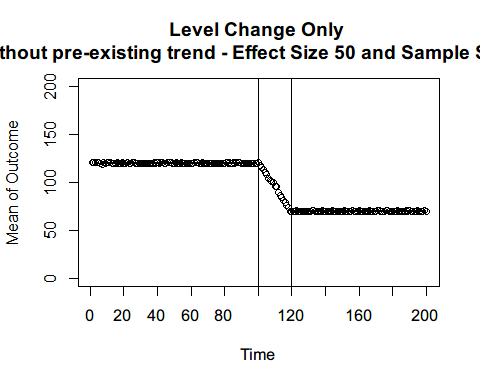


### Sample size: 1000

S1SamplePopAfterS1000E50Delay<-subset(S1SamplePopAfterS1000E50,x>=120)  
S1SamplePopAfterS1000E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(41)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS1000E50Delay=rbind(S1SamplePopAfterS1000E50Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S1CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS1000E50Delay=rbind(S1SamplePopAfterS1000E50Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS1000E50=rbind(S1SamplePopBefore1000,S1SamplePopAfterS1000E50Delay)  
#Individual level variation  
plot(S1PhaseInS1000E50$x,S1PhaseInS1000E50$yindv,ylim=c(0,200))



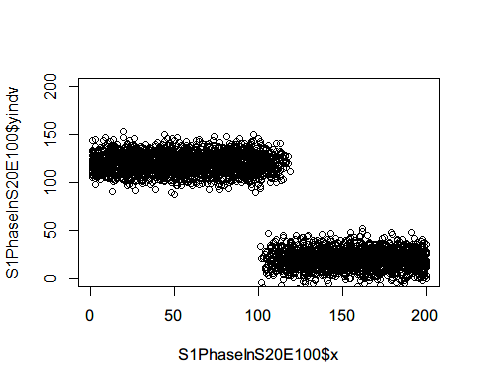
#Compute mean at each time point  
S1PhaseInS1000E50AGG<-S1PhaseInS1000E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS1000E50AGG$x,S1PhaseInS1000E50AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 without pre-existing trend - Effect Size 50 and Sample Size 1000")  
abline(v=100)  
abline(v=120)



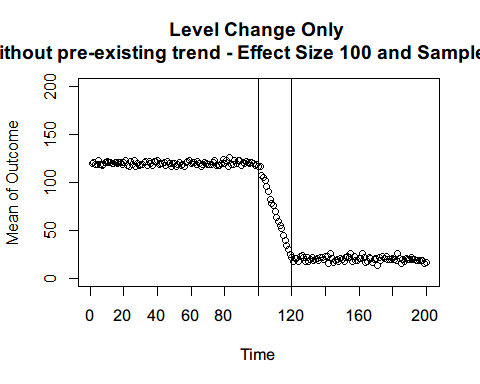
## Effect Size: 100

### Sample size: 20

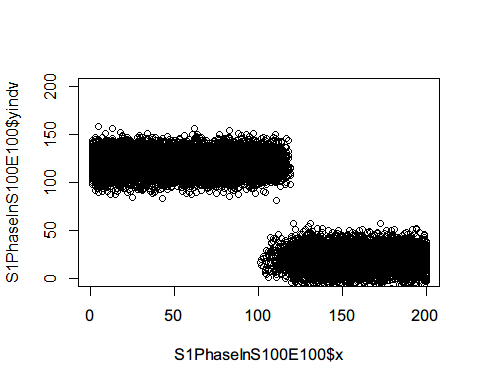
S1SamplePopAfterS20E100Delay<-subset(S1SamplePopAfterS20E100,x>=120)  
S1SamplePopAfterS20E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(42)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS20E100Delay=rbind(S1SamplePopAfterS20E100Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S1CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS20E100Delay=rbind(S1SamplePopAfterS20E100Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS20E100=rbind(S1SamplePopBefore20,S1SamplePopAfterS20E100Delay)  
#Individual level variation  
plot(S1PhaseInS20E100$x,S1PhaseInS20E100$yindv,ylim=c(0,200))



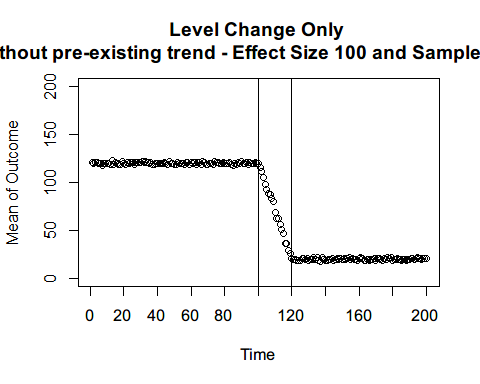
#Compute mean at each time point  
S1PhaseInS20E100AGG<-S1PhaseInS20E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS20E100AGG$x,S1PhaseInS20E100AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 without pre-existing trend - Effect Size 100 and Sample Size 20")  
abline(v=100)  
abline(v=120)

 ### Sample size: 100

S1SamplePopAfterS100E100Delay<-subset(S1SamplePopAfterS100E100,x>=120)  
S1SamplePopAfterS100E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(43)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS100E100Delay=rbind(S1SamplePopAfterS100E100Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S1CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS100E100Delay=rbind(S1SamplePopAfterS100E100Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS100E100=rbind(S1SamplePopBefore100,S1SamplePopAfterS100E100Delay)  
#Individual level variation  
plot(S1PhaseInS100E100$x,S1PhaseInS100E100$yindv,ylim=c(0,200))

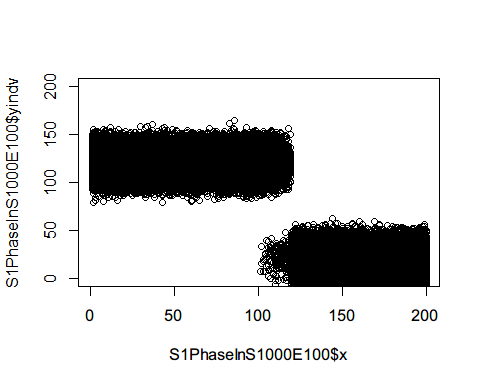


#Compute mean at each time point  
S1PhaseInS100E100AGG<-S1PhaseInS100E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS100E100AGG$x,S1PhaseInS100E100AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 without pre-existing trend - Effect Size 100 and Sample Size 100")  
abline(v=100)  
abline(v=120)

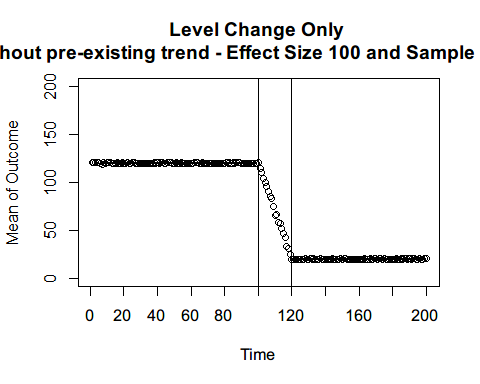


### Sample size: 1000

S1SamplePopAfterS1000E100Delay<-subset(S1SamplePopAfterS1000E100,x>=120)  
S1SamplePopAfterS1000E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(44)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S1CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS1000E100Delay=rbind(S1SamplePopAfterS1000E100Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S1CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S1SamplePopAfterS1000E100Delay=rbind(S1SamplePopAfterS1000E100Delay,temp2)  
 i=i+1  
}  
  
S1PhaseInS1000E100=rbind(S1SamplePopBefore1000,S1SamplePopAfterS1000E100Delay)  
#Individual level variation  
plot(S1PhaseInS1000E100$x,S1PhaseInS1000E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
S1PhaseInS1000E100AGG<-S1PhaseInS1000E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S1PhaseInS1000E100AGG$x,S1PhaseInS1000E100AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 without pre-existing trend - Effect Size 100 and Sample Size 1000")  
abline(v=100)  
abline(v=120)

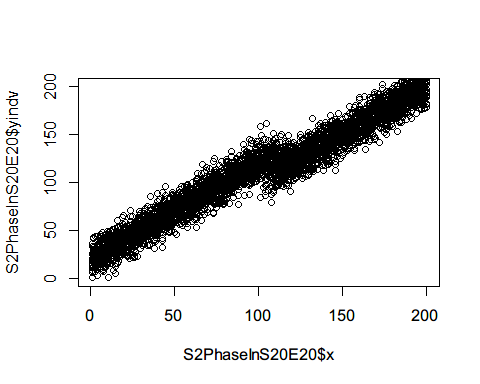


# Senario 2

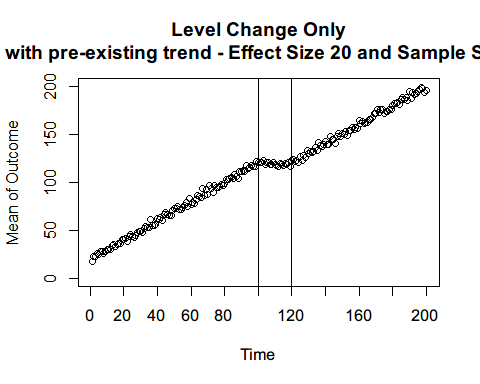
## Effect Size: 20

### Sample size: 20

S2SamplePopBefore20$Int<-FALSE  
S2SamplePopAfterS20E20Delay<-subset(S2SamplePopAfterS20E20,x>=120)  
S2SamplePopAfterS20E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(45)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS20E20Delay=rbind(S2SamplePopAfterS20E20Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S2CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS20E20Delay=rbind(S2SamplePopAfterS20E20Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS20E20=rbind(S2SamplePopBefore20,S2SamplePopAfterS20E20Delay)  
#Individual level variation  
plot(S2PhaseInS20E20$x,S2PhaseInS20E20$yindv,ylim=c(0,200))

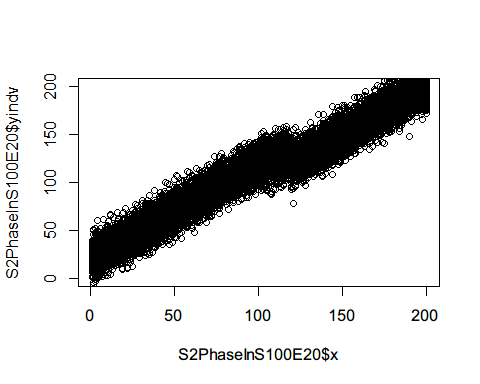


#Compute mean at each time point  
S2PhaseInS20E20AGG<-S2PhaseInS20E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS20E20AGG$x,S2PhaseInS20E20AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only  
 with pre-existing trend - Effect Size 20 and Sample Size 20")  
abline(v=100)  
abline(v=120)

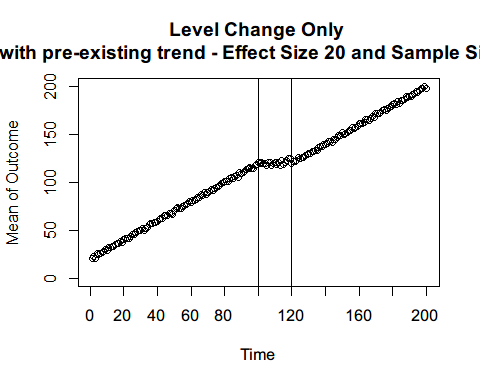


### Sample size: 100

S2SamplePopBefore100$Int<-FALSE  
S2SamplePopAfterS100E20Delay<-subset(S2SamplePopAfterS100E20,x>=120)  
S2SamplePopAfterS100E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(46)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS100E20Delay=rbind(S2SamplePopAfterS100E20Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S2CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS100E20Delay=rbind(S2SamplePopAfterS100E20Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS100E20=rbind(S2SamplePopBefore100,S2SamplePopAfterS100E20Delay)  
#Individual level variation  
plot(S2PhaseInS100E20$x,S2PhaseInS100E20$yindv,ylim=c(0,200))

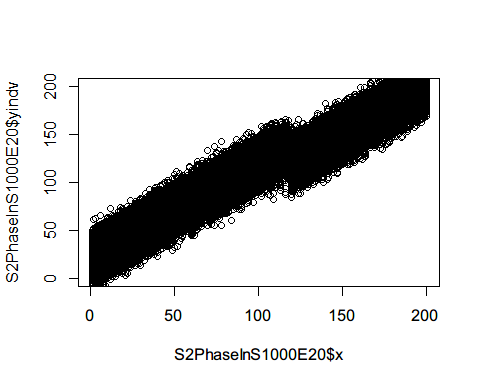


#Compute mean at each time point  
S2PhaseInS100E20AGG<-S2PhaseInS100E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS100E20AGG$x,S2PhaseInS100E20AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 with pre-existing trend - Effect Size 20 and Sample Size 100")  
abline(v=100)  
abline(v=120)

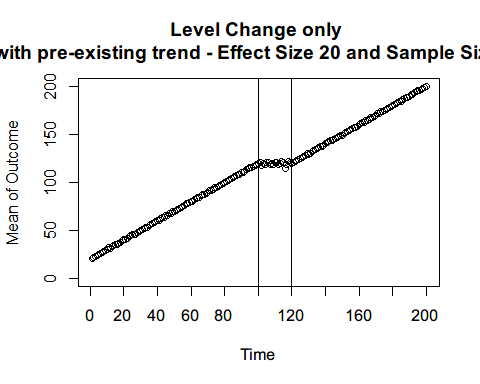


### Sample size: 1000

S2SamplePopBefore1000$Int<-FALSE  
S2SamplePopAfterS1000E20Delay<-subset(S2SamplePopAfterS1000E20,x>=120)  
S2SamplePopAfterS1000E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(47)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS1000E20Delay=rbind(S2SamplePopAfterS1000E20Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S2CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS1000E20Delay=rbind(S2SamplePopAfterS1000E20Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS1000E20=rbind(S2SamplePopBefore1000,S2SamplePopAfterS1000E20Delay)  
#Individual level variation  
plot(S2PhaseInS1000E20$x,S2PhaseInS1000E20$yindv,ylim=c(0,200))



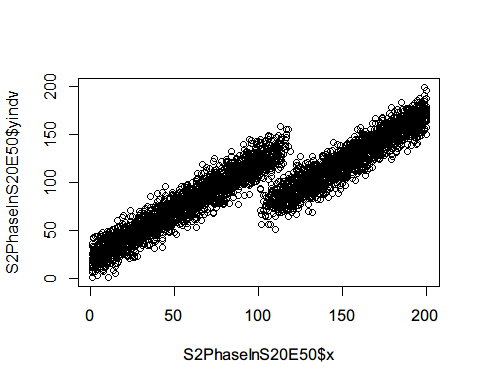
#Compute mean at each time point  
S2PhaseInS1000E20AGG<-S2PhaseInS1000E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS1000E20AGG$x,S2PhaseInS1000E20AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change only   
 with pre-existing trend - Effect Size 20 and Sample Size 1000")  
abline(v=100)  
abline(v=120)



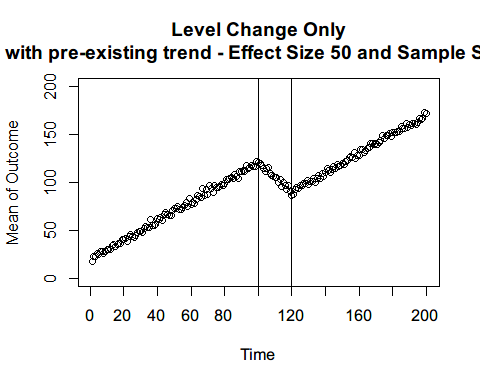
## Effect Size: 50

### Sample size: 20

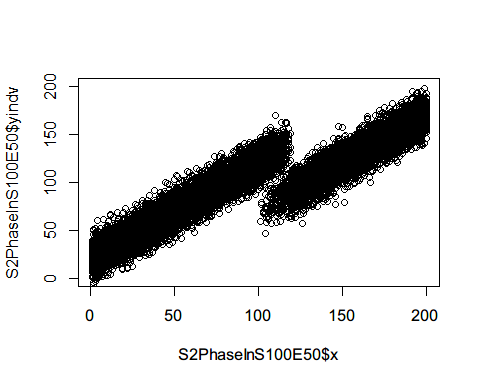
S2SamplePopAfterS20E50Delay<-subset(S2SamplePopAfterS20E50,x>=120)  
S2SamplePopAfterS20E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(48)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS20E50Delay=rbind(S2SamplePopAfterS20E50Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S2CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS20E50Delay=rbind(S2SamplePopAfterS20E50Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS20E50=rbind(S2SamplePopBefore20,S2SamplePopAfterS20E50Delay)  
#Individual level variation  
plot(S2PhaseInS20E50$x,S2PhaseInS20E50$yindv,ylim=c(0,200))



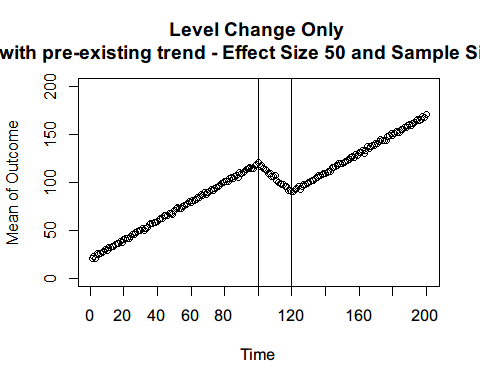
#Compute mean at each time point  
S2PhaseInS20E50AGG<-S2PhaseInS20E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS20E50AGG$x,S2PhaseInS20E50AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only  
 with pre-existing trend - Effect Size 50 and Sample Size 20")  
abline(v=100)  
abline(v=120)

 ### Sample size: 100

S2SamplePopAfterS100E50Delay<-subset(S2SamplePopAfterS100E50,x>=120)  
S2SamplePopAfterS100E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(49)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS100E50Delay=rbind(S2SamplePopAfterS100E50Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S2CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS100E50Delay=rbind(S2SamplePopAfterS100E50Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS100E50=rbind(S2SamplePopBefore100,S2SamplePopAfterS100E50Delay)  
#Individual level variation  
plot(S2PhaseInS100E50$x,S2PhaseInS100E50$yindv,ylim=c(0,200))

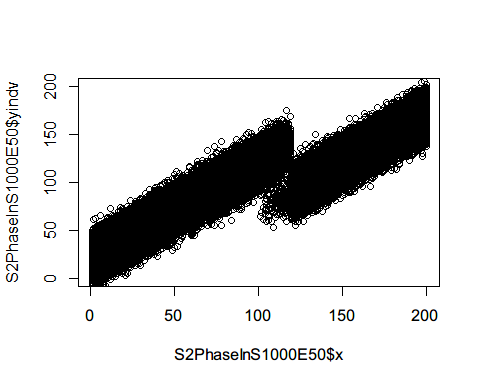


#Compute mean at each time point  
S2PhaseInS100E50AGG<-S2PhaseInS100E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS100E50AGG$x,S2PhaseInS100E50AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 with pre-existing trend - Effect Size 50 and Sample Size 100")  
abline(v=100)  
abline(v=120)

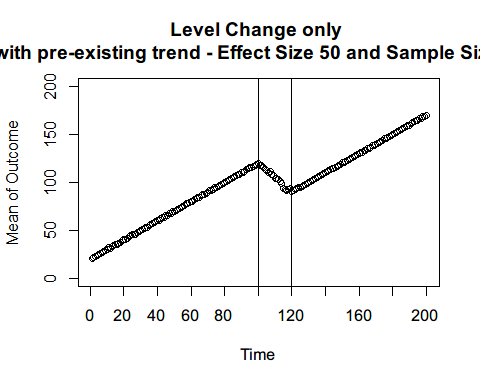


### Sample size: 1000

S2SamplePopAfterS1000E50Delay<-subset(S2SamplePopAfterS1000E50,x>=120)  
S2SamplePopAfterS1000E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(50)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS1000E50Delay=rbind(S2SamplePopAfterS1000E50Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S2CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS1000E50Delay=rbind(S2SamplePopAfterS1000E50Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS1000E50=rbind(S2SamplePopBefore1000,S2SamplePopAfterS1000E50Delay)  
#Individual level variation  
plot(S2PhaseInS1000E50$x,S2PhaseInS1000E50$yindv,ylim=c(0,200))



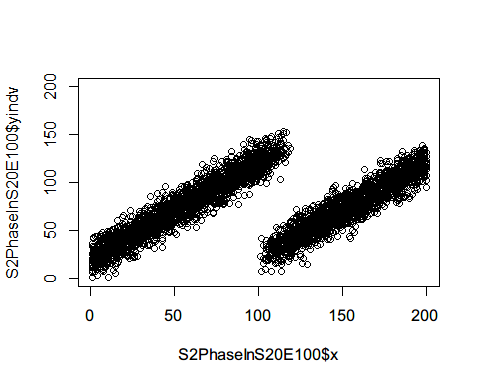
#Compute mean at each time point  
S2PhaseInS1000E50AGG<-S2PhaseInS1000E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS1000E50AGG$x,S2PhaseInS1000E50AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change only   
 with pre-existing trend - Effect Size 50 and Sample Size 1000")  
abline(v=100)  
abline(v=120)



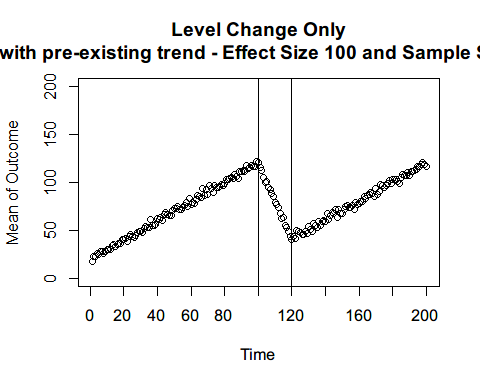
## Effect Size: 100

### Sample size: 20

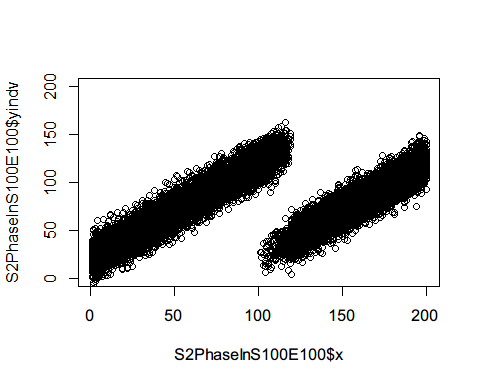
S2SamplePopAfterS20E100Delay<-subset(S2SamplePopAfterS20E100,x>=120)  
S2SamplePopAfterS20E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(51)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS20E100Delay=rbind(S2SamplePopAfterS20E100Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S2CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS20E100Delay=rbind(S2SamplePopAfterS20E100Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS20E100=rbind(S2SamplePopBefore20,S2SamplePopAfterS20E100Delay)  
#Individual level variation  
plot(S2PhaseInS20E100$x,S2PhaseInS20E100$yindv,ylim=c(0,200))



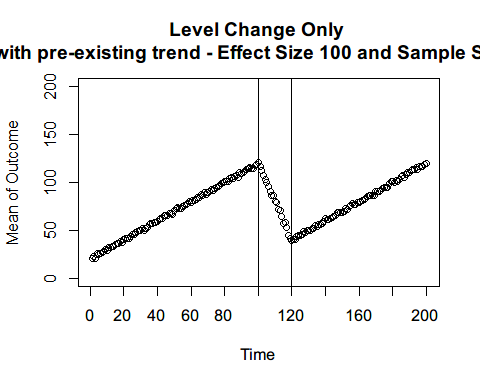
#Compute mean at each time point  
S2PhaseInS20E100AGG<-S2PhaseInS20E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS20E100AGG$x,S2PhaseInS20E100AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only  
 with pre-existing trend - Effect Size 100 and Sample Size 20")  
abline(v=100)  
abline(v=120)

 ### Sample size: 100

S2SamplePopAfterS100E100Delay<-subset(S2SamplePopAfterS100E100,x>=120)  
S2SamplePopAfterS100E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(52)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS100E100Delay=rbind(S2SamplePopAfterS100E100Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S2CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS100E100Delay=rbind(S2SamplePopAfterS100E100Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS100E100=rbind(S2SamplePopBefore100,S2SamplePopAfterS100E100Delay)  
#Individual level variation  
plot(S2PhaseInS100E100$x,S2PhaseInS100E100$yindv,ylim=c(0,200))

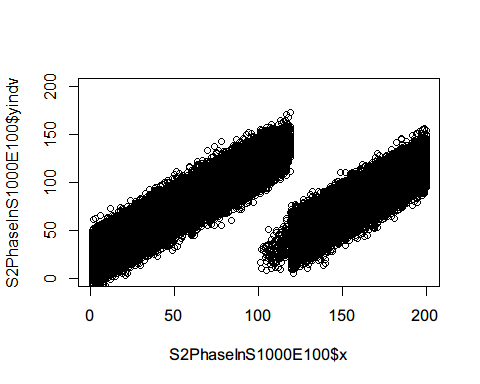


#Compute mean at each time point  
S2PhaseInS100E100AGG<-S2PhaseInS100E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS100E100AGG$x,S2PhaseInS100E100AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change Only   
 with pre-existing trend - Effect Size 100 and Sample Size 100")  
abline(v=100)  
abline(v=120)

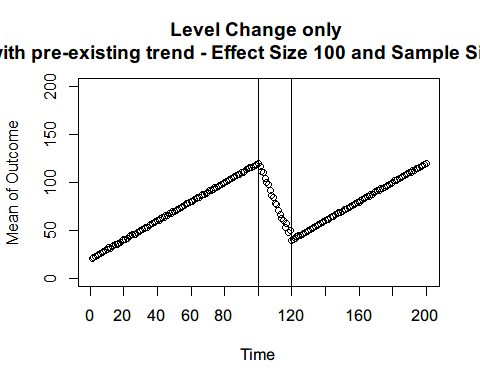


### Sample size: 1000

S2SamplePopAfterS1000E100Delay<-subset(S2SamplePopAfterS1000E100,x>=120)  
S2SamplePopAfterS1000E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(53)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S2CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS1000E100Delay=rbind(S2SamplePopAfterS1000E100Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S2CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S2SamplePopAfterS1000E100Delay=rbind(S2SamplePopAfterS1000E100Delay,temp2)  
 i=i+1  
}  
  
S2PhaseInS1000E100=rbind(S2SamplePopBefore1000,S2SamplePopAfterS1000E100Delay)  
#Individual level variation  
plot(S2PhaseInS1000E100$x,S2PhaseInS1000E100$yindv,ylim=c(0,200))



#Compute mean at each time point  
S2PhaseInS1000E100AGG<-S2PhaseInS1000E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S2PhaseInS1000E100AGG$x,S2PhaseInS1000E100AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level Change only   
 with pre-existing trend - Effect Size 100 and Sample Size 1000")  
abline(v=100)  
abline(v=120)

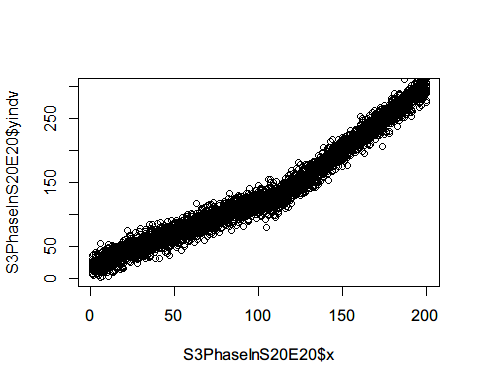


# Senario 3

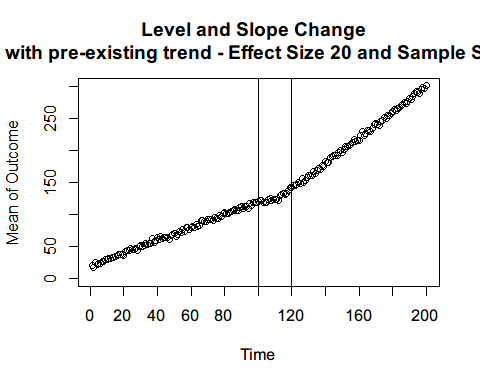
## Effect Size: 20

### Sample size: 20

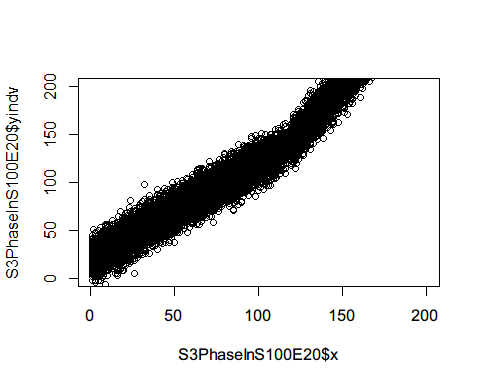
S3SamplePopBefore20$Int<-FALSE  
S3SamplePopAfterS20E20Delay<-subset(S3SamplePopAfterS20E20,x>=120)  
S3SamplePopAfterS20E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(54)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS20E20Delay=rbind(S3SamplePopAfterS20E20Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S3CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS20E20Delay=rbind(S3SamplePopAfterS20E20Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS20E20=rbind(S3SamplePopBefore20,S3SamplePopAfterS20E20Delay)  
#Individual level variation  
plot(S3PhaseInS20E20$x,S3PhaseInS20E20$yindv,ylim=c(0,300))



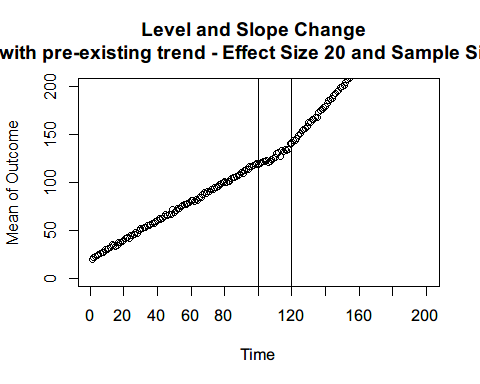
#Compute mean at each time point  
S3PhaseInS20E20AGG<-S3PhaseInS20E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS20E20AGG$x,S3PhaseInS20E20AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 20 and Sample Size 20")  
abline(v=100)  
abline(v=120)

 ### Sample size: 100

S3SamplePopBefore100$Int<-FALSE  
S3SamplePopAfterS100E20Delay<-subset(S3SamplePopAfterS100E20,x>=120)  
S3SamplePopAfterS100E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(55)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS100E20Delay=rbind(S3SamplePopAfterS100E20Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S3CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS100E20Delay=rbind(S3SamplePopAfterS100E20Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS100E20=rbind(S3SamplePopBefore100,S3SamplePopAfterS100E20Delay)  
#Individual level variation  
plot(S3PhaseInS100E20$x,S3PhaseInS100E20$yindv,ylim=c(0,200))

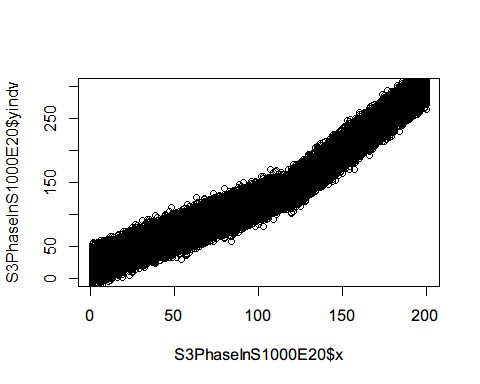


#Compute mean at each time point  
S3PhaseInS100E20AGG<-S3PhaseInS100E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS100E20AGG$x,S3PhaseInS100E20AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 20 and Sample Size 100")  
abline(v=100)  
abline(v=120)

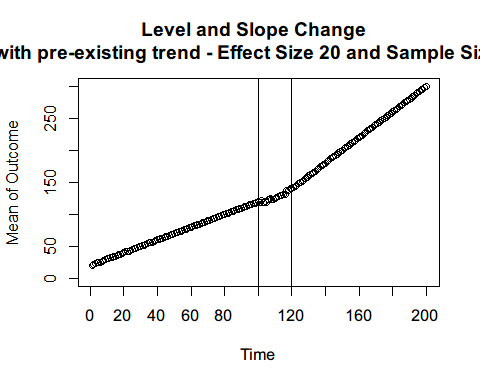


### Sample size: 1000

S3SamplePopBefore1000$Int<-FALSE  
S3SamplePopAfterS1000E20Delay<-subset(S3SamplePopAfterS1000E20,x>=120)  
S3SamplePopAfterS1000E20Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(56)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS1000E20Delay=rbind(S3SamplePopAfterS1000E20Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S3CounterfactualAfterE20$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS1000E20Delay=rbind(S3SamplePopAfterS1000E20Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS1000E20=rbind(S3SamplePopBefore1000,S3SamplePopAfterS1000E20Delay)  
#Individual level variation  
plot(S3PhaseInS1000E20$x,S3PhaseInS1000E20$yindv,ylim=c(0,300))



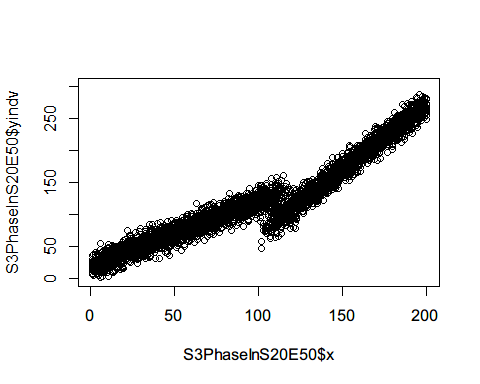
#Compute mean at each time point  
S3PhaseInS1000E20AGG<-S3PhaseInS1000E20 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS1000E20AGG$x,S3PhaseInS1000E20AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 20 and Sample Size 1000")  
abline(v=100)  
abline(v=120)



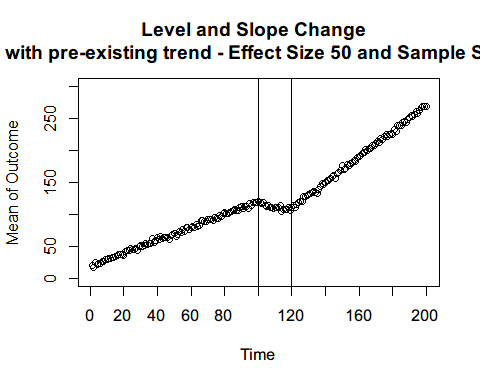
## Effect Size: 50

### Sample size: 20

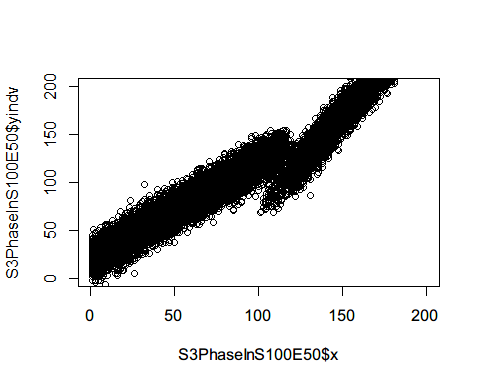
S3SamplePopAfterS20E50Delay<-subset(S3SamplePopAfterS20E50,x>=120)  
S3SamplePopAfterS20E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(57)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS20E50Delay=rbind(S3SamplePopAfterS20E50Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S3CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS20E50Delay=rbind(S3SamplePopAfterS20E50Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS20E50=rbind(S3SamplePopBefore20,S3SamplePopAfterS20E50Delay)  
#Individual level variation  
plot(S3PhaseInS20E50$x,S3PhaseInS20E50$yindv,ylim=c(0,300))



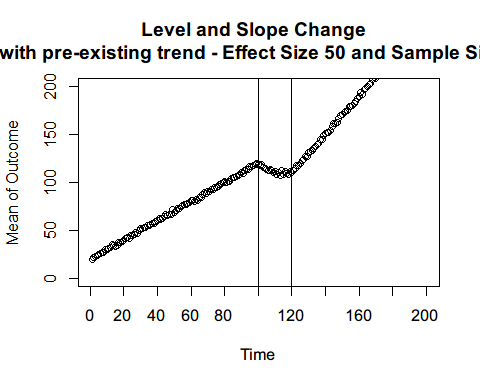
#Compute mean at each time point  
S3PhaseInS20E50AGG<-S3PhaseInS20E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS20E50AGG$x,S3PhaseInS20E50AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 50 and Sample Size 20")  
abline(v=100)  
abline(v=120)

 ### Sample size: 100

S3SamplePopAfterS100E50Delay<-subset(S3SamplePopAfterS100E50,x>=120)  
S3SamplePopAfterS100E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(58)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS100E50Delay=rbind(S3SamplePopAfterS100E50Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S3CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS100E50Delay=rbind(S3SamplePopAfterS100E50Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS100E50=rbind(S3SamplePopBefore100,S3SamplePopAfterS100E50Delay)  
#Individual level variation  
plot(S3PhaseInS100E50$x,S3PhaseInS100E50$yindv,ylim=c(0,200))

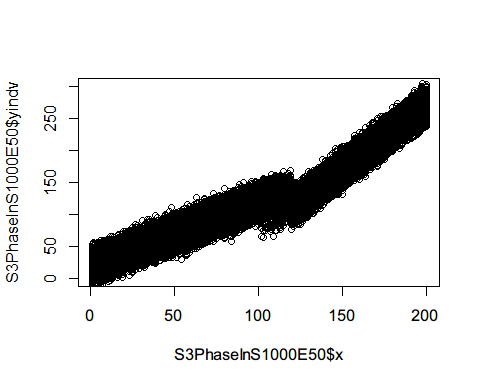


#Compute mean at each time point  
S3PhaseInS100E50AGG<-S3PhaseInS100E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS100E50AGG$x,S3PhaseInS100E50AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 50 and Sample Size 100")  
abline(v=100)  
abline(v=120)

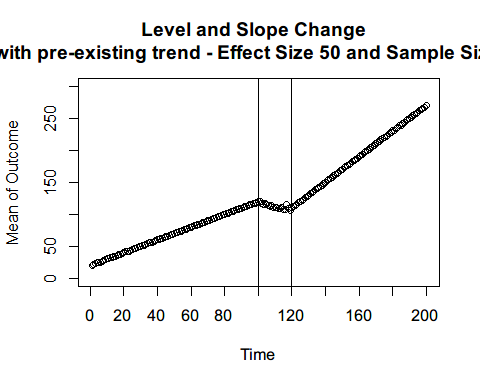


### Sample size: 1000

S3SamplePopAfterS1000E50Delay<-subset(S3SamplePopAfterS1000E50,x>=120)  
S3SamplePopAfterS1000E50Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(59)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS1000E50Delay=rbind(S3SamplePopAfterS1000E50Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S3CounterfactualAfterE50$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS1000E50Delay=rbind(S3SamplePopAfterS1000E50Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS1000E50=rbind(S3SamplePopBefore1000,S3SamplePopAfterS1000E50Delay)  
#Individual level variation  
plot(S3PhaseInS1000E50$x,S3PhaseInS1000E50$yindv,ylim=c(0,300))



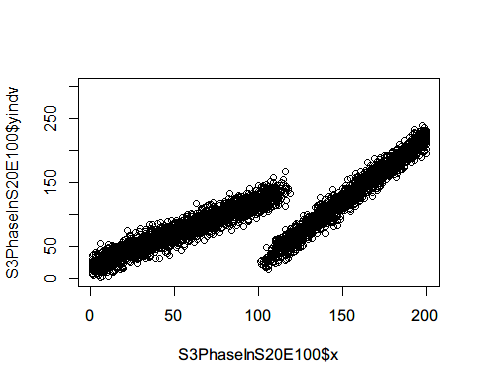
#Compute mean at each time point  
S3PhaseInS1000E50AGG<-S3PhaseInS1000E50 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS1000E50AGG$x,S3PhaseInS1000E50AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 50 and Sample Size 1000")  
abline(v=100)  
abline(v=120)



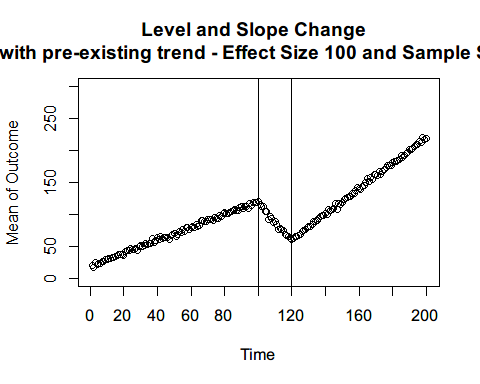
## Effect Size: 100

### Sample size: 20

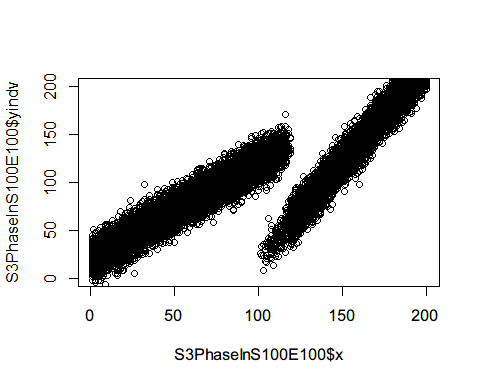
S3SamplePopAfterS20E100Delay<-subset(S3SamplePopAfterS20E100,x>=120)  
S3SamplePopAfterS20E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(60)  
p=1:19  
ss=20  
for(i in p){  
 x=rep(i+100,ss-i)  
 Individual=head(1:ss,ss-i)  
 yindv=rnorm(ss-i,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS20E100Delay=rbind(S3SamplePopAfterS20E100Delay,temp1)  
   
 x=rep(i+100,i)  
 Individual=tail(1:ss,i)  
 yindv=rnorm(i,S3CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS20E100Delay=rbind(S3SamplePopAfterS20E100Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS20E100=rbind(S3SamplePopBefore20,S3SamplePopAfterS20E100Delay)  
#Individual level variation  
plot(S3PhaseInS20E100$x,S3PhaseInS20E100$yindv,ylim=c(0,300))



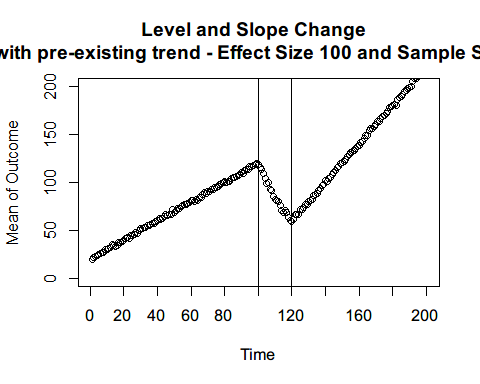
#Compute mean at each time point  
S3PhaseInS20E100AGG<-S3PhaseInS20E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS20E100AGG$x,S3PhaseInS20E100AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 100 and Sample Size 20")  
abline(v=100)  
abline(v=120)

 ### Sample size: 100

S3SamplePopAfterS100E100Delay<-subset(S3SamplePopAfterS100E100,x>=120)  
S3SamplePopAfterS100E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(61)  
p=1:19  
ss=100  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS100E100Delay=rbind(S3SamplePopAfterS100E100Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S3CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS100E100Delay=rbind(S3SamplePopAfterS100E100Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS100E100=rbind(S3SamplePopBefore100,S3SamplePopAfterS100E100Delay)  
#Individual level variation  
plot(S3PhaseInS100E100$x,S3PhaseInS100E100$yindv,ylim=c(0,200))

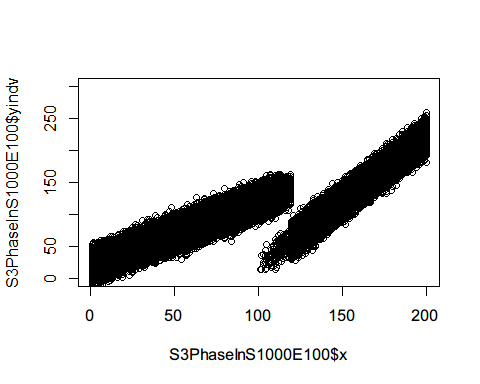


#Compute mean at each time point  
S3PhaseInS100E100AGG<-S3PhaseInS100E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS100E100AGG$x,S3PhaseInS100E100AGG$y,ylim=c(0,200),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 100 and Sample Size 100")  
abline(v=100)  
abline(v=120)

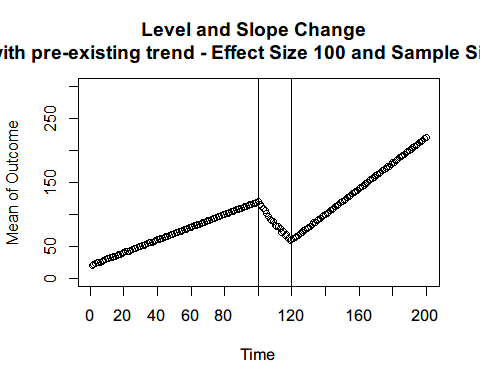


### Sample size: 1000

S3SamplePopAfterS1000E100Delay<-subset(S3SamplePopAfterS1000E100,x>=120)  
S3SamplePopAfterS1000E100Delay$Int<-TRUE  
  
# Phase-in period  
i=1  
temp1=data.frame()  
temp2=data.frame()  
set.seed(62)  
p=1:19  
ss=1000  
step=ss/20  
for(i in p){  
 x=rep(i+100,ss-i\*step)  
 Individual=head(1:ss,ss-i\*step)  
 yindv=rnorm(ss-i\*step,S3CounterfactualBefore$y[i],10)  
 Int=FALSE  
 temp1=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS1000E100Delay=rbind(S3SamplePopAfterS1000E100Delay,temp1)  
   
 x=rep(i+100,i\*step)  
 Individual=tail(1:ss,i\*step)  
 yindv=rnorm(i,S3CounterfactualAfterE100$y[i],10)  
 Int=TRUE  
 temp2=data.frame(cbind(x,Individual,yindv,Int))  
 S3SamplePopAfterS1000E100Delay=rbind(S3SamplePopAfterS1000E100Delay,temp2)  
 i=i+1  
}  
  
S3PhaseInS1000E100=rbind(S3SamplePopBefore1000,S3SamplePopAfterS1000E100Delay)  
#Individual level variation  
plot(S3PhaseInS1000E100$x,S3PhaseInS1000E100$yindv,ylim=c(0,300))



#Compute mean at each time point  
S3PhaseInS1000E100AGG<-S3PhaseInS1000E100 %>%   
 group\_by(x) %>%   
 summarise(y=mean(yindv))  
plot(S3PhaseInS1000E100AGG$x,S3PhaseInS1000E100AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Level and Slope Change   
 with pre-existing trend - Effect Size 100 and Sample Size 1000")  
abline(v=100)  
abline(v=120)



# Creating and Analyzing delayed ITS

# Senario 1

Sample size 20 Effect Size 20 Model 1: Abrupt at time 100

S1PhaseInS20E20AGGM1<-S1PhaseInS20E20AGG  
S1PhaseInS20E20AGGM1$intervention = S1PhaseInS20E20AGGM1$x > 100  
S1PhaseInS20E20AGGM1$time\_after\_intervention = ifelse(S1PhaseInS20E20AGGM1$x > 100, S1PhaseInS20E20AGGM1$x - 100, 0)  
S1S20E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E20AGGM1)  
summary(S1S20E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -9.8693 -1.9588 -0.0217 1.6634 13.3122   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.853722 0.708537 169.157 < 0.0000000000000002 \*\*\*  
## x -0.001125 0.012181 -0.092 0.927   
## interventionTRUE -12.970783 0.994591 -13.041 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.098288 0.017226 -5.706 0.0000000423 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 3.516 on 196 degrees of freedom  
## Multiple R-squared: 0.8759, Adjusted R-squared: 0.874   
## F-statistic: 461.3 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E20M1)

## 2.5 % 97.5 %  
## (Intercept) 118.45638836 121.25105650  
## x -0.02514724 0.02289764  
## interventionTRUE -14.93225630 -11.00930984  
## time\_after\_intervention -0.13226111 -0.06431538

Model 2: Abrupt at time 120

S1PhaseInS20E20AGGM2<-S1PhaseInS20E20AGG  
S1PhaseInS20E20AGGM2$intervention = S1PhaseInS20E20AGGM2$x > 120  
S1PhaseInS20E20AGGM2$time\_after\_intervention = ifelse(S1PhaseInS20E20AGGM2$x > 120, S1PhaseInS20E20AGGM2$x - 120, 0)  
S1S20E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E20AGGM2)  
summary(S1S20E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -18.4856 -1.6578 0.4358 1.9074 9.4243   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 122.808675 0.681622 180.17 < 0.0000000000000002 \*\*\*  
## x -0.078418 0.009777 -8.02 0.0000000000000939 \*\*\*  
## interventionTRUE -13.723526 1.074449 -12.77 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.082420 0.020451 4.03 0.0000797545001763 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 3.71 on 196 degrees of freedom  
## Multiple R-squared: 0.8619, Adjusted R-squared: 0.8598   
## F-statistic: 407.6 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E20M2)

## 2.5 % 97.5 %  
## (Intercept) 121.46442056 124.15292895  
## x -0.09769972 -0.05913539  
## interventionTRUE -15.84249203 -11.60456038  
## time\_after\_intervention 0.04208748 0.12275327

Model 3: Excluding Phase-in Period

S1PhaseInS20E20AGGM3<-subset(S1PhaseInS20E20AGG,x<100|x>120)  
  
S1PhaseInS20E20AGGM3$intervention = S1PhaseInS20E20AGGM3$x > 100  
S1PhaseInS20E20AGGM3$time\_after\_intervention = ifelse(S1PhaseInS20E20AGGM3$x > 100, S1PhaseInS20E20AGGM3$x - 100, 0)  
S1S20E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E20AGGM3)  
summary(S1S20E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.2189 -1.3469 0.1526 1.2725 5.8599   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.7826674 0.4035496 296.823 <0.0000000000000002 \*\*\*  
## x 0.0009857 0.0070072 0.141 0.888   
## interventionTRUE -20.2862562 0.7436993 -27.277 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.0030171 0.0119230 0.253 0.801   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.992 on 175 degrees of freedom  
## Multiple R-squared: 0.9622, Adjusted R-squared: 0.9616   
## F-statistic: 1485 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S20E20M3)

## 2.5 % 97.5 %  
## (Intercept) 118.98621688 120.57911787  
## x -0.01284380 0.01481529  
## interventionTRUE -21.75403049 -18.81848194  
## time\_after\_intervention -0.02051436 0.02654852

Model 4: Counterfactual from Before

S1PhaseInS20E20AGGM4<-subset(S1PhaseInS20E20AGG,x<=100|x>=120)  
S1PhaseInS20E20AGGM4<-rbind(S1PhaseInS20E20AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS20E20AGGM4$intervention = S1PhaseInS20E20AGGM4$x > 119  
S1PhaseInS20E20AGGM4$time\_after\_intervention = ifelse(S1PhaseInS20E20AGGM4$x > 120, S1PhaseInS20E20AGGM4$x - 120, 0)  
S1S20E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E20AGGM4)  
summary(S1S20E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.1774 -1.2091 0.1336 1.0922 5.8787   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.7869565 0.3558526 336.620 <0.0000000000000002 \*\*\*  
## x 0.0007065 0.0051470 0.137 0.891   
## interventionTRUE -20.4275544 0.5540520 -36.869 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.0075982 0.0105120 0.723 0.471   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.929 on 196 degrees of freedom  
## Multiple R-squared: 0.9637, Adjusted R-squared: 0.9632   
## F-statistic: 1737 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E20M4)

## 2.5 % 97.5 %  
## (Intercept) 119.085165025 120.48874802  
## x -0.009444191 0.01085712  
## interventionTRUE -21.520223190 -19.33488564  
## time\_after\_intervention -0.013133001 0.02832934

Model 5: Counterfactual from After

S1PhaseInS20E20AGGM5<-subset(S1PhaseInS20E20AGG,x<=100|x>=120)  
S1PhaseInS20E20AGGM5<-rbind(S1PhaseInS20E20AGGM5,S1CounterfactualAfterE20)  
  
S1PhaseInS20E20AGGM5$intervention = S1PhaseInS20E20AGGM5$x > 100  
S1PhaseInS20E20AGGM5$time\_after\_intervention = ifelse(S1PhaseInS20E20AGGM5$x > 100, S1PhaseInS20E20AGGM5$x - 100, 0)  
S1S20E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E20AGGM5)  
summary(S1S20E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.2183 -1.2339 0.2586 1.1189 5.9640   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.853722 0.389368 307.816 <0.0000000000000002 \*\*\*  
## x -0.001125 0.006694 -0.168 0.867   
## interventionTRUE -20.040958 0.546565 -36.667 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.003473 0.009467 0.367 0.714   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.932 on 196 degrees of freedom  
## Multiple R-squared: 0.9646, Adjusted R-squared: 0.9641   
## F-statistic: 1782 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E20M5)

## 2.5 % 97.5 %  
## (Intercept) 119.08583437 120.62161049  
## x -0.01432605 0.01207644  
## interventionTRUE -21.11886199 -18.96305414  
## time\_after\_intervention -0.01519665 0.02214210

Sample size 20 Effect Size 50 Model 1: Abrupt at time 100

S1PhaseInS20E50AGGM1<-S1PhaseInS20E50AGG  
S1PhaseInS20E50AGGM1$intervention = S1PhaseInS20E50AGGM1$x > 100  
S1PhaseInS20E50AGGM1$time\_after\_intervention = ifelse(S1PhaseInS20E50AGGM1$x > 100, S1PhaseInS20E50AGGM1$x - 100, 0)  
S1S20E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E50AGGM1)  
summary(S1S20E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -14.050 -2.591 -0.025 2.213 30.106   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.853722 1.363050 87.931 < 0.0000000000000002 \*\*\*  
## x -0.001125 0.023433 -0.048 0.962   
## interventionTRUE -32.749391 1.913347 -17.116 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.242689 0.033139 -7.323 0.00000000000613 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.764 on 196 degrees of freedom  
## Multiple R-squared: 0.9225, Adjusted R-squared: 0.9213   
## F-statistic: 777.6 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E50M1)

## 2.5 % 97.5 %  
## (Intercept) 117.16559587 122.54184899  
## x -0.04733806 0.04508846  
## interventionTRUE -36.52278261 -28.97599991  
## time\_after\_intervention -0.30804395 -0.17733311

Model 2: Abrupt at time 120

S1PhaseInS20E50AGGM2<-S1PhaseInS20E50AGG  
S1PhaseInS20E50AGGM2$intervention = S1PhaseInS20E50AGGM2$x > 120  
S1PhaseInS20E50AGGM2$time\_after\_intervention = ifelse(S1PhaseInS20E50AGGM2$x > 120, S1PhaseInS20E50AGGM2$x - 120, 0)  
S1S20E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E50AGGM2)  
summary(S1S20E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -35.681 -3.141 0.341 3.774 14.715   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 127.21883 1.38993 91.529 < 0.0000000000000002 \*\*\*  
## x -0.19530 0.01994 -9.796 < 0.0000000000000002 \*\*\*  
## interventionTRUE -33.89133 2.19096 -15.469 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.19775 0.04170 4.742 0.00000407 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.565 on 196 degrees of freedom  
## Multiple R-squared: 0.903, Adjusted R-squared: 0.9016   
## F-statistic: 608.5 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E50M2)

## 2.5 % 97.5 %  
## (Intercept) 124.4777014 129.9599588  
## x -0.2346195 -0.1559812  
## interventionTRUE -38.2122069 -29.5704515  
## time\_after\_intervention 0.1155015 0.2799907

Model 3: Excluding Phase-in Period

S1PhaseInS20E50AGGM3<-subset(S1PhaseInS20E50AGG,x<100|x>120)  
  
S1PhaseInS20E50AGGM3$intervention = S1PhaseInS20E50AGGM3$x > 100  
S1PhaseInS20E50AGGM3$time\_after\_intervention = ifelse(S1PhaseInS20E50AGGM3$x > 100, S1PhaseInS20E50AGGM3$x - 100, 0)  
S1S20E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E50AGGM3)  
summary(S1S20E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.2354 -1.3535 -0.2004 1.4513 6.4686   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.7826674 0.4413049 271.428 <0.0000000000000002 \*\*\*  
## x 0.0009857 0.0076628 0.129 0.898   
## interventionTRUE -50.0386979 0.8132784 -61.527 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.0014600 0.0130385 0.112 0.911   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.179 on 175 degrees of freedom  
## Multiple R-squared: 0.9925, Adjusted R-squared: 0.9924   
## F-statistic: 7718 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S20E50M3)

## 2.5 % 97.5 %  
## (Intercept) 118.91170250 120.65363225  
## x -0.01413767 0.01610915  
## interventionTRUE -51.64379428 -48.43360146  
## time\_after\_intervention -0.02427303 0.02719296

Model 4: Counterfactual from Before

S1PhaseInS20E50AGGM4<-subset(S1PhaseInS20E50AGG,x<=100|x>=120)  
S1PhaseInS20E50AGGM4<-rbind(S1PhaseInS20E50AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS20E50AGGM4$intervention = S1PhaseInS20E50AGGM4$x > 119  
S1PhaseInS20E50AGGM4$time\_after\_intervention = ifelse(S1PhaseInS20E50AGGM4$x > 120, S1PhaseInS20E50AGGM4$x - 120, 0)  
S1S20E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E50AGGM4)  
summary(S1S20E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.2279 -1.2864 0.0163 1.1779 6.4810   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.7869565 0.3834651 312.380 <0.0000000000000002 \*\*\*  
## x 0.0007065 0.0055464 0.127 0.899   
## interventionTRUE -50.0670187 0.5970439 -83.858 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.0033556 0.0113277 0.296 0.767   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.078 on 196 degrees of freedom  
## Multiple R-squared: 0.993, Adjusted R-squared: 0.9929   
## F-statistic: 9246 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E50M4)

## 2.5 % 97.5 %  
## (Intercept) 119.03070915 120.54320389  
## x -0.01023184 0.01164477  
## interventionTRUE -51.24447365 -48.88956370  
## time\_after\_intervention -0.01898422 0.02569541

Model 5: Counterfactual from After

S1PhaseInS20E50AGGM5<-subset(S1PhaseInS20E50AGG,x<=100|x>=120)  
S1PhaseInS20E50AGGM5<-rbind(S1PhaseInS20E50AGGM5,S1CounterfactualAfterE50)  
  
S1PhaseInS20E50AGGM5$intervention = S1PhaseInS20E50AGGM5$x > 100  
S1PhaseInS20E50AGGM5$time\_after\_intervention = ifelse(S1PhaseInS20E50AGGM5$x > 100, S1PhaseInS20E50AGGM5$x - 100, 0)  
S1S20E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E50AGGM5)  
summary(S1S20E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.2319 -1.2762 0.0503 1.1984 6.4704   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.853722 0.418757 286.213 <0.0000000000000002 \*\*\*  
## x -0.001125 0.007199 -0.156 0.876   
## interventionTRUE -49.861526 0.587820 -84.825 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.002980 0.010181 0.293 0.770   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.078 on 196 degrees of freedom  
## Multiple R-squared: 0.9932, Adjusted R-squared: 0.9931   
## F-statistic: 9580 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E50M5)

## 2.5 % 97.5 %  
## (Intercept) 119.02787479 120.67957007  
## x -0.01532246 0.01307286  
## interventionTRUE -51.02078903 -48.70226252  
## time\_after\_intervention -0.01709803 0.02305902

Sample size 20 Effect Size 100 Model 1: Abrupt at time 100

S1PhaseInS20E100AGGM1<-S1PhaseInS20E100AGG  
S1PhaseInS20E100AGGM1$intervention = S1PhaseInS20E100AGGM1$x > 100  
S1PhaseInS20E100AGGM1$time\_after\_intervention = ifelse(S1PhaseInS20E100AGGM1$x > 100, S1PhaseInS20E100AGGM1$x - 100, 0)  
S1S20E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E100AGGM1)  
summary(S1S20E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -26.775 -3.157 -0.236 2.887 62.504   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.853722 2.576576 46.517 < 0.0000000000000002 \*\*\*  
## x -0.001125 0.044296 -0.025 0.98   
## interventionTRUE -64.821825 3.616805 -17.922 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.502952 0.062643 -8.029 0.0000000000000892 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.79 on 196 degrees of freedom  
## Multiple R-squared: 0.9305, Adjusted R-squared: 0.9295   
## F-statistic: 875 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E100M1)

## 2.5 % 97.5 %  
## (Intercept) 114.77235126 124.93509361  
## x -0.08848183 0.08623222  
## interventionTRUE -71.95467484 -57.68897597  
## time\_after\_intervention -0.62649357 -0.37941059

Model 2: Abrupt at time 120

S1PhaseInS20E100AGGM2<-S1PhaseInS20E100AGG  
S1PhaseInS20E100AGGM2$intervention = S1PhaseInS20E100AGGM2$x > 120  
S1PhaseInS20E100AGGM2$time\_after\_intervention = ifelse(S1PhaseInS20E100AGGM2$x > 120, S1PhaseInS20E100AGGM2$x - 120, 0)  
S1S20E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E100AGGM2)  
summary(S1S20E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -66.095 -3.285 0.370 5.945 23.666   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 134.52908 2.67511 50.289 < 0.0000000000000002 \*\*\*  
## x -0.38805 0.03837 -10.113 < 0.0000000000000002 \*\*\*  
## interventionTRUE -67.18496 4.21680 -15.933 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.36875 0.08026 4.594 0.00000776 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14.56 on 196 degrees of freedom  
## Multiple R-squared: 0.9099, Adjusted R-squared: 0.9085   
## F-statistic: 659.8 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E100M2)

## 2.5 % 97.5 %  
## (Intercept) 129.2533959 139.8047685  
## x -0.4637211 -0.3123707  
## interventionTRUE -75.5010949 -58.8688253  
## time\_after\_intervention 0.2104582 0.5270407

Model 3: Excluding Phase-in Period

S1PhaseInS20E100AGGM3<-subset(S1PhaseInS20E100AGG,x<100|x>120)  
  
S1PhaseInS20E100AGGM3$intervention = S1PhaseInS20E100AGGM3$x > 100  
S1PhaseInS20E100AGGM3$time\_after\_intervention = ifelse(S1PhaseInS20E100AGGM3$x > 100, S1PhaseInS20E100AGGM3$x - 100, 0)  
S1S20E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E100AGGM3)  
summary(S1S20E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.0930 -1.4361 -0.0158 1.3520 5.9581   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.7826674 0.4320950 277.214 <0.0000000000000002  
## x 0.0009857 0.0075029 0.131 0.896  
## interventionTRUE -98.7166977 0.7963056 -123.968 <0.0000000000000002  
## time\_after\_intervention -0.0202822 0.0127664 -1.589 0.114  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.133 on 175 degrees of freedom  
## Multiple R-squared: 0.9982, Adjusted R-squared: 0.9982   
## F-statistic: 3.23e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S20E100M3)

## 2.5 % 97.5 %  
## (Intercept) 118.92987923 120.635455519  
## x -0.01382205 0.015793534  
## interventionTRUE -100.28829627 -97.145099038  
## time\_after\_intervention -0.04547815 0.004913765

Model 4: Counterfactual from Before

S1PhaseInS20E100AGGM4<-subset(S1PhaseInS20E100AGG,x<=100|x>=120)  
S1PhaseInS20E100AGGM4<-rbind(S1PhaseInS20E100AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS20E100AGGM4$intervention = S1PhaseInS20E100AGGM4$x > 119  
S1PhaseInS20E100AGGM4$time\_after\_intervention = ifelse(S1PhaseInS20E100AGGM4$x > 120, S1PhaseInS20E100AGGM4$x - 120, 0)  
S1S20E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E100AGGM4)  
summary(S1S20E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.0956 -1.3295 0.1293 1.2280 5.9673   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.7869565 0.3751705 319.287 <0.0000000000000002  
## x 0.0007065 0.0054264 0.130 0.8965  
## interventionTRUE -99.0402955 0.5841294 -169.552 <0.0000000000000002  
## time\_after\_intervention -0.0209872 0.0110827 -1.894 0.0597  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.033 on 196 degrees of freedom  
## Multiple R-squared: 0.9983, Adjusted R-squared: 0.9983   
## F-statistic: 3.871e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E100M4)

## 2.5 % 97.5 %  
## (Intercept) 119.047067393 120.5268456477  
## x -0.009995232 0.0114081640  
## interventionTRUE -100.192281178 -97.8883098372  
## time\_after\_intervention -0.042843758 0.0008694149

Model 5: Counterfactual from After

S1PhaseInS20E100AGGM5<-subset(S1PhaseInS20E100AGG,x<=100|x>=120)  
S1PhaseInS20E100AGGM5<-rbind(S1PhaseInS20E100AGGM5,S1CounterfactualAfterE100)  
  
S1PhaseInS20E100AGGM5$intervention = S1PhaseInS20E100AGGM5$x > 100  
S1PhaseInS20E100AGGM5$time\_after\_intervention = ifelse(S1PhaseInS20E100AGGM5$x > 100, S1PhaseInS20E100AGGM5$x - 100, 0)  
S1S20E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS20E100AGGM5)  
summary(S1S20E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS20E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.0978 -1.2452 -0.3411 1.2961 5.9640   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.853722 0.411818 291.036 <0.0000000000000002 \*\*\*  
## x -0.001125 0.007080 -0.159 0.874   
## interventionTRUE -99.190037 0.578079 -171.586 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.009466 0.010012 -0.945 0.346   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.044 on 196 degrees of freedom  
## Multiple R-squared: 0.9984, Adjusted R-squared: 0.9983   
## F-statistic: 3.973e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S20E100M5)

## 2.5 % 97.5 %  
## (Intercept) 119.04155959 120.66588527  
## x -0.01508720 0.01283760  
## interventionTRUE -100.33009093 -98.04998383  
## time\_after\_intervention -0.02921182 0.01027981

Sample size 100 Effect Size 20 Model 1: Abrupt at time 100

S1PhaseInS100E20AGGM1<-S1PhaseInS100E20AGG  
S1PhaseInS100E20AGGM1$intervention = S1PhaseInS100E20AGGM1$x > 100  
S1PhaseInS100E20AGGM1$time\_after\_intervention = ifelse(S1PhaseInS100E20AGGM1$x > 100, S1PhaseInS100E20AGGM1$x - 100, 0)  
S1S100E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E20AGGM1)  
summary(S1S100E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.7324 -1.3827 -0.1439 0.8591 12.4534   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9596674 0.5472075 219.222 < 0.0000000000000002  
## x -0.0004958 0.0094074 -0.053 0.958  
## interventionTRUE -13.0842973 0.7681290 -17.034 < 0.0000000000000002  
## time\_after\_intervention -0.1000879 0.0133041 -7.523 0.00000000000189  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.716 on 196 degrees of freedom  
## Multiple R-squared: 0.9232, Adjusted R-squared: 0.9221   
## F-statistic: 785.8 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E20M1)

## 2.5 % 97.5 %  
## (Intercept) 118.88049693 121.03883784  
## x -0.01904849 0.01805690  
## interventionTRUE -14.59915619 -11.56943838  
## time\_after\_intervention -0.12632541 -0.07385047

Model 2: Abrupt at time 120

S1PhaseInS100E20AGGM2<-S1PhaseInS100E20AGG  
S1PhaseInS100E20AGGM2$intervention = S1PhaseInS100E20AGGM2$x > 120  
S1PhaseInS100E20AGGM2$time\_after\_intervention = ifelse(S1PhaseInS100E20AGGM2$x > 120, S1PhaseInS100E20AGGM2$x - 120, 0)  
S1S100E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E20AGGM2)  
summary(S1S100E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -12.9257 -0.9856 0.1757 1.4166 6.3699   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 122.924628 0.566932 216.824 < 0.0000000000000002 \*\*\*  
## x -0.078770 0.008132 -9.686 < 0.0000000000000002 \*\*\*  
## interventionTRUE -13.420421 0.893662 -15.017 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.074100 0.017010 4.356 0.0000213 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 3.086 on 196 degrees of freedom  
## Multiple R-squared: 0.9009, Adjusted R-squared: 0.8994   
## F-statistic: 593.8 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E20M2)

## 2.5 % 97.5 %  
## (Intercept) 121.80655907 124.04269766  
## x -0.09480800 -0.06273252  
## interventionTRUE -15.18284901 -11.65799391  
## time\_after\_intervention 0.04055366 0.10764659

Model 3: Excluding Phase-in Period

S1PhaseInS100E20AGGM3<-subset(S1PhaseInS100E20AGG,x<100|x>120)  
  
S1PhaseInS100E20AGGM3$intervention = S1PhaseInS100E20AGGM3$x > 100  
S1PhaseInS100E20AGGM3$time\_after\_intervention = ifelse(S1PhaseInS100E20AGGM3$x > 100, S1PhaseInS100E20AGGM3$x - 100, 0)  
S1S100E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E20AGGM3)  
summary(S1S100E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.55095 -0.68562 0.02458 0.73973 2.47083   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.9622226 0.2019666 593.970 <0.0000000000000002 \*\*\*  
## x -0.0005717 0.0035069 -0.163 0.871   
## interventionTRUE -19.7598746 0.3722032 -53.089 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.0040984 0.0059672 -0.687 0.493   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9972 on 175 degrees of freedom  
## Multiple R-squared: 0.9903, Adjusted R-squared: 0.9902   
## F-statistic: 5976 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S100E20M3)

## 2.5 % 97.5 %  
## (Intercept) 119.563618751 120.360826507  
## x -0.007493043 0.006349651  
## interventionTRUE -20.494459531 -19.025289704  
## time\_after\_intervention -0.015875346 0.007678468

Model 4: Counterfactual from Before

S1PhaseInS100E20AGGM4<-subset(S1PhaseInS100E20AGG,x<=100|x>=120)  
S1PhaseInS100E20AGGM4<-rbind(S1PhaseInS100E20AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS100E20AGGM4$intervention = S1PhaseInS100E20AGGM4$x > 119  
S1PhaseInS100E20AGGM4$time\_after\_intervention = ifelse(S1PhaseInS100E20AGGM4$x > 120, S1PhaseInS100E20AGGM4$x - 120, 0)  
S1S100E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E20AGGM4)  
summary(S1S100E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.56738 -0.53874 0.04746 0.64152 2.48751   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.9361837 0.1742289 688.383 <0.0000000000000002 \*\*\*  
## x 0.0001481 0.0025200 0.059 0.953   
## interventionTRUE -19.8614819 0.2712692 -73.217 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.0055764 0.0051468 -1.083 0.280   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9443 on 196 degrees of freedom  
## Multiple R-squared: 0.9911, Adjusted R-squared: 0.9909   
## F-statistic: 7257 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E20M4)

## 2.5 % 97.5 %  
## (Intercept) 119.592579840 120.279787649  
## x -0.004821807 0.005117912  
## interventionTRUE -20.396463063 -19.326500659  
## time\_after\_intervention -0.015726614 0.004573748

Model 5: Counterfactual from After

S1PhaseInS100E20AGGM5<-subset(S1PhaseInS100E20AGG,x<=100|x>=120)  
S1PhaseInS100E20AGGM5<-rbind(S1PhaseInS100E20AGGM5,S1CounterfactualAfterE20)  
  
S1PhaseInS100E20AGGM5$intervention = S1PhaseInS100E20AGGM5$x > 100  
S1PhaseInS100E20AGGM5$time\_after\_intervention = ifelse(S1PhaseInS100E20AGGM5$x > 100, S1PhaseInS100E20AGGM5$x - 100, 0)  
S1S100E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E20AGGM5)  
summary(S1S100E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.54159 -0.49998 -0.04835 0.66046 2.47240   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 119.9596674 0.1903450 630.222 <0.0000000000000002 \*\*\*  
## x -0.0004958 0.0032723 -0.152 0.880   
## interventionTRUE -19.8072498 0.2671922 -74.131 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.0035402 0.0046278 -0.765 0.445   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9446 on 196 degrees of freedom  
## Multiple R-squared: 0.9914, Adjusted R-squared: 0.9912   
## F-statistic: 7499 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E20M5)

## 2.5 % 97.5 %  
## (Intercept) 119.584280087 120.335054688  
## x -0.006949315 0.005957720  
## interventionTRUE -20.334190422 -19.280309098  
## time\_after\_intervention -0.012666857 0.005586447

Sample size 100 Effect Size 50 Model 1: Abrupt at time 100

S1PhaseInS100E50AGGM1<-S1PhaseInS100E50AGG  
S1PhaseInS100E50AGGM1$intervention = S1PhaseInS100E50AGGM1$x > 100  
S1PhaseInS100E50AGGM1$time\_after\_intervention = ifelse(S1PhaseInS100E50AGGM1$x > 100, S1PhaseInS100E50AGGM1$x - 100, 0)  
S1S100E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E50AGGM1)  
summary(S1S100E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -12.1992 -1.8713 -0.1476 1.2453 31.5888   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9596674 1.2937049 92.726 < 0.0000000000000002  
## x -0.0004958 0.0222409 -0.022 0.982  
## interventionTRUE -32.8214661 1.8160064 -18.073 < 0.0000000000000002  
## time\_after\_intervention -0.2450706 0.0314534 -7.792 0.000000000000378  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.42 on 196 degrees of freedom  
## Multiple R-squared: 0.93, Adjusted R-squared: 0.929   
## F-statistic: 868.5 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E50M1)

## 2.5 % 97.5 %  
## (Intercept) 117.40829859 122.51103619  
## x -0.04435797 0.04336638  
## interventionTRUE -36.40288714 -29.24004511  
## time\_after\_intervention -0.30710106 -0.18304010

Model 2: Abrupt at time 120

S1PhaseInS100E50AGGM2<-S1PhaseInS100E50AGG  
S1PhaseInS100E50AGGM2$intervention = S1PhaseInS100E50AGGM2$x > 120  
S1PhaseInS100E50AGGM2$time\_after\_intervention = ifelse(S1PhaseInS100E50AGGM2$x > 120, S1PhaseInS100E50AGGM2$x - 120, 0)  
S1S100E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E50AGGM2)  
summary(S1S100E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -32.723 -1.209 0.209 3.145 12.456   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 127.35603 1.34363 94.785 < 0.0000000000000002 \*\*\*  
## x -0.19563 0.01927 -10.150 < 0.0000000000000002 \*\*\*  
## interventionTRUE -33.82902 2.11798 -15.972 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.19428 0.04031 4.819 0.00000288 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.313 on 196 degrees of freedom  
## Multiple R-squared: 0.9092, Adjusted R-squared: 0.9078   
## F-statistic: 654.3 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E50M2)

## 2.5 % 97.5 %  
## (Intercept) 124.7062115 130.0058507  
## x -0.2336387 -0.1576199  
## interventionTRUE -38.0059638 -29.6520718  
## time\_after\_intervention 0.1147786 0.2737886

Model 3: Excluding Phase-in Period

S1PhaseInS100E50AGGM3<-subset(S1PhaseInS100E50AGG,x<100|x>120)  
  
S1PhaseInS100E50AGGM3$intervention = S1PhaseInS100E50AGGM3$x > 100  
S1PhaseInS100E50AGGM3$time\_after\_intervention = ifelse(S1PhaseInS100E50AGGM3$x > 100, S1PhaseInS100E50AGGM3$x - 100, 0)  
S1S100E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E50AGGM3)  
summary(S1S100E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.6134 -0.5368 0.0059 0.7242 2.4708   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9622226 0.1984138 604.606 <0.0000000000000002  
## x -0.0005717 0.0034453 -0.166 0.868  
## interventionTRUE -49.8266410 0.3656558 -136.267 <0.0000000000000002  
## time\_after\_intervention -0.0007740 0.0058622 -0.132 0.895  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9796 on 175 degrees of freedom  
## Multiple R-squared: 0.9985, Adjusted R-squared: 0.9985   
## F-statistic: 3.832e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S100E50M3)

## 2.5 % 97.5 %  
## (Intercept) 119.570630589 120.353814669  
## x -0.007371289 0.006227897  
## interventionTRUE -50.548303867 -49.104978196  
## time\_after\_intervention -0.012343730 0.010795749

Model 4: Counterfactual from Before

S1PhaseInS100E50AGGM4<-subset(S1PhaseInS100E50AGG,x<=100|x>=120)  
S1PhaseInS100E50AGGM4<-rbind(S1PhaseInS100E50AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS100E50AGGM4$intervention = S1PhaseInS100E50AGGM4$x > 119  
S1PhaseInS100E50AGGM4$time\_after\_intervention = ifelse(S1PhaseInS100E50AGGM4$x > 120, S1PhaseInS100E50AGGM4$x - 120, 0)  
S1S100E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E50AGGM4)  
summary(S1S100E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.63506 -0.48581 0.04731 0.61365 2.48751   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9361837 0.1714276 699.632 <0.0000000000000002  
## x 0.0001481 0.0024795 0.060 0.952  
## interventionTRUE -49.8488441 0.2669078 -186.764 <0.0000000000000002  
## time\_after\_intervention -0.0024926 0.0050640 -0.492 0.623  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9291 on 196 degrees of freedom  
## Multiple R-squared: 0.9986, Adjusted R-squared: 0.9986   
## F-statistic: 4.64e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E50M4)

## 2.5 % 97.5 %  
## (Intercept) 119.598104299 120.274263190  
## x -0.004741902 0.005038007  
## interventionTRUE -50.375223924 -49.322464362  
## time\_after\_intervention -0.012479625 0.007494348

Model 5: Counterfactual from After

S1PhaseInS100E50AGGM5<-subset(S1PhaseInS100E50AGG,x<=100|x>=120)  
S1PhaseInS100E50AGGM5<-rbind(S1PhaseInS100E50AGGM5,S1CounterfactualAfterE50)  
  
S1PhaseInS100E50AGGM5$intervention = S1PhaseInS100E50AGGM5$x > 100  
S1PhaseInS100E50AGGM5$time\_after\_intervention = ifelse(S1PhaseInS100E50AGGM5$x > 100, S1PhaseInS100E50AGGM5$x - 100, 0)  
S1S100E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E50AGGM5)  
summary(S1S100E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.61244 -0.46479 -0.05254 0.60904 2.47240   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9596674 0.1872589 640.609 <0.0000000000000002  
## x -0.0004958 0.0032193 -0.154 0.878  
## interventionTRUE -49.8432766 0.2628600 -189.619 <0.0000000000000002  
## time\_after\_intervention -0.0006456 0.0045528 -0.142 0.887  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9293 on 196 degrees of freedom  
## Multiple R-squared: 0.9986, Adjusted R-squared: 0.9986   
## F-statistic: 4.811e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E50M5)

## 2.5 % 97.5 %  
## (Intercept) 119.590366436 120.328968340  
## x -0.006844681 0.005853086  
## interventionTRUE -50.361673749 -49.324879547  
## time\_after\_intervention -0.009624261 0.008333093

Sample size 100 Effect Size 100 Model 1: Abrupt at time 100

S1PhaseInS100E100AGGM1<-S1PhaseInS100E100AGG  
S1PhaseInS100E100AGGM1$intervention = S1PhaseInS100E100AGGM1$x > 100  
S1PhaseInS100E100AGGM1$time\_after\_intervention = ifelse(S1PhaseInS100E100AGGM1$x > 100, S1PhaseInS100E100AGGM1$x - 100, 0)  
S1S100E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E100AGGM1)  
summary(S1S100E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -24.857 -2.791 -0.144 1.284 60.975   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9596674 2.6077427 46.001 < 0.0000000000000002  
## x -0.0004958 0.0448313 -0.011 0.991  
## interventionTRUE -65.3441964 3.6605545 -17.851 < 0.0000000000000002  
## time\_after\_intervention -0.4952819 0.0634011 -7.812 0.000000000000334  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.94 on 196 degrees of freedom  
## Multiple R-squared: 0.9289, Adjusted R-squared: 0.9279   
## F-statistic: 854.2 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E100M1)

## 2.5 % 97.5 %  
## (Intercept) 114.81683045 125.10250432  
## x -0.08890952 0.08791792  
## interventionTRUE -72.56332688 -58.12506591  
## time\_after\_intervention -0.62031779 -0.37024603

Model 2: Abrupt at time 120

S1PhaseInS100E100AGGM2<-S1PhaseInS100E100AGG  
S1PhaseInS100E100AGGM2$intervention = S1PhaseInS100E100AGGM2$x > 120  
S1PhaseInS100E100AGGM2$time\_after\_intervention = ifelse(S1PhaseInS100E100AGGM2$x > 120, S1PhaseInS100E100AGGM2$x - 120, 0)  
S1S100E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E100AGGM2)  
summary(S1S100E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.024 -1.503 0.214 6.009 24.050   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 134.58647 2.65216 50.746 < 0.0000000000000002 \*\*\*  
## x -0.38604 0.03804 -10.147 < 0.0000000000000002 \*\*\*  
## interventionTRUE -68.46626 4.18064 -16.377 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.39066 0.07958 4.909 0.00000192 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14.44 on 196 degrees of freedom  
## Multiple R-squared: 0.9116, Adjusted R-squared: 0.9102   
## F-statistic: 673.6 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E100M2)

## 2.5 % 97.5 %  
## (Intercept) 129.3560285 139.8169073  
## x -0.4610646 -0.3110123  
## interventionTRUE -76.7110696 -60.2214467  
## time\_after\_intervention 0.2337311 0.5475985

Model 3: Excluding Phase-in Period

S1PhaseInS100E100AGGM3<-subset(S1PhaseInS100E100AGG,x<100|x>120)  
  
S1PhaseInS100E100AGGM3$intervention = S1PhaseInS100E100AGGM3$x > 100  
S1PhaseInS100E100AGGM3$time\_after\_intervention = ifelse(S1PhaseInS100E100AGGM3$x > 100, S1PhaseInS100E100AGGM3$x - 100, 0)  
S1S100E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E100AGGM3)  
summary(S1S100E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.53164 -0.64741 0.05539 0.63923 2.47083   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9622226 0.1936270 619.553 <0.0000000000000002  
## x -0.0005717 0.0033621 -0.170 0.865  
## interventionTRUE -100.2019814 0.3568341 -280.808 <0.0000000000000002  
## time\_after\_intervention 0.0051981 0.0057208 0.909 0.365  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.956 on 175 degrees of freedom  
## Multiple R-squared: 0.9996, Adjusted R-squared: 0.9996   
## F-statistic: 1.612e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S100E100M3)

## 2.5 % 97.5 %  
## (Intercept) 119.580077998 120.344367260  
## x -0.007207245 0.006063853  
## interventionTRUE -100.906233645 -99.497729133  
## time\_after\_intervention -0.006092529 0.016488695

Model 4: Counterfactual from Before

S1PhaseInS100E100AGGM4<-subset(S1PhaseInS100E100AGG,x<=100|x>=120)  
S1PhaseInS100E100AGGM4<-rbind(S1PhaseInS100E100AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS100E100AGGM4$intervention = S1PhaseInS100E100AGGM4$x > 119  
S1PhaseInS100E100AGGM4$time\_after\_intervention = ifelse(S1PhaseInS100E100AGGM4$x > 120, S1PhaseInS100E100AGGM4$x - 120, 0)  
S1S100E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E100AGGM4)  
summary(S1S100E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.5463 -0.4889 0.0479 0.5766 2.4875   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9361837 0.1668150 718.977 <0.0000000000000002  
## x 0.0001481 0.0024128 0.061 0.951  
## interventionTRUE -100.1369193 0.2597261 -385.548 <0.0000000000000002  
## time\_after\_intervention 0.0040790 0.0049278 0.828 0.409  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9041 on 196 degrees of freedom  
## Multiple R-squared: 0.9997, Adjusted R-squared: 0.9997   
## F-statistic: 1.964e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E100M4)

## 2.5 % 97.5 %  
## (Intercept) 119.607200999 120.265166489  
## x -0.004610328 0.004906433  
## interventionTRUE -100.649135786 -99.624702816  
## time\_after\_intervention -0.005639274 0.013797260

Model 5: Counterfactual from After

S1PhaseInS100E100AGGM5<-subset(S1PhaseInS100E100AGG,x<=100|x>=120)  
S1PhaseInS100E100AGGM5<-rbind(S1PhaseInS100E100AGGM5,S1CounterfactualAfterE100)  
  
S1PhaseInS100E100AGGM5$intervention = S1PhaseInS100E100AGGM5$x > 100  
S1PhaseInS100E100AGGM5$time\_after\_intervention = ifelse(S1PhaseInS100E100AGGM5$x > 100, S1PhaseInS100E100AGGM5$x - 100, 0)  
S1S100E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS100E100AGGM5)  
summary(S1S100E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS100E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.61755 -0.48187 0.08696 0.55726 2.47240   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 119.9596674 0.1823829 657.735 <0.0000000000000002  
## x -0.0004958 0.0031355 -0.158 0.875  
## interventionTRUE -100.0282984 0.2560156 -390.712 <0.0000000000000002  
## time\_after\_intervention 0.0026139 0.0044342 0.589 0.556  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9051 on 196 degrees of freedom  
## Multiple R-squared: 0.9997, Adjusted R-squared: 0.9997   
## F-statistic: 2.032e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S100E100M5)

## 2.5 % 97.5 %  
## (Intercept) 119.599982457 120.319352319  
## x -0.006679366 0.005687771  
## interventionTRUE -100.533197226 -99.523399528  
## time\_after\_intervention -0.006131030 0.011358742

Sample size 1000 Effect Size 20 Model 1: Abrupt at time 100

S1PhaseInS1000E20AGGM1<-S1PhaseInS1000E20AGG  
S1PhaseInS1000E20AGGM1$intervention = S1PhaseInS1000E20AGGM1$x > 100  
S1PhaseInS1000E20AGGM1$time\_after\_intervention = ifelse(S1PhaseInS1000E20AGGM1$x > 100, S1PhaseInS1000E20AGGM1$x - 100, 0)  
S1S1000E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E20AGGM1)  
summary(S1S1000E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.7388 -0.7458 -0.0355 0.4322 11.6605   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 120.085386 0.546432 219.763 < 0.0000000000000002 \*\*\*  
## x -0.001081 0.009394 -0.115 0.908   
## interventionTRUE -12.543143 0.767040 -16.353 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.106684 0.013285 -8.030 0.0000000000000884 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.712 on 196 degrees of freedom  
## Multiple R-squared: 0.9228, Adjusted R-squared: 0.9217   
## F-statistic: 781.4 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E20M1)

## 2.5 % 97.5 %  
## (Intercept) 119.0077448 121.16302707  
## x -0.0196076 0.01744521  
## interventionTRUE -14.0558548 -11.03043051  
## time\_after\_intervention -0.1328841 -0.08048349

Model 2: Abrupt at time 120

S1PhaseInS1000E20AGGM2<-S1PhaseInS1000E20AGG  
S1PhaseInS1000E20AGGM2$intervention = S1PhaseInS1000E20AGGM2$x > 120  
S1PhaseInS1000E20AGGM2$time\_after\_intervention = ifelse(S1PhaseInS1000E20AGGM2$x > 120, S1PhaseInS1000E20AGGM2$x - 120, 0)  
S1S1000E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E20AGGM2)  
summary(S1S1000E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -14.1508 -0.5822 0.0311 1.3238 5.0266   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 122.813464 0.510128 240.750 < 0.0000000000000002 \*\*\*  
## x -0.072853 0.007317 -9.956 < 0.0000000000000002 \*\*\*  
## interventionTRUE -14.113872 0.804121 -17.552 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.071924 0.015306 4.699 0.00000491 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.777 on 196 degrees of freedom  
## Multiple R-squared: 0.9191, Adjusted R-squared: 0.9179   
## F-statistic: 742.3 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E20M2)

## 2.5 % 97.5 %  
## (Intercept) 121.80741947 123.81950809  
## x -0.08728346 -0.05842179  
## interventionTRUE -15.69971352 -12.52803136  
## time\_after\_intervention 0.04173837 0.10210891

Model 3: Excluding Phase-in Period

S1PhaseInS1000E20AGGM3<-subset(S1PhaseInS1000E20AGG,x<100|x>120)  
  
S1PhaseInS1000E20AGGM3$intervention = S1PhaseInS1000E20AGGM3$x > 100  
S1PhaseInS1000E20AGGM3$time\_after\_intervention = ifelse(S1PhaseInS1000E20AGGM3$x > 100, S1PhaseInS1000E20AGGM3$x - 100, 0)  
S1S1000E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E20AGGM3)  
summary(S1S1000E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.93258 -0.16752 -0.02271 0.18470 0.95976   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 120.0974110 0.0693071 1732.831 <0.0000000000000002  
## x -0.0014384 0.0012034 -1.195 0.234  
## interventionTRUE -19.9777172 0.1277256 -156.411 <0.0000000000000002  
## time\_after\_intervention 0.0005094 0.0020477 0.249 0.804  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3422 on 175 degrees of freedom  
## Multiple R-squared: 0.9989, Adjusted R-squared: 0.9988   
## F-statistic: 5.092e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S1000E20M3)

## 2.5 % 97.5 %  
## (Intercept) 119.960625719 120.2341962420  
## x -0.003813510 0.0009367606  
## interventionTRUE -20.229798020 -19.7256363955  
## time\_after\_intervention -0.003531984 0.0045507639

Model 4: Counterfactual from Before

S1PhaseInS1000E20AGGM4<-subset(S1PhaseInS1000E20AGG,x<=100|x>=120)  
S1PhaseInS1000E20AGGM4<-rbind(S1PhaseInS1000E20AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS1000E20AGGM4$intervention = S1PhaseInS1000E20AGGM4$x > 119  
S1PhaseInS1000E20AGGM4$time\_after\_intervention = ifelse(S1PhaseInS1000E20AGGM4$x > 120, S1PhaseInS1000E20AGGM4$x - 120, 0)  
S1S1000E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E20AGGM4)  
summary(S1S1000E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.9162 -0.1537 0.0094 0.1717 0.9556   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 120.07686163 0.06017767 1995.372 <0.0000000000000002  
## x -0.00084986 0.00087041 -0.976 0.330  
## interventionTRUE -20.01939051 0.09369487 -213.666 <0.0000000000000002  
## time\_after\_intervention -0.00004581 0.00177767 -0.026 0.979  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3262 on 196 degrees of freedom  
## Multiple R-squared: 0.9989, Adjusted R-squared: 0.9989   
## F-statistic: 6.105e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E20M4)

## 2.5 % 97.5 %  
## (Intercept) 119.958182771 120.195540496  
## x -0.002566419 0.000866705  
## interventionTRUE -20.204170022 -19.834611007  
## time\_after\_intervention -0.003551622 0.003460009

Model 5: Counterfactual from After

S1PhaseInS1000E20AGGM5<-subset(S1PhaseInS1000E20AGG,x<=100|x>=120)  
S1PhaseInS1000E20AGGM5<-rbind(S1PhaseInS1000E20AGGM5,S1CounterfactualAfterE20)  
  
S1PhaseInS1000E20AGGM5$intervention = S1PhaseInS1000E20AGGM5$x > 100  
S1PhaseInS1000E20AGGM5$time\_after\_intervention = ifelse(S1PhaseInS1000E20AGGM5$x > 100, S1PhaseInS1000E20AGGM5$x - 100, 0)  
S1S1000E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E20AGGM5)  
summary(S1S1000E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.92306 -0.15140 0.00662 0.16743 0.95679   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 120.0853859 0.0657253 1827.079 <0.0000000000000002  
## x -0.0010812 0.0011299 -0.957 0.340  
## interventionTRUE -19.9808372 0.0922603 -216.570 <0.0000000000000002  
## time\_after\_intervention -0.0001367 0.0015980 -0.086 0.932  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3262 on 196 degrees of freedom  
## Multiple R-squared: 0.999, Adjusted R-squared: 0.999   
## F-statistic: 6.327e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E20M5)

## 2.5 % 97.5 %  
## (Intercept) 119.955766287 120.215005577  
## x -0.003309568 0.001147177  
## interventionTRUE -20.162787577 -19.798886818  
## time\_after\_intervention -0.003288083 0.003014705

Sample size 1000 Effect Size 50 Model 1: Abrupt at time 100

S1PhaseInS1000E50AGGM1<-S1PhaseInS1000E50AGG  
S1PhaseInS1000E50AGGM1$intervention = S1PhaseInS1000E50AGGM1$x > 100  
S1PhaseInS1000E50AGGM1$time\_after\_intervention = ifelse(S1PhaseInS1000E50AGGM1$x > 100, S1PhaseInS1000E50AGGM1$x - 100, 0)  
S1S1000E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E50AGGM1)  
summary(S1S1000E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -12.8508 -1.2766 -0.0505 0.5406 30.4962   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 120.085386 1.323825 90.711 < 0.0000000000000002 \*\*\*  
## x -0.001081 0.022759 -0.048 0.962   
## interventionTRUE -32.775461 1.858287 -17.637 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.245950 0.032186 -7.642 0.000000000000931 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.57 on 196 degrees of freedom  
## Multiple R-squared: 0.9272, Adjusted R-squared: 0.9261   
## F-statistic: 831.9 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E50M1)

## 2.5 % 97.5 %  
## (Intercept) 117.47461586 122.69615600  
## x -0.04596457 0.04380218  
## interventionTRUE -36.44026485 -29.11065669  
## time\_after\_intervention -0.30942480 -0.18247543

Model 2: Abrupt at time 120

S1PhaseInS1000E50AGGM2<-S1PhaseInS1000E50AGG  
S1PhaseInS1000E50AGGM2$intervention = S1PhaseInS1000E50AGGM2$x > 120  
S1PhaseInS1000E50AGGM2$time\_after\_intervention = ifelse(S1PhaseInS1000E50AGGM2$x > 120, S1PhaseInS1000E50AGGM2$x - 120, 0)  
S1S1000E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E50AGGM2)  
summary(S1S1000E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -34.477 -0.684 0.061 3.190 12.689   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 127.50656 1.36041 93.726 < 0.0000000000000002 \*\*\*  
## x -0.19641 0.01951 -10.065 < 0.0000000000000002 \*\*\*  
## interventionTRUE -33.95346 2.14444 -15.833 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.19707 0.04082 4.828 0.00000277 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.405 on 196 degrees of freedom  
## Multiple R-squared: 0.9075, Adjusted R-squared: 0.9061   
## F-statistic: 640.9 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E50M2)

## 2.5 % 97.5 %  
## (Intercept) 124.8236373 130.1894857  
## x -0.2348918 -0.1579233  
## interventionTRUE -38.1825878 -29.7243294  
## time\_after\_intervention 0.1165717 0.2775682

Model 3: Excluding Phase-in Period

S1PhaseInS1000E50AGGM3<-subset(S1PhaseInS1000E50AGG,x<100|x>120)  
  
S1PhaseInS1000E50AGGM3$intervention = S1PhaseInS1000E50AGGM3$x > 100  
S1PhaseInS1000E50AGGM3$time\_after\_intervention = ifelse(S1PhaseInS1000E50AGGM3$x > 100, S1PhaseInS1000E50AGGM3$x - 100, 0)  
S1S1000E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E50AGGM3)  
summary(S1S1000E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.93258 -0.18520 -0.01019 0.18532 0.95976   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 120.097411 0.065545 1832.296 <0.0000000000000002 \*\*\*  
## x -0.001438 0.001138 -1.264 0.208   
## interventionTRUE -49.982621 0.120792 -413.791 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.002101 0.001937 1.085 0.280   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3236 on 175 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 3.523e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S1000E50M3)

## 2.5 % 97.5 %  
## (Intercept) 119.968051049 120.2267709118  
## x -0.003684577 0.0008078273  
## interventionTRUE -50.221017531 -49.7442241074  
## time\_after\_intervention -0.001721217 0.0059227622

Model 4: Counterfactual from Before

S1PhaseInS1000E50AGGM4<-subset(S1PhaseInS1000E50AGG,x<=100|x>=120)  
S1PhaseInS1000E50AGGM4<-rbind(S1PhaseInS1000E50AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS1000E50AGGM4$intervention = S1PhaseInS1000E50AGGM4$x > 119  
S1PhaseInS1000E50AGGM4$time\_after\_intervention = ifelse(S1PhaseInS1000E50AGGM4$x > 120, S1PhaseInS1000E50AGGM4$x - 120, 0)  
S1S1000E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E50AGGM4)  
summary(S1S1000E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.91615 -0.15707 0.01371 0.17470 0.95559   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 120.0768616 0.0571964 2099.378 <0.0000000000000002  
## x -0.0008499 0.0008273 -1.027 0.306  
## interventionTRUE -50.0099805 0.0890531 -561.575 <0.0000000000000002  
## time\_after\_intervention 0.0018719 0.0016896 1.108 0.269  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.31 on 196 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 4.182e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E50M4)

## 2.5 % 97.5 %  
## (Intercept) 119.964062275 120.1896609921  
## x -0.002481378 0.0007816643  
## interventionTRUE -50.185605778 -49.8343551926  
## time\_after\_intervention -0.001460209 0.0052040573

Model 5: Counterfactual from After

S1PhaseInS1000E50AGGM5<-subset(S1PhaseInS1000E50AGG,x<=100|x>=120)  
S1PhaseInS1000E50AGGM5<-rbind(S1PhaseInS1000E50AGGM5,S1CounterfactualAfterE50)  
  
S1PhaseInS1000E50AGGM5$intervention = S1PhaseInS1000E50AGGM5$x > 100  
S1PhaseInS1000E50AGGM5$time\_after\_intervention = ifelse(S1PhaseInS1000E50AGGM5$x > 100, S1PhaseInS1000E50AGGM5$x - 100, 0)  
S1S1000E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E50AGGM5)  
summary(S1S1000E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.92306 -0.16579 0.01679 0.16941 0.95679   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 120.085386 0.062479 1922.013 <0.0000000000000002 \*\*\*  
## x -0.001081 0.001074 -1.007 0.315   
## interventionTRUE -50.002708 0.087703 -570.135 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.001678 0.001519 1.104 0.271   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3101 on 196 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 4.339e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E50M5)

## 2.5 % 97.5 %  
## (Intercept) 119.962168610 120.208603254  
## x -0.003199501 0.001037111  
## interventionTRUE -50.175671681 -49.829745130  
## time\_after\_intervention -0.001318014 0.004673460

Sample size 1000 Effect Size 100 Model 1: Abrupt at time 100

S1PhaseInS1000E100AGGM1<-S1PhaseInS1000E100AGG  
S1PhaseInS1000E100AGGM1$intervention = S1PhaseInS1000E100AGGM1$x > 100  
S1PhaseInS1000E100AGGM1$time\_after\_intervention = ifelse(S1PhaseInS1000E100AGGM1$x > 100, S1PhaseInS1000E100AGGM1$x - 100, 0)  
S1S1000E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E100AGGM1)  
summary(S1S1000E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -25.322 -1.934 -0.051 0.541 60.050   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 120.085386 2.591071 46.346 < 0.0000000000000002 \*\*\*  
## x -0.001081 0.044545 -0.024 0.981   
## interventionTRUE -65.287388 3.637152 -17.950 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.495783 0.062996 -7.870 0.000000000000235 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.86 on 196 degrees of freedom  
## Multiple R-squared: 0.9298, Adjusted R-squared: 0.9288   
## F-statistic: 865.9 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E100M1)

## 2.5 % 97.5 %  
## (Intercept) 114.97542784 125.19534402  
## x -0.08892967 0.08676728  
## interventionTRUE -72.46036555 -58.11441033  
## time\_after\_intervention -0.62001956 -0.37154653

Model 2: Abrupt at time 120

S1PhaseInS1000E100AGGM2<-S1PhaseInS1000E100AGG  
S1PhaseInS1000E100AGGM2$intervention = S1PhaseInS1000E100AGGM2$x > 120  
S1PhaseInS1000E100AGGM2$time\_after\_intervention = ifelse(S1PhaseInS1000E100AGGM2$x > 120, S1PhaseInS1000E100AGGM2$x - 100, 0)  
S1S1000E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E100AGGM2)  
summary(S1S1000E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.892 -0.963 0.111 6.106 24.502   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 134.70643 2.64235 50.98 < 0.0000000000000002 \*\*\*  
## x -0.38653 0.03790 -10.20 < 0.0000000000000002 \*\*\*  
## interventionTRUE -76.11744 4.92939 -15.44 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.38849 0.07928 4.90 0.000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14.38 on 196 degrees of freedom  
## Multiple R-squared: 0.9122, Adjusted R-squared: 0.9109   
## F-statistic: 679 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E100M2)

## 2.5 % 97.5 %  
## (Intercept) 129.4953526 139.9175108  
## x -0.4612803 -0.3117834  
## interventionTRUE -85.8388927 -66.3959892  
## time\_after\_intervention 0.2321391 0.5448447

Model 3: Excluding Phase-in Period

S1PhaseInS1000E100AGGM3<-subset(S1PhaseInS1000E100AGG,x<100|x>120)  
  
S1PhaseInS1000E100AGGM3$intervention = S1PhaseInS1000E100AGGM3$x > 100  
S1PhaseInS1000E100AGGM3$time\_after\_intervention = ifelse(S1PhaseInS1000E100AGGM3$x > 100, S1PhaseInS1000E100AGGM3$x - 100, 0)  
S1S1000E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E100AGGM3)  
summary(S1S1000E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.93258 -0.20092 0.02904 0.19399 0.95976   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 120.097411 0.068587 1751.025 <0.0000000000000002  
## x -0.001438 0.001191 -1.208 0.2288  
## interventionTRUE -100.017765 0.126398 -791.289 <0.0000000000000002  
## time\_after\_intervention 0.003398 0.002026 1.677 0.0953  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3386 on 175 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 1.285e+06 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S1S1000E100M3)

## 2.5 % 97.5 %  
## (Intercept) 119.9620469877 120.2327749732  
## x -0.0037888316 0.0009120817  
## interventionTRUE -100.2672266143 -99.7683034861  
## time\_after\_intervention -0.0006009758 0.0073977880

Model 4: Counterfactual from Before

S1PhaseInS1000E100AGGM4<-subset(S1PhaseInS1000E100AGG,x<=100|x>=120)  
S1PhaseInS1000E100AGGM4<-rbind(S1PhaseInS1000E100AGGM4,S1CounterfactualBefore)  
  
S1PhaseInS1000E100AGGM4$intervention = S1PhaseInS1000E100AGGM4$x > 119  
S1PhaseInS1000E100AGGM4$time\_after\_intervention = ifelse(S1PhaseInS1000E100AGGM4$x > 120, S1PhaseInS1000E100AGGM4$x - 120, 0)  
S1S1000E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E100AGGM4)  
summary(S1S1000E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.9162 -0.1755 0.0162 0.1767 0.9556   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 120.0768616 0.0599707 2002.259 <0.0000000000000002  
## x -0.0008499 0.0008674 -0.980 0.3284  
## interventionTRUE -100.0262490 0.0933726 -1071.259 <0.0000000000000002  
## time\_after\_intervention 0.0033014 0.0017716 1.864 0.0639  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.325 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 1.52e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E100M4)

## 2.5 % 97.5 %  
## (Intercept) 119.9585909644 120.1951323028  
## x -0.0025605144 0.0008608009  
## interventionTRUE -100.2103929772 -99.8421050510  
## time\_after\_intervention -0.0001923306 0.0067951842

Model 5: Counterfactual from After

S1PhaseInS1000E100AGGM5<-subset(S1PhaseInS1000E100AGG,x<=100|x>=120)  
S1PhaseInS1000E100AGGM5<-rbind(S1PhaseInS1000E100AGGM5,S1CounterfactualAfterE100)  
  
S1PhaseInS1000E100AGGM5$intervention = S1PhaseInS1000E100AGGM5$x > 100  
S1PhaseInS1000E100AGGM5$time\_after\_intervention = ifelse(S1PhaseInS1000E100AGGM5$x > 100, S1PhaseInS1000E100AGGM5$x - 100, 0)  
S1S1000E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S1PhaseInS1000E100AGGM5)  
summary(S1S1000E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S1PhaseInS1000E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.92306 -0.18156 0.03149 0.17911 0.95679   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 120.085386 0.065559 1831.710 <0.0000000000000002  
## x -0.001081 0.001127 -0.959 0.3386  
## interventionTRUE -100.027012 0.092027 -1086.930 <0.0000000000000002  
## time\_after\_intervention 0.002815 0.001594 1.766 0.0789  
##   
## (Intercept) \*\*\*  
## x   
## interventionTRUE \*\*\*  
## time\_after\_intervention .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3253 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 1.574e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S1S1000E100M5)

## 2.5 % 97.5 %  
## (Intercept) 119.9560939985 120.214677865  
## x -0.0033039336 0.001141543  
## interventionTRUE -100.2085027128 -99.845521989  
## time\_after\_intervention -0.0003282322 0.005958621

# Senario 2

Sample size 20 Effect Size 20 Model 1: Abrupt at time 100

S2PhaseInS20E20AGGM1<-S2PhaseInS20E20AGG  
S2PhaseInS20E20AGGM1$intervention = S2PhaseInS20E20AGGM1$x > 100  
S2PhaseInS20E20AGGM1$time\_after\_intervention = ifelse(S2PhaseInS20E20AGGM1$x > 100, S2PhaseInS20E20AGGM1$x - 100, 0)  
S2S20E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E20AGGM1)  
summary(S2S20E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -8.1935 -2.1636 -0.5698 1.7661 13.1780   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.39915 0.67526 28.728 < 0.0000000000000002 \*\*\*  
## x 1.01274 0.01161 87.238 < 0.0000000000000002 \*\*\*  
## interventionTRUE -13.66352 0.94788 -14.415 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.11608 0.01642 -7.071 0.0000000000265 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 3.351 on 196 degrees of freedom  
## Multiple R-squared: 0.9955, Adjusted R-squared: 0.9954   
## F-statistic: 1.444e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E20M1)

## 2.5 % 97.5 %  
## (Intercept) 18.0674406 20.73085625  
## x 0.9898410 1.03562943  
## interventionTRUE -15.5328756 -11.79417159  
## time\_after\_intervention -0.1484615 -0.08370686

Model 2: Abrupt at time 120

S2PhaseInS20E20AGGM2<-S2PhaseInS20E20AGG  
S2PhaseInS20E20AGGM2$intervention = S2PhaseInS20E20AGGM2$x > 120  
S2PhaseInS20E20AGGM2$time\_after\_intervention = ifelse(S2PhaseInS20E20AGGM2$x > 120, S2PhaseInS20E20AGGM2$x - 120, 0)  
S2S20E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E20AGGM2)  
summary(S2S20E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -16.0841 -2.0504 0.1391 2.4442 9.4507   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 22.71041 0.72442 31.350 < 0.0000000000000002 \*\*\*  
## x 0.92539 0.01039 89.055 < 0.0000000000000002 \*\*\*  
## interventionTRUE -13.09333 1.14191 -11.466 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.05811 0.02174 2.673 0.00814 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 3.943 on 196 degrees of freedom  
## Multiple R-squared: 0.9938, Adjusted R-squared: 0.9937   
## F-statistic: 1.041e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E20M2)

## 2.5 % 97.5 %  
## (Intercept) 21.2817528 24.1390748  
## x 0.9048975 0.9458833  
## interventionTRUE -15.3453426 -10.8413078  
## time\_after\_intervention 0.0152413 0.1009722

Model 3: Excluding Phase-in Period

S2PhaseInS20E20AGGM3<-subset(S2PhaseInS20E20AGG,x<100|x>120)  
  
S2PhaseInS20E20AGGM3$intervention = S2PhaseInS20E20AGGM3$x > 100  
S2PhaseInS20E20AGGM3$time\_after\_intervention = ifelse(S2PhaseInS20E20AGGM3$x > 100, S2PhaseInS20E20AGGM3$x - 100, 0)  
S2S20E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E20AGGM3)  
summary(S2S20E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.1733 -1.5657 0.0441 1.5398 6.9081   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.39737 0.47052 41.225 <0.0000000000000002 \*\*\*  
## x 1.01279 0.00817 123.962 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.68217 0.86713 -22.698 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.02929 0.01390 -2.107 0.0365 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.323 on 175 degrees of freedom  
## Multiple R-squared: 0.9981, Adjusted R-squared: 0.998   
## F-statistic: 3.003e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S20E20M3)

## 2.5 % 97.5 %  
## (Intercept) 18.46874060 20.326006604  
## x 0.99666317 1.028912682  
## interventionTRUE -21.39354293 -17.970797546  
## time\_after\_intervention -0.05672761 -0.001853959

Model 4: Counterfactual from Before

S2PhaseInS20E20AGGM4<-subset(S2PhaseInS20E20AGG,x<=100|x>=120)  
S2PhaseInS20E20AGGM4<-rbind(S2PhaseInS20E20AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS20E20AGGM4$intervention = S2PhaseInS20E20AGGM4$x > 119  
S2PhaseInS20E20AGGM4$time\_after\_intervention = ifelse(S2PhaseInS20E20AGGM4$x > 120, S2PhaseInS20E20AGGM4$x - 120, 0)  
S2S20E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E20AGGM4)  
summary(S2S20E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.2153 -1.3430 -0.3373 1.3976 7.0759   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.599264 0.406893 48.168 <0.0000000000000002 \*\*\*  
## x 1.007271 0.005885 171.151 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.726268 0.633521 -31.138 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.025294 0.012020 -2.104 0.0366 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.205 on 196 degrees of freedom  
## Multiple R-squared: 0.9981, Adjusted R-squared: 0.998   
## F-statistic: 3.382e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E20M4)

## 2.5 % 97.5 %  
## (Intercept) 18.79681337 20.401715301  
## x 0.99566445 1.018877621  
## interventionTRUE -20.97566090 -18.476875661  
## time\_after\_intervention -0.04899873 -0.001589359

Model 5: Counterfactual from After

S2PhaseInS20E20AGGM5<-subset(S2PhaseInS20E20AGG,x<=100|x>=120)  
S2PhaseInS20E20AGGM5<-rbind(S2PhaseInS20E20AGGM5,S2CounterfactualAfterE20)  
  
S2PhaseInS20E20AGGM5$intervention = S2PhaseInS20E20AGGM5$x > 100  
S2PhaseInS20E20AGGM5$time\_after\_intervention = ifelse(S2PhaseInS20E20AGGM5$x > 100, S2PhaseInS20E20AGGM5$x - 100, 0)  
S2S20E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E20AGGM5)  
summary(S2S20E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.0004 -1.4267 -0.2832 1.4249 6.9099   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.399148 0.444633 43.630 <0.0000000000000002 \*\*\*  
## x 1.012735 0.007644 132.488 <0.0000000000000002 \*\*\*  
## interventionTRUE -20.180544 0.624142 -32.333 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.022086 0.010810 -2.043 0.0424 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.207 on 196 degrees of freedom  
## Multiple R-squared: 0.998, Adjusted R-squared: 0.998   
## F-statistic: 3.335e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E20M5)

## 2.5 % 97.5 %  
## (Intercept) 18.52226970 20.2760271811  
## x 0.99766024 1.0278101758  
## interventionTRUE -21.41144053 -18.9496467328  
## time\_after\_intervention -0.04340492 -0.0007664688

Sample size 20 Effect Size 50 Model 1: Abrupt at time 100

S2PhaseInS20E50AGGM1<-S2PhaseInS20E50AGG  
S2PhaseInS20E50AGGM1$intervention = S2PhaseInS20E50AGGM1$x > 100  
S2PhaseInS20E50AGGM1$time\_after\_intervention = ifelse(S2PhaseInS20E50AGGM1$x > 100, S2PhaseInS20E50AGGM1$x - 100, 0)  
S2S20E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E50AGGM1)  
summary(S2S20E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -15.989 -2.801 -0.087 2.286 31.975   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.39915 1.37972 14.060 < 0.0000000000000002 \*\*\*  
## x 1.01274 0.02372 42.696 < 0.0000000000000002 \*\*\*  
## interventionTRUE -33.35006 1.93675 -17.220 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.25838 0.03354 -7.703 0.000000000000646 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.847 on 196 degrees of freedom  
## Multiple R-squared: 0.9686, Adjusted R-squared: 0.9681   
## F-statistic: 2015 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E50M1)

## 2.5 % 97.5 %  
## (Intercept) 16.6781428 22.1201541  
## x 0.9659567 1.0595137  
## interventionTRUE -37.1695998 -29.5305107  
## time\_after\_intervention -0.3245360 -0.1922264

Model 2: Abrupt at time 120

S2PhaseInS20E50AGGM2<-S2PhaseInS20E50AGG  
S2PhaseInS20E50AGGM2$intervention = S2PhaseInS20E50AGGM2$x > 120  
S2PhaseInS20E50AGGM2$time\_after\_intervention = ifelse(S2PhaseInS20E50AGGM2$x > 120, S2PhaseInS20E50AGGM2$x - 120, 0)  
S2S20E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E50AGGM2)  
summary(S2S20E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -37.865 -2.372 0.404 3.556 15.250   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 26.92953 1.41364 19.050 < 0.0000000000000002 \*\*\*  
## x 0.81420 0.02028 40.153 < 0.0000000000000002 \*\*\*  
## interventionTRUE -34.68064 2.22835 -15.563 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.19109 0.04241 4.505 0.0000114 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.695 on 196 degrees of freedom  
## Multiple R-squared: 0.9603, Adjusted R-squared: 0.9597   
## F-statistic: 1582 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E50M2)

## 2.5 % 97.5 %  
## (Intercept) 24.1416274 29.7174389  
## x 0.7742076 0.8541878  
## interventionTRUE -39.0752482 -30.2860220  
## time\_after\_intervention 0.1074467 0.2747429

Model 3: Excluding Phase-in Period

S2PhaseInS20E50AGGM3<-subset(S2PhaseInS20E50AGG,x<100|x>120)  
  
S2PhaseInS20E50AGGM3$intervention = S2PhaseInS20E50AGGM3$x > 100  
S2PhaseInS20E50AGGM3$time\_after\_intervention = ifelse(S2PhaseInS20E50AGGM3$x > 100, S2PhaseInS20E50AGGM3$x - 100, 0)  
S2S20E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E50AGGM3)  
summary(S2S20E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.3031 -1.5376 -0.0263 1.5215 6.9081   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.397374 0.430822 45.024 <0.0000000000000002 \*\*\*  
## x 1.012788 0.007481 135.385 <0.0000000000000002 \*\*\*  
## interventionTRUE -50.829393 0.793960 -64.020 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.007495 0.012729 -0.589 0.557   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.127 on 175 degrees of freedom  
## Multiple R-squared: 0.9973, Adjusted R-squared: 0.9972   
## F-statistic: 2.127e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S20E50M3)

## 2.5 % 97.5 %  
## (Intercept) 18.54709696 20.24765024  
## x 0.99802374 1.02755210  
## interventionTRUE -52.39636351 -49.26242314  
## time\_after\_intervention -0.03261722 0.01762629

Model 4: Counterfactual from Before

S2PhaseInS20E50AGGM4<-subset(S2PhaseInS20E50AGG,x<=100|x>=120)  
S2PhaseInS20E50AGGM4<-rbind(S2PhaseInS20E50AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS20E50AGGM4$intervention = S2PhaseInS20E50AGGM4$x > 119  
S2PhaseInS20E50AGGM4$time\_after\_intervention = ifelse(S2PhaseInS20E50AGGM4$x > 120, S2PhaseInS20E50AGGM4$x - 120, 0)  
S2S20E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E50AGGM4)  
summary(S2S20E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.301 -1.310 -0.351 1.369 7.076   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.5992643 0.3745083 52.333 <0.0000000000000002 \*\*\*  
## x 1.0072710 0.0054169 185.951 <0.0000000000000002 \*\*\*  
## interventionTRUE -50.6735371 0.5830985 -86.904 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.0008979 0.0110631 0.081 0.935   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.03 on 196 degrees of freedom  
## Multiple R-squared: 0.9974, Adjusted R-squared: 0.9973   
## F-statistic: 2.495e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E50M4)

## 2.5 % 97.5 %  
## (Intercept) 18.86068104 20.3378476  
## x 0.99658822 1.0179538  
## interventionTRUE -51.82348961 -49.5235846  
## time\_after\_intervention -0.02092012 0.0227159

Model 5: Counterfactual from After

S2PhaseInS20E50AGGM5<-subset(S2PhaseInS20E50AGG,x<=100|x>=120)  
S2PhaseInS20E50AGGM5<-rbind(S2PhaseInS20E50AGGM5,S2CounterfactualAfterE50)  
  
S2PhaseInS20E50AGGM5$intervention = S2PhaseInS20E50AGGM5$x > 100  
S2PhaseInS20E50AGGM5$time\_after\_intervention = ifelse(S2PhaseInS20E50AGGM5$x > 100, S2PhaseInS20E50AGGM5$x - 100, 0)  
S2S20E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E50AGGM5)  
summary(S2S20E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.3002 -1.4329 0.0966 1.3457 6.9099   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.399148 0.407652 47.59 <0.0000000000000002 \*\*\*  
## x 1.012735 0.007008 144.51 <0.0000000000000002 \*\*\*  
## interventionTRUE -50.848936 0.572232 -88.86 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.007240 0.009911 -0.73 0.466   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.023 on 196 degrees of freedom  
## Multiple R-squared: 0.9973, Adjusted R-squared: 0.9972   
## F-statistic: 2.403e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E50M5)

## 2.5 % 97.5 %  
## (Intercept) 18.59520087 20.20309601  
## x 0.99891404 1.02655637  
## interventionTRUE -51.97745746 -49.72041433  
## time\_after\_intervention -0.02678577 0.01230639

Sample size 20 Effect Size 100 Model 1: Abrupt at time 100

S2PhaseInS20E100AGGM1<-S2PhaseInS20E100AGG  
S2PhaseInS20E100AGGM1$intervention = S2PhaseInS20E100AGGM1$x > 100  
S2PhaseInS20E100AGGM1$time\_after\_intervention = ifelse(S2PhaseInS20E100AGGM1$x > 100, S2PhaseInS20E100AGGM1$x - 100, 0)  
S2S20E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E100AGGM1)  
summary(S2S20E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -24.712 -4.022 -0.501 2.501 59.818   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.39915 2.54581 7.62 0.0000000000010597 \*\*\*  
## x 1.01274 0.04377 23.14 < 0.0000000000000002 \*\*\*  
## interventionTRUE -65.47141 3.57362 -18.32 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.51250 0.06190 -8.28 0.0000000000000189 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.63 on 196 degrees of freedom  
## Multiple R-squared: 0.7805, Adjusted R-squared: 0.7771   
## F-statistic: 232.3 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E100M1)

## 2.5 % 97.5 %  
## (Intercept) 14.3784503 24.4198466  
## x 0.9264213 1.0990492  
## interventionTRUE -72.5190885 -58.4237262  
## time\_after\_intervention -0.6345661 -0.3904334

Model 2: Abrupt at time 120

S2PhaseInS20E100AGGM2<-S2PhaseInS20E100AGG  
S2PhaseInS20E100AGGM2$intervention = S2PhaseInS20E100AGGM2$x > 120  
S2PhaseInS20E100AGGM2$time\_after\_intervention = ifelse(S2PhaseInS20E100AGGM2$x > 120, S2PhaseInS20E100AGGM2$x - 120, 0)  
S2S20E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E100AGGM2)  
summary(S2S20E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.132 -3.806 0.755 5.746 26.506   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 34.30174 2.69796 12.714 < 0.0000000000000002 \*\*\*  
## x 0.61937 0.03870 16.004 < 0.0000000000000002 \*\*\*  
## interventionTRUE -67.15612 4.25283 -15.791 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.35906 0.08095 4.436 0.0000153 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14.69 on 196 degrees of freedom  
## Multiple R-squared: 0.7034, Adjusted R-squared: 0.6989   
## F-statistic: 155 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E100M2)

## 2.5 % 97.5 %  
## (Intercept) 28.9809837 39.6225049  
## x 0.5430472 0.6956907  
## interventionTRUE -75.5433022 -58.7689303  
## time\_after\_intervention 0.1994203 0.5187076

Model 3: Excluding Phase-in Period

S2PhaseInS20E100AGGM3<-subset(S2PhaseInS20E100AGG,x<100|x>120)  
  
S2PhaseInS20E100AGGM3$intervention = S2PhaseInS20E100AGGM3$x > 100  
S2PhaseInS20E100AGGM3$time\_after\_intervention = ifelse(S2PhaseInS20E100AGGM3$x > 100, S2PhaseInS20E100AGGM3$x - 100, 0)  
S2S20E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E100AGGM3)  
summary(S2S20E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.4459 -1.5922 -0.0928 1.7045 6.9081   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.397374 0.482393 40.21 <0.0000000000000002 \*\*\*  
## x 1.012788 0.008376 120.91 <0.0000000000000002 \*\*\*  
## interventionTRUE -98.774921 0.889000 -111.11 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.034355 0.014253 -2.41 0.017 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.382 on 175 degrees of freedom  
## Multiple R-squared: 0.9924, Adjusted R-squared: 0.9922   
## F-statistic: 7591 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S20E100M3)

## 2.5 % 97.5 %  
## (Intercept) 18.44531590 20.349431309  
## x 0.99625642 1.029319428  
## interventionTRUE -100.52946298 -97.020379068  
## time\_after\_intervention -0.06248393 -0.006226102

Model 4: Counterfactual from Before

S2PhaseInS20E100AGGM4<-subset(S2PhaseInS20E100AGG,x<=100|x>=120)  
S2PhaseInS20E100AGGM4<-rbind(S2PhaseInS20E100AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS20E100AGGM4$intervention = S2PhaseInS20E100AGGM4$x > 119  
S2PhaseInS20E100AGGM4$time\_after\_intervention = ifelse(S2PhaseInS20E100AGGM4$x > 120, S2PhaseInS20E100AGGM4$x - 120, 0)  
S2S20E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E100AGGM4)  
summary(S2S20E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.4312 -1.3430 -0.3546 1.5840 7.0759   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.599264 0.416691 47.036 <0.0000000000000002 \*\*\*  
## x 1.007271 0.006027 167.127 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.049183 0.648775 -152.671 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.027957 0.012309 -2.271 0.0242 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.258 on 196 degrees of freedom  
## Multiple R-squared: 0.9946, Adjusted R-squared: 0.9945   
## F-statistic: 1.209e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E100M4)

## 2.5 % 97.5 %  
## (Intercept) 18.77749150 20.42103716  
## x 0.99538498 1.01915709  
## interventionTRUE -100.32865883 -97.76970645  
## time\_after\_intervention -0.05223227 -0.00368135

Model 5: Counterfactual from After

S2PhaseInS20E100AGGM5<-subset(S2PhaseInS20E100AGG,x<=100|x>=120)  
S2PhaseInS20E100AGGM5<-rbind(S2PhaseInS20E100AGGM5,S2CounterfactualAfterE100)  
  
S2PhaseInS20E100AGGM5$intervention = S2PhaseInS20E100AGGM5$x > 100  
S2PhaseInS20E100AGGM5$time\_after\_intervention = ifelse(S2PhaseInS20E100AGGM5$x > 100, S2PhaseInS20E100AGGM5$x - 100, 0)  
S2S20E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS20E100AGGM5)  
summary(S2S20E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS20E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.4370 -1.3310 -0.4989 1.5520 6.9099   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.399148 0.458677 42.294 <0.0000000000000002 \*\*\*  
## x 1.012735 0.007885 128.432 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.913014 0.643856 -155.179 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.018232 0.011152 -1.635 0.104   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.276 on 196 degrees of freedom  
## Multiple R-squared: 0.994, Adjusted R-squared: 0.9939   
## F-statistic: 1.08e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S20E100M5)

## 2.5 % 97.5 %  
## (Intercept) 18.49457292 20.303723963  
## x 0.99718408 1.028286328  
## interventionTRUE -101.18278994 -98.643238793  
## time\_after\_intervention -0.04022412 0.003761101

Sample size 100 Effect Size 20 Model 1: Abrupt at time 100

S2PhaseInS100E20AGGM1<-S2PhaseInS100E20AGG  
S2PhaseInS100E20AGGM1$intervention = S2PhaseInS100E20AGGM1$x > 100  
S2PhaseInS100E20AGGM1$time\_after\_intervention = ifelse(S2PhaseInS100E20AGGM1$x > 100, S2PhaseInS100E20AGGM1$x - 100, 0)  
S2S100E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E20AGGM1)  
summary(S2S100E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.2299 -1.1981 0.0014 1.0551 12.0780   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.106621 0.541338 37.142 < 0.0000000000000002 \*\*\*  
## x 0.996466 0.009306 107.072 < 0.0000000000000002 \*\*\*  
## interventionTRUE -12.610945 0.759890 -16.596 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.101108 0.013161 -7.682 0.00000000000073 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.686 on 196 degrees of freedom  
## Multiple R-squared: 0.9971, Adjusted R-squared: 0.997   
## F-statistic: 2.241e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E20M1)

## 2.5 % 97.5 %  
## (Intercept) 19.0390255 21.17421700  
## x 0.9781128 1.01482016  
## interventionTRUE -14.1095561 -11.11233359  
## time\_after\_intervention -0.1270644 -0.07515227

Model 2: Abrupt at time 120

S2PhaseInS100E20AGGM2<-S2PhaseInS100E20AGG  
S2PhaseInS100E20AGGM2$intervention = S2PhaseInS100E20AGGM2$x > 120  
S2PhaseInS100E20AGGM2$time\_after\_intervention = ifelse(S2PhaseInS100E20AGGM2$x > 120, S2PhaseInS100E20AGGM2$x - 120, 0)  
S2S100E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E20AGGM2)  
summary(S2S100E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.9675 -0.9848 0.1756 1.5228 5.7428   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 22.816853 0.514722 44.328 < 0.0000000000000002 \*\*\*  
## x 0.924752 0.007383 125.250 < 0.0000000000000002 \*\*\*  
## interventionTRUE -13.880156 0.811364 -17.107 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.073500 0.015444 4.759 0.00000377 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.802 on 196 degrees of freedom  
## Multiple R-squared: 0.9968, Adjusted R-squared: 0.9968   
## F-statistic: 2.06e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E20M2)

## 2.5 % 97.5 %  
## (Intercept) 21.80174779 23.8319586  
## x 0.91019093 0.9393126  
## interventionTRUE -15.48028029 -12.2800320  
## time\_after\_intervention 0.04304298 0.1039573

Model 3: Excluding Phase-in Period

S2PhaseInS100E20AGGM3<-subset(S2PhaseInS100E20AGG,x<100|x>120)  
  
S2PhaseInS100E20AGGM3$intervention = S2PhaseInS100E20AGGM3$x > 100  
S2PhaseInS100E20AGGM3$time\_after\_intervention = ifelse(S2PhaseInS100E20AGGM3$x > 100, S2PhaseInS100E20AGGM3$x - 100, 0)  
S2S100E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E20AGGM3)  
summary(S2S100E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.79530 -0.64998 -0.02007 0.69093 2.31405   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.133303 0.191969 104.878 <0.0000000000000002 \*\*\*  
## x 0.995674 0.003333 298.701 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.758827 0.353779 -55.851 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.002578 0.005672 0.455 0.65   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9478 on 175 degrees of freedom  
## Multiple R-squared: 0.9997, Adjusted R-squared: 0.9997   
## F-statistic: 1.797e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S100E20M3)

## 2.5 % 97.5 %  
## (Intercept) 19.754430004 20.51217615  
## x 0.989095186 1.00225267  
## interventionTRUE -20.457050138 -19.06060389  
## time\_after\_intervention -0.008616021 0.01377188

Model 4: Counterfactual from Before

S2PhaseInS100E20AGGM4<-subset(S2PhaseInS100E20AGG,x<=100|x>=120)  
S2PhaseInS100E20AGGM4<-rbind(S2PhaseInS100E20AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS100E20AGGM4$intervention = S2PhaseInS100E20AGGM4$x > 119  
S2PhaseInS100E20AGGM4$time\_after\_intervention = ifelse(S2PhaseInS100E20AGGM4$x > 120, S2PhaseInS100E20AGGM4$x - 120, 0)  
S2S100E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E20AGGM4)  
summary(S2S100E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.8313 -0.5973 0.1244 0.5515 2.2699   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 20.03629812 0.16653434 120.313 <0.0000000000000002  
## x 0.99838911 0.00240874 414.486 <0.0000000000000002  
## interventionTRUE -19.94032030 0.25928908 -76.904 <0.0000000000000002  
## time\_after\_intervention -0.00005834 0.00491948 -0.012 0.991  
##   
## (Intercept) \*\*\*  
## x \*\*\*  
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9026 on 196 degrees of freedom  
## Multiple R-squared: 0.9997, Adjusted R-squared: 0.9997   
## F-statistic: 2.012e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E20M4)

## 2.5 % 97.5 %  
## (Intercept) 19.70786888 20.364727352  
## x 0.99363874 1.003139487  
## interventionTRUE -20.45167498 -19.428965613  
## time\_after\_intervention -0.00976026 0.009643572

Model 5: Counterfactual from After

S2PhaseInS100E20AGGM5<-subset(S2PhaseInS100E20AGG,x<=100|x>=120)  
S2PhaseInS100E20AGGM5<-rbind(S2PhaseInS100E20AGGM5,S2CounterfactualAfterE20)  
  
S2PhaseInS100E20AGGM5$intervention = S2PhaseInS100E20AGGM5$x > 100  
S2PhaseInS100E20AGGM5$time\_after\_intervention = ifelse(S2PhaseInS100E20AGGM5$x > 100, S2PhaseInS100E20AGGM5$x - 100, 0)  
S2S100E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E20AGGM5)  
summary(S2S100E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.80745 -0.54889 0.02663 0.54258 2.29952   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.106621 0.181486 110.789 <0.0000000000000002 \*\*\*  
## x 0.996466 0.003120 319.376 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.764861 0.254757 -77.583 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.001131 0.004412 0.256 0.798   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9006 on 196 degrees of freedom  
## Multiple R-squared: 0.9997, Adjusted R-squared: 0.9997   
## F-statistic: 1.994e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E20M5)

## 2.5 % 97.5 %  
## (Intercept) 19.748704723 20.464537732  
## x 0.990313292 1.002619624  
## interventionTRUE -20.267277442 -19.262444514  
## time\_after\_intervention -0.007570833 0.009832948

Sample size 100 Effect Size 50 Model 1: Abrupt at time 100

S2PhaseInS100E50AGGM1<-S2PhaseInS100E50AGG  
S2PhaseInS100E50AGGM1$intervention = S2PhaseInS100E50AGGM1$x > 100  
S2PhaseInS100E50AGGM1$time\_after\_intervention = ifelse(S2PhaseInS100E50AGGM1$x > 100, S2PhaseInS100E50AGGM1$x - 100, 0)  
S2S100E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E50AGGM1)  
summary(S2S100E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.0354 -1.9392 -0.1071 1.1736 29.3583   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.10662 1.28033 15.704 < 0.0000000000000002 \*\*\*  
## x 0.99647 0.02201 45.271 < 0.0000000000000002 \*\*\*  
## interventionTRUE -32.79186 1.79723 -18.246 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.24116 0.03113 -7.747 0.000000000000494 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.354 on 196 degrees of freedom  
## Multiple R-squared: 0.9725, Adjusted R-squared: 0.9721   
## F-statistic: 2310 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E50M1)

## 2.5 % 97.5 %  
## (Intercept) 17.5816276 22.6316149  
## x 0.9530577 1.0398752  
## interventionTRUE -36.3362571 -29.2474620  
## time\_after\_intervention -0.3025448 -0.1797664

Model 2: Abrupt at time 120

S2PhaseInS100E50AGGM2<-S2PhaseInS100E50AGG  
S2PhaseInS100E50AGGM2$intervention = S2PhaseInS100E50AGGM2$x > 120  
S2PhaseInS100E50AGGM2$time\_after\_intervention = ifelse(S2PhaseInS100E50AGGM2$x > 120, S2PhaseInS100E50AGGM2$x - 120, 0)  
S2S100E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E50AGGM2)  
summary(S2S100E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -33.589 -1.400 0.166 3.309 13.419   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 27.51398 1.34075 20.521 < 0.0000000000000002 \*\*\*  
## x 0.80102 0.01923 41.650 < 0.0000000000000002 \*\*\*  
## interventionTRUE -33.55292 2.11345 -15.876 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.19574 0.04023 4.866 0.00000234 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.298 on 196 degrees of freedom  
## Multiple R-squared: 0.9637, Adjusted R-squared: 0.9632   
## F-statistic: 1735 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E50M2)

## 2.5 % 97.5 %  
## (Intercept) 24.8698198 30.1581319  
## x 0.7630923 0.8389486  
## interventionTRUE -37.7209407 -29.3849036  
## time\_after\_intervention 0.1164075 0.2750776

Model 3: Excluding Phase-in Period

S2PhaseInS100E50AGGM3<-subset(S2PhaseInS100E50AGG,x<100|x>120)  
  
S2PhaseInS100E50AGGM3$intervention = S2PhaseInS100E50AGGM3$x > 100  
S2PhaseInS100E50AGGM3$time\_after\_intervention = ifelse(S2PhaseInS100E50AGGM3$x > 100, S2PhaseInS100E50AGGM3$x - 100, 0)  
S2S100E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E50AGGM3)  
summary(S2S100E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.79530 -0.64493 0.02739 0.67385 2.90899   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.133303 0.197826 101.773 <0.0000000000000002 \*\*\*  
## x 0.995674 0.003435 289.857 <0.0000000000000002 \*\*\*  
## interventionTRUE -49.552449 0.364573 -135.919 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.001089 0.005845 0.186 0.852   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9767 on 175 degrees of freedom  
## Multiple R-squared: 0.9994, Adjusted R-squared: 0.9994   
## F-statistic: 9.947e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S100E50M3)

## 2.5 % 97.5 %  
## (Intercept) 19.74287073 20.52373543  
## x 0.98889447 1.00245338  
## interventionTRUE -50.27197417 -48.83292287  
## time\_after\_intervention -0.01044639 0.01262456

Model 4: Counterfactual from Before

S2PhaseInS100E50AGGM4<-subset(S2PhaseInS100E50AGG,x<=100|x>=120)  
S2PhaseInS100E50AGGM4<-rbind(S2PhaseInS100E50AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS100E50AGGM4$intervention = S2PhaseInS100E50AGGM4$x > 119  
S2PhaseInS100E50AGGM4$time\_after\_intervention = ifelse(S2PhaseInS100E50AGGM4$x > 120, S2PhaseInS100E50AGGM4$x - 120, 0)  
S2S100E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E50AGGM4)  
summary(S2S100E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.8313 -0.5956 0.1244 0.5598 2.9093   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.036298 0.171535 116.806 <0.0000000000000002 \*\*\*  
## x 0.998389 0.002481 402.404 <0.0000000000000002 \*\*\*  
## interventionTRUE -49.761227 0.267074 -186.320 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.001594 0.005067 -0.314 0.753   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9297 on 196 degrees of freedom  
## Multiple R-squared: 0.9994, Adjusted R-squared: 0.9994   
## F-statistic: 1.174e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E50M4)

## 2.5 % 97.5 %  
## (Intercept) 19.69800771 20.374588525  
## x 0.99349611 1.003282118  
## interventionTRUE -50.28793545 -49.234518964  
## time\_after\_intervention -0.01158683 0.008399604

Model 5: Counterfactual from After

S2PhaseInS100E50AGGM5<-subset(S2PhaseInS100E50AGG,x<=100|x>=120)  
S2PhaseInS100E50AGGM5<-rbind(S2PhaseInS100E50AGGM5,S2CounterfactualAfterE50)  
  
S2PhaseInS100E50AGGM5$intervention = S2PhaseInS100E50AGGM5$x > 100  
S2PhaseInS100E50AGGM5$time\_after\_intervention = ifelse(S2PhaseInS100E50AGGM5$x > 100, S2PhaseInS100E50AGGM5$x - 100, 0)  
S2S100E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E50AGGM5)  
summary(S2S100E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.80745 -0.54054 -0.03701 0.57974 2.91534   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.106621 0.186988 107.529 <0.0000000000000002 \*\*\*  
## x 0.996466 0.003215 309.979 <0.0000000000000002 \*\*\*  
## interventionTRUE -49.683220 0.262480 -189.284 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.001402 0.004546 0.308 0.758   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9279 on 196 degrees of freedom  
## Multiple R-squared: 0.9994, Adjusted R-squared: 0.9994   
## F-statistic: 1.126e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E50M5)

## 2.5 % 97.5 %  
## (Intercept) 19.737854196 20.47538826  
## x 0.990126754 1.00280616  
## interventionTRUE -50.200867620 -49.16557237  
## time\_after\_intervention -0.007563714 0.01036768

Sample size 100 Effect Size 100 Model 1: Abrupt at time 100

S2PhaseInS100E100AGGM1<-S2PhaseInS100E100AGG  
S2PhaseInS100E100AGGM1$intervention = S2PhaseInS100E100AGGM1$x > 100  
S2PhaseInS100E100AGGM1$time\_after\_intervention = ifelse(S2PhaseInS100E100AGGM1$x > 100, S2PhaseInS100E100AGGM1$x - 100, 0)  
S2S100E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E100AGGM1)  
summary(S2S100E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -25.120 -2.950 -0.169 1.233 61.365   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.10662 2.59934 7.735 0.000000000000531 \*\*\*  
## x 0.99647 0.04469 22.299 < 0.0000000000000002 \*\*\*  
## interventionTRUE -65.37792 3.64876 -17.918 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.49192 0.06320 -7.784 0.000000000000396 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.9 on 196 degrees of freedom  
## Multiple R-squared: 0.7687, Adjusted R-squared: 0.7652   
## F-statistic: 217.1 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E100M1)

## 2.5 % 97.5 %  
## (Intercept) 14.9803495 25.2328930  
## x 0.9083375 1.0845954  
## interventionTRUE -72.5738024 -58.1820474  
## time\_after\_intervention -0.6165519 -0.3672856

Model 2: Abrupt at time 120

S2PhaseInS100E100AGGM2<-S2PhaseInS100E100AGG  
S2PhaseInS100E100AGGM2$intervention = S2PhaseInS100E100AGGM2$x > 120  
S2PhaseInS100E100AGGM2$time\_after\_intervention = ifelse(S2PhaseInS100E100AGGM2$x > 120, S2PhaseInS100E100AGGM2$x - 120, 0)  
S2S100E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E100AGGM2)  
summary(S2S100E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.548 -1.971 0.145 6.763 25.322   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 34.80410 2.66666 13.052 < 0.0000000000000002 \*\*\*  
## x 0.60909 0.03825 15.924 < 0.0000000000000002 \*\*\*  
## interventionTRUE -68.01485 4.20349 -16.181 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.39074 0.08001 4.884 0.00000216 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14.51 on 196 degrees of freedom  
## Multiple R-squared: 0.7072, Adjusted R-squared: 0.7027   
## F-statistic: 157.8 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E100M2)

## 2.5 % 97.5 %  
## (Intercept) 29.5450789 40.0631308  
## x 0.5336534 0.6845258  
## interventionTRUE -76.3047209 -59.7249753  
## time\_after\_intervention 0.2329444 0.5485271

Model 3: Excluding Phase-in Period

S2PhaseInS100E100AGGM3<-subset(S2PhaseInS100E100AGG,x<100|x>120)  
  
S2PhaseInS100E100AGGM3$intervention = S2PhaseInS100E100AGGM3$x > 100  
S2PhaseInS100E100AGGM3$time\_after\_intervention = ifelse(S2PhaseInS100E100AGGM3$x > 100, S2PhaseInS100E100AGGM3$x - 100, 0)  
S2S100E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E100AGGM3)  
summary(S2S100E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.79530 -0.72002 -0.01298 0.74322 2.31405   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.133303 0.207848 96.866 <0.0000000000000002 \*\*\*  
## x 0.995674 0.003609 275.881 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.817194 0.383042 -260.591 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.004151 0.006141 0.676 0.5   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.026 on 175 degrees of freedom  
## Multiple R-squared: 0.9986, Adjusted R-squared: 0.9985   
## F-statistic: 4.04e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S100E100M3)

## 2.5 % 97.5 %  
## (Intercept) 19.723091949 20.54351421  
## x 0.988551033 1.00279682  
## interventionTRUE -100.573170103 -99.06121840  
## time\_after\_intervention -0.007968418 0.01627128

Model 4: Counterfactual from Before

S2PhaseInS100E100AGGM4<-subset(S2PhaseInS100E100AGG,x<=100|x>=120)  
S2PhaseInS100E100AGGM4<-rbind(S2PhaseInS100E100AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS100E100AGGM4$intervention = S2PhaseInS100E100AGGM4$x > 119  
S2PhaseInS100E100AGGM4$time\_after\_intervention = ifelse(S2PhaseInS100E100AGGM4$x > 120, S2PhaseInS100E100AGGM4$x - 120, 0)  
S2S100E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E100AGGM4)  
summary(S2S100E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.83134 -0.66907 0.09818 0.63510 2.26987   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.036298 0.180231 111.17 <0.0000000000000002 \*\*\*  
## x 0.998389 0.002607 382.99 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.988849 0.280614 -356.32 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.001918 0.005324 0.36 0.719   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9769 on 196 degrees of freedom  
## Multiple R-squared: 0.999, Adjusted R-squared: 0.999   
## F-statistic: 6.437e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E100M4)

## 2.5 % 97.5 %  
## (Intercept) 19.680857901 20.39173833  
## x 0.993248053 1.00353017  
## interventionTRUE -100.542258839 -99.43543885  
## time\_after\_intervention -0.008581609 0.01241805

Model 5: Counterfactual from After

S2PhaseInS100E100AGGM5<-subset(S2PhaseInS100E100AGG,x<=100|x>=120)  
S2PhaseInS100E100AGGM5<-rbind(S2PhaseInS100E100AGGM5,S2CounterfactualAfterE100)  
  
S2PhaseInS100E100AGGM5$intervention = S2PhaseInS100E100AGGM5$x > 100  
S2PhaseInS100E100AGGM5$time\_after\_intervention = ifelse(S2PhaseInS100E100AGGM5$x > 100, S2PhaseInS100E100AGGM5$x - 100, 0)  
S2S100E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS100E100AGGM5)  
summary(S2S100E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS100E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.80745 -0.66792 0.05896 0.59169 2.29952   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.106621 0.196542 102.302 <0.0000000000000002 \*\*\*  
## x 0.996466 0.003379 294.910 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.807412 0.275891 -361.764 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.002463 0.004778 0.516 0.607   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9753 on 196 degrees of freedom  
## Multiple R-squared: 0.9989, Adjusted R-squared: 0.9989   
## F-statistic: 5.812e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S100E100M5)

## 2.5 % 97.5 %  
## (Intercept) 19.719012234 20.4942302  
## x 0.989802830 1.0031301  
## interventionTRUE -100.351508753 -99.2633156  
## time\_after\_intervention -0.006960383 0.0118872

Sample size 1000 Effect Size 20 Model 1: Abrupt at time 100

S2PhaseInS1000E20AGGM1<-S2PhaseInS1000E20AGG  
S2PhaseInS1000E20AGGM1$intervention = S2PhaseInS1000E20AGGM1$x > 100  
S2PhaseInS1000E20AGGM1$time\_after\_intervention = ifelse(S2PhaseInS1000E20AGGM1$x > 100, S2PhaseInS1000E20AGGM1$x - 100, 0)  
S2S1000E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E20AGGM1)  
summary(S2S1000E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -7.1398 -0.6276 -0.0676 0.4522 13.1974   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.015174 0.522138 38.333 < 0.0000000000000002 \*\*\*  
## x 0.998801 0.008976 111.270 < 0.0000000000000002 \*\*\*  
## interventionTRUE -13.182516 0.732939 -17.986 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.095476 0.012695 -7.521 0.00000000000191 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.591 on 196 degrees of freedom  
## Multiple R-squared: 0.9973, Adjusted R-squared: 0.9973   
## F-statistic: 2.414e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E20M1)

## 2.5 % 97.5 %  
## (Intercept) 18.9854440 21.04490430  
## x 0.9810983 1.01650375  
## interventionTRUE -14.6279740 -11.73705740  
## time\_after\_intervention -0.1205113 -0.07044045

Model 2: Abrupt at time 120

S2PhaseInS1000E20AGGM2<-S2PhaseInS1000E20AGG  
S2PhaseInS1000E20AGGM2$intervention = S2PhaseInS1000E20AGGM2$x > 120  
S2PhaseInS1000E20AGGM2$time\_after\_intervention = ifelse(S2PhaseInS1000E20AGGM2$x > 120, S2PhaseInS1000E20AGGM2$x - 120, 0)  
S2S1000E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E20AGGM2)  
summary(S2S1000E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -15.7115 -0.4841 0.0974 1.3072 4.8856   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 22.994283 0.545727 42.135 < 0.0000000000000002 \*\*\*  
## x 0.920201 0.007828 117.553 < 0.0000000000000002 \*\*\*  
## interventionTRUE -13.437071 0.860237 -15.620 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.079815 0.016374 4.874 0.00000225 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.97 on 196 degrees of freedom  
## Multiple R-squared: 0.9965, Adjusted R-squared: 0.9964   
## F-statistic: 1.836e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E20M2)

## 2.5 % 97.5 %  
## (Intercept) 21.91803197 24.0705336  
## x 0.90476310 0.9356389  
## interventionTRUE -15.13357911 -11.7405621  
## time\_after\_intervention 0.04752299 0.1121065

Model 3: Excluding Phase-in Period

S2PhaseInS1000E20AGGM3<-subset(S2PhaseInS1000E20AGG,x<100|x>120)  
  
S2PhaseInS1000E20AGGM3$intervention = S2PhaseInS1000E20AGGM3$x > 100  
S2PhaseInS1000E20AGGM3$time\_after\_intervention = ifelse(S2PhaseInS1000E20AGGM3$x > 100, S2PhaseInS1000E20AGGM3$x - 100, 0)  
S2S1000E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E20AGGM3)  
summary(S2S1000E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.88598 -0.19852 -0.00984 0.20979 0.75110   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.015272 0.060982 328.215 <0.0000000000000002 \*\*\*  
## x 0.998798 0.001059 943.247 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.914067 0.112384 -177.197 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.001218 0.001802 0.676 0.5   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3011 on 175 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 1.787e+06 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S1000E20M3)

## 2.5 % 97.5 %  
## (Intercept) 19.894916831 20.135627366  
## x 0.996708263 1.000887954  
## interventionTRUE -20.135868745 -19.692264613  
## time\_after\_intervention -0.002338335 0.004773552

Model 4: Counterfactual from Before

S2PhaseInS1000E20AGGM4<-subset(S2PhaseInS1000E20AGG,x<=100|x>=120)  
S2PhaseInS1000E20AGGM4<-rbind(S2PhaseInS1000E20AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS1000E20AGGM4$intervention = S2PhaseInS1000E20AGGM4$x > 119  
S2PhaseInS1000E20AGGM4$time\_after\_intervention = ifelse(S2PhaseInS1000E20AGGM4$x > 120, S2PhaseInS1000E20AGGM4$x - 120, 0)  
S2S1000E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E20AGGM4)  
summary(S2S1000E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.88569 -0.18717 0.04636 0.18189 0.73479   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 19.9861400 0.0527100 379.172 <0.0000000000000002  
## x 0.9995955 0.0007624 1311.129 <0.0000000000000002  
## interventionTRUE -19.9590286 0.0820679 -243.201 <0.0000000000000002  
## time\_after\_intervention 0.0004716 0.0015571 0.303 0.762  
##   
## (Intercept) \*\*\*  
## x \*\*\*  
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2857 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 2.014e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E20M4)

## 2.5 % 97.5 %  
## (Intercept) 19.882188537 20.090091536  
## x 0.998091957 1.001099050  
## interventionTRUE -20.120878012 -19.797179139  
## time\_after\_intervention -0.002599144 0.003542385

Model 5: Counterfactual from After

S2PhaseInS1000E20AGGM5<-subset(S2PhaseInS1000E20AGG,x<=100|x>=120)  
S2PhaseInS1000E20AGGM5<-rbind(S2PhaseInS1000E20AGGM5,S2CounterfactualAfterE20)  
  
S2PhaseInS1000E20AGGM5$intervention = S2PhaseInS1000E20AGGM5$x > 100  
S2PhaseInS1000E20AGGM5$time\_after\_intervention = ifelse(S2PhaseInS1000E20AGGM5$x > 100, S2PhaseInS1000E20AGGM5$x - 100, 0)  
S2S1000E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E20AGGM5)  
summary(S2S1000E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.88631 -0.17674 0.00927 0.18576 0.75104   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 20.0151741 0.0573425 349.046 <0.0000000000000002  
## x 0.9988010 0.0009858 1013.178 <0.0000000000000002  
## interventionTRUE -19.9035182 0.0804931 -247.270 <0.0000000000000002  
## time\_after\_intervention 0.0010616 0.0013941 0.761 0.447  
##   
## (Intercept) \*\*\*  
## x \*\*\*  
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2846 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 2.003e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E20M5)

## 2.5 % 97.5 %  
## (Intercept) 19.902086689 20.128261593  
## x 0.996856862 1.000745176  
## interventionTRUE -20.062261920 -19.744774478  
## time\_after\_intervention -0.001687893 0.003811013

Sample size 1000 Effect Size 50 Model 1: Abrupt at time 100

S2PhaseInS1000E50AGGM1<-S2PhaseInS1000E50AGG  
S2PhaseInS1000E50AGGM1$intervention = S2PhaseInS1000E50AGGM1$x > 100  
S2PhaseInS1000E50AGGM1$time\_after\_intervention = ifelse(S2PhaseInS1000E50AGGM1$x > 100, S2PhaseInS1000E50AGGM1$x - 100, 0)  
S2S1000E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E50AGGM1)  
summary(S2S1000E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -11.8899 -1.5028 -0.0649 0.4399 30.0990   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.01517 1.29583 15.446 < 0.0000000000000002 \*\*\*  
## x 0.99880 0.02228 44.835 < 0.0000000000000002 \*\*\*  
## interventionTRUE -32.71695 1.81899 -17.986 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.24567 0.03150 -7.798 0.000000000000364 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.431 on 196 degrees of freedom  
## Multiple R-squared: 0.9719, Adjusted R-squared: 0.9715   
## F-statistic: 2259 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E50M1)

## 2.5 % 97.5 %  
## (Intercept) 17.4596183 22.5707299  
## x 0.9548669 1.0427352  
## interventionTRUE -36.3042437 -29.1296469  
## time\_after\_intervention -0.3078059 -0.1835413

Model 2: Abrupt at time 120

S2PhaseInS1000E50AGGM2<-S2PhaseInS1000E50AGG  
S2PhaseInS1000E50AGGM2$intervention = S2PhaseInS1000E50AGGM2$x > 120  
S2PhaseInS1000E50AGGM2$time\_after\_intervention = ifelse(S2PhaseInS1000E50AGGM2$x > 120, S2PhaseInS1000E50AGGM2$x - 120, 0)  
S2S1000E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E50AGGM2)  
summary(S2S1000E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -33.444 -0.561 0.045 3.017 12.112   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 27.41945 1.34508 20.385 < 0.0000000000000002 \*\*\*  
## x 0.80369 0.01929 41.655 < 0.0000000000000002 \*\*\*  
## interventionTRUE -33.74288 2.12027 -15.914 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.19384 0.04036 4.803 0.0000031 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.321 on 196 degrees of freedom  
## Multiple R-squared: 0.9636, Adjusted R-squared: 0.963   
## F-statistic: 1728 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E50M2)

## 2.5 % 97.5 %  
## (Intercept) 24.7667612 30.0721446  
## x 0.7656360 0.8417371  
## interventionTRUE -37.9243569 -29.5614102  
## time\_after\_intervention 0.1142452 0.2734275

Model 3: Excluding Phase-in Period

S2PhaseInS1000E50AGGM3<-subset(S2PhaseInS1000E50AGG,x<100|x>120)  
  
S2PhaseInS1000E50AGGM3$intervention = S2PhaseInS1000E50AGGM3$x > 100  
S2PhaseInS1000E50AGGM3$time\_after\_intervention = ifelse(S2PhaseInS1000E50AGGM3$x > 100, S2PhaseInS1000E50AGGM3$x - 100, 0)  
S2S1000E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E50AGGM3)  
summary(S2S1000E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.80389 -0.20649 -0.04012 0.24216 0.86902   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.015272 0.061354 326.227 <0.0000000000000002 \*\*\*  
## x 0.998798 0.001065 937.534 <0.0000000000000002 \*\*\*  
## interventionTRUE -49.726588 0.113069 -439.791 <0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.001275 0.001813 -0.703 0.483   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3029 on 175 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 1.037e+06 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S1000E50M3)

## 2.5 % 97.5 %  
## (Intercept) 19.894183425 20.136360773  
## x 0.996695529 1.000900689  
## interventionTRUE -49.949741215 -49.503433900  
## time\_after\_intervention -0.004852793 0.002302431

Model 4: Counterfactual from Before

S2PhaseInS1000E50AGGM4<-subset(S2PhaseInS1000E50AGG,x<=100|x>=120)  
S2PhaseInS1000E50AGGM4<-rbind(S2PhaseInS1000E50AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS1000E50AGGM4$intervention = S2PhaseInS1000E50AGGM4$x > 119  
S2PhaseInS1000E50AGGM4$time\_after\_intervention = ifelse(S2PhaseInS1000E50AGGM4$x > 120, S2PhaseInS1000E50AGGM4$x - 120, 0)  
S2S1000E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E50AGGM4)  
summary(S2S1000E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.79628 -0.19689 0.00762 0.18032 0.85562   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 19.9861400 0.0531622 375.947 <0.0000000000000002  
## x 0.9995955 0.0007689 1299.976 <0.0000000000000002  
## interventionTRUE -49.8041730 0.0827719 -601.704 <0.0000000000000002  
## time\_after\_intervention -0.0023423 0.0015704 -1.491 0.137  
##   
## (Intercept) \*\*\*  
## x \*\*\*  
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2881 on 196 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 1.225e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E50M4)

## 2.5 % 97.5 %  
## (Intercept) 19.881296717 20.0909833561  
## x 0.998079058 1.0011119488  
## interventionTRUE -49.967410965 -49.6409350178  
## time\_after\_intervention -0.005439376 0.0007548418

Model 5: Counterfactual from After

S2PhaseInS1000E50AGGM5<-subset(S2PhaseInS1000E50AGG,x<=100|x>=120)  
S2PhaseInS1000E50AGGM5<-rbind(S2PhaseInS1000E50AGGM5,S2CounterfactualAfterE50)  
  
S2PhaseInS1000E50AGGM5$intervention = S2PhaseInS1000E50AGGM5$x > 100  
S2PhaseInS1000E50AGGM5$time\_after\_intervention = ifelse(S2PhaseInS1000E50AGGM5$x > 100, S2PhaseInS1000E50AGGM5$x - 100, 0)  
S2S1000E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E50AGGM5)  
summary(S2S1000E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.80387 -0.18304 -0.06214 0.19000 0.92607   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 20.01517414 0.05821324 343.82 <0.0000000000000002  
## x 0.99880102 0.00100078 998.02 <0.0000000000000002  
## interventionTRUE -49.81346784 0.08171540 -609.60 <0.0000000000000002  
## time\_after\_intervention -0.00004314 0.00141532 -0.03 0.976  
##   
## (Intercept) \*\*\*  
## x \*\*\*  
## interventionTRUE \*\*\*  
## time\_after\_intervention   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2889 on 196 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 1.165e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E50M5)

## 2.5 % 97.5 %  
## (Intercept) 19.900369407 20.129978875  
## x 0.996827339 1.000774698  
## interventionTRUE -49.974622157 -49.652313530  
## time\_after\_intervention -0.002834344 0.002748066

Sample size 1000 Effect Size 100 Model 1: Abrupt at time 100

S2PhaseInS1000E100AGGM1<-S2PhaseInS1000E100AGG  
S2PhaseInS1000E100AGGM1$intervention = S2PhaseInS1000E100AGGM1$x > 100  
S2PhaseInS1000E100AGGM1$time\_after\_intervention = ifelse(S2PhaseInS1000E100AGGM1$x > 100, S2PhaseInS1000E100AGGM1$x - 100, 0)  
S2S1000E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E100AGGM1)  
summary(S2S1000E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -24.925 -2.077 -0.065 0.486 61.083   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.01517 2.58099 7.755 0.000000000000472 \*\*\*  
## x 0.99880 0.04437 22.510 < 0.0000000000000002 \*\*\*  
## interventionTRUE -65.35878 3.62301 -18.040 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention -0.49370 0.06275 -7.868 0.000000000000238 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.81 on 196 degrees of freedom  
## Multiple R-squared: 0.7722, Adjusted R-squared: 0.7687   
## F-statistic: 221.4 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E100M1)

## 2.5 % 97.5 %  
## (Intercept) 14.9250897 25.105259  
## x 0.9112942 1.086308  
## interventionTRUE -72.5038647 -58.213704  
## time\_after\_intervention -0.6174516 -0.369945

Model 2: Abrupt at time 120

S2PhaseInS1000E100AGGM2<-S2PhaseInS1000E100AGG  
S2PhaseInS1000E100AGGM2$intervention = S2PhaseInS1000E100AGGM2$x > 120  
S2PhaseInS1000E100AGGM2$time\_after\_intervention = ifelse(S2PhaseInS1000E100AGGM2$x > 120, S2PhaseInS1000E100AGGM2$x - 100, 0)  
S2S1000E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E100AGGM2)  
summary(S2S1000E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.484 -0.765 0.077 5.889 23.960   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 34.64850 2.63928 13.128 < 0.0000000000000002 \*\*\*  
## x 0.61291 0.03786 16.190 < 0.0000000000000002 \*\*\*  
## interventionTRUE -76.06574 4.92366 -15.449 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.38966 0.07919 4.921 0.00000182 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14.37 on 196 degrees of freedom  
## Multiple R-squared: 0.7134, Adjusted R-squared: 0.709   
## F-statistic: 162.6 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E100M2)

## 2.5 % 97.5 %  
## (Intercept) 29.4434731 39.8535196  
## x 0.5382487 0.6875718  
## interventionTRUE -85.7758960 -66.3555874  
## time\_after\_intervention 0.2334869 0.5458291

Model 3: Excluding Phase-in Period

S2PhaseInS1000E100AGGM3<-subset(S2PhaseInS1000E100AGG,x<100|x>120)  
  
S2PhaseInS1000E100AGGM3$intervention = S2PhaseInS1000E100AGGM3$x > 100  
S2PhaseInS1000E100AGGM3$time\_after\_intervention = ifelse(S2PhaseInS1000E100AGGM3$x > 100, S2PhaseInS1000E100AGGM3$x - 100, 0)  
S2S1000E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E100AGGM3)  
summary(S2S1000E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.8039 -0.2198 -0.0384 0.2422 0.7551   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 20.015272 0.062738 319.031 <0.0000000000000002  
## x 0.998798 0.001089 916.853 <0.0000000000000002  
## interventionTRUE -100.021305 0.115619 -865.094 <0.0000000000000002  
## time\_after\_intervention 0.003770 0.001854 2.034 0.0435  
##   
## (Intercept) \*\*\*  
## x \*\*\*  
## interventionTRUE \*\*\*  
## time\_after\_intervention \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3098 on 175 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 4.464e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S2S1000E100M3)

## 2.5 % 97.5 %  
## (Intercept) 19.8914521558 20.139092042  
## x 0.9966481028 1.000948115  
## interventionTRUE -100.2494917417 -99.793117546  
## time\_after\_intervention 0.0001118383 0.007428455

Model 4: Counterfactual from Before

S2PhaseInS1000E100AGGM4<-subset(S2PhaseInS1000E100AGG,x<=100|x>=120)  
S2PhaseInS1000E100AGGM4<-rbind(S2PhaseInS1000E100AGGM4,S2CounterfactualBefore)  
  
S2PhaseInS1000E100AGGM4$intervention = S2PhaseInS1000E100AGGM4$x > 119  
S2PhaseInS1000E100AGGM4$time\_after\_intervention = ifelse(S2PhaseInS1000E100AGGM4$x > 120, S2PhaseInS1000E100AGGM4$x - 120, 0)  
S2S1000E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E100AGGM4)  
summary(S2S1000E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.7963 -0.2024 0.0378 0.1772 0.7537   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 19.9861400 0.0542783 368.216 <0.0000000000000002  
## x 0.9995955 0.0007851 1273.246 <0.0000000000000002  
## interventionTRUE -100.0227214 0.0845097 -1183.565 <0.0000000000000002  
## time\_after\_intervention 0.0031640 0.0016034 1.973 0.0499  
##   
## (Intercept) \*\*\*  
## x \*\*\*  
## interventionTRUE \*\*\*  
## time\_after\_intervention \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2942 on 196 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 7.119e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E100M4)

## 2.5 % 97.5 %  
## (Intercept) 19.879095636739 20.093184436  
## x 0.998047221514 1.001143785  
## interventionTRUE -100.189386352720 -99.856056371  
## time\_after\_intervention 0.000001884875 0.006326144

Model 5: Counterfactual from After

S2PhaseInS1000E100AGGM5<-subset(S2PhaseInS1000E100AGG,x<=100|x>=120)  
S2PhaseInS1000E100AGGM5<-rbind(S2PhaseInS1000E100AGGM5,S2CounterfactualAfterE100)  
  
S2PhaseInS1000E100AGGM5$intervention = S2PhaseInS1000E100AGGM5$x > 100  
S2PhaseInS1000E100AGGM5$time\_after\_intervention = ifelse(S2PhaseInS1000E100AGGM5$x > 100, S2PhaseInS1000E100AGGM5$x - 100, 0)  
S2S1000E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S2PhaseInS1000E100AGGM5)  
summary(S2S1000E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S2PhaseInS1000E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.8039 -0.1930 0.0278 0.1804 0.7646   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.015174 0.059241 337.860 <0.0000000000000002 \*\*\*  
## x 0.998801 0.001018 980.708 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.960651 0.083158 -1202.056 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.002899 0.001440 2.013 0.0455 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.294 on 196 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 6.431e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S2S1000E100M5)

## 2.5 % 97.5 %  
## (Intercept) 19.89834258769 20.13200569  
## x 0.99679249440 1.00080954  
## interventionTRUE -100.12465064916 -99.79665183  
## time\_after\_intervention 0.00005821533 0.00573918

# Senario 3

Sample size 20 Effect Size 20 Model 1: Abrupt at time 100

S3PhaseInS20E20AGGM1<-S3PhaseInS20E20AGG  
S3PhaseInS20E20AGGM1$intervention = S3PhaseInS20E20AGGM1$x > 100  
S3PhaseInS20E20AGGM1$time\_after\_intervention = ifelse(S3PhaseInS20E20AGGM1$x > 100, S3PhaseInS20E20AGGM1$x - 100, 0)  
S3S20E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E20AGGM1)  
summary(S3S20E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.9401 -1.5039 -0.1159 1.2519 15.8803   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.19209 0.59659 32.17 <0.0000000000000002 \*\*\*  
## x 1.01063 0.01026 98.54 <0.0000000000000002 \*\*\*  
## interventionTRUE -15.87718 0.83745 -18.96 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.92256 0.01450 63.60 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.961 on 196 degrees of freedom  
## Multiple R-squared: 0.9986, Adjusted R-squared: 0.9986   
## F-statistic: 4.81e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E20M1)

## 2.5 % 97.5 %  
## (Intercept) 18.0155393 20.3686499  
## x 0.9904070 1.0308608  
## interventionTRUE -17.5287436 -14.2256226  
## time\_after\_intervention 0.8939534 0.9511637

Model 2: Abrupt at time 120

S3PhaseInS20E20AGGM2<-S3PhaseInS20E20AGG  
S3PhaseInS20E20AGGM2$intervention = S3PhaseInS20E20AGGM2$x > 120  
S3PhaseInS20E20AGGM2$time\_after\_intervention = ifelse(S3PhaseInS20E20AGGM2$x > 120, S3PhaseInS20E20AGGM2$x - 120, 0)  
S3S20E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E20AGGM2)  
summary(S3S20E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -7.9870 -1.4607 0.0152 1.4825 5.3195   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.133535 0.434654 46.321 <0.0000000000000002 \*\*\*  
## x 0.984511 0.006235 157.907 <0.0000000000000002 \*\*\*  
## interventionTRUE 1.427722 0.685151 2.084 0.0385 \*   
## time\_after\_intervention 1.016596 0.013041 77.952 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.366 on 196 degrees of freedom  
## Multiple R-squared: 0.9991, Adjusted R-squared: 0.9991   
## F-statistic: 7.536e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E20M2)

## 2.5 % 97.5 %  
## (Intercept) 19.27633667 20.9907341  
## x 0.97221503 0.9968066  
## interventionTRUE 0.07650822 2.7789357  
## time\_after\_intervention 0.99087646 1.0423151

Model 3: Excluding Phase-in Period

S3PhaseInS20E20AGGM3<-subset(S3PhaseInS20E20AGG,x<100|x>120)  
  
S3PhaseInS20E20AGGM3$intervention = S3PhaseInS20E20AGGM3$x > 100  
S3PhaseInS20E20AGGM3$time\_after\_intervention = ifelse(S3PhaseInS20E20AGGM3$x > 100, S3PhaseInS20E20AGGM3$x - 100, 0)  
S3S20E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E20AGGM3)  
summary(S3S20E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.3445 -1.3240 0.0122 1.2615 5.3195   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.198509 0.414882 46.27 <0.0000000000000002 \*\*\*  
## x 1.010443 0.007204 140.26 <0.0000000000000002 \*\*\*  
## interventionTRUE -20.562421 0.764583 -26.89 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.990663 0.012258 80.82 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.048 on 175 degrees of freedom  
## Multiple R-squared: 0.9994, Adjusted R-squared: 0.9994   
## F-statistic: 1.003e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S20E20M3)

## 2.5 % 97.5 %  
## (Intercept) 18.3796942 20.017325  
## x 0.9962254 1.024661  
## interventionTRUE -22.0714115 -19.053431  
## time\_after\_intervention 0.9664710 1.014855

Model 4: Counterfactual from Before

S3PhaseInS20E20AGGM4<-subset(S3PhaseInS20E20AGG,x<=100|x>=120)  
S3PhaseInS20E20AGGM4<-rbind(S3PhaseInS20E20AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS20E20AGGM4$intervention = S3PhaseInS20E20AGGM4$x > 119  
S3PhaseInS20E20AGGM4$time\_after\_intervention = ifelse(S3PhaseInS20E20AGGM4$x > 120, S3PhaseInS20E20AGGM4$x - 120, 0)  
S3S20E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E20AGGM4)  
summary(S3S20E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.3217 -1.2006 -0.1184 1.1180 5.2952   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.283787 0.358678 53.764 <0.0000000000000002 \*\*\*  
## x 1.008143 0.005188 194.326 <0.0000000000000002 \*\*\*  
## interventionTRUE -0.446431 0.558451 -0.799 0.425   
## time\_after\_intervention 0.990878 0.010595 93.519 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.944 on 196 degrees of freedom  
## Multiple R-squared: 0.9994, Adjusted R-squared: 0.9994   
## F-statistic: 1.115e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E20M4)

## 2.5 % 97.5 %  
## (Intercept) 18.5764239 19.9911501  
## x 0.9979116 1.0183741  
## interventionTRUE -1.5477746 0.6549126  
## time\_after\_intervention 0.9699821 1.0117736

Model 5: Counterfactual from After

S3PhaseInS20E20AGGM5<-subset(S3PhaseInS20E20AGG,x<=100|x>=120)  
S3PhaseInS20E20AGGM5<-rbind(S3PhaseInS20E20AGGM5,S3CounterfactualAfterE20)  
  
S3PhaseInS20E20AGGM5$intervention = S3PhaseInS20E20AGGM5$x > 100  
S3PhaseInS20E20AGGM5$time\_after\_intervention = ifelse(S3PhaseInS20E20AGGM5$x > 100, S3PhaseInS20E20AGGM5$x - 100, 0)  
S3S20E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E20AGGM5)  
summary(S3S20E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.3471 -1.1671 0.0732 1.1013 5.2804   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.192095 0.391471 49.03 <0.0000000000000002 \*\*\*  
## x 1.010634 0.006730 150.17 <0.0000000000000002 \*\*\*  
## interventionTRUE -20.306408 0.549518 -36.95 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.986771 0.009518 103.68 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.943 on 196 degrees of freedom  
## Multiple R-squared: 0.9994, Adjusted R-squared: 0.9994   
## F-statistic: 1.122e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E20M5)

## 2.5 % 97.5 %  
## (Intercept) 18.4200585 19.964131  
## x 0.9973613 1.023906  
## interventionTRUE -21.3901345 -19.222681  
## time\_after\_intervention 0.9680006 1.005541

Sample size 20 Effect Size 50 Model 1: Abrupt at time 100

S3PhaseInS20E50AGGM1<-S3PhaseInS20E50AGG  
S3PhaseInS20E50AGGM1$intervention = S3PhaseInS20E50AGGM1$x > 100  
S3PhaseInS20E50AGGM1$time\_after\_intervention = ifelse(S3PhaseInS20E50AGGM1$x > 100, S3PhaseInS20E50AGGM1$x - 100, 0)  
S3S20E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E50AGGM1)  
summary(S3S20E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -14.268 -2.471 -0.213 1.952 32.193   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.19209 1.28217 14.97 <0.0000000000000002 \*\*\*  
## x 1.01063 0.02204 45.85 <0.0000000000000002 \*\*\*  
## interventionTRUE -35.41896 1.79982 -19.68 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.77780 0.03117 24.95 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.363 on 196 degrees of freedom  
## Multiple R-squared: 0.9913, Adjusted R-squared: 0.9911   
## F-statistic: 7427 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E50M1)

## 2.5 % 97.5 %  
## (Intercept) 16.6634678 21.720721  
## x 0.9671627 1.054105  
## interventionTRUE -38.9684547 -31.869460  
## time\_after\_intervention 0.7163179 0.839273

Model 2: Abrupt at time 120

S3PhaseInS20E50AGGM2<-S3PhaseInS20E50AGG  
S3PhaseInS20E50AGGM2$intervention = S3PhaseInS20E50AGGM2$x > 120  
S3PhaseInS20E50AGGM2$time\_after\_intervention = ifelse(S3PhaseInS20E50AGGM2$x > 120, S3PhaseInS20E50AGGM2$x - 120, 0)  
S3S20E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E50AGGM2)  
summary(S3S20E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -21.1146 -2.1330 0.3594 2.8380 10.0838   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 24.54152 0.99876 24.57 <0.0000000000000002 \*\*\*  
## x 0.86867 0.01433 60.63 <0.0000000000000002 \*\*\*  
## interventionTRUE -18.99612 1.57435 -12.07 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.13866 0.02997 38.00 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 5.436 on 196 degrees of freedom  
## Multiple R-squared: 0.9936, Adjusted R-squared: 0.9935   
## F-statistic: 1.02e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E50M2)

## 2.5 % 97.5 %  
## (Intercept) 22.5718270 26.5112036  
## x 0.8404168 0.8969237  
## interventionTRUE -22.1009682 -15.8912762  
## time\_after\_intervention 1.0795577 1.1977544

Model 3: Excluding Phase-in Period

S3PhaseInS20E50AGGM3<-subset(S3PhaseInS20E50AGG,x<100|x>120)  
  
S3PhaseInS20E50AGGM3$intervention = S3PhaseInS20E50AGGM3$x > 100  
S3PhaseInS20E50AGGM3$time\_after\_intervention = ifelse(S3PhaseInS20E50AGGM3$x > 100, S3PhaseInS20E50AGGM3$x - 100, 0)  
S3S20E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E50AGGM3)  
summary(S3S20E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.7324 -1.1204 0.2405 1.3984 6.2750   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.198509 0.420554 45.65 <0.0000000000000002 \*\*\*  
## x 1.010443 0.007302 138.37 <0.0000000000000002 \*\*\*  
## interventionTRUE -50.603544 0.775036 -65.29 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.996883 0.012425 80.23 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.076 on 175 degrees of freedom  
## Multiple R-squared: 0.9992, Adjusted R-squared: 0.9992   
## F-statistic: 7.006e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S20E50M3)

## 2.5 % 97.5 %  
## (Intercept) 18.3684995 20.028519  
## x 0.9960311 1.024856  
## interventionTRUE -52.1331652 -49.073923  
## time\_after\_intervention 0.9723600 1.021406

Model 4: Counterfactual from Before

S3PhaseInS20E50AGGM4<-subset(S3PhaseInS20E50AGG,x<=100|x>=120)  
S3PhaseInS20E50AGGM4<-rbind(S3PhaseInS20E50AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS20E50AGGM4$intervention = S3PhaseInS20E50AGGM4$x > 119  
S3PhaseInS20E50AGGM4$time\_after\_intervention = ifelse(S3PhaseInS20E50AGGM4$x > 119, S3PhaseInS20E50AGGM4$x - 119, 0)  
S3S20E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E50AGGM4)  
summary(S3S20E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.7758 -1.0226 -0.0992 1.2672 6.2484   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.283787 0.362677 53.17 <0.0000000000000002 \*\*\*  
## x 1.008143 0.005246 192.18 <0.0000000000000002 \*\*\*  
## interventionTRUE -31.412969 0.568026 -55.30 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.998062 0.010714 93.16 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.966 on 196 degrees of freedom  
## Multiple R-squared: 0.9992, Adjusted R-squared: 0.9992   
## F-statistic: 7.829e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E50M4)

## 2.5 % 97.5 %  
## (Intercept) 18.5685377 19.999036  
## x 0.9977975 1.018488  
## interventionTRUE -32.5331963 -30.292741  
## time\_after\_intervention 0.9769331 1.019191

Model 5: Counterfactual from After

S3PhaseInS20E50AGGM5<-subset(S3PhaseInS20E50AGG,x<=100|x>=120)  
S3PhaseInS20E50AGGM5<-rbind(S3PhaseInS20E50AGGM5,S3CounterfactualAfterE50)  
  
S3PhaseInS20E50AGGM5$intervention = S3PhaseInS20E50AGGM5$x > 100  
S3PhaseInS20E50AGGM5$time\_after\_intervention = ifelse(S3PhaseInS20E50AGGM5$x > 100, S3PhaseInS20E50AGGM5$x - 100, 0)  
S3S20E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E50AGGM5)  
summary(S3S20E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.8484 -1.0508 0.1071 1.2296 6.2064   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.192095 0.395877 48.48 <0.0000000000000002 \*\*\*  
## x 1.010634 0.006806 148.50 <0.0000000000000002 \*\*\*  
## interventionTRUE -50.389620 0.555703 -90.68 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.993533 0.009625 103.23 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.965 on 196 degrees of freedom  
## Multiple R-squared: 0.9992, Adjusted R-squared: 0.9992   
## F-statistic: 8.018e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E50M5)

## 2.5 % 97.5 %  
## (Intercept) 18.4113691 19.972820  
## x 0.9972119 1.024056  
## interventionTRUE -51.4855437 -49.293695  
## time\_after\_intervention 0.9745519 1.012515

Sample size 20 Effect Size 50

Sample size 20 Effect Size 100 Model 1: Abrupt at time 100

S3PhaseInS20E100AGGM1<-S3PhaseInS20E100AGG  
S3PhaseInS20E100AGGM1$intervention = S3PhaseInS20E100AGGM1$x > 100  
S3PhaseInS20E100AGGM1$time\_after\_intervention = ifelse(S3PhaseInS20E100AGGM1$x > 100, S3PhaseInS20E100AGGM1$x - 100, 0)  
S3S20E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E100AGGM1)  
summary(S3S20E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -23.669 -3.695 -0.121 2.550 61.410   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.19209 2.51382 7.635 0.00000000000097107 \*\*\*  
## x 1.01063 0.04322 23.385 < 0.0000000000000002 \*\*\*  
## interventionTRUE -67.04806 3.52871 -19.001 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.51362 0.06112 8.404 0.00000000000000873 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.47 on 196 degrees of freedom  
## Multiple R-squared: 0.9376, Adjusted R-squared: 0.9367   
## F-statistic: 981.9 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E100M1)

## 2.5 % 97.5 %  
## (Intercept) 14.2344904 24.1496987  
## x 0.9254046 1.0958631  
## interventionTRUE -74.0071762 -60.0889472  
## time\_after\_intervention 0.3930836 0.6341483

Model 2: Abrupt at time 120

S3PhaseInS20E100AGGM2<-S3PhaseInS20E100AGG  
S3PhaseInS20E100AGGM2$intervention = S3PhaseInS20E100AGGM2$x > 120  
S3PhaseInS20E100AGGM2$time\_after\_intervention = ifelse(S3PhaseInS20E100AGGM2$x > 120, S3PhaseInS20E100AGGM2$x - 120, 0)  
S3S20E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E100AGGM2)  
summary(S3S20E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -53.393 -2.294 0.199 5.161 20.775   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 31.64883 2.23689 14.15 <0.0000000000000002 \*\*\*  
## x 0.68140 0.03209 21.24 <0.0000000000000002 \*\*\*  
## interventionTRUE -52.79630 3.52604 -14.97 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.30833 0.06712 19.49 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.18 on 196 degrees of freedom  
## Multiple R-squared: 0.9406, Adjusted R-squared: 0.9397   
## F-statistic: 1034 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E100M2)

## 2.5 % 97.5 %  
## (Intercept) 27.2373670 36.060297  
## x 0.6181167 0.744674  
## interventionTRUE -59.7501528 -45.842451  
## time\_after\_intervention 1.1759736 1.440696

Model 3: Excluding Phase-in Period

S3PhaseInS20E100AGGM3<-subset(S3PhaseInS20E100AGG,x<100|x>120)  
  
S3PhaseInS20E100AGGM3$intervention = S3PhaseInS20E100AGGM3$x > 100  
S3PhaseInS20E100AGGM3$time\_after\_intervention = ifelse(S3PhaseInS20E100AGGM3$x > 100, S3PhaseInS20E100AGGM3$x - 100, 0)  
S3S20E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E100AGGM3)  
summary(S3S20E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.9035 -1.3093 -0.0034 1.2279 5.2139   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.198509 0.402820 47.66 <0.0000000000000002 \*\*\*  
## x 1.010443 0.006995 144.46 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.417473 0.742356 -133.92 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.979287 0.011901 82.28 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.989 on 175 degrees of freedom  
## Multiple R-squared: 0.9986, Adjusted R-squared: 0.9985   
## F-statistic: 4.024e+04 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S20E100M3)

## 2.5 % 97.5 %  
## (Intercept) 18.4034979 19.993521  
## x 0.9966388 1.024248  
## interventionTRUE -100.8825953 -97.952350  
## time\_after\_intervention 0.9557980 1.002776

Model 4: Counterfactual from Before

S3PhaseInS20E100AGGM4<-subset(S3PhaseInS20E100AGG,x<=100|x>=120)  
S3PhaseInS20E100AGGM4<-rbind(S3PhaseInS20E100AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS20E100AGGM4$intervention = S3PhaseInS20E100AGGM4$x > 119  
S3PhaseInS20E100AGGM4$time\_after\_intervention = ifelse(S3PhaseInS20E100AGGM4$x > 119, S3PhaseInS20E100AGGM4$x - 119, 0)  
S3S20E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E100AGGM4)  
summary(S3S20E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.8891 -1.1850 -0.1321 0.9947 5.2186   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.283787 0.347160 55.55 <0.0000000000000002 \*\*\*  
## x 1.008143 0.005021 200.77 <0.0000000000000002 \*\*\*  
## interventionTRUE -80.652005 0.543725 -148.33 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.982126 0.010255 95.77 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.882 on 196 degrees of freedom  
## Multiple R-squared: 0.9986, Adjusted R-squared: 0.9986   
## F-statistic: 4.652e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E100M4)

## 2.5 % 97.5 %  
## (Intercept) 18.5991375 19.968437  
## x 0.9982401 1.018046  
## interventionTRUE -81.7243068 -79.579703  
## time\_after\_intervention 0.9619016 1.002351

Model 5: Counterfactual from After

S3PhaseInS20E100AGGM5<-subset(S3PhaseInS20E100AGG,x<=100|x>=120)  
S3PhaseInS20E100AGGM5<-rbind(S3PhaseInS20E100AGGM5,S3CounterfactualAfterE100)  
  
S3PhaseInS20E100AGGM5$intervention = S3PhaseInS20E100AGGM5$x > 100  
S3PhaseInS20E100AGGM5$time\_after\_intervention = ifelse(S3PhaseInS20E100AGGM5$x > 100, S3PhaseInS20E100AGGM5$x - 100, 0)  
S3S20E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS20E100AGGM5)  
summary(S3S20E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS20E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.7359 -1.1083 -0.2453 1.0364 5.2562   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 19.192095 0.379880 50.52 <0.0000000000000002 \*\*\*  
## x 1.010634 0.006531 154.75 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.924992 0.533247 -187.39 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.986059 0.009236 106.76 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.885 on 196 degrees of freedom  
## Multiple R-squared: 0.9987, Adjusted R-squared: 0.9987   
## F-statistic: 5.131e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S20E100M5)

## 2.5 % 97.5 %  
## (Intercept) 18.4429182 19.941271  
## x 0.9977543 1.023513  
## interventionTRUE -100.9766296 -98.873354  
## time\_after\_intervention 0.9678444 1.004273

Sample size 100 Effect Size 20 Model 1: Abrupt at time 100

S3PhaseInS100E20AGGM1<-S3PhaseInS100E20AGG  
S3PhaseInS100E20AGGM1$intervention = S3PhaseInS100E20AGGM1$x > 100  
S3PhaseInS100E20AGGM1$time\_after\_intervention = ifelse(S3PhaseInS100E20AGGM1$x > 100, S3PhaseInS100E20AGGM1$x - 100, 0)  
S3S100E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E20AGGM1)  
summary(S3S100E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.8997 -1.2826 -0.0735 0.9114 12.1581   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.036564 0.472823 42.38 <0.0000000000000002 \*\*\*  
## x 0.998701 0.008129 122.86 <0.0000000000000002 \*\*\*  
## interventionTRUE -14.556715 0.663713 -21.93 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.925490 0.011496 80.51 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.346 on 196 degrees of freedom  
## Multiple R-squared: 0.9991, Adjusted R-squared: 0.9991   
## F-statistic: 7.65e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E20M1)

## 2.5 % 97.5 %  
## (Intercept) 19.1040909 20.9690369  
## x 0.9826703 1.0147318  
## interventionTRUE -15.8656512 -13.2477793  
## time\_after\_intervention 0.9028193 0.9481611

Model 2: Abrupt at time 120

S3PhaseInS100E20AGGM2<-S3PhaseInS100E20AGG  
S3PhaseInS100E20AGGM2$intervention = S3PhaseInS100E20AGGM2$x > 120  
S3PhaseInS100E20AGGM2$time\_after\_intervention = ifelse(S3PhaseInS100E20AGGM2$x > 120, S3PhaseInS100E20AGGM2$x - 120, 0)  
S3S100E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E20AGGM2)  
summary(S3S100E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.5590 -0.6130 0.0565 0.7879 2.8637   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.640406 0.220886 93.444 < 0.0000000000000002 \*\*\*  
## x 0.981995 0.003168 309.932 < 0.0000000000000002 \*\*\*  
## interventionTRUE 1.927852 0.348186 5.537 0.0000000981 \*\*\*  
## time\_after\_intervention 1.011991 0.006627 152.697 < 0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.202 on 196 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 2.915e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E20M2)

## 2.5 % 97.5 %  
## (Intercept) 20.2047875 21.0760249  
## x 0.9757463 0.9882434  
## interventionTRUE 1.2411806 2.6145237  
## time\_after\_intervention 0.9989211 1.0250616

Model 3: Excluding Phase-in Period

S3PhaseInS100E20AGGM3<-subset(S3PhaseInS100E20AGG,x<100|x>120)  
  
S3PhaseInS100E20AGGM3$intervention = S3PhaseInS100E20AGGM3$x > 100  
S3PhaseInS100E20AGGM3$time\_after\_intervention = ifelse(S3PhaseInS100E20AGGM3$x > 100, S3PhaseInS100E20AGGM3$x - 100, 0)  
S3S100E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E20AGGM3)  
summary(S3S100E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.6501 -0.5525 0.0413 0.5999 2.4097   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.008183 0.190058 105.27 <0.0000000000000002 \*\*\*  
## x 0.999544 0.003300 302.88 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.434672 0.350257 -55.49 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.994442 0.005615 177.09 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9384 on 175 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 4.776e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S100E20M3)

## 2.5 % 97.5 %  
## (Intercept) 19.6330821 20.383283  
## x 0.9930308 1.006057  
## interventionTRUE -20.1259427 -18.743401  
## time\_after\_intervention 0.9833597 1.005525

Model 4: Counterfactual from Before

S3PhaseInS100E20AGGM4<-subset(S3PhaseInS100E20AGG,x<=100|x>=120)  
S3PhaseInS100E20AGGM4<-rbind(S3PhaseInS100E20AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS100E20AGGM4$intervention = S3PhaseInS100E20AGGM4$x > 119  
S3PhaseInS100E20AGGM4$time\_after\_intervention = ifelse(S3PhaseInS100E20AGGM4$x > 120, S3PhaseInS100E20AGGM4$x - 120, 0)  
S3S100E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E20AGGM4)  
summary(S3S100E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.64441 -0.49095 0.05259 0.54542 2.41362   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.010065 0.164745 121.461 <0.0000000000000002 \*\*\*  
## x 0.999426 0.002383 419.423 <0.0000000000000002 \*\*\*  
## interventionTRUE 0.448199 0.256503 1.747 0.0821 .   
## time\_after\_intervention 0.994902 0.004867 204.433 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.8929 on 196 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 5.282e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E20M4)

## 2.5 % 97.5 %  
## (Intercept) 19.68516449 20.3349659  
## x 0.99472629 1.0041250  
## interventionTRUE -0.05766141 0.9540603  
## time\_after\_intervention 0.98530394 1.0044993

Model 5: Counterfactual from After

S3PhaseInS100E20AGGM5<-subset(S3PhaseInS100E20AGG,x<=100|x>=120)  
S3PhaseInS100E20AGGM5<-rbind(S3PhaseInS100E20AGGM5,S3CounterfactualAfterE20)  
  
S3PhaseInS100E20AGGM5$intervention = S3PhaseInS100E20AGGM5$x > 100  
S3PhaseInS100E20AGGM5$time\_after\_intervention = ifelse(S3PhaseInS100E20AGGM5$x > 100, S3PhaseInS100E20AGGM5$x - 100, 0)  
S3S100E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E20AGGM5)  
summary(S3S100E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.62454 -0.45833 -0.06365 0.55970 2.42263   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.036564 0.180812 110.81 <0.0000000000000002 \*\*\*  
## x 0.998701 0.003108 321.29 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.698617 0.253810 -77.61 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.999784 0.004396 227.43 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.8973 on 196 degrees of freedom  
## Multiple R-squared: 0.9999, Adjusted R-squared: 0.9999   
## F-statistic: 5.256e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E20M5)

## 2.5 % 97.5 %  
## (Intercept) 19.6799772 20.393151  
## x 0.9925708 1.004831  
## interventionTRUE -20.1991668 -19.198067  
## time\_after\_intervention 0.9911148 1.008454

Sample size 100 Effect Size 50 Model 1: Abrupt at time 100

S3PhaseInS100E50AGGM1<-S3PhaseInS100E50AGG  
S3PhaseInS100E50AGGM1$intervention = S3PhaseInS100E50AGGM1$x > 100  
S3PhaseInS100E50AGGM1$time\_after\_intervention = ifelse(S3PhaseInS100E50AGGM1$x > 100, S3PhaseInS100E50AGGM1$x - 100, 0)  
S3S100E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E50AGGM1)  
summary(S3S100E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -10.5926 -1.8667 -0.0456 1.1253 30.9294   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.03656 1.21464 16.50 <0.0000000000000002 \*\*\*  
## x 0.99870 0.02088 47.83 <0.0000000000000002 \*\*\*  
## interventionTRUE -34.68407 1.70502 -20.34 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.78202 0.02953 26.48 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.028 on 196 degrees of freedom  
## Multiple R-squared: 0.9921, Adjusted R-squared: 0.992   
## F-statistic: 8213 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E50M1)

## 2.5 % 97.5 %  
## (Intercept) 17.6411171 22.4320107  
## x 0.9575194 1.0398827  
## interventionTRUE -38.0466211 -31.3215225  
## time\_after\_intervention 0.7237845 0.8402637

Model 2: Abrupt at time 120

S3PhaseInS100E50AGGM2<-S3PhaseInS100E50AGG  
S3PhaseInS100E50AGGM2$intervention = S3PhaseInS100E50AGGM2$x > 120  
S3PhaseInS100E50AGGM2$time\_after\_intervention = ifelse(S3PhaseInS100E50AGGM2$x > 120, S3PhaseInS100E50AGGM2$x - 120, 0)  
S3S100E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E50AGGM2)  
summary(S3S100E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -18.6642 -1.3019 0.2307 1.9500 9.6277   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 25.12590 0.89565 28.05 <0.0000000000000002 \*\*\*  
## x 0.86358 0.01285 67.22 <0.0000000000000002 \*\*\*  
## interventionTRUE -18.85363 1.41183 -13.35 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.13802 0.02687 42.35 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 4.875 on 196 degrees of freedom  
## Multiple R-squared: 0.9948, Adjusted R-squared: 0.9948   
## F-statistic: 1.259e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E50M2)

## 2.5 % 97.5 %  
## (Intercept) 23.3595435 26.8922475  
## x 0.8382424 0.8889159  
## interventionTRUE -21.6379567 -16.0693083  
## time\_after\_intervention 1.0850239 1.1910189

Model 3: Excluding Phase-in Period

S3PhaseInS100E50AGGM3<-subset(S3PhaseInS100E50AGG,x<100|x>120)  
  
S3PhaseInS100E50AGGM3$intervention = S3PhaseInS100E50AGGM3$x > 100  
S3PhaseInS100E50AGGM3$time\_after\_intervention = ifelse(S3PhaseInS100E50AGGM3$x > 100, S3PhaseInS100E50AGGM3$x - 100, 0)  
S3S100E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E50AGGM3)  
summary(S3S100E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.77797 -0.56304 0.05645 0.62871 2.40970   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.008183 0.194049 103.1 <0.0000000000000002 \*\*\*  
## x 0.999544 0.003369 296.6 <0.0000000000000002 \*\*\*  
## interventionTRUE -50.092839 0.357612 -140.1 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.002056 0.005733 174.8 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9581 on 175 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 3.266e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S100E50M3)

## 2.5 % 97.5 %  
## (Intercept) 19.6252044 20.391161  
## x 0.9928940 1.006194  
## interventionTRUE -50.7986272 -49.387050  
## time\_after\_intervention 0.9907412 1.013372

Model 4: Counterfactual from Before

S3PhaseInS100E50AGGM4<-subset(S3PhaseInS100E50AGG,x<=100|x>=120)  
S3PhaseInS100E50AGGM4<-rbind(S3PhaseInS100E50AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS100E50AGGM4$intervention = S3PhaseInS100E50AGGM4$x > 119  
S3PhaseInS100E50AGGM4$time\_after\_intervention = ifelse(S3PhaseInS100E50AGGM4$x > 120, S3PhaseInS100E50AGGM4$x - 120, 0)  
S3S100E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E50AGGM4)  
summary(S3S100E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.78158 -0.52968 0.05283 0.58356 2.41362   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.010065 0.168145 119.0 <0.0000000000000002 \*\*\*  
## x 0.999426 0.002432 410.9 <0.0000000000000002 \*\*\*  
## interventionTRUE -30.022762 0.261797 -114.7 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.001865 0.004967 201.7 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9113 on 196 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 3.615e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E50M4)

## 2.5 % 97.5 %  
## (Intercept) 19.6784594 20.341671  
## x 0.9946293 1.004222  
## interventionTRUE -30.5390629 -29.506462  
## time\_after\_intervention 0.9920695 1.011661

Model 5: Counterfactual from After

S3PhaseInS100E50AGGM5<-subset(S3PhaseInS100E50AGG,x<=100|x>=120)  
S3PhaseInS100E50AGGM5<-rbind(S3PhaseInS100E50AGGM5,S3CounterfactualAfterE50)  
  
S3PhaseInS100E50AGGM5$intervention = S3PhaseInS100E50AGGM5$x > 100  
S3PhaseInS100E50AGGM5$time\_after\_intervention = ifelse(S3PhaseInS100E50AGGM5$x > 100, S3PhaseInS100E50AGGM5$x - 100, 0)  
S3S100E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E50AGGM5)  
summary(S3S100E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2.78940 -0.51833 0.04147 0.60120 2.42263   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.036564 0.183626 109.1 <0.0000000000000002 \*\*\*  
## x 0.998701 0.003157 316.4 <0.0000000000000002 \*\*\*  
## interventionTRUE -49.951617 0.257761 -193.8 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.001708 0.004464 224.4 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9113 on 196 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 3.7e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E50M5)

## 2.5 % 97.5 %  
## (Intercept) 19.6744272 20.398701  
## x 0.9924753 1.004927  
## interventionTRUE -50.4599576 -49.443277  
## time\_after\_intervention 0.9929035 1.010513

Sample size 100 Effect Size 100 Model 1: Abrupt at time 100

S3PhaseInS100E100AGGM1<-S3PhaseInS100E100AGG  
S3PhaseInS100E100AGGM1$intervention = S3PhaseInS100E100AGGM1$x > 100  
S3PhaseInS100E100AGGM1$time\_after\_intervention = ifelse(S3PhaseInS100E100AGGM1$x > 100, S3PhaseInS100E100AGGM1$x - 100, 0)  
S3S100E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E100AGGM1)  
summary(S3S100E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -23.749 -2.682 -0.042 1.343 61.795   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.03656 2.47117 8.108 0.0000000000000548 \*\*\*  
## x 0.99870 0.04248 23.508 < 0.0000000000000002 \*\*\*  
## interventionTRUE -67.87034 3.46885 -19.566 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.54089 0.06008 9.003 < 0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.26 on 196 degrees of freedom  
## Multiple R-squared: 0.9394, Adjusted R-squared: 0.9384   
## F-statistic: 1012 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E100M1)

## 2.5 % 97.5 %  
## (Intercept) 15.1630622 24.9100657  
## x 0.9149176 1.0824845  
## interventionTRUE -74.7113980 -61.0292823  
## time\_after\_intervention 0.4224068 0.6593821

Model 2: Abrupt at time 120

S3PhaseInS100E100AGGM2<-S3PhaseInS100E100AGG  
S3PhaseInS100E100AGGM2$intervention = S3PhaseInS100E100AGGM2$x > 120  
S3PhaseInS100E100AGGM2$time\_after\_intervention = ifelse(S3PhaseInS100E100AGGM2$x > 120, S3PhaseInS100E100AGGM2$x - 120, 0)  
S3S100E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E100AGGM2)  
summary(S3S100E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -53.210 -1.809 0.069 6.070 21.614   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 32.72971 2.24725 14.56 <0.0000000000000002 \*\*\*  
## x 0.66299 0.03223 20.57 <0.0000000000000002 \*\*\*  
## interventionTRUE -52.07744 3.54236 -14.70 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.33328 0.06743 19.77 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.23 on 196 degrees of freedom  
## Multiple R-squared: 0.9397, Adjusted R-squared: 0.9387   
## F-statistic: 1017 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E100M2)

## 2.5 % 97.5 %  
## (Intercept) 28.2978281 37.1616012  
## x 0.5994192 0.7265624  
## interventionTRUE -59.0634798 -45.0913961  
## time\_after\_intervention 1.2003051 1.4662530

Model 3: Excluding Phase-in Period

S3PhaseInS100E100AGGM3<-subset(S3PhaseInS100E100AGG,x<100|x>120)  
  
S3PhaseInS100E100AGGM3$intervention = S3PhaseInS100E100AGGM3$x > 100  
S3PhaseInS100E100AGGM3$time\_after\_intervention = ifelse(S3PhaseInS100E100AGGM3$x > 100, S3PhaseInS100E100AGGM3$x - 100, 0)  
S3S100E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E100AGGM3)  
summary(S3S100E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3.3837 -0.5603 0.0016 0.6732 2.7429   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.008183 0.206096 97.08 <0.0000000000000002 \*\*\*  
## x 0.999544 0.003579 279.31 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.676813 0.379813 -262.44 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.996726 0.006089 163.69 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.018 on 175 degrees of freedom  
## Multiple R-squared: 0.9996, Adjusted R-squared: 0.9996   
## F-statistic: 1.527e+05 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S100E100M3)

## 2.5 % 97.5 %  
## (Intercept) 19.6014297 20.414935  
## x 0.9924812 1.006607  
## interventionTRUE -100.4264158 -98.927210  
## time\_after\_intervention 0.9847081 1.008743

Model 4: Counterfactual from Before

S3PhaseInS100E100AGGM4<-subset(S3PhaseInS100E100AGG,x<=100|x>=120)  
S3PhaseInS100E100AGGM4<-rbind(S3PhaseInS100E100AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS100E100AGGM4$intervention = S3PhaseInS100E100AGGM4$x > 119  
S3PhaseInS100E100AGGM4$time\_after\_intervention = ifelse(S3PhaseInS100E100AGGM4$x > 120, S3PhaseInS100E100AGGM4$x - 120, 0)  
S3S100E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E100AGGM4)  
summary(S3S100E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3.3922 -0.5170 0.0500 0.6021 2.7957   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.010065 0.178988 111.8 <0.0000000000000002 \*\*\*  
## x 0.999426 0.002589 386.0 <0.0000000000000002 \*\*\*  
## interventionTRUE -79.784861 0.278678 -286.3 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.997867 0.005287 188.7 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9701 on 196 degrees of freedom  
## Multiple R-squared: 0.9996, Adjusted R-squared: 0.9996   
## F-statistic: 1.738e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E100M4)

## 2.5 % 97.5 %  
## (Intercept) 19.6570765 20.363054  
## x 0.9943200 1.004531  
## interventionTRUE -80.3344539 -79.235268  
## time\_after\_intervention 0.9874397 1.008294

Model 5: Counterfactual from After

S3PhaseInS100E100AGGM5<-subset(S3PhaseInS100E100AGG,x<=100|x>=120)  
S3PhaseInS100E100AGGM5<-rbind(S3PhaseInS100E100AGGM5,S3CounterfactualAfterE100)  
  
S3PhaseInS100E100AGGM5$intervention = S3PhaseInS100E100AGGM5$x > 100  
S3PhaseInS100E100AGGM5$time\_after\_intervention = ifelse(S3PhaseInS100E100AGGM5$x > 100, S3PhaseInS100E100AGGM5$x - 100, 0)  
S3S100E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS100E100AGGM5)  
summary(S3S100E100M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS100E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3.4113 -0.5162 -0.0545 0.6174 2.8794   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.036564 0.195577 102.4 <0.0000000000000002 \*\*\*  
## x 0.998701 0.003362 297.0 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.817525 0.274537 -363.6 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.000303 0.004755 210.4 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.9706 on 196 degrees of freedom  
## Multiple R-squared: 0.9997, Adjusted R-squared: 0.9997   
## F-statistic: 1.925e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S100E100M5)

## 2.5 % 97.5 %  
## (Intercept) 19.6508579 20.422270  
## x 0.9920701 1.005332  
## interventionTRUE -100.3589508 -99.276100  
## time\_after\_intervention 0.9909259 1.009681

Sample size 1000 Effect Size 20 Model 1: Abrupt at time 100

S3PhaseInS1000E20AGGM1<-S3PhaseInS1000E20AGG  
S3PhaseInS1000E20AGGM1$intervention = S3PhaseInS1000E20AGGM1$x > 100  
S3PhaseInS1000E20AGGM1$time\_after\_intervention = ifelse(S3PhaseInS1000E20AGGM1$x > 100, S3PhaseInS1000E20AGGM1$x - 100, 0)  
S3S1000E20M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E20AGGM1)  
summary(S3S1000E20M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E20AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.2237 -0.5663 -0.0397 0.3493 12.8180   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.037403 0.431691 46.42 <0.0000000000000002 \*\*\*  
## x 0.999463 0.007421 134.67 <0.0000000000000002 \*\*\*  
## interventionTRUE -15.173971 0.605976 -25.04 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.932126 0.010496 88.81 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.142 on 196 degrees of freedom  
## Multiple R-squared: 0.9993, Adjusted R-squared: 0.9993   
## F-statistic: 9.175e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E20M1)

## 2.5 % 97.5 %  
## (Intercept) 19.1860469 20.8887584  
## x 0.9848268 1.0140992  
## interventionTRUE -16.3690409 -13.9789016  
## time\_after\_intervention 0.9114278 0.9528251

Model 2: Abrupt at time 120

S3PhaseInS1000E20AGGM2<-S3PhaseInS1000E20AGG  
S3PhaseInS1000E20AGGM2$intervention = S3PhaseInS1000E20AGGM2$x > 120  
S3PhaseInS1000E20AGGM2$time\_after\_intervention = ifelse(S3PhaseInS1000E20AGGM2$x > 120, S3PhaseInS1000E20AGGM2$x - 120, 0)  
S3S1000E20M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E20AGGM2)  
summary(S3S1000E20M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E20AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.4098 -0.2615 0.0633 0.4303 2.8988   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.756266 0.185229 112.06 < 0.0000000000000002 \*\*\*  
## x 0.979420 0.002657 368.63 < 0.0000000000000002 \*\*\*  
## interventionTRUE 1.731345 0.291978 5.93 0.0000000135 \*\*\*  
## time\_after\_intervention 1.021736 0.005558 183.84 < 0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.008 on 196 degrees of freedom  
## Multiple R-squared: 0.9998, Adjusted R-squared: 0.9998   
## F-statistic: 4.145e+05 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E20M2)

## 2.5 % 97.5 %  
## (Intercept) 20.3909695 21.1215634  
## x 0.9741802 0.9846599  
## interventionTRUE 1.1555227 2.3071676  
## time\_after\_intervention 1.0107753 1.0326960

Model 3: Excluding Phase-in Period

S3PhaseInS1000E20AGGM3<-subset(S3PhaseInS1000E20AGG,x<100|x>120)  
  
S3PhaseInS1000E20AGGM3$intervention = S3PhaseInS1000E20AGGM3$x > 100  
S3PhaseInS1000E20AGGM3$time\_after\_intervention = ifelse(S3PhaseInS1000E20AGGM3$x > 100, S3PhaseInS1000E20AGGM3$x - 100, 0)  
S3S1000E20M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E20AGGM3)  
summary(S3S1000E20M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E20AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.84198 -0.20663 0.00024 0.23536 0.84717   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.034252 0.064005 313.0 <0.0000000000000002 \*\*\*  
## x 0.999557 0.001111 899.4 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.995004 0.117955 -169.5 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.001599 0.001891 529.7 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.316 on 175 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 4.21e+06 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S1000E20M3)

## 2.5 % 97.5 %  
## (Intercept) 19.9079303 20.160573  
## x 0.9973631 1.001750  
## interventionTRUE -20.2278008 -19.762207  
## time\_after\_intervention 0.9978670 1.005331

Model 4: Counterfactual from Before

S3PhaseInS1000E20AGGM4<-subset(S3PhaseInS1000E20AGG,x<=100|x>=120)  
S3PhaseInS1000E20AGGM4<-rbind(S3PhaseInS1000E20AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS1000E20AGGM4$intervention = S3PhaseInS1000E20AGGM4$x > 119  
S3PhaseInS1000E20AGGM4$time\_after\_intervention = ifelse(S3PhaseInS1000E20AGGM4$x > 120, S3PhaseInS1000E20AGGM4$x - 120, 0)  
S3S1000E20M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E20AGGM4)  
summary(S3S1000E20M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E20AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.84508 -0.17256 0.00941 0.20466 0.84862   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.0319355 0.0551416 363.282 <0.0000000000000002 \*\*\*  
## x 0.9996118 0.0007976 1253.331 <0.0000000000000002 \*\*\*  
## interventionTRUE 0.0301287 0.0858539 0.351 0.726   
## time\_after\_intervention 1.0015914 0.0016289 614.887 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2989 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 4.713e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E20M4)

## 2.5 % 97.5 %  
## (Intercept) 19.9231884 20.1406825  
## x 0.9980389 1.0011847  
## interventionTRUE -0.1391873 0.1994446  
## time\_after\_intervention 0.9983790 1.0048038

Model 5: Counterfactual from After

S3PhaseInS1000E20AGGM5<-subset(S3PhaseInS1000E20AGG,x<=100|x>=120)  
S3PhaseInS1000E20AGGM5<-rbind(S3PhaseInS1000E20AGGM5,S3CounterfactualAfterE20)  
  
S3PhaseInS1000E20AGGM5$intervention = S3PhaseInS1000E20AGGM5$x > 100  
S3PhaseInS1000E20AGGM5$time\_after\_intervention = ifelse(S3PhaseInS1000E20AGGM5$x > 100, S3PhaseInS1000E20AGGM5$x - 100, 0)  
S3S1000E20M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E20AGGM5)  
summary(S3S1000E20M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E20AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.83596 -0.17381 -0.00245 0.20852 0.84946   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.037403 0.060219 332.7 <0.0000000000000002 \*\*\*  
## x 0.999463 0.001035 965.4 <0.0000000000000002 \*\*\*  
## interventionTRUE -19.994133 0.084530 -236.5 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.001764 0.001464 684.2 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2988 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 4.737e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E20M5)

## 2.5 % 97.5 %  
## (Intercept) 19.9186431 20.156162  
## x 0.9974213 1.001505  
## interventionTRUE -20.1608386 -19.827427  
## time\_after\_intervention 0.9988764 1.004651

Sample size 1000 Effect Size 50 Model 1: Abrupt at time 100

S3PhaseInS1000E50AGGM1<-S3PhaseInS1000E50AGG  
S3PhaseInS1000E50AGGM1$intervention = S3PhaseInS1000E50AGGM1$x > 100  
S3PhaseInS1000E50AGGM1$time\_after\_intervention = ifelse(S3PhaseInS1000E50AGGM1$x > 100, S3PhaseInS1000E50AGGM1$x - 100, 0)  
S3S1000E50M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E50AGGM1)  
summary(S3S1000E50M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E50AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -12.777 -1.003 -0.040 0.418 32.916   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.03740 1.22103 16.41 <0.0000000000000002 \*\*\*  
## x 0.99946 0.02099 47.61 <0.0000000000000002 \*\*\*  
## interventionTRUE -34.47579 1.71399 -20.11 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.77710 0.02969 26.18 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.059 on 196 degrees of freedom  
## Multiple R-squared: 0.992, Adjusted R-squared: 0.9919   
## F-statistic: 8121 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E50M1)

## 2.5 % 97.5 %  
## (Intercept) 17.6293643 22.4454410  
## x 0.9580649 1.0408611  
## interventionTRUE -37.8560150 -31.0955662  
## time\_after\_intervention 0.7185550 0.8356465

Model 2: Abrupt at time 120

S3PhaseInS1000E50AGGM2<-S3PhaseInS1000E50AGG  
S3PhaseInS1000E50AGGM2$intervention = S3PhaseInS1000E50AGGM2$x > 120  
S3PhaseInS1000E50AGGM2$time\_after\_intervention = ifelse(S3PhaseInS1000E50AGGM2$x > 120, S3PhaseInS1000E50AGGM2$x - 120, 0)  
S3S1000E50M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E50AGGM2)  
summary(S3S1000E50M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E50AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -21.5484 -0.5224 0.0552 1.8811 8.5170   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 25.11623 0.89210 28.15 <0.0000000000000002 \*\*\*  
## x 0.86486 0.01280 67.59 <0.0000000000000002 \*\*\*  
## interventionTRUE -18.79979 1.40622 -13.37 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.13290 0.02677 42.33 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 4.856 on 196 degrees of freedom  
## Multiple R-squared: 0.9949, Adjusted R-squared: 0.9948   
## F-statistic: 1.268e+04 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E50M2)

## 2.5 % 97.5 %  
## (Intercept) 23.3568893 26.8755721  
## x 0.8396195 0.8900919  
## interventionTRUE -21.5730622 -16.0265155  
## time\_after\_intervention 1.0801153 1.1856895

Model 3: Excluding Phase-in Period

S3PhaseInS1000E50AGGM3<-subset(S3PhaseInS1000E50AGG,x<100|x>120)  
  
S3PhaseInS1000E50AGGM3$intervention = S3PhaseInS1000E50AGGM3$x > 100  
S3PhaseInS1000E50AGGM3$time\_after\_intervention = ifelse(S3PhaseInS1000E50AGGM3$x > 100, S3PhaseInS1000E50AGGM3$x - 100, 0)  
S3S1000E50M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E50AGGM3)  
summary(S3S1000E50M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E50AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.84198 -0.23161 -0.00478 0.24244 0.81995   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.034252 0.063725 314.4 <0.0000000000000002 \*\*\*  
## x 0.999557 0.001107 903.3 <0.0000000000000002 \*\*\*  
## interventionTRUE -49.845946 0.117439 -424.4 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.998202 0.001883 530.2 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3146 on 175 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 3.026e+06 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S1000E50M3)

## 2.5 % 97.5 %  
## (Intercept) 19.9084823 20.160021  
## x 0.9973727 1.001740  
## interventionTRUE -50.0777262 -49.614167  
## time\_after\_intervention 0.9944856 1.001917

Model 4: Counterfactual from Before

S3PhaseInS1000E50AGGM4<-subset(S3PhaseInS1000E50AGG,x<=100|x>=120)  
S3PhaseInS1000E50AGGM4<-rbind(S3PhaseInS1000E50AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS1000E50AGGM4$intervention = S3PhaseInS1000E50AGGM4$x > 119  
S3PhaseInS1000E50AGGM4$time\_after\_intervention = ifelse(S3PhaseInS1000E50AGGM4$x > 120, S3PhaseInS1000E50AGGM4$x - 120, 0)  
S3S1000E50M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E50AGGM4)  
summary(S3S1000E50M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E50AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.8451 -0.2019 0.0098 0.2113 0.8126   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.0319355 0.0549909 364.3 <0.0000000000000002 \*\*\*  
## x 0.9996118 0.0007954 1256.8 <0.0000000000000002 \*\*\*  
## interventionTRUE -29.8741028 0.0856193 -348.9 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.9979205 0.0016245 614.3 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2981 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 3.378e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E50M4)

## 2.5 % 97.5 %  
## (Intercept) 19.9234856 20.140385  
## x 0.9980432 1.001180  
## interventionTRUE -30.0429561 -29.705249  
## time\_after\_intervention 0.9947168 1.001124

Model 5: Counterfactual from After

S3PhaseInS1000E50AGGM5<-subset(S3PhaseInS1000E50AGG,x<=100|x>=120)  
S3PhaseInS1000E50AGGM5<-rbind(S3PhaseInS1000E50AGGM5,S3CounterfactualAfterE50)  
  
S3PhaseInS1000E50AGGM5$intervention = S3PhaseInS1000E50AGGM5$x > 100  
S3PhaseInS1000E50AGGM5$time\_after\_intervention = ifelse(S3PhaseInS1000E50AGGM5$x > 100, S3PhaseInS1000E50AGGM5$x - 100, 0)  
S3S1000E50M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E50AGGM5)  
summary(S3S1000E50M5)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E50AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.83596 -0.19754 -0.03975 0.22440 0.85048   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.037403 0.060316 332.2 <0.0000000000000002 \*\*\*  
## x 0.999463 0.001037 963.9 <0.0000000000000002 \*\*\*  
## interventionTRUE -49.913168 0.084667 -589.5 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.999341 0.001466 681.5 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2993 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 3.427e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E50M5)

## 2.5 % 97.5 %  
## (Intercept) 19.9184517 20.156354  
## x 0.9974180 1.001508  
## interventionTRUE -50.0801425 -49.746193  
## time\_after\_intervention 0.9964494 1.002233

Sample size 1000 Effect Size 100 Model 1: Abrupt at time 100

S3PhaseInS1000E100AGGM1<-S3PhaseInS1000E100AGG  
S3PhaseInS1000E100AGGM1$intervention = S3PhaseInS1000E100AGGM1$x > 100  
S3PhaseInS1000E100AGGM1$time\_after\_intervention = ifelse(S3PhaseInS1000E100AGGM1$x > 100, S3PhaseInS1000E100AGGM1$x - 100, 0)  
S3S1000E100M1<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E100AGGM1)  
summary(S3S1000E100M1)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E100AGGM1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -22.795 -2.346 -0.071 0.418 62.580   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.03740 2.47902 8.083 0.000000000000064015 \*\*\*  
## x 0.99946 0.04262 23.451 < 0.0000000000000002 \*\*\*  
## interventionTRUE -67.87393 3.47987 -19.505 < 0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.53899 0.06027 8.943 0.000000000000000285 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.3 on 196 degrees of freedom  
## Multiple R-squared: 0.9389, Adjusted R-squared: 0.938   
## F-statistic: 1005 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E100M1)

## 2.5 % 97.5 %  
## (Intercept) 15.1484154 24.9263900  
## x 0.9154133 1.0835126  
## interventionTRUE -74.7367269 -61.0111362  
## time\_after\_intervention 0.4201307 0.6578589

Model 2: Abrupt at time 120

S3PhaseInS1000E100AGGM2<-S3PhaseInS1000E100AGG  
S3PhaseInS1000E100AGGM2$intervention = S3PhaseInS1000E100AGGM2$x > 120  
S3PhaseInS1000E100AGGM2$time\_after\_intervention = ifelse(S3PhaseInS1000E100AGGM2$x > 120, S3PhaseInS1000E100AGGM2$x - 100, 0)  
S3S1000E100M2<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E100AGGM2)  
summary(S3S1000E100M2)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E100AGGM2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -52.846 -0.947 0.055 5.012 20.778   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 32.71628 2.24230 14.59 <0.0000000000000002 \*\*\*  
## x 0.66424 0.03216 20.65 <0.0000000000000002 \*\*\*  
## interventionTRUE -78.99746 4.18308 -18.89 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 1.33401 0.06728 19.83 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12.2 on 196 degrees of freedom  
## Multiple R-squared: 0.9399, Adjusted R-squared: 0.939   
## F-statistic: 1022 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E100M2)

## 2.5 % 97.5 %  
## (Intercept) 28.2941523 37.1384029  
## x 0.6008053 0.7276685  
## interventionTRUE -87.2470905 -70.7478291  
## time\_after\_intervention 1.2013264 1.4666886

Model 3: Excluding Phase-in Period

S3PhaseInS1000E100AGGM3<-subset(S3PhaseInS1000E100AGG,x<100|x>120)  
  
S3PhaseInS1000E100AGGM3$intervention = S3PhaseInS1000E100AGGM3$x > 100  
S3PhaseInS1000E100AGGM3$time\_after\_intervention = ifelse(S3PhaseInS1000E100AGGM3$x > 100, S3PhaseInS1000E100AGGM3$x - 100, 0)  
S3S1000E100M3<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E100AGGM3)  
summary(S3S1000E100M3)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E100AGGM3)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.91630 -0.21845 0.00826 0.23484 0.74885   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.034252 0.063520 315.4 <0.0000000000000002 \*\*\*  
## x 0.999557 0.001103 906.2 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.847399 0.117061 -852.9 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.998688 0.001877 532.1 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3136 on 175 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 1.607e+06 on 3 and 175 DF, p-value: < 0.00000000000000022

confint(S3S1000E100M3)

## 2.5 % 97.5 %  
## (Intercept) 19.9088870 20.159616  
## x 0.9973797 1.001733  
## interventionTRUE -100.0784332 -99.616366  
## time\_after\_intervention 0.9949839 1.002392

Model 4: Counterfactual from Before

S3PhaseInS1000E100AGGM4<-subset(S3PhaseInS1000E100AGG,x<=100|x>=120)  
S3PhaseInS1000E100AGGM4<-rbind(S3PhaseInS1000E100AGGM4,S3CounterfactualBefore)  
  
S3PhaseInS1000E100AGGM4$intervention = S3PhaseInS1000E100AGGM4$x > 119  
S3PhaseInS1000E100AGGM4$time\_after\_intervention = ifelse(S3PhaseInS1000E100AGGM4$x > 120, S3PhaseInS1000E100AGGM4$x - 120, 0)  
S3S1000E100M4<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E100AGGM4)  
summary(S3S1000E100M4)

##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E100AGGM4)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.91676 -0.17774 0.01019 0.20798 0.74901   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.0319355 0.0547214 366.1 <0.0000000000000002 \*\*\*  
## x 0.9996118 0.0007915 1263.0 <0.0000000000000002 \*\*\*  
## interventionTRUE -79.8790909 0.0851997 -937.6 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.9986539 0.0016165 617.8 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2966 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 1.86e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E100M4)

## 2.5 % 97.5 %  
## (Intercept) 19.9240171 20.139854  
## x 0.9980508 1.001173  
## interventionTRUE -80.0471166 -79.711065  
## time\_after\_intervention 0.9954660 1.001842

Model 5: Counterfactual from After

S3PhaseInS1000E100AGGM5<-subset(S3PhaseInS1000E100AGG,x<=100|x>=120)  
S3PhaseInS1000E100AGGM5<-rbind(S3PhaseInS1000E100AGGM5,S3CounterfactualAfterE100)  
  
S3PhaseInS1000E100AGGM5$intervention = S3PhaseInS1000E100AGGM5$x > 100  
S3PhaseInS1000E100AGGM5$time\_after\_intervention = ifelse(S3PhaseInS1000E100AGGM5$x > 100, S3PhaseInS1000E100AGGM5$x - 100, 0)  
S3S1000E100M5<-lm(y ~ x + intervention + time\_after\_intervention, data=S3PhaseInS1000E100AGGM5)  
summary(S3S1000E100M5)

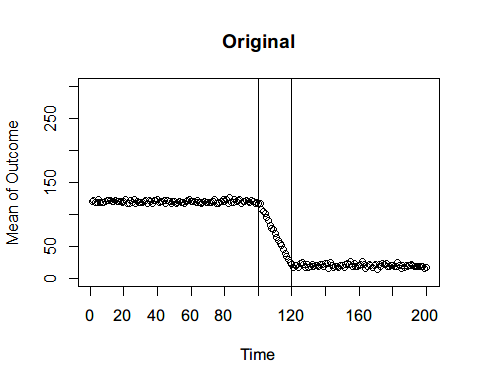
##   
## Call:  
## lm(formula = y ~ x + intervention + time\_after\_intervention,   
## data = S3PhaseInS1000E100AGGM5)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.94459 -0.18272 -0.03966 0.22590 0.75462   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 20.037403 0.059976 334.1 <0.0000000000000002 \*\*\*  
## x 0.999463 0.001031 969.3 <0.0000000000000002 \*\*\*  
## interventionTRUE -99.924483 0.084190 -1186.9 <0.0000000000000002 \*\*\*  
## time\_after\_intervention 0.999956 0.001458 685.8 <0.0000000000000002 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.2976 on 196 degrees of freedom  
## Multiple R-squared: 1, Adjusted R-squared: 1   
## F-statistic: 2.047e+06 on 3 and 196 DF, p-value: < 0.00000000000000022

confint(S3S1000E100M5)

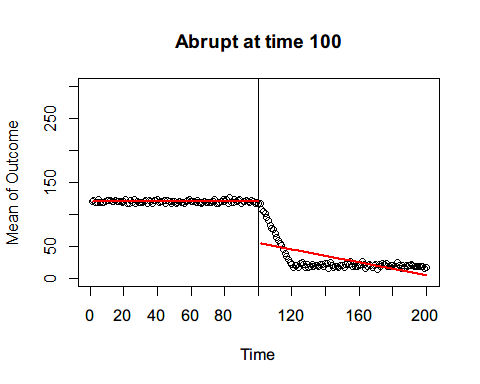
## 2.5 % 97.5 %  
## (Intercept) 19.9191215 20.155684  
## x 0.9974295 1.001496  
## interventionTRUE -100.0905172 -99.758449  
## time\_after\_intervention 0.9970803 1.002832

#Plot ##Senario 1 Original

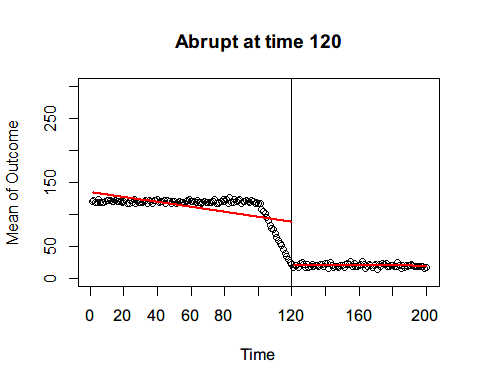
plot(S1PhaseInS20E100AGGM1$x,S1PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Original")  
abline(v=100)  
abline(v=120)

 Abrupt at time 100

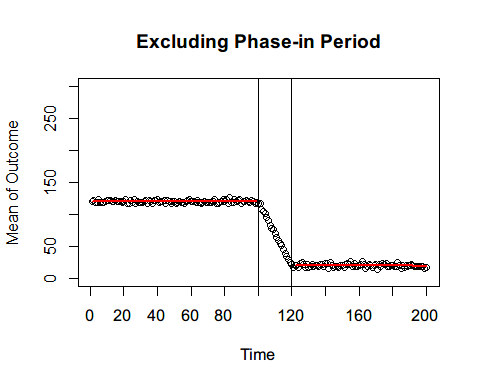
plot(S1PhaseInS20E100AGGM1$x,S1PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Abrupt at time 100")  
abline(v=100)  
#abline(v=120)  
lines(S1PhaseInS20E100AGGM1$x[1:100], fitted(S1S20E100M1)[1:100], col="red",lwd=2)  
lines(S1PhaseInS20E100AGGM1$x[101:200], fitted(S1S20E100M1)[101:200], col="red",lwd=2)

 Abrupt at time 120

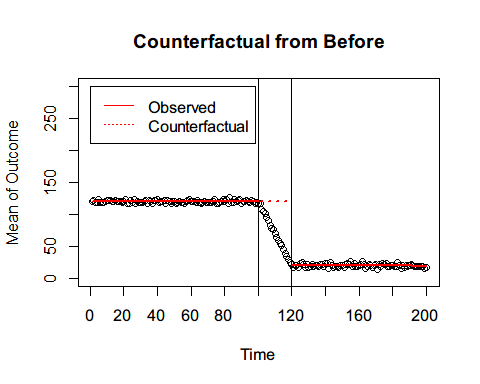
plot(S1PhaseInS20E100AGGM2$x,S1PhaseInS20E100AGGM2$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Abrupt at time 120")  
#abline(v=100)  
abline(v=120)  
lines(S1PhaseInS20E100AGGM2$x[1:120], fitted(S1S20E100M2)[1:120], col="red",lwd=2)  
lines(S1PhaseInS20E100AGGM2$x[121:200], fitted(S1S20E100M2)[121:200], col="red",lwd=2)

 Excluding Phase-in Period

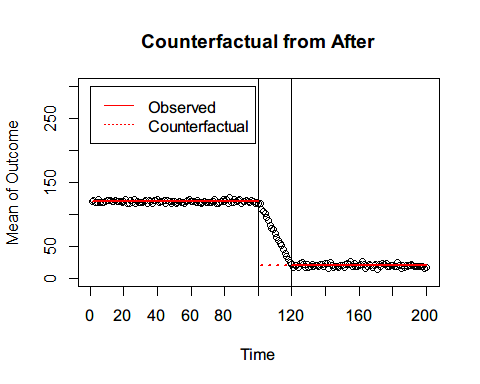
plot(S1PhaseInS20E100AGG$x,S1PhaseInS20E100AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Excluding Phase-in Period")  
abline(v=100)  
abline(v=120)  
lines(S1PhaseInS20E100AGGM3$x[1:99], fitted(S1S20E100M3)[1:99], col="red",lwd=2)  
lines(S1PhaseInS20E100AGGM3$x[101:180], fitted(S1S20E100M3)[101:180], col="red",lwd=2)

 Counterfactual from Before

plot(S1PhaseInS20E100AGGM1$x,S1PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Counterfactual from Before")  
abline(v=100)  
abline(v=120)  
lines(S1PhaseInS20E100AGGM4$x[1:100], fitted(S1S20E100M4)[1:100], col="red",lwd=2)  
lines(S1PhaseInS20E100AGGM4$x[182:200], fitted(S1S20E100M4)[182:200], col="red",lwd=2,lty=3)  
lines(S1PhaseInS20E100AGGM4$x[101:181], fitted(S1S20E100M4)[101:181], col="red",lwd=2)  
legend(x=0, y=300,lty = c(1,3), legend=c("Observed","Counterfactual"), col=c("red"))

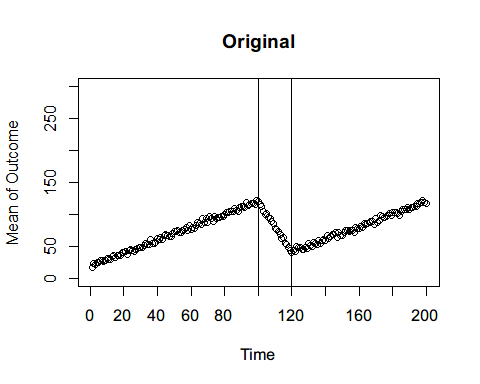
 Counterfactual from After

plot(S1PhaseInS20E100AGGM1$x,S1PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Counterfactual from After")  
abline(v=100)  
abline(v=120)  
lines(S1PhaseInS20E100AGGM5$x[1:100], fitted(S1S20E100M5)[1:100], col="red",lwd=2)  
lines(S1PhaseInS20E100AGGM5$x[182:200], fitted(S1S20E100M5)[182:200], col="red",lwd=2,lty=3)  
lines(S1PhaseInS20E100AGGM5$x[101:181], fitted(S1S20E100M5)[101:181], col="red",lwd=2)  
legend(x=0, y=300,lty = c(1,3), legend=c("Observed","Counterfactual"), col=c("red"))

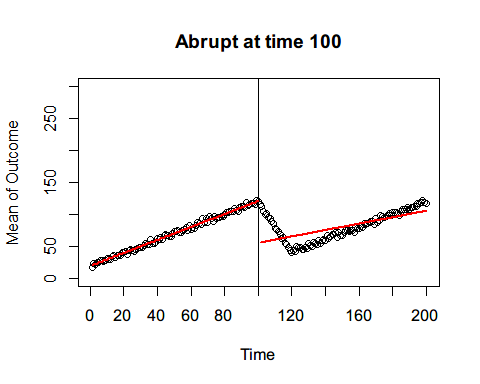


##Senario 2 Original

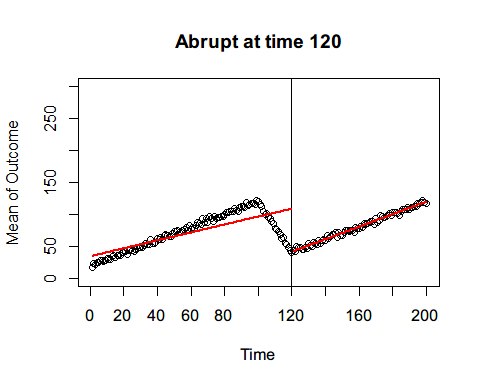
plot(S2PhaseInS20E100AGGM1$x,S2PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Original")  
abline(v=100)  
abline(v=120)

 Abrupt at time 100

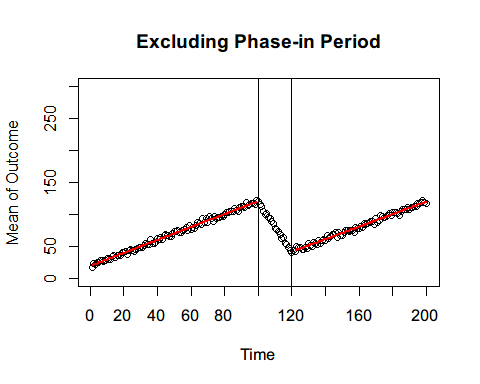
plot(S2PhaseInS20E100AGGM1$x,S2PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Abrupt at time 100")  
abline(v=100)  
#abline(v=120)  
lines(S2PhaseInS20E100AGGM1$x[1:100], fitted(S2S20E100M1)[1:100], col="red",lwd=2)  
lines(S2PhaseInS20E100AGGM1$x[101:200], fitted(S2S20E100M1)[101:200], col="red",lwd=2)

 Abrupt at time 120

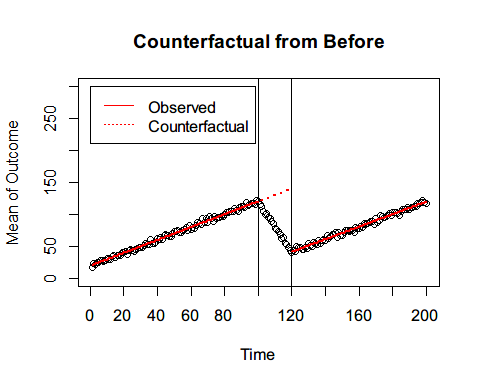
plot(S2PhaseInS20E100AGGM2$x,S2PhaseInS20E100AGGM2$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Abrupt at time 120")  
#abline(v=100)  
abline(v=120)  
lines(S2PhaseInS20E100AGGM2$x[1:120], fitted(S2S20E100M2)[1:120], col="red",lwd=2)  
lines(S2PhaseInS20E100AGGM2$x[121:200], fitted(S2S20E100M2)[121:200], col="red",lwd=2)

 Excluding Phase-in Period

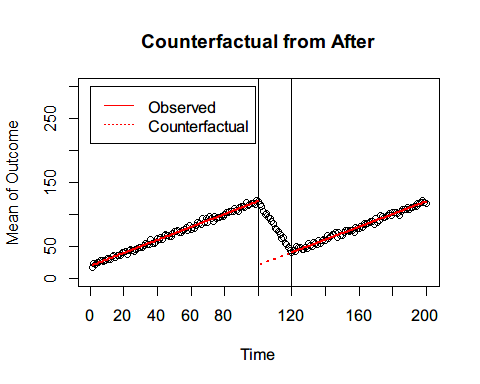
plot(S2PhaseInS20E100AGG$x,S2PhaseInS20E100AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Excluding Phase-in Period")  
abline(v=100)  
abline(v=120)  
lines(S2PhaseInS20E100AGGM3$x[1:99], fitted(S2S20E100M3)[1:99], col="red",lwd=2)  
lines(S2PhaseInS20E100AGGM3$x[101:180], fitted(S2S20E100M3)[101:180], col="red",lwd=2)

 Counterfactual from Before

plot(S2PhaseInS20E100AGGM1$x,S2PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Counterfactual from Before")  
abline(v=100)  
abline(v=120)  
lines(S2PhaseInS20E100AGGM4$x[1:100], fitted(S2S20E100M4)[1:100], col="red",lwd=2)  
lines(S2PhaseInS20E100AGGM4$x[182:200], fitted(S2S20E100M4)[182:200], col="red",lwd=2,lty=3)  
lines(S2PhaseInS20E100AGGM4$x[101:181], fitted(S2S20E100M4)[101:181], col="red",lwd=2)  
legend(x=0, y=300,lty = c(1,3), legend=c("Observed","Counterfactual"), col=c("red"))

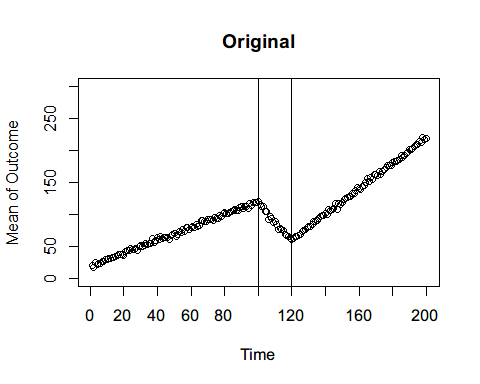
 Counterfactual from After

plot(S2PhaseInS20E100AGGM1$x,S2PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Counterfactual from After")  
abline(v=100)  
abline(v=120)  
lines(S2PhaseInS20E100AGGM5$x[1:100], fitted(S2S20E100M5)[1:100], col="red",lwd=2)  
lines(S2PhaseInS20E100AGGM5$x[182:200], fitted(S2S20E100M5)[182:200], col="red",lwd=2,lty=3)  
lines(S2PhaseInS20E100AGGM5$x[101:181], fitted(S2S20E100M5)[101:181], col="red",lwd=2)  
legend(x=0, y=300,lty = c(1,3), legend=c("Observed","Counterfactual"), col=c("red"))

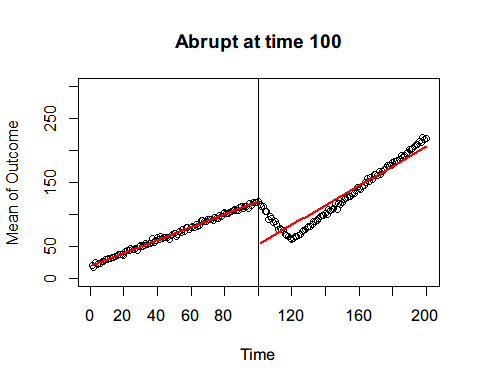


##Senario 3 Original

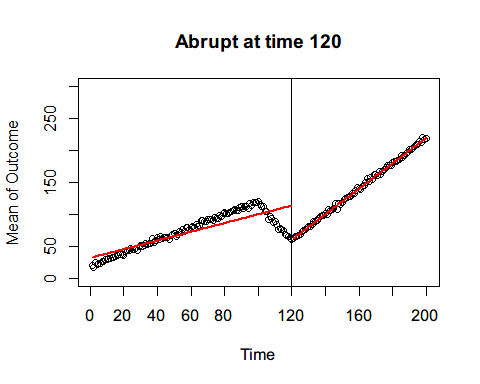
plot(S3PhaseInS20E100AGGM1$x,S3PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Original")  
abline(v=100)  
abline(v=120)

 Abrupt at time 100

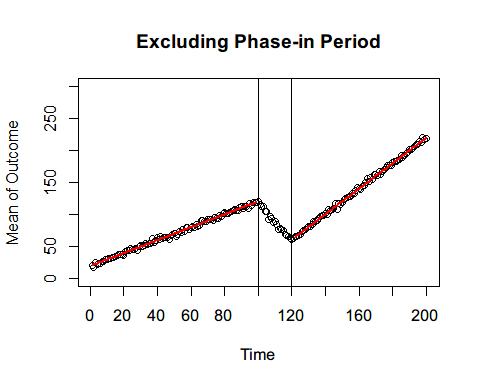
plot(S3PhaseInS20E100AGGM1$x,S3PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Abrupt at time 100")  
abline(v=100)  
#abline(v=120)  
lines(S3PhaseInS20E100AGGM1$x[1:100], fitted(S3S20E100M1)[1:100], col="red",lwd=2)  
lines(S3PhaseInS20E100AGGM1$x[101:200], fitted(S3S20E100M1)[101:200], col="red",lwd=2)

 Abrupt at time 120

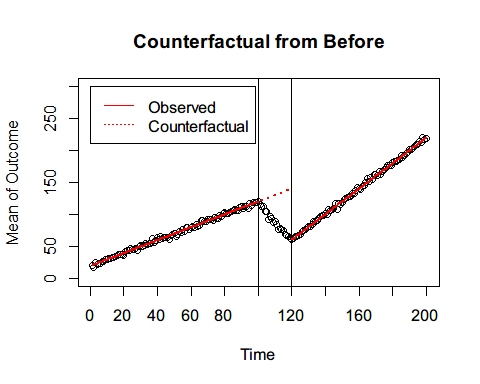
plot(S3PhaseInS20E100AGGM2$x,S3PhaseInS20E100AGGM2$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Abrupt at time 120")  
#abline(v=100)  
abline(v=120)  
lines(S3PhaseInS20E100AGGM2$x[1:120], fitted(S3S20E100M2)[1:120], col="red",lwd=2)  
lines(S3PhaseInS20E100AGGM2$x[121:200], fitted(S3S20E100M2)[121:200], col="red",lwd=2)

 Excluding Phase-in Period

plot(S3PhaseInS20E100AGG$x,S3PhaseInS20E100AGG$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Excluding Phase-in Period")  
abline(v=100)  
abline(v=120)  
lines(S3PhaseInS20E100AGGM3$x[1:99], fitted(S3S20E100M3)[1:99], col="red",lwd=2)  
lines(S3PhaseInS20E100AGGM3$x[101:180], fitted(S3S20E100M3)[101:180], col="red",lwd=2)

 Counterfactual from Before

plot(S3PhaseInS20E100AGGM1$x,S3PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Counterfactual from Before")  
abline(v=100)  
abline(v=120)  
lines(S3PhaseInS20E100AGGM4$x[1:100], fitted(S3S20E100M4)[1:100], col="red",lwd=2)  
lines(S3PhaseInS20E100AGGM4$x[182:200], fitted(S3S20E100M4)[182:200], col="red",lwd=2,lty=3)  
lines(S3PhaseInS20E100AGGM4$x[101:181], fitted(S3S20E100M4)[101:181], col="red",lwd=2)  
legend(x=0, y=300,lty = c(1,3), legend=c("Observed","Counterfactual"), col=c("red"))

 Counterfactual from After

plot(S3PhaseInS20E100AGGM1$x,S3PhaseInS20E100AGGM1$y,ylim=c(0,300),xaxp=c(0,200,10),  
 ylab = "Mean of Outcome",xlab="Time",main = "Counterfactual from After")  
abline(v=100)  
abline(v=120)  
lines(S3PhaseInS20E100AGGM5$x[1:100], fitted(S3S20E100M5)[1:100], col="red",lwd=2)  
lines(S3PhaseInS20E100AGGM5$x[182:200], fitted(S3S20E100M5)[182:200], col="red",lwd=2,lty=3)  
lines(S3PhaseInS20E100AGGM5$x[101:181], fitted(S3S20E100M5)[101:181], col="red",lwd=2)  
legend(x=0, y=300,lty = c(1,3), legend=c("Observed","Counterfactual"), col=c("red"))

