Research2

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Adjust Inflation to Monthly (Task 3)

```
EconData <- read.csv("C:/Users/caste/Desktop/PSTAT199/EconData.csv")
EconData$Inflation  <- EconData$Inflation/12
EconData$Inflation[1] <- 0.024/12
EconData$AdjustedSP <- EconData$S.P.500.Real.Price.by.Month/(1+ EconData$Inflation)
EconData$AdjustedPE <- EconData$S.P.500.PE.Ratio.by.Month./(1+ EconData$Inflation)
EconData$AdjustedPE2 <- EconData$Shiller.PE.Ratio.by.Month/(1+ EconData$Inflation)
attach(EconData)
```

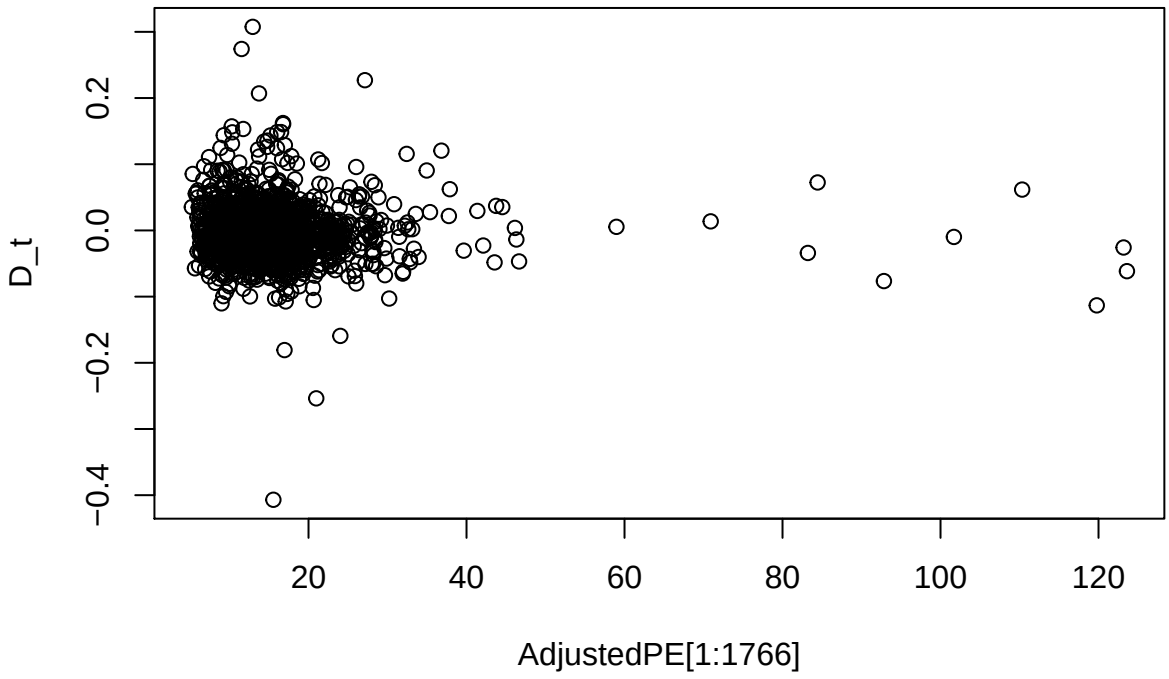
Linear regression for inflation-adjusted PE

```
D_t <- matrix(nrow = 1767, ncol = 1)
for(i in 2:1767){D_t[i-1] = log(AdjustedSP[i]/AdjustedSP[i-1])}
D_t = D_t[-1767,]
```

```
PElm = lm(D_t ~ AdjustedPE[1:1766])
summary(PElm)
```

```
##
## Call:
## lm(formula = D_t ~ AdjustedPE[1:1766])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.40334 -0.02336 -0.00258  0.01894  0.31031
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)          0.0010546  0.0020442   0.516  0.60599
## AdjustedPE[1:1766] -0.0002969  0.0001149  -2.585  0.00983 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.04056 on 1752 degrees of freedom
##   (12 observations deleted due to missingness)
## Multiple R-squared:  0.003798,   Adjusted R-squared:  0.00323
## F-statistic:  6.68 on 1 and 1752 DF,  p-value: 0.009832
```

```
plot( AdjustedPE[1:1766], D_t)
```



Linear regression for inflation-adjusted PE 10-year

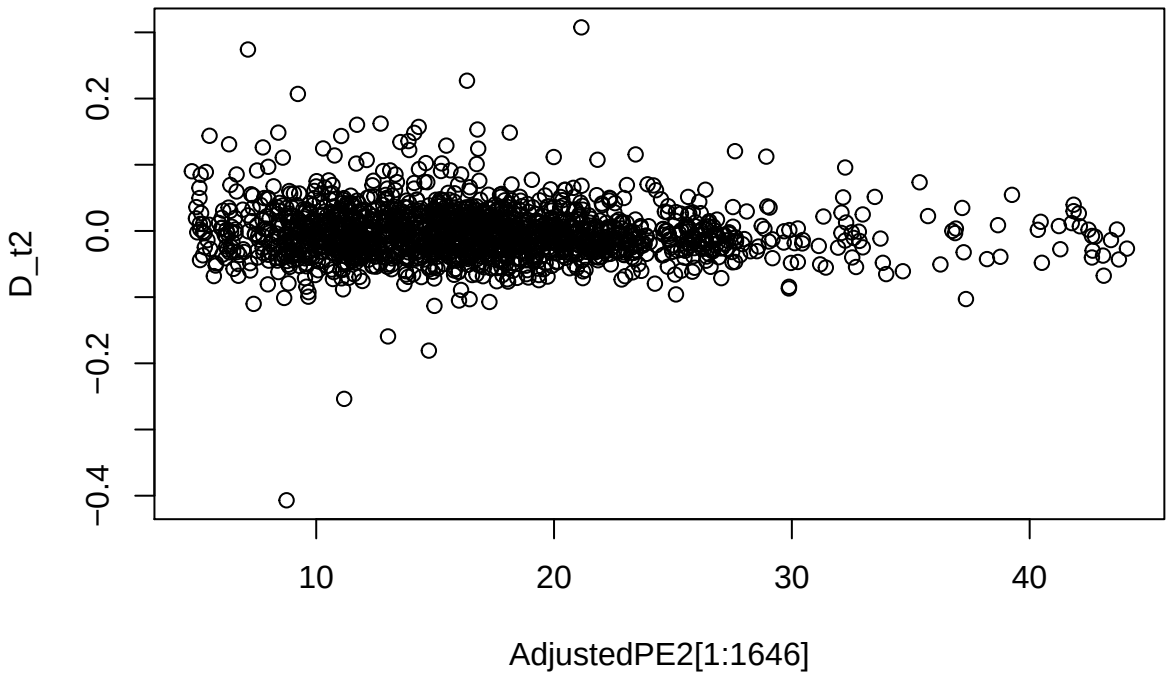
```
D_t2 <- matrix(nrow = 1647, ncol = 1)
for(i in 2:1647){D_t2[i-1] = log(AdjustedSP[i]/AdjustedSP[i-1])}
D_t2 = D_t2[-1647,]
```

```
PElm2 = lm(D_t2 ~ AdjustedPE2[1:1646])
summary(PElm2)
```

```
##
## Call:
## lm(formula = D_t2 ~ AdjustedPE2[1:1646])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.40685 -0.02316 -0.00303  0.01907  0.31319
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)           0.0039022  0.0027135   1.438  0.15061
## AdjustedPE2[1:1646] -0.0004524  0.0001501  -3.014  0.00262 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.04097 on 1644 degrees of freedom
## Multiple R-squared:  0.005496,   Adjusted R-squared:  0.004891
## F-statistic: 9.085 on 1 and 1644 DF,  p-value: 0.002617
```

```
plot( AdjustedPE2[1:1646], D_t2)
```



Calculate for different values of k for PE

k = 12

```
D_t <- matrix(nrow = 1755, ncol = 1)
for(i in 1:1755){D_t[i] = log(AdjustedSP[i+12]/AdjustedSP[i])}
```

```
PElm = lm(D_t ~ AdjustedPE[1:1755])
summary(PElm)
```

```
##
## Call:
## lm(formula = D_t ~ AdjustedPE[1:1755])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.77835 -0.12781 -0.02212  0.10650  1.11560
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)        -0.0563294  0.0093811  -6.005 2.33e-09 ***
## AdjustedPE[1:1755]  0.0008581  0.0005263   1.630    0.103
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1857 on 1741 degrees of freedom
##   (12 observations deleted due to missingness)
## Multiple R-squared:  0.001525,   Adjusted R-squared:  0.000951
## F-statistic: 2.658 on 1 and 1741 DF,  p-value: 0.1032
```

$k = 36$

```
D_t <- matrix(nrow = (1767-36), ncol = 1)
for(i in 1:(1767-36)){D_t[i] = log(AdjustedSP[i+36]/AdjustedSP[i])}
```

```
PElm = lm(D_t ~ AdjustedPE[1:(1767-36)])
summary(PElm)
```

```
##
## Call:
## lm(formula = D_t ~ AdjustedPE[1:(1767 - 36)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.75146 -0.21100 -0.02462  0.18861  1.87880
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.1426741  0.0159107  -8.967   <2e-16 ***
## AdjustedPE[1:(1767 - 36)]  0.0008792  0.0008885   0.989    0.323
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3126 on 1717 degrees of freedom
##   (12 observations deleted due to missingness)
## Multiple R-squared:  0.0005699,  Adjusted R-squared:  -1.217e-05
## F-statistic: 0.9791 on 1 and 1717 DF,  p-value: 0.3226
```

$k = 120$

```
D_t <- matrix(nrow = (1767-120), ncol = 1)
for(i in 1:(1767-120)){D_t[i] = log(AdjustedSP[i+120]/AdjustedSP[i])}
```

```
PElm = lm(D_t ~ AdjustedPE[1:(1767-120)])
summary(PElm)
```

```
##
## Call:
## lm(formula = D_t ~ AdjustedPE[1:(1767 - 120)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.00739 -0.39883  0.02096  0.33391  1.81541
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.287927   0.024811 -11.605  < 2e-16 ***
```

```
## AdjustedPE[1:(1767 - 120)] -0.008978   0.001366  -6.573 6.61e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4776 on 1633 degrees of freedom
##   (12 observations deleted due to missingness)
## Multiple R-squared:  0.02578,    Adjusted R-squared:  0.02518
## F-statistic: 43.21 on 1 and 1633 DF,  p-value: 6.612e-11
```

k = 240

```
D_t <- matrix(nrow = (1767-240), ncol = 1)
for(i in 1:(1767-240)){D_t[i] = log(AdjustedSP[i+240]/AdjustedSP[i])}
```

```
PElm = lm(D_t ~ AdjustedPE[1:(1767-240)])
summary(PElm)
```

```
##
## Call:
## lm(formula = D_t ~ AdjustedPE[1:(1767 - 240)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.39193 -0.49955  0.00272  0.46199  3.06703
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 -0.416944   0.033222  -12.55   <2e-16 ***
## AdjustedPE[1:(1767 - 240)] -0.030012   0.001813  -16.55   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6327 on 1513 degrees of freedom
##   (12 observations deleted due to missingness)
## Multiple R-squared:  0.1533, Adjusted R-squared:  0.1527
## F-statistic: 273.9 on 1 and 1513 DF,  p-value: < 2.2e-16
```

k = 6

```
D_t <- matrix(nrow = (1767-6), ncol = 1)
for(i in 1:(1767-6)){D_t[i] = log(AdjustedSP[i+6]/AdjustedSP[i])}
```

```
PElm = lm(D_t ~ AdjustedPE[1:(1767-6)])
summary(PElm)
```

```
##
## Call:
## lm(formula = D_t ~ AdjustedPE[1:(1767 - 6)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.51492 -0.07374 -0.01167  0.06418  0.65299
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)               -0.0131557  0.0061197  -2.150   0.0317 *
## AdjustedPE[1:(1767 - 6)] -0.0005320  0.0003437  -1.548   0.1218
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1213 on 1747 degrees of freedom
##   (12 observations deleted due to missingness)
## Multiple R-squared:  0.00137,    Adjusted R-squared:  0.0007984
## F-statistic: 2.397 on 1 and 1747 DF,  p-value: 0.1218
```

Calculate for different values of k for PE 10 year

k = 12

```
D_t2 <- matrix(nrow = (1646-12), ncol = 1)
for(i in 1:(1646-12)){D_t2[i] = log(AdjustedSP[i+12]/AdjustedSP[i])}
```

```
PElm2 = lm(D_t2 ~ AdjustedPE[1:(1646-12)])
summary(PElm2)
```

```
##
## Call:
## lm(formula = D_t2 ~ AdjustedPE[1:(1646 - 12)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.77864 -0.12684 -0.02424  0.10540  1.11835
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.0607723  0.0096895  -6.272 4.56e-10 ***
## AdjustedPE[1:(1646 - 12)]  0.0010401  0.0005333   1.950   0.0513 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1865 on 1632 degrees of freedom
## Multiple R-squared:  0.002325,   Adjusted R-squared:  0.001714
## F-statistic: 3.803 on 1 and 1632 DF,  p-value: 0.05132
```

k = 36

```
D_t2 <- matrix(nrow = (1646-36), ncol = 1)
for(i in 1:(1646-36)){D_t2[i] = log(AdjustedSP[i+36]/AdjustedSP[i])}
```

```
PElm2 = lm(D_t2 ~ AdjustedPE[1:(1646-36)])
summary(PElm2)
```

```
##
## Call:
## lm(formula = D_t2 ~ AdjustedPE[1:(1646 - 36)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.74836 -0.20480 -0.02639  0.17725  1.88575
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.1541328  0.0161632  -9.536   <2e-16 ***
```

```
## AdjustedPE[1:(1646 - 36)]  0.0013238  0.0008867   1.493    0.136
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3098 on 1608 degrees of freedom
## Multiple R-squared:  0.001384,   Adjusted R-squared:  0.0007632
## F-statistic: 2.229 on 1 and 1608 DF,  p-value: 0.1356
```

k = 120

```
D_t2 <- matrix(nrow = (1646-120), ncol = 1)
for(i in 1:(1646-120)){D_t2[i] = log(AdjustedSP[i+120]/AdjustedSP[i])}
```

```
PElm2 = lm(D_t2 ~ AdjustedPE[1:(1646-120)])
summary(PElm2)
```

```
##
## Call:
## lm(formula = D_t2 ~ AdjustedPE[1:(1646 - 120)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.99277 -0.41136  0.01504  0.34820  1.82229
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.304835   0.025587 -11.913  < 2e-16 ***
## AdjustedPE[1:(1646 - 120)] -0.008894   0.001398  -6.362 2.62e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4877 on 1524 degrees of freedom
## Multiple R-squared:  0.02587,    Adjusted R-squared:  0.02523
## F-statistic: 40.48 on 1 and 1524 DF,  p-value: 2.623e-10
```

k = 240

```
D_t2 <- matrix(nrow = (1646-240), ncol = 1)
for(i in 1:(1646-240)){D_t2[i] = log(AdjustedSP[i+240]/AdjustedSP[i])}
```

```
PElm2 = lm(D_t2 ~ AdjustedPE[1:(1646-240)])
summary(PElm2)
```

```
##
## Call:
## lm(formula = D_t2 ~ AdjustedPE[1:(1646 - 240)])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.3182 -0.4684  0.0097  0.4486  3.2523
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.457305   0.032605  -14.03   <2e-16 ***
## AdjustedPE[1:(1646 - 240)] -0.031185   0.001771  -17.61   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.6149 on 1404 degrees of freedom
## Multiple R-squared:  0.1808, Adjusted R-squared:  0.1802
## F-statistic: 309.9 on 1 and 1404 DF,  p-value: < 2.2e-16
```

$k = 6$

```
D_t2 <- matrix(nrow = (1646-6), ncol = 1)
for(i in 1:(1646-6)){D_t2[i] = log(AdjustedSP[i+6]/AdjustedSP[i])}
```

```
PElm2 = lm(D_t2 ~ AdjustedPE[1:(1646-6)])
summary(PElm2)
```

```
##
## Call:
## lm(formula = D_t2 ~ AdjustedPE[1:(1646 - 6)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.51510 -0.07409 -0.01396  0.06612  0.65383
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.0147065  0.0063337  -2.322   0.0204 *
## AdjustedPE[1:(1646 - 6)] -0.0004622  0.0003489  -1.325   0.1855
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.122 on 1638 degrees of freedom
## Multiple R-squared:  0.00107,    Adjusted R-squared:  0.0004603
## F-statistic: 1.755 on 1 and 1638 DF,  p-value: 0.1855
```

```
res <- matrix(nrow = 271, ncol = 6)
pos <- 1
for (i in 30:301){
  D_ti <- matrix(nrow = (1755-i), ncol =1)
  D_ti <- log(AdjustedSP[(i+1):1755]/AdjustedSP[1:(1755-i)])
  lmod <- summary(lm(D_ti ~ AdjustedPE[1:(1755-i)]))
  res[(i-30),1] <-  lmod$coefficients[1,1]
  res[(i-30),2] <-  lmod$coefficients[1,2]
  res[(i-30),3] <-  lmod$coefficients[2,1]
  res[(i-30),4] <-  lmod$coefficients[2,2]
  res[(i-30),5] <-  lmod$coefficients[1,4]
  res[(i-30),6] <-  lmod$coefficients[2,4]
}
res <- as.data.frame(res)
colnames(res) <- c("Intercept", "PE Estimate Coefficient", "Intercept Std. Error", "PE Estimate Std. Er
row.names(res) <- c(30:(nrow(res)+29))
```

```
library(xlsx)
```

```
## Warning: package 'xlsx' was built under R version 3.4.3
```

```
## Loading required package: rJava
```

```
## Warning: package 'rJava' was built under R version 3.4.3
```

```
## Loading required package: xlsxjars
```

```
## Warning: package 'xlsxjars' was built under R version 3.4.3
```

```
write.csv(res, file = "C:/Users/caste/Desktop/PSTAT199/Research_Wk2.csv")
```