M03\_Assignment

Xueyi Fan

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# Assingment

* Download the compressed data from the U.S. Bureau of Labor Statistics <http://www.bls.gov/> @ <http://www.bls.gov/cew/data/files/2014/csv/2014_annual_singlefile.zip>, and extract the .csv file.
* Run Principal Components Analysis on the BLS data and answer the following questions. (You can use any PCA function you wish, i.e. princomp(), prcomp(), principal() or by hand.)
* Questions:

1. What proportion of the total variation in the data is explained by each of the principal components?
2. Plot a screeplot.
3. Based on the variation explained for each of these components, which, if any, components would you use?
4. Is there evidence of clustering in the data by creating biplots of the each of the components plotted against one another?
5. Do any of the biplots reveal any interesting structure?
6. How many pcs are required to explain 75% of the variance in the data?

Write up your report as an .Rmd file.

## Load the csv file

url = 'http://www.bls.gov/cew/data/files/2014/csv/2014\_annual\_singlefile.zip'  
temp = tempfile()  
download.file(url,temp, mode = "w")  
data <- read.csv(unzip(temp), header = TRUE)  
unlink(temp)  
#file = unzip('/Users/fanxueyi/Downloads/test.csv.zip' )  
#data = read.csv('~/Downloads/2014.annual.singlefile.csv', header = TRUE)  
head(data)

## area\_fips own\_code industry\_code agglvl\_code size\_code year qtr  
## 1 01000 0 10 50 0 2014 A  
## 2 01000 1 10 51 0 2014 A  
## 3 01000 1 102 52 0 2014 A  
## 4 01000 1 1021 53 0 2014 A  
## 5 01000 1 1022 53 0 2014 A  
## 6 01000 1 1023 53 0 2014 A  
## disclosure\_code annual\_avg\_estabs annual\_avg\_emplvl total\_annual\_wages  
## 1 117452 1863561 80668352987  
## 2 1186 53491 4148191291  
## 3 1186 53491 4148191291  
## 4 587 11462 719550831  
## 5 2 13 430575  
## 6 17 147 11630538  
## taxable\_annual\_wages annual\_contributions annual\_avg\_wkly\_wage  
## 1 13917605638 316127565 832  
## 2 0 0 1491  
## 3 0 0 1491  
## 4 0 0 1207  
## 5 0 0 649  
## 6 0 0 1527  
## avg\_annual\_pay lq\_disclosure\_code lq\_annual\_avg\_estabs  
## 1 43287 1.00  
## 2 77550 1.55  
## 3 77550 1.55  
## 4 62776 1.55  
## 5 33771 1.24  
## 6 79389 1.70  
## lq\_annual\_avg\_emplvl lq\_total\_annual\_wages lq\_taxable\_annual\_wages  
## 1 1.00 1.00 1  
## 2 1.44 1.74 0  
## 3 1.46 1.77 0  
## 4 1.26 1.60 0  
## 5 0.14 0.08 0  
## 6 0.79 0.69 0  
## lq\_annual\_contributions lq\_annual\_avg\_wkly\_wage lq\_avg\_annual\_pay  
## 1 1 1.00 1.00  
## 2 0 1.21 1.21  
## 3 0 1.22 1.21  
## 4 0 1.27 1.27  
## 5 0 0.55 0.55  
## 6 0 0.88 0.88  
## oty\_disclosure\_code oty\_annual\_avg\_estabs\_chg  
## 1 1394  
## 2 -10  
## 3 -10  
## 4 0  
## 5 0  
## 6 0  
## oty\_annual\_avg\_estabs\_pct\_chg oty\_annual\_avg\_emplvl\_chg  
## 1 1.2 18475  
## 2 -0.8 -1097  
## 3 -0.8 -1097  
## 4 0.0 -75  
## 5 0.0 0  
## 6 0.0 -7  
## oty\_annual\_avg\_emplvl\_pct\_chg oty\_total\_annual\_wages\_chg  
## 1 1.0 2665745136  
## 2 -2.0 97930469  
## 3 -2.0 97930469  
## 4 -0.7 24761729  
## 5 0.0 -7288  
## 6 -4.5 -263697  
## oty\_total\_annual\_wages\_pct\_chg oty\_taxable\_annual\_wages\_chg  
## 1 3.4 311188704  
## 2 2.4 0  
## 3 2.4 0  
## 4 3.6 0  
## 5 -1.7 0  
## 6 -2.2 0  
## oty\_taxable\_annual\_wages\_pct\_chg oty\_annual\_contributions\_chg  
## 1 2.3 -70421983  
## 2 0.0 0  
## 3 0.0 0  
## 4 0.0 0  
## 5 0.0 0  
## 6 0.0 0  
## oty\_annual\_contributions\_pct\_chg oty\_annual\_avg\_wkly\_wage\_chg  
## 1 -18.2 19  
## 2 0.0 64  
## 3 0.0 64  
## 4 0.0 49  
## 5 0.0 -25  
## 6 0.0 43  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg oty\_avg\_annual\_pay\_chg  
## 1 2.3 1011  
## 2 4.5 3353  
## 3 4.5 3353  
## 4 4.2 2552  
## 5 -3.7 -1258  
## 6 2.9 2195  
## oty\_avg\_annual\_pay\_pct\_chg  
## 1 2.4  
## 2 4.5  
## 3 4.5  
## 4 4.2  
## 5 -3.6  
## 6 2.8

names(data)

## [1] "area\_fips" "own\_code"   
## [3] "industry\_code" "agglvl\_code"   
## [5] "size\_code" "year"   
## [7] "qtr" "disclosure\_code"   
## [9] "annual\_avg\_estabs" "annual\_avg\_emplvl"   
## [11] "total\_annual\_wages" "taxable\_annual\_wages"   
## [13] "annual\_contributions" "annual\_avg\_wkly\_wage"   
## [15] "avg\_annual\_pay" "lq\_disclosure\_code"   
## [17] "lq\_annual\_avg\_estabs" "lq\_annual\_avg\_emplvl"   
## [19] "lq\_total\_annual\_wages" "lq\_taxable\_annual\_wages"   
## [21] "lq\_annual\_contributions" "lq\_annual\_avg\_wkly\_wage"   
## [23] "lq\_avg\_annual\_pay" "oty\_disclosure\_code"   
## [25] "oty\_annual\_avg\_estabs\_chg" "oty\_annual\_avg\_estabs\_pct\_chg"   
## [27] "oty\_annual\_avg\_emplvl\_chg" "oty\_annual\_avg\_emplvl\_pct\_chg"   
## [29] "oty\_total\_annual\_wages\_chg" "oty\_total\_annual\_wages\_pct\_chg"   
## [31] "oty\_taxable\_annual\_wages\_chg" "oty\_taxable\_annual\_wages\_pct\_chg"  
## [33] "oty\_annual\_contributions\_chg" "oty\_annual\_contributions\_pct\_chg"  
## [35] "oty\_annual\_avg\_wkly\_wage\_chg" "oty\_annual\_avg\_wkly\_wage\_pct\_chg"  
## [37] "oty\_avg\_annual\_pay\_chg" "oty\_avg\_annual\_pay\_pct\_chg"

str(data)

## 'data.frame': 3569127 obs. of 38 variables:  
## $ area\_fips : Factor w/ 4426 levels "01000","01001",..: 1 1 1 1 1 1 1 1 1 1 ...  
## $ own\_code : int 0 1 1 1 1 1 1 1 1 1 ...  
## $ industry\_code : Factor w/ 2244 levels "10","101","1011",..: 1 1 6 7 8 9 10 11 12 13 ...  
## $ agglvl\_code : int 50 51 52 53 53 53 53 53 53 53 ...  
## $ size\_code : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ year : int 2014 2014 2014 2014 2014 2014 2014 2014 2014 2014 ...  
## $ qtr : Factor w/ 1 level "A": 1 1 1 1 1 1 1 1 1 1 ...  
## $ disclosure\_code : Factor w/ 2 levels "","N": 1 1 1 1 1 1 1 1 1 1 ...  
## $ annual\_avg\_estabs : int 117452 1186 1186 587 2 17 43 34 26 3 ...  
## $ annual\_avg\_emplvl : int 1863561 53491 53491 11462 13 147 1712 6239 810 500 ...  
## $ total\_annual\_wages : num 8.07e+10 4.15e+09 4.15e+09 7.20e+08 4.31e+05 ...  
## $ taxable\_annual\_wages : num 1.39e+10 0.00 0.00 0.00 0.00 ...  
## $ annual\_contributions : num 3.16e+08 0.00 0.00 0.00 0.00 ...  
## $ annual\_avg\_wkly\_wage : int 832 1491 1491 1207 649 1527 1616 1283 383 2085 ...  
## $ avg\_annual\_pay : int 43287 77550 77550 62776 33771 79389 84056 66729 19904 108424 ...  
## $ lq\_disclosure\_code : Factor w/ 2 levels "","N": 1 1 1 1 1 1 1 1 1 1 ...  
## $ lq\_annual\_avg\_estabs : num 1 1.55 1.55 1.55 1.24 1.7 2.26 2.19 1.31 1.45 ...  
## $ lq\_annual\_avg\_emplvl : num 1 1.44 1.46 1.26 0.14 0.79 1.92 1.21 1.13 7.92 ...  
## $ lq\_total\_annual\_wages : num 1 1.74 1.77 1.6 0.08 ...  
## $ lq\_taxable\_annual\_wages : num 1 0 0 0 0 0 0 0 0 0 ...  
## $ lq\_annual\_contributions : num 1 0 0 0 0 0 0 0 0 0 ...  
## $ lq\_annual\_avg\_wkly\_wage : num 1 1.21 1.22 1.27 0.55 0.88 1.2 1.1 0.55 2.47 ...  
## $ lq\_avg\_annual\_pay : num 1 1.21 1.21 1.27 0.55 0.88 1.2 1.1 0.55 2.47 ...  
## $ oty\_disclosure\_code : Factor w/ 2 levels "","N": 1 1 1 1 1 1 1 1 1 1 ...  
## $ oty\_annual\_avg\_estabs\_chg : int 1394 -10 -10 0 0 0 -3 2 0 0 ...  
## $ oty\_annual\_avg\_estabs\_pct\_chg : num 1.2 -0.8 -0.8 0 0 0 -6.5 6.2 0 0 ...  
## $ oty\_annual\_avg\_emplvl\_chg : int 18475 -1097 -1097 -75 0 -7 -48 -6 -52 -66 ...  
## $ oty\_annual\_avg\_emplvl\_pct\_chg : num 1 -2 -2 -0.7 0 -4.5 -2.7 -0.1 -6 -11.7 ...  
## $ oty\_total\_annual\_wages\_chg : num 2.67e+09 9.79e+07 9.79e+07 2.48e+07 -7.29e+03 ...  
## $ oty\_total\_annual\_wages\_pct\_chg : num 3.4 2.4 2.4 3.6 -1.7 -2.2 -0.4 2.4 -4.7 9.2 ...  
## $ oty\_taxable\_annual\_wages\_chg : num 3.11e+08 0.00 0.00 0.00 0.00 ...  
## $ oty\_taxable\_annual\_wages\_pct\_chg: num 2.3 0 0 0 0 0 0 0 0 0 ...  
## $ oty\_annual\_contributions\_chg : num -70421983 0 0 0 0 ...  
## $ oty\_annual\_contributions\_pct\_chg: num -18.2 0 0 0 0 0 0 0 0 0 ...  
## $ oty\_annual\_avg\_wkly\_wage\_chg : int 19 64 64 49 -25 43 38 31 5 398 ...  
## $ oty\_annual\_avg\_wkly\_wage\_pct\_chg: num 2.3 4.5 4.5 4.2 -3.7 2.9 2.4 2.5 1.3 23.6 ...  
## $ oty\_avg\_annual\_pay\_chg : int 1011 3353 3353 2552 -1258 2195 1984 1635 256 20696 ...  
## $ oty\_avg\_annual\_pay\_pct\_chg : num 2.4 4.5 4.5 4.2 -3.6 2.8 2.4 2.5 1.3 23.6 ...

## Run principal component analysis

### Organize the data

* First, the BLS data have NA data and non-numeric data. I will process the data according to the result of str(data)

In this file, there are 38 variables. Six variables(are\_fisp, industry\_code, qtr, disclosure\_code, lq\_disclosure\_code, oty\_disclosure\_code) are factor variables. 32 variables are numeric variables. Principal component analysis only accept the numeric variables. I will keep only numeric variables and remove all factor variables.

However, there are some variables are meaningless for PCA even though they are numeric variables. Own\_code, agglvl\_code are interger and not continious, so I remove them. Size\_code, and year are the same number in rows, these two columns will be exlcuded.

Now I subset the original data and keep 28 variables.

keep\_data = data.frame(data[,9:15],data[,17:23], data[,25:38])  
names(keep\_data)

## [1] "annual\_avg\_estabs" "annual\_avg\_emplvl"   
## [3] "total\_annual\_wages" "taxable\_annual\_wages"   
## [5] "annual\_contributions" "annual\_avg\_wkly\_wage"   
## [7] "avg\_annual\_pay" "lq\_annual\_avg\_estabs"   
## [9] "lq\_annual\_avg\_emplvl" "lq\_total\_annual\_wages"   
## [11] "lq\_taxable\_annual\_wages" "lq\_annual\_contributions"   
## [13] "lq\_annual\_avg\_wkly\_wage" "lq\_avg\_annual\_pay"   
## [15] "oty\_annual\_avg\_estabs\_chg" "oty\_annual\_avg\_estabs\_pct\_chg"   
## [17] "oty\_annual\_avg\_emplvl\_chg" "oty\_annual\_avg\_emplvl\_pct\_chg"   
## [19] "oty\_total\_annual\_wages\_chg" "oty\_total\_annual\_wages\_pct\_chg"   
## [21] "oty\_taxable\_annual\_wages\_chg" "oty\_taxable\_annual\_wages\_pct\_chg"  
## [23] "oty\_annual\_contributions\_chg" "oty\_annual\_contributions\_pct\_chg"  
## [25] "oty\_annual\_avg\_wkly\_wage\_chg" "oty\_annual\_avg\_wkly\_wage\_pct\_chg"  
## [27] "oty\_avg\_annual\_pay\_chg" "oty\_avg\_annual\_pay\_pct\_chg"

I will calculate corelation value to see whether the remaining variables have highly correlation

I use all keep\_data to calculate the corelation overall.

cor(keep\_data)

## annual\_avg\_estabs annual\_avg\_emplvl  
## annual\_avg\_estabs 1.000000e+00 9.833765e-01  
## annual\_avg\_emplvl 9.833765e-01 1.000000e+00  
## total\_annual\_wages 9.793355e-01 9.946181e-01  
## taxable\_annual\_wages 9.872725e-01 9.894928e-01  
## annual\_contributions 9.845771e-01 9.844440e-01  
## annual\_avg\_wkly\_wage 9.459478e-03 1.011364e-02  
## avg\_annual\_pay 9.459412e-03 1.011361e-02  
## lq\_annual\_avg\_estabs -2.104964e-04 -2.098775e-04  
## lq\_annual\_avg\_emplvl -2.573698e-05 1.848801e-05  
## lq\_total\_annual\_wages -5.054296e-05 -8.991811e-06  
## lq\_taxable\_annual\_wages 1.280650e-04 1.762700e-04  
## lq\_annual\_contributions 6.820105e-05 1.144750e-04  
## lq\_annual\_avg\_wkly\_wage 8.710513e-03 9.420326e-03  
## lq\_avg\_annual\_pay 8.711500e-03 9.421189e-03  
## oty\_annual\_avg\_estabs\_chg 9.470161e-01 9.138888e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -3.675062e-04 -4.780059e-04  
## oty\_annual\_avg\_emplvl\_chg 9.848161e-01 9.821288e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 5.993884e-04 3.325045e-04  
## oty\_total\_annual\_wages\_chg 9.802549e-01 9.853406e-01  
## oty\_total\_annual\_wages\_pct\_chg 4.995590e-05 3.614739e-05  
## oty\_taxable\_annual\_wages\_chg 9.712103e-01 9.807860e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 1.093593e-04 2.247588e-04  
## oty\_annual\_contributions\_chg -8.631331e-01 -8.713379e-01  
## oty\_annual\_contributions\_pct\_chg -2.322915e-04 2.590830e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 1.006584e-03 1.083069e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 7.399823e-05 7.942909e-05  
## oty\_avg\_annual\_pay\_chg 1.005893e-03 1.082550e-03  
## oty\_avg\_annual\_pay\_pct\_chg 7.706793e-05 8.275358e-05  
## total\_annual\_wages taxable\_annual\_wages  
## annual\_avg\_estabs 9.793355e-01 9.872725e-01  
## annual\_avg\_emplvl 9.946181e-01 9.894928e-01  
## total\_annual\_wages 1.000000e+00 9.863994e-01  
## taxable\_annual\_wages 9.863994e-01 1.000000e+00  
## annual\_contributions 9.854710e-01 9.953382e-01  
## annual\_avg\_wkly\_wage 1.351022e-02 1.049512e-02  
## avg\_annual\_pay 1.351023e-02 1.049509e-02  
## lq\_annual\_avg\_estabs -2.083437e-04 -2.056437e-04  
## lq\_annual\_avg\_emplvl 4.228200e-05 1.796888e-05  
## lq\_total\_annual\_wages 9.279886e-06 -7.378696e-06  
## lq\_taxable\_annual\_wages 2.028038e-04 2.705183e-04  
## lq\_annual\_contributions 1.335527e-04 1.795278e-04  
## lq\_annual\_avg\_wkly\_wage 9.500181e-03 9.227069e-03  
## lq\_avg\_annual\_pay 9.500954e-03 9.227644e-03  
## oty\_annual\_avg\_estabs\_chg 9.131838e-01 9.151000e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -4.566917e-04 -4.743376e-04  
## oty\_annual\_avg\_emplvl\_chg 9.746165e-01 9.867493e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 3.107054e-04 4.477687e-04  
## oty\_total\_annual\_wages\_chg 9.939038e-01 9.857033e-01  
## oty\_total\_annual\_wages\_pct\_chg 4.241368e-05 4.556067e-05  
## oty\_taxable\_annual\_wages\_chg 9.800598e-01 9.837473e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 2.302964e-04 1.356876e-04  
## oty\_annual\_contributions\_chg -8.650946e-01 -8.914731e-01  
## oty\_annual\_contributions\_pct\_chg 2.173006e-04 -2.760370e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 1.690570e-03 1.184240e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 9.600913e-05 8.360450e-05  
## oty\_avg\_annual\_pay\_chg 1.690125e-03 1.183642e-03  
## oty\_avg\_annual\_pay\_pct\_chg 9.998311e-05 8.710981e-05  
## annual\_contributions annual\_avg\_wkly\_wage  
## annual\_avg\_estabs 9.845771e-01 0.009459478  
## annual\_avg\_emplvl 9.844440e-01 0.010113641  
## total\_annual\_wages 9.854710e-01 0.013510223  
## taxable\_annual\_wages 9.953382e-01 0.010495121  
## annual\_contributions 1.000000e+00 0.010986833  
## annual\_avg\_wkly\_wage 1.098683e-02 1.000000000  
## avg\_annual\_pay 1.098687e-02 0.999999948  
## lq\_annual\_avg\_estabs -2.055741e-04 -0.008561596  
## lq\_annual\_avg\_emplvl 1.667518e-05 0.026648998  
## lq\_total\_annual\_wages -8.464126e-06 0.024412483  
## lq\_taxable\_annual\_wages 2.418934e-04 0.034423907  
## lq\_annual\_contributions 1.778258e-04 0.029963517  
## lq\_annual\_avg\_wkly\_wage 9.183180e-03 0.762985694  
## lq\_avg\_annual\_pay 9.183647e-03 0.762965830  
## oty\_annual\_avg\_estabs\_chg 9.189017e-01 0.009674155  
## oty\_annual\_avg\_estabs\_pct\_chg -4.656916e-04 -0.007475844  
## oty\_annual\_avg\_emplvl\_chg 9.853402e-01 0.009110906  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.836003e-04 0.063574080  
## oty\_total\_annual\_wages\_chg 9.876977e-01 0.014829846  
## oty\_total\_annual\_wages\_pct\_chg 4.938001e-05 0.014560174  
## oty\_taxable\_annual\_wages\_chg 9.822547e-01 0.010674431  
## oty\_taxable\_annual\_wages\_pct\_chg 1.258211e-04 0.011151365  
## oty\_annual\_contributions\_chg -8.767926e-01 -0.008880963  
## oty\_annual\_contributions\_pct\_chg -2.263964e-04 0.012916970  
## oty\_annual\_avg\_wkly\_wage\_chg 1.267445e-03 0.338190489  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 8.696442e-05 0.015911907  
## oty\_avg\_annual\_pay\_chg 1.267109e-03 0.338188874  
## oty\_avg\_annual\_pay\_pct\_chg 9.060670e-05 0.016437029  
## avg\_annual\_pay lq\_annual\_avg\_estabs  
## annual\_avg\_estabs 0.009459412 -0.0002104964  
## annual\_avg\_emplvl 0.010113610 -0.0002098775  
## total\_annual\_wages 0.013510228 -0.0002083437  
## taxable\_annual\_wages 0.010495089 -0.0002056437  
## annual\_contributions 0.010986865 -0.0002055741  
## annual\_avg\_wkly\_wage 0.999999948 -0.0085615962  
## avg\_annual\_pay 1.000000000 -0.0085616629  
## lq\_annual\_avg\_estabs -0.008561663 1.0000000000  
## lq\_annual\_avg\_emplvl 0.026649023 0.1062468607  
## lq\_total\_annual\_wages 0.024412708 0.1145212304  
## lq\_taxable\_annual\_wages 0.034423746 0.0407523568  
## lq\_annual\_contributions 0.029963467 0.0355421652  
## lq\_annual\_avg\_wkly\_wage 0.762985263 -0.0101973798  
## lq\_avg\_annual\_pay 0.762965569 -0.0101978946  
## oty\_annual\_avg\_estabs\_chg 0.009674282 -0.0001719184  
## oty\_annual\_avg\_estabs\_pct\_chg -0.007475172 0.0020199649  
## oty\_annual\_avg\_emplvl\_chg 0.009110887 -0.0002033500  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.063574281 -0.0013310460  
## oty\_total\_annual\_wages\_chg 0.014829885 -0.0002030880  
## oty\_total\_annual\_wages\_pct\_chg 0.014558936 -0.0001710462  
## oty\_taxable\_annual\_wages\_chg 0.010674335 -0.0002023640  
## oty\_taxable\_annual\_wages\_pct\_chg 0.011151363 -0.0002401246  
## oty\_annual\_contributions\_chg -0.008880968 0.0001811165  
## oty\_annual\_contributions\_pct\_chg 0.012917266 -0.0002401905  
## oty\_annual\_avg\_wkly\_wage\_chg 0.338190377 -0.0011435317  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.015910854 -0.0001740132  
## oty\_avg\_annual\_pay\_chg 0.338189072 -0.0011441296  
## oty\_avg\_annual\_pay\_pct\_chg 0.016436035 -0.0001799642  
## lq\_annual\_avg\_emplvl  
## annual\_avg\_estabs -2.573698e-05  
## annual\_avg\_emplvl 1.848801e-05  
## total\_annual\_wages 4.228200e-05  
## taxable\_annual\_wages 1.796888e-05  
## annual\_contributions 1.667518e-05  
## annual\_avg\_wkly\_wage 2.664900e-02  
## avg\_annual\_pay 2.664902e-02  
## lq\_annual\_avg\_estabs 1.062469e-01  
## lq\_annual\_avg\_emplvl 1.000000e+00  
## lq\_total\_annual\_wages 9.032182e-01  
## lq\_taxable\_annual\_wages 2.638993e-01  
## lq\_annual\_contributions 2.173727e-01  
## lq\_annual\_avg\_wkly\_wage 3.589109e-02  
## lq\_avg\_annual\_pay 3.588629e-02  
## oty\_annual\_avg\_estabs\_chg 1.766933e-04  
## oty\_annual\_avg\_estabs\_pct\_chg 4.820487e-05  
## oty\_annual\_avg\_emplvl\_chg 4.532012e-07  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.052968e-03  
## oty\_total\_annual\_wages\_chg 5.585496e-05  
## oty\_total\_annual\_wages\_pct\_chg 2.384916e-04  
## oty\_taxable\_annual\_wages\_chg 1.939965e-05  
## oty\_taxable\_annual\_wages\_pct\_chg 1.922866e-04  
## oty\_annual\_contributions\_chg -1.888375e-05  
## oty\_annual\_contributions\_pct\_chg 2.554902e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 3.828788e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 3.463134e-04  
## oty\_avg\_annual\_pay\_chg 3.823981e-03  
## oty\_avg\_annual\_pay\_pct\_chg 3.601937e-04  
## lq\_total\_annual\_wages  
## annual\_avg\_estabs -5.054296e-05  
## annual\_avg\_emplvl -8.991811e-06  
## total\_annual\_wages 9.279886e-06  
## taxable\_annual\_wages -7.378696e-06  
## annual\_contributions -8.464126e-06  
## annual\_avg\_wkly\_wage 2.441248e-02  
## avg\_annual\_pay 2.441271e-02  
## lq\_annual\_avg\_estabs 1.145212e-01  
## lq\_annual\_avg\_emplvl 9.032182e-01  
## lq\_total\_annual\_wages 1.000000e+00  
## lq\_taxable\_annual\_wages 3.302446e-01  
## lq\_annual\_contributions 2.635839e-01  
## lq\_annual\_avg\_wkly\_wage 3.605785e-02  
## lq\_avg\_annual\_pay 3.605320e-02  
## oty\_annual\_avg\_estabs\_chg 6.307813e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 3.041628e-04  
## oty\_annual\_avg\_emplvl\_chg -2.278975e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.366544e-03  
## oty\_total\_annual\_wages\_chg 2.131995e-05  
## oty\_total\_annual\_wages\_pct\_chg 2.201220e-04  
## oty\_taxable\_annual\_wages\_chg -8.215396e-06  
## oty\_taxable\_annual\_wages\_pct\_chg 1.515235e-04  
## oty\_annual\_contributions\_chg -2.783002e-06  
## oty\_annual\_contributions\_pct\_chg 1.420367e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 4.326751e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 3.523293e-04  
## oty\_avg\_annual\_pay\_chg 4.322269e-03  
## oty\_avg\_annual\_pay\_pct\_chg 3.664123e-04  
## lq\_taxable\_annual\_wages  
## annual\_avg\_estabs 0.0001280650  
## annual\_avg\_emplvl 0.0001762700  
## total\_annual\_wages 0.0002028038  
## taxable\_annual\_wages 0.0002705183  
## annual\_contributions 0.0002418934  
## annual\_avg\_wkly\_wage 0.0344239066  
## avg\_annual\_pay 0.0344237459  
## lq\_annual\_avg\_estabs 0.0407523568  
## lq\_annual\_avg\_emplvl 0.2638993252  
## lq\_total\_annual\_wages 0.3302445797  
## lq\_taxable\_annual\_wages 1.0000000000  
## lq\_annual\_contributions 0.8498554538  
## lq\_annual\_avg\_wkly\_wage 0.0551532682  
## lq\_avg\_annual\_pay 0.0551513410  
## oty\_annual\_avg\_estabs\_chg 0.0004339986  
## oty\_annual\_avg\_estabs\_pct\_chg -0.0001634154  
## oty\_annual\_avg\_emplvl\_chg 0.0002317044  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0059316149  
## oty\_total\_annual\_wages\_chg 0.0002540708  
## oty\_total\_annual\_wages\_pct\_chg 0.0004846174  
## oty\_taxable\_annual\_wages\_chg 0.0003303864  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0010476052  
## oty\_annual\_contributions\_chg -0.0001704925  
## oty\_annual\_contributions\_pct\_chg 0.0027459607  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0044964536  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0004112763  
## oty\_avg\_annual\_pay\_chg 0.0044960839  
## oty\_avg\_annual\_pay\_pct\_chg 0.0004288754  
## lq\_annual\_contributions  
## annual\_avg\_estabs 6.820105e-05  
## annual\_avg\_emplvl 1.144750e-04  
## total\_annual\_wages 1.335527e-04  
## taxable\_annual\_wages 1.795278e-04  
## annual\_contributions 1.778258e-04  
## annual\_avg\_wkly\_wage 2.996352e-02  
## avg\_annual\_pay 2.996347e-02  
## lq\_annual\_avg\_estabs 3.554217e-02  
## lq\_annual\_avg\_emplvl 2.173727e-01  
## lq\_total\_annual\_wages 2.635839e-01  
## lq\_taxable\_annual\_wages 8.498555e-01  
## lq\_annual\_contributions 1.000000e+00  
## lq\_annual\_avg\_wkly\_wage 4.969348e-02  
## lq\_avg\_annual\_pay 4.969073e-02  
## oty\_annual\_avg\_estabs\_chg 3.095544e-04  
## oty\_annual\_avg\_estabs\_pct\_chg -3.730961e-05  
## oty\_annual\_avg\_emplvl\_chg 1.354558e-04  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.610962e-03  
## oty\_total\_annual\_wages\_chg 1.607856e-04  
## oty\_total\_annual\_wages\_pct\_chg 4.051675e-04  
## oty\_taxable\_annual\_wages\_chg 2.726897e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 9.984711e-04  
## oty\_annual\_contributions\_chg -8.275078e-05  
## oty\_annual\_contributions\_pct\_chg 5.831921e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.973134e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 4.082155e-04  
## oty\_avg\_annual\_pay\_chg 3.972459e-03  
## oty\_avg\_annual\_pay\_pct\_chg 4.255312e-04  
## lq\_annual\_avg\_wkly\_wage lq\_avg\_annual\_pay  
## annual\_avg\_estabs 0.008710513 0.008711500  
## annual\_avg\_emplvl 0.009420326 0.009421189  
## total\_annual\_wages 0.009500181 0.009500954  
## taxable\_annual\_wages 0.009227069 0.009227644  
## annual\_contributions 0.009183180 0.009183647  
## annual\_avg\_wkly\_wage 0.762985694 0.762965830  
## avg\_annual\_pay 0.762985263 0.762965569  
## lq\_annual\_avg\_estabs -0.010197380 -0.010197895  
## lq\_annual\_avg\_emplvl 0.035891092 0.035886286  
## lq\_total\_annual\_wages 0.036057854 0.036053197  
## lq\_taxable\_annual\_wages 0.055153268 0.055151341  
## lq\_annual\_contributions 0.049693484 0.049690734  
## lq\_annual\_avg\_wkly\_wage 1.000000000 0.999995950  
## lq\_avg\_annual\_pay 0.999995950 1.000000000  
## oty\_annual\_avg\_estabs\_chg 0.007964215 0.007964651  
## oty\_annual\_avg\_estabs\_pct\_chg -0.016153058 -0.016156864  
## oty\_annual\_avg\_emplvl\_chg 0.008935153 0.008935962  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.067716063 0.067718324  
## oty\_total\_annual\_wages\_chg 0.009364843 0.009365926  
## oty\_total\_annual\_wages\_pct\_chg 0.013208962 0.013209330  
## oty\_taxable\_annual\_wages\_chg 0.009078553 0.009079288  
## oty\_taxable\_annual\_wages\_pct\_chg 0.013415448 0.013415269  
## oty\_annual\_contributions\_chg -0.008474295 -0.008473749  
## oty\_annual\_contributions\_pct\_chg 0.016380660 0.016377048  
## oty\_annual\_avg\_wkly\_wage\_chg 0.146514021 0.146499891  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.015980124 0.015979543  
## oty\_avg\_annual\_pay\_chg 0.146511308 0.146497684  
## oty\_avg\_annual\_pay\_pct\_chg 0.016528158 0.016527664  
## oty\_annual\_avg\_estabs\_chg  
## annual\_avg\_estabs 9.470161e-01  
## annual\_avg\_emplvl 9.138888e-01  
## total\_annual\_wages 9.131838e-01  
## taxable\_annual\_wages 9.151000e-01  
## annual\_contributions 9.189017e-01  
## annual\_avg\_wkly\_wage 9.674155e-03  
## avg\_annual\_pay 9.674282e-03  
## lq\_annual\_avg\_estabs -1.719184e-04  
## lq\_annual\_avg\_emplvl 1.766933e-04  
## lq\_total\_annual\_wages 6.307813e-05  
## lq\_taxable\_annual\_wages 4.339986e-04  
## lq\_annual\_contributions 3.095544e-04  
## lq\_annual\_avg\_wkly\_wage 7.964215e-03  
## lq\_avg\_annual\_pay 7.964651e-03  
## oty\_annual\_avg\_estabs\_chg 1.000000e+00  
## oty\_annual\_avg\_estabs\_pct\_chg 7.093236e-03  
## oty\_annual\_avg\_emplvl\_chg 9.292865e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.025404e-03  
## oty\_total\_annual\_wages\_chg 9.211880e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.024419e-04  
## oty\_taxable\_annual\_wages\_chg 9.013644e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 3.938296e-04  
## oty\_annual\_contributions\_chg -7.812147e-01  
## oty\_annual\_contributions\_pct\_chg 2.698927e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 1.275496e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 8.820686e-05  
## oty\_avg\_annual\_pay\_chg 1.274969e-03  
## oty\_avg\_annual\_pay\_pct\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg  
## annual\_avg\_estabs -3.675062e-04  
## annual\_avg\_emplvl -4.780059e-04  
## total\_annual\_wages -4.566917e-04  
## taxable\_annual\_wages -4.743376e-04  
## annual\_contributions -4.656916e-04  
## annual\_avg\_wkly\_wage -7.475844e-03  
## avg\_annual\_pay -7.475172e-03  
## lq\_annual\_avg\_estabs 2.019965e-03  
## lq\_annual\_avg\_emplvl 4.820487e-05  
## lq\_total\_annual\_wages 3.041628e-04  
## lq\_taxable\_annual\_wages -1.634154e-04  
## lq\_annual\_contributions -3.730961e-05  
## lq\_annual\_avg\_wkly\_wage -1.615306e-02  
## lq\_avg\_annual\_pay -1.615686e-02  
## oty\_annual\_avg\_estabs\_chg 7.093236e-03  
## oty\_annual\_avg\_estabs\_pct\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.138907e-01  
## oty\_total\_annual\_wages\_chg -2.672994e-04  
## oty\_total\_annual\_wages\_pct\_chg 1.543635e-02  
## oty\_taxable\_annual\_wages\_chg -2.239930e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.189892e-02  
## oty\_annual\_contributions\_chg 7.700292e-04  
## oty\_annual\_contributions\_pct\_chg 1.958854e-02  
## oty\_annual\_avg\_wkly\_wage\_chg 1.806866e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 7.567398e-04  
## oty\_avg\_annual\_pay\_chg 1.806449e-03  
## oty\_avg\_annual\_pay\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg  
## annual\_avg\_estabs 9.848161e-01  
## annual\_avg\_emplvl 9.821288e-01  
## total\_annual\_wages 9.746165e-01  
## taxable\_annual\_wages 9.867493e-01  
## annual\_contributions 9.853402e-01  
## annual\_avg\_wkly\_wage 9.110906e-03  
## avg\_annual\_pay 9.110887e-03  
## lq\_annual\_avg\_estabs -2.033500e-04  
## lq\_annual\_avg\_emplvl 4.532012e-07  
## lq\_total\_annual\_wages -2.278975e-05  
## lq\_taxable\_annual\_wages 2.317044e-04  
## lq\_annual\_contributions 1.354558e-04  
## lq\_annual\_avg\_wkly\_wage 8.935153e-03  
## lq\_avg\_annual\_pay 8.935962e-03  
## oty\_annual\_avg\_estabs\_chg 9.292865e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.807178e-03  
## oty\_total\_annual\_wages\_chg 9.815811e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.063543e-04  
## oty\_taxable\_annual\_wages\_chg 9.767026e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 4.426258e-04  
## oty\_annual\_contributions\_chg -8.572621e-01  
## oty\_annual\_contributions\_pct\_chg 5.005389e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 7.647589e-04  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 5.394112e-05  
## oty\_avg\_annual\_pay\_chg 7.638574e-04  
## oty\_avg\_annual\_pay\_pct\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg  
## annual\_avg\_estabs 0.0005993884  
## annual\_avg\_emplvl 0.0003325045  
## total\_annual\_wages 0.0003107054  
## taxable\_annual\_wages 0.0004477687  
## annual\_contributions 0.0004836003  
## annual\_avg\_wkly\_wage 0.0635740801  
## avg\_annual\_pay 0.0635742812  
## lq\_annual\_avg\_estabs -0.0013310460  
## lq\_annual\_avg\_emplvl 0.0020529681  
## lq\_total\_annual\_wages 0.0013665438  
## lq\_taxable\_annual\_wages 0.0059316149  
## lq\_annual\_contributions 0.0046109622  
## lq\_annual\_avg\_wkly\_wage 0.0677160631  
## lq\_avg\_annual\_pay 0.0677183237  
## oty\_annual\_avg\_estabs\_chg 0.0040254039  
## oty\_annual\_avg\_estabs\_pct\_chg 0.1138907430  
## oty\_annual\_avg\_emplvl\_chg 0.0048071782  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.0000000000  
## oty\_total\_annual\_wages\_chg 0.0021446051  
## oty\_total\_annual\_wages\_pct\_chg 0.0813343520  
## oty\_taxable\_annual\_wages\_chg 0.0022657179  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0601069631  
## oty\_annual\_contributions\_chg 0.0019402235  
## oty\_annual\_contributions\_pct\_chg 0.1097278601  
## oty\_annual\_avg\_wkly\_wage\_chg -0.0135281227  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0028411488  
## oty\_avg\_annual\_pay\_chg -0.0135267362  
## oty\_avg\_annual\_pay\_pct\_chg 0.0029341643  
## oty\_total\_annual\_wages\_chg  
## annual\_avg\_estabs 9.802549e-01  
## annual\_avg\_emplvl 9.853406e-01  
## total\_annual\_wages 9.939038e-01  
## taxable\_annual\_wages 9.857033e-01  
## annual\_contributions 9.876977e-01  
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## avg\_annual\_pay 1.482988e-02  
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## lq\_annual\_avg\_emplvl 5.585496e-05  
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## lq\_taxable\_annual\_wages 2.540708e-04  
## lq\_annual\_contributions 1.607856e-04  
## lq\_annual\_avg\_wkly\_wage 9.364843e-03  
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## oty\_annual\_avg\_estabs\_chg 9.211880e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -2.672994e-04  
## oty\_annual\_avg\_emplvl\_chg 9.815811e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.144605e-03  
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## oty\_total\_annual\_wages\_pct\_chg 2.081526e-04  
## oty\_taxable\_annual\_wages\_chg 9.811283e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 3.310573e-04  
## oty\_annual\_contributions\_chg -8.523860e-01  
## oty\_annual\_contributions\_pct\_chg 3.328761e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 4.238939e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 1.992161e-04  
## oty\_avg\_annual\_pay\_chg 4.238406e-03  
## oty\_avg\_annual\_pay\_pct\_chg 2.071458e-04  
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## total\_annual\_wages 4.241368e-05  
## taxable\_annual\_wages 4.556067e-05  
## annual\_contributions 4.938001e-05  
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## oty\_annual\_avg\_estabs\_chg 3.024419e-04  
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## oty\_annual\_avg\_emplvl\_chg 3.063543e-04  
## oty\_annual\_avg\_emplvl\_pct\_chg 8.133435e-02  
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## oty\_total\_annual\_wages\_pct\_chg 1.000000e+00  
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## oty\_taxable\_annual\_wages\_pct\_chg 5.649533e-03  
## oty\_annual\_contributions\_chg 1.215768e-04  
## oty\_annual\_contributions\_pct\_chg 1.027751e-02  
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## oty\_annual\_avg\_wkly\_wage\_pct\_chg 8.740225e-01  
## oty\_avg\_annual\_pay\_chg 3.122798e-02  
## oty\_avg\_annual\_pay\_pct\_chg 8.741519e-01  
## oty\_taxable\_annual\_wages\_chg  
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## taxable\_annual\_wages 9.837473e-01  
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## oty\_annual\_avg\_estabs\_chg 9.013644e-01  
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## oty\_annual\_avg\_emplvl\_pct\_chg 2.265718e-03  
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## oty\_taxable\_annual\_wages\_pct\_chg 9.878633e-04  
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## oty\_annual\_contributions\_pct\_chg 1.127843e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 1.542510e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 1.042345e-04  
## oty\_avg\_annual\_pay\_chg 1.541665e-03  
## oty\_avg\_annual\_pay\_pct\_chg 1.084494e-04  
## oty\_taxable\_annual\_wages\_pct\_chg  
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## total\_annual\_wages 0.0002302964  
## taxable\_annual\_wages 0.0001356876  
## annual\_contributions 0.0001258211  
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## lq\_annual\_avg\_estabs -0.0002401246  
## lq\_annual\_avg\_emplvl 0.0001922866  
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## lq\_taxable\_annual\_wages 0.0010476052  
## lq\_annual\_contributions 0.0009984711  
## lq\_annual\_avg\_wkly\_wage 0.0134154478  
## lq\_avg\_annual\_pay 0.0134152686  
## oty\_annual\_avg\_estabs\_chg 0.0003938296  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0118989234  
## oty\_annual\_avg\_emplvl\_chg 0.0004426258  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0601069631  
## oty\_total\_annual\_wages\_chg 0.0003310573  
## oty\_total\_annual\_wages\_pct\_chg 0.0056495328  
## oty\_taxable\_annual\_wages\_chg 0.0009878633  
## oty\_taxable\_annual\_wages\_pct\_chg 1.0000000000  
## oty\_annual\_contributions\_chg 0.0006658204  
## oty\_annual\_contributions\_pct\_chg 0.3580519080  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0030797901  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0010483198  
## oty\_avg\_annual\_pay\_chg 0.0030801375  
## oty\_avg\_annual\_pay\_pct\_chg 0.0010907424  
## oty\_annual\_contributions\_chg  
## annual\_avg\_estabs -8.631331e-01  
## annual\_avg\_emplvl -8.713379e-01  
## total\_annual\_wages -8.650946e-01  
## taxable\_annual\_wages -8.914731e-01  
## annual\_contributions -8.767926e-01  
## annual\_avg\_wkly\_wage -8.880963e-03  
## avg\_annual\_pay -8.880968e-03  
## lq\_annual\_avg\_estabs 1.811165e-04  
## lq\_annual\_avg\_emplvl -1.888375e-05  
## lq\_total\_annual\_wages -2.783002e-06  
## lq\_taxable\_annual\_wages -1.704925e-04  
## lq\_annual\_contributions -8.275078e-05  
## lq\_annual\_avg\_wkly\_wage -8.474295e-03  
## lq\_avg\_annual\_pay -8.473749e-03  
## oty\_annual\_avg\_estabs\_chg -7.812147e-01  
## oty\_annual\_avg\_estabs\_pct\_chg 7.700292e-04  
## oty\_annual\_avg\_emplvl\_chg -8.572621e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.940223e-03  
## oty\_total\_annual\_wages\_chg -8.523860e-01  
## oty\_total\_annual\_wages\_pct\_chg 1.215768e-04  
## oty\_taxable\_annual\_wages\_chg -8.193021e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 6.658204e-04  
## oty\_annual\_contributions\_chg 1.000000e+00  
## oty\_annual\_contributions\_pct\_chg 2.856920e-03  
## oty\_annual\_avg\_wkly\_wage\_chg -4.245500e-04  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg -4.229288e-05  
## oty\_avg\_annual\_pay\_chg -4.236233e-04  
## oty\_avg\_annual\_pay\_pct\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg  
## annual\_avg\_estabs -0.0002322915  
## annual\_avg\_emplvl 0.0002590830  
## total\_annual\_wages 0.0002173006  
## taxable\_annual\_wages -0.0002760370  
## annual\_contributions -0.0002263964  
## annual\_avg\_wkly\_wage 0.0129169703  
## avg\_annual\_pay 0.0129172664  
## lq\_annual\_avg\_estabs -0.0002401905  
## lq\_annual\_avg\_emplvl 0.0002554902  
## lq\_total\_annual\_wages 0.0001420367  
## lq\_taxable\_annual\_wages 0.0027459607  
## lq\_annual\_contributions 0.0058319213  
## lq\_annual\_avg\_wkly\_wage 0.0163806603  
## lq\_avg\_annual\_pay 0.0163770479  
## oty\_annual\_avg\_estabs\_chg 0.0002698927  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0195885383  
## oty\_annual\_avg\_emplvl\_chg 0.0005005389  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.1097278601  
## oty\_total\_annual\_wages\_chg 0.0003328761  
## oty\_total\_annual\_wages\_pct\_chg 0.0102775060  
## oty\_taxable\_annual\_wages\_chg 0.0011278428  
## oty\_taxable\_annual\_wages\_pct\_chg 0.3580519080  
## oty\_annual\_contributions\_chg 0.0028569203  
## oty\_annual\_contributions\_pct\_chg 1.0000000000  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0067594232  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0021717370  
## oty\_avg\_annual\_pay\_chg 0.0067616347  
## oty\_avg\_annual\_pay\_pct\_chg 0.0022588086  
## oty\_annual\_avg\_wkly\_wage\_chg  
## annual\_avg\_estabs 0.0010065842  
## annual\_avg\_emplvl 0.0010830695  
## total\_annual\_wages 0.0016905700  
## taxable\_annual\_wages 0.0011842396  
## annual\_contributions 0.0012674451  
## annual\_avg\_wkly\_wage 0.3381904895  
## avg\_annual\_pay 0.3381903768  
## lq\_annual\_avg\_estabs -0.0011435317  
## lq\_annual\_avg\_emplvl 0.0038287882  
## lq\_total\_annual\_wages 0.0043267512  
## lq\_taxable\_annual\_wages 0.0044964536  
## lq\_annual\_contributions 0.0039731338  
## lq\_annual\_avg\_wkly\_wage 0.1465140209  
## lq\_avg\_annual\_pay 0.1464998910  
## oty\_annual\_avg\_estabs\_chg 0.0012754958  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0018068656  
## oty\_annual\_avg\_emplvl\_chg 0.0007647589  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0135281227  
## oty\_total\_annual\_wages\_chg 0.0042389392  
## oty\_total\_annual\_wages\_pct\_chg 0.0312322004  
## oty\_taxable\_annual\_wages\_chg 0.0015425105  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0030797901  
## oty\_annual\_contributions\_chg -0.0004245500  
## oty\_annual\_contributions\_pct\_chg 0.0067594232  
## oty\_annual\_avg\_wkly\_wage\_chg 1.0000000000  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0385049283  
## oty\_avg\_annual\_pay\_chg 0.9999989966  
## oty\_avg\_annual\_pay\_pct\_chg 0.0396159688  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg  
## annual\_avg\_estabs 7.399823e-05  
## annual\_avg\_emplvl 7.942909e-05  
## total\_annual\_wages 9.600913e-05  
## taxable\_annual\_wages 8.360450e-05  
## annual\_contributions 8.696442e-05  
## annual\_avg\_wkly\_wage 1.591191e-02  
## avg\_annual\_pay 1.591085e-02  
## lq\_annual\_avg\_estabs -1.740132e-04  
## lq\_annual\_avg\_emplvl 3.463134e-04  
## lq\_total\_annual\_wages 3.523293e-04  
## lq\_taxable\_annual\_wages 4.112763e-04  
## lq\_annual\_contributions 4.082155e-04  
## lq\_annual\_avg\_wkly\_wage 1.598012e-02  
## lq\_avg\_annual\_pay 1.597954e-02  
## oty\_annual\_avg\_estabs\_chg 8.820686e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 7.567398e-04  
## oty\_annual\_avg\_emplvl\_chg 5.394112e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.841149e-03  
## oty\_total\_annual\_wages\_chg 1.992161e-04  
## oty\_total\_annual\_wages\_pct\_chg 8.740225e-01  
## oty\_taxable\_annual\_wages\_chg 1.042345e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.048320e-03  
## oty\_annual\_contributions\_chg -4.229288e-05  
## oty\_annual\_contributions\_pct\_chg 2.171737e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.850493e-02  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 1.000000e+00  
## oty\_avg\_annual\_pay\_chg 3.850112e-02  
## oty\_avg\_annual\_pay\_pct\_chg 9.999939e-01  
## oty\_avg\_annual\_pay\_chg  
## annual\_avg\_estabs 0.0010058930  
## annual\_avg\_emplvl 0.0010825502  
## total\_annual\_wages 0.0016901249  
## taxable\_annual\_wages 0.0011836422  
## annual\_contributions 0.0012671092  
## annual\_avg\_wkly\_wage 0.3381888738  
## avg\_annual\_pay 0.3381890717  
## lq\_annual\_avg\_estabs -0.0011441296  
## lq\_annual\_avg\_emplvl 0.0038239814  
## lq\_total\_annual\_wages 0.0043222691  
## lq\_taxable\_annual\_wages 0.0044960839  
## lq\_annual\_contributions 0.0039724586  
## lq\_annual\_avg\_wkly\_wage 0.1465113082  
## lq\_avg\_annual\_pay 0.1464976841  
## oty\_annual\_avg\_estabs\_chg 0.0012749692  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0018064489  
## oty\_annual\_avg\_emplvl\_chg 0.0007638574  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0135267362  
## oty\_total\_annual\_wages\_chg 0.0042384059  
## oty\_total\_annual\_wages\_pct\_chg 0.0312279792  
## oty\_taxable\_annual\_wages\_chg 0.0015416652  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0030801375  
## oty\_annual\_contributions\_chg -0.0004236233  
## oty\_annual\_contributions\_pct\_chg 0.0067616347  
## oty\_annual\_avg\_wkly\_wage\_chg 0.9999989966  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0385011231  
## oty\_avg\_annual\_pay\_chg 1.0000000000  
## oty\_avg\_annual\_pay\_pct\_chg 0.0396125653  
## oty\_avg\_annual\_pay\_pct\_chg  
## annual\_avg\_estabs 7.706793e-05  
## annual\_avg\_emplvl 8.275358e-05  
## total\_annual\_wages 9.998311e-05  
## taxable\_annual\_wages 8.710981e-05  
## annual\_contributions 9.060670e-05  
## annual\_avg\_wkly\_wage 1.643703e-02  
## avg\_annual\_pay 1.643604e-02  
## lq\_annual\_avg\_estabs -1.799642e-04  
## lq\_annual\_avg\_emplvl 3.601937e-04  
## lq\_total\_annual\_wages 3.664123e-04  
## lq\_taxable\_annual\_wages 4.288754e-04  
## lq\_annual\_contributions 4.255312e-04  
## lq\_annual\_avg\_wkly\_wage 1.652816e-02  
## lq\_avg\_annual\_pay 1.652766e-02  
## oty\_annual\_avg\_estabs\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.934164e-03  
## oty\_total\_annual\_wages\_chg 2.071458e-04  
## oty\_total\_annual\_wages\_pct\_chg 8.741519e-01  
## oty\_taxable\_annual\_wages\_chg 1.084494e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.090742e-03  
## oty\_annual\_contributions\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg 2.258809e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.961597e-02  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 9.999939e-01  
## oty\_avg\_annual\_pay\_chg 3.961257e-02  
## oty\_avg\_annual\_pay\_pct\_chg 1.000000e+00

In order to analysis the correlation of each two pairs variables, I analyze the data part by part.

For column 1 to column 7 of keep\_data which are about annual data:

annual.cor = cor(keep\_data[,1:7])  
annual.cor

## annual\_avg\_estabs annual\_avg\_emplvl  
## annual\_avg\_estabs 1.000000000 0.98337654  
## annual\_avg\_emplvl 0.983376537 1.00000000  
## total\_annual\_wages 0.979335515 0.99461814  
## taxable\_annual\_wages 0.987272494 0.98949277  
## annual\_contributions 0.984577111 0.98444402  
## annual\_avg\_wkly\_wage 0.009459478 0.01011364  
## avg\_annual\_pay 0.009459412 0.01011361  
## total\_annual\_wages taxable\_annual\_wages  
## annual\_avg\_estabs 0.97933552 0.98727249  
## annual\_avg\_emplvl 0.99461814 0.98949277  
## total\_annual\_wages 1.00000000 0.98639939  
## taxable\_annual\_wages 0.98639939 1.00000000  
## annual\_contributions 0.98547097 0.99533815  
## annual\_avg\_wkly\_wage 0.01351022 0.01049512  
## avg\_annual\_pay 0.01351023 0.01049509  
## annual\_contributions annual\_avg\_wkly\_wage  
## annual\_avg\_estabs 0.98457711 0.009459478  
## annual\_avg\_emplvl 0.98444402 0.010113641  
## total\_annual\_wages 0.98547097 0.013510223  
## taxable\_annual\_wages 0.99533815 0.010495121  
## annual\_contributions 1.00000000 0.010986833  
## annual\_avg\_wkly\_wage 0.01098683 1.000000000  
## avg\_annual\_pay 0.01098687 0.999999948  
## avg\_annual\_pay  
## annual\_avg\_estabs 0.009459412  
## annual\_avg\_emplvl 0.010113610  
## total\_annual\_wages 0.013510228  
## taxable\_annual\_wages 0.010495089  
## annual\_contributions 0.010986865  
## annual\_avg\_wkly\_wage 0.999999948  
## avg\_annual\_pay 1.000000000

The result of correlation shows that avg\_annual\_pay is highly correlative with annual\_ave\_wkly\_wage and the correlation value is 0.999999948.

Annual\_ave\_estabs are highly correlative with annual\_ave\_emplvl, total\_annual\_wages, taxable\_annual\_wages and annual\_contributions and their correlation are larger than 0.97. Amoung them, annual\_avg\_emplvl and total\_annual\_wages have corelation value 0.99461814, and taxable\_annual\_wages and annual\_contributions have corelation value 0.99533815.

Here, I foucus on the perfect correlated variables which is almost to 1. That means the weekly wage can be reflected by the annual pay, and So I keep avg\_annual\_pay.

For column 8 to column 14 of keep\_data which are about lq data:

lq.cor = cor(keep\_data[,8:14])  
lq.cor

## lq\_annual\_avg\_estabs lq\_annual\_avg\_emplvl  
## lq\_annual\_avg\_estabs 1.00000000 0.10624686  
## lq\_annual\_avg\_emplvl 0.10624686 1.00000000  
## lq\_total\_annual\_wages 0.11452123 0.90321817  
## lq\_taxable\_annual\_wages 0.04075236 0.26389933  
## lq\_annual\_contributions 0.03554217 0.21737275  
## lq\_annual\_avg\_wkly\_wage -0.01019738 0.03589109  
## lq\_avg\_annual\_pay -0.01019789 0.03588629  
## lq\_total\_annual\_wages lq\_taxable\_annual\_wages  
## lq\_annual\_avg\_estabs 0.11452123 0.04075236  
## lq\_annual\_avg\_emplvl 0.90321817 0.26389933  
## lq\_total\_annual\_wages 1.00000000 0.33024458  
## lq\_taxable\_annual\_wages 0.33024458 1.00000000  
## lq\_annual\_contributions 0.26358387 0.84985545  
## lq\_annual\_avg\_wkly\_wage 0.03605785 0.05515327  
## lq\_avg\_annual\_pay 0.03605320 0.05515134  
## lq\_annual\_contributions lq\_annual\_avg\_wkly\_wage  
## lq\_annual\_avg\_estabs 0.03554217 -0.01019738  
## lq\_annual\_avg\_emplvl 0.21737275 0.03589109  
## lq\_total\_annual\_wages 0.26358387 0.03605785  
## lq\_taxable\_annual\_wages 0.84985545 0.05515327  
## lq\_annual\_contributions 1.00000000 0.04969348  
## lq\_annual\_avg\_wkly\_wage 0.04969348 1.00000000  
## lq\_avg\_annual\_pay 0.04969073 0.99999595  
## lq\_avg\_annual\_pay  
## lq\_annual\_avg\_estabs -0.01019789  
## lq\_annual\_avg\_emplvl 0.03588629  
## lq\_total\_annual\_wages 0.03605320  
## lq\_taxable\_annual\_wages 0.05515134  
## lq\_annual\_contributions 0.04969073  
## lq\_annual\_avg\_wkly\_wage 0.99999595  
## lq\_avg\_annual\_pay 1.00000000

The result of correlation shows that lq\_annual\_avg\_wkly\_wage and lq\_ave\_annual\_pay are highly correlative and their correlation value is 0.99999595. I will remove the weekly wage.

For column 15 to column 28 of keep\_data which are about oty data:

oty.cor = cor(keep\_data[,15:28])  
oty.cor

## oty\_annual\_avg\_estabs\_chg  
## oty\_annual\_avg\_estabs\_chg 1.000000e+00  
## oty\_annual\_avg\_estabs\_pct\_chg 7.093236e-03  
## oty\_annual\_avg\_emplvl\_chg 9.292865e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.025404e-03  
## oty\_total\_annual\_wages\_chg 9.211880e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.024419e-04  
## oty\_taxable\_annual\_wages\_chg 9.013644e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 3.938296e-04  
## oty\_annual\_contributions\_chg -7.812147e-01  
## oty\_annual\_contributions\_pct\_chg 2.698927e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 1.275496e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 8.820686e-05  
## oty\_avg\_annual\_pay\_chg 1.274969e-03  
## oty\_avg\_annual\_pay\_pct\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg  
## oty\_annual\_avg\_estabs\_chg 7.093236e-03  
## oty\_annual\_avg\_estabs\_pct\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.138907e-01  
## oty\_total\_annual\_wages\_chg -2.672994e-04  
## oty\_total\_annual\_wages\_pct\_chg 1.543635e-02  
## oty\_taxable\_annual\_wages\_chg -2.239930e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.189892e-02  
## oty\_annual\_contributions\_chg 7.700292e-04  
## oty\_annual\_contributions\_pct\_chg 1.958854e-02  
## oty\_annual\_avg\_wkly\_wage\_chg 1.806866e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 7.567398e-04  
## oty\_avg\_annual\_pay\_chg 1.806449e-03  
## oty\_avg\_annual\_pay\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg  
## oty\_annual\_avg\_estabs\_chg 9.292865e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.807178e-03  
## oty\_total\_annual\_wages\_chg 9.815811e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.063543e-04  
## oty\_taxable\_annual\_wages\_chg 9.767026e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 4.426258e-04  
## oty\_annual\_contributions\_chg -8.572621e-01  
## oty\_annual\_contributions\_pct\_chg 5.005389e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 7.647589e-04  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 5.394112e-05  
## oty\_avg\_annual\_pay\_chg 7.638574e-04  
## oty\_avg\_annual\_pay\_pct\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg  
## oty\_annual\_avg\_estabs\_chg 0.004025404  
## oty\_annual\_avg\_estabs\_pct\_chg 0.113890743  
## oty\_annual\_avg\_emplvl\_chg 0.004807178  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.000000000  
## oty\_total\_annual\_wages\_chg 0.002144605  
## oty\_total\_annual\_wages\_pct\_chg 0.081334352  
## oty\_taxable\_annual\_wages\_chg 0.002265718  
## oty\_taxable\_annual\_wages\_pct\_chg 0.060106963  
## oty\_annual\_contributions\_chg 0.001940223  
## oty\_annual\_contributions\_pct\_chg 0.109727860  
## oty\_annual\_avg\_wkly\_wage\_chg -0.013528123  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.002841149  
## oty\_avg\_annual\_pay\_chg -0.013526736  
## oty\_avg\_annual\_pay\_pct\_chg 0.002934164  
## oty\_total\_annual\_wages\_chg  
## oty\_annual\_avg\_estabs\_chg 0.9211879872  
## oty\_annual\_avg\_estabs\_pct\_chg -0.0002672994  
## oty\_annual\_avg\_emplvl\_chg 0.9815810891  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0021446051  
## oty\_total\_annual\_wages\_chg 1.0000000000  
## oty\_total\_annual\_wages\_pct\_chg 0.0002081526  
## oty\_taxable\_annual\_wages\_chg 0.9811283001  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0003310573  
## oty\_annual\_contributions\_chg -0.8523859890  
## oty\_annual\_contributions\_pct\_chg 0.0003328761  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0042389392  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0001992161  
## oty\_avg\_annual\_pay\_chg 0.0042384059  
## oty\_avg\_annual\_pay\_pct\_chg 0.0002071458  
## oty\_total\_annual\_wages\_pct\_chg  
## oty\_annual\_avg\_estabs\_chg 0.0003024419  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0154363535  
## oty\_annual\_avg\_emplvl\_chg 0.0003063543  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0813343520  
## oty\_total\_annual\_wages\_chg 0.0002081526  
## oty\_total\_annual\_wages\_pct\_chg 1.0000000000  
## oty\_taxable\_annual\_wages\_chg 0.0001696696  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0056495328  
## oty\_annual\_contributions\_chg 0.0001215768  
## oty\_annual\_contributions\_pct\_chg 0.0102775060  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0312322004  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.8740224876  
## oty\_avg\_annual\_pay\_chg 0.0312279792  
## oty\_avg\_annual\_pay\_pct\_chg 0.8741518664  
## oty\_taxable\_annual\_wages\_chg  
## oty\_annual\_avg\_estabs\_chg 0.9013644493  
## oty\_annual\_avg\_estabs\_pct\_chg -0.0002239930  
## oty\_annual\_avg\_emplvl\_chg 0.9767026428  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0022657179  
## oty\_total\_annual\_wages\_chg 0.9811283001  
## oty\_total\_annual\_wages\_pct\_chg 0.0001696696  
## oty\_taxable\_annual\_wages\_chg 1.0000000000  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0009878633  
## oty\_annual\_contributions\_chg -0.8193021423  
## oty\_annual\_contributions\_pct\_chg 0.0011278428  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0015425105  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0001042345  
## oty\_avg\_annual\_pay\_chg 0.0015416652  
## oty\_avg\_annual\_pay\_pct\_chg 0.0001084494  
## oty\_taxable\_annual\_wages\_pct\_chg  
## oty\_annual\_avg\_estabs\_chg 0.0003938296  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0118989234  
## oty\_annual\_avg\_emplvl\_chg 0.0004426258  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0601069631  
## oty\_total\_annual\_wages\_chg 0.0003310573  
## oty\_total\_annual\_wages\_pct\_chg 0.0056495328  
## oty\_taxable\_annual\_wages\_chg 0.0009878633  
## oty\_taxable\_annual\_wages\_pct\_chg 1.0000000000  
## oty\_annual\_contributions\_chg 0.0006658204  
## oty\_annual\_contributions\_pct\_chg 0.3580519080  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0030797901  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0010483198  
## oty\_avg\_annual\_pay\_chg 0.0030801375  
## oty\_avg\_annual\_pay\_pct\_chg 0.0010907424  
## oty\_annual\_contributions\_chg  
## oty\_annual\_avg\_estabs\_chg -7.812147e-01  
## oty\_annual\_avg\_estabs\_pct\_chg 7.700292e-04  
## oty\_annual\_avg\_emplvl\_chg -8.572621e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.940223e-03  
## oty\_total\_annual\_wages\_chg -8.523860e-01  
## oty\_total\_annual\_wages\_pct\_chg 1.215768e-04  
## oty\_taxable\_annual\_wages\_chg -8.193021e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 6.658204e-04  
## oty\_annual\_contributions\_chg 1.000000e+00  
## oty\_annual\_contributions\_pct\_chg 2.856920e-03  
## oty\_annual\_avg\_wkly\_wage\_chg -4.245500e-04  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg -4.229288e-05  
## oty\_avg\_annual\_pay\_chg -4.236233e-04  
## oty\_avg\_annual\_pay\_pct\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg  
## oty\_annual\_avg\_estabs\_chg 0.0002698927  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0195885383  
## oty\_annual\_avg\_emplvl\_chg 0.0005005389  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.1097278601  
## oty\_total\_annual\_wages\_chg 0.0003328761  
## oty\_total\_annual\_wages\_pct\_chg 0.0102775060  
## oty\_taxable\_annual\_wages\_chg 0.0011278428  
## oty\_taxable\_annual\_wages\_pct\_chg 0.3580519080  
## oty\_annual\_contributions\_chg 0.0028569203  
## oty\_annual\_contributions\_pct\_chg 1.0000000000  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0067594232  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0021717370  
## oty\_avg\_annual\_pay\_chg 0.0067616347  
## oty\_avg\_annual\_pay\_pct\_chg 0.0022588086  
## oty\_annual\_avg\_wkly\_wage\_chg  
## oty\_annual\_avg\_estabs\_chg 0.0012754958  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0018068656  
## oty\_annual\_avg\_emplvl\_chg 0.0007647589  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0135281227  
## oty\_total\_annual\_wages\_chg 0.0042389392  
## oty\_total\_annual\_wages\_pct\_chg 0.0312322004  
## oty\_taxable\_annual\_wages\_chg 0.0015425105  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0030797901  
## oty\_annual\_contributions\_chg -0.0004245500  
## oty\_annual\_contributions\_pct\_chg 0.0067594232  
## oty\_annual\_avg\_wkly\_wage\_chg 1.0000000000  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0385049283  
## oty\_avg\_annual\_pay\_chg 0.9999989966  
## oty\_avg\_annual\_pay\_pct\_chg 0.0396159688  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg  
## oty\_annual\_avg\_estabs\_chg 8.820686e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 7.567398e-04  
## oty\_annual\_avg\_emplvl\_chg 5.394112e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.841149e-03  
## oty\_total\_annual\_wages\_chg 1.992161e-04  
## oty\_total\_annual\_wages\_pct\_chg 8.740225e-01  
## oty\_taxable\_annual\_wages\_chg 1.042345e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.048320e-03  
## oty\_annual\_contributions\_chg -4.229288e-05  
## oty\_annual\_contributions\_pct\_chg 2.171737e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.850493e-02  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 1.000000e+00  
## oty\_avg\_annual\_pay\_chg 3.850112e-02  
## oty\_avg\_annual\_pay\_pct\_chg 9.999939e-01  
## oty\_avg\_annual\_pay\_chg  
## oty\_annual\_avg\_estabs\_chg 0.0012749692  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0018064489  
## oty\_annual\_avg\_emplvl\_chg 0.0007638574  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0135267362  
## oty\_total\_annual\_wages\_chg 0.0042384059  
## oty\_total\_annual\_wages\_pct\_chg 0.0312279792  
## oty\_taxable\_annual\_wages\_chg 0.0015416652  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0030801375  
## oty\_annual\_contributions\_chg -0.0004236233  
## oty\_annual\_contributions\_pct\_chg 0.0067616347  
## oty\_annual\_avg\_wkly\_wage\_chg 0.9999989966  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0385011231  
## oty\_avg\_annual\_pay\_chg 1.0000000000  
## oty\_avg\_annual\_pay\_pct\_chg 0.0396125653  
## oty\_avg\_annual\_pay\_pct\_chg  
## oty\_annual\_avg\_estabs\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.934164e-03  
## oty\_total\_annual\_wages\_chg 2.071458e-04  
## oty\_total\_annual\_wages\_pct\_chg 8.741519e-01  
## oty\_taxable\_annual\_wages\_chg 1.084494e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.090742e-03  
## oty\_annual\_contributions\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg 2.258809e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.961597e-02  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 9.999939e-01  
## oty\_avg\_annual\_pay\_chg 3.961257e-02  
## oty\_avg\_annual\_pay\_pct\_chg 1.000000e+00

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## annual\_avg\_estabs annual\_avg\_emplvl  
## annual\_avg\_estabs 1.000000e+00 9.833765e-01  
## annual\_avg\_emplvl 9.833765e-01 1.000000e+00  
## total\_annual\_wages 9.793355e-01 9.946181e-01  
## taxable\_annual\_wages 9.872725e-01 9.894928e-01  
## annual\_contributions 9.845771e-01 9.844440e-01  
## annual\_avg\_wkly\_wage 9.459478e-03 1.011364e-02  
## avg\_annual\_pay 9.459412e-03 1.011361e-02  
## lq\_annual\_avg\_estabs -2.104964e-04 -2.098775e-04  
## lq\_annual\_avg\_emplvl -2.573698e-05 1.848801e-05  
## lq\_total\_annual\_wages -5.054296e-05 -8.991811e-06  
## lq\_taxable\_annual\_wages 1.280650e-04 1.762700e-04  
## lq\_annual\_contributions 6.820105e-05 1.144750e-04  
## lq\_annual\_avg\_wkly\_wage 8.710513e-03 9.420326e-03  
## lq\_avg\_annual\_pay 8.711500e-03 9.421189e-03  
## oty\_annual\_avg\_estabs\_chg 9.470161e-01 9.138888e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -3.675062e-04 -4.780059e-04  
## oty\_annual\_avg\_emplvl\_chg 9.848161e-01 9.821288e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 5.993884e-04 3.325045e-04  
## oty\_total\_annual\_wages\_chg 9.802549e-01 9.853406e-01  
## oty\_total\_annual\_wages\_pct\_chg 4.995590e-05 3.614739e-05  
## oty\_taxable\_annual\_wages\_chg 9.712103e-01 9.807860e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 1.093593e-04 2.247588e-04  
## oty\_annual\_contributions\_chg -8.631331e-01 -8.713379e-01  
## oty\_annual\_contributions\_pct\_chg -2.322915e-04 2.590830e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 1.006584e-03 1.083069e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 7.399823e-05 7.942909e-05  
## oty\_avg\_annual\_pay\_chg 1.005893e-03 1.082550e-03  
## oty\_avg\_annual\_pay\_pct\_chg 7.706793e-05 8.275358e-05  
## total\_annual\_wages taxable\_annual\_wages  
## annual\_avg\_estabs 9.793355e-01 9.872725e-01  
## annual\_avg\_emplvl 9.946181e-01 9.894928e-01  
## total\_annual\_wages 1.000000e+00 9.863994e-01  
## taxable\_annual\_wages 9.863994e-01 1.000000e+00  
## annual\_contributions 9.854710e-01 9.953382e-01  
## annual\_avg\_wkly\_wage 1.351022e-02 1.049512e-02  
## avg\_annual\_pay 1.351023e-02 1.049509e-02  
## lq\_annual\_avg\_estabs -2.083437e-04 -2.056437e-04  
## lq\_annual\_avg\_emplvl 4.228200e-05 1.796888e-05  
## lq\_total\_annual\_wages 9.279886e-06 -7.378696e-06  
## lq\_taxable\_annual\_wages 2.028038e-04 2.705183e-04  
## lq\_annual\_contributions 1.335527e-04 1.795278e-04  
## lq\_annual\_avg\_wkly\_wage 9.500181e-03 9.227069e-03  
## lq\_avg\_annual\_pay 9.500954e-03 9.227644e-03  
## oty\_annual\_avg\_estabs\_chg 9.131838e-01 9.151000e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -4.566917e-04 -4.743376e-04  
## oty\_annual\_avg\_emplvl\_chg 9.746165e-01 9.867493e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 3.107054e-04 4.477687e-04  
## oty\_total\_annual\_wages\_chg 9.939038e-01 9.857033e-01  
## oty\_total\_annual\_wages\_pct\_chg 4.241368e-05 4.556067e-05  
## oty\_taxable\_annual\_wages\_chg 9.800598e-01 9.837473e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 2.302964e-04 1.356876e-04  
## oty\_annual\_contributions\_chg -8.650946e-01 -8.914731e-01  
## oty\_annual\_contributions\_pct\_chg 2.173006e-04 -2.760370e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 1.690570e-03 1.184240e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 9.600913e-05 8.360450e-05  
## oty\_avg\_annual\_pay\_chg 1.690125e-03 1.183642e-03  
## oty\_avg\_annual\_pay\_pct\_chg 9.998311e-05 8.710981e-05  
## annual\_contributions annual\_avg\_wkly\_wage  
## annual\_avg\_estabs 9.845771e-01 0.009459478  
## annual\_avg\_emplvl 9.844440e-01 0.010113641  
## total\_annual\_wages 9.854710e-01 0.013510223  
## taxable\_annual\_wages 9.953382e-01 0.010495121  
## annual\_contributions 1.000000e+00 0.010986833  
## annual\_avg\_wkly\_wage 1.098683e-02 1.000000000  
## avg\_annual\_pay 1.098687e-02 0.999999948  
## lq\_annual\_avg\_estabs -2.055741e-04 -0.008561596  
## lq\_annual\_avg\_emplvl 1.667518e-05 0.026648998  
## lq\_total\_annual\_wages -8.464126e-06 0.024412483  
## lq\_taxable\_annual\_wages 2.418934e-04 0.034423907  
## lq\_annual\_contributions 1.778258e-04 0.029963517  
## lq\_annual\_avg\_wkly\_wage 9.183180e-03 0.762985694  
## lq\_avg\_annual\_pay 9.183647e-03 0.762965830  
## oty\_annual\_avg\_estabs\_chg 9.189017e-01 0.009674155  
## oty\_annual\_avg\_estabs\_pct\_chg -4.656916e-04 -0.007475844  
## oty\_annual\_avg\_emplvl\_chg 9.853402e-01 0.009110906  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.836003e-04 0.063574080  
## oty\_total\_annual\_wages\_chg 9.876977e-01 0.014829846  
## oty\_total\_annual\_wages\_pct\_chg 4.938001e-05 0.014560174  
## oty\_taxable\_annual\_wages\_chg 9.822547e-01 0.010674431  
## oty\_taxable\_annual\_wages\_pct\_chg 1.258211e-04 0.011151365  
## oty\_annual\_contributions\_chg -8.767926e-01 -0.008880963  
## oty\_annual\_contributions\_pct\_chg -2.263964e-04 0.012916970  
## oty\_annual\_avg\_wkly\_wage\_chg 1.267445e-03 0.338190489  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 8.696442e-05 0.015911907  
## oty\_avg\_annual\_pay\_chg 1.267109e-03 0.338188874  
## oty\_avg\_annual\_pay\_pct\_chg 9.060670e-05 0.016437029  
## avg\_annual\_pay lq\_annual\_avg\_estabs  
## annual\_avg\_estabs 0.009459412 -0.0002104964  
## annual\_avg\_emplvl 0.010113610 -0.0002098775  
## total\_annual\_wages 0.013510228 -0.0002083437  
## taxable\_annual\_wages 0.010495089 -0.0002056437  
## annual\_contributions 0.010986865 -0.0002055741  
## annual\_avg\_wkly\_wage 0.999999948 -0.0085615962  
## avg\_annual\_pay 1.000000000 -0.0085616629  
## lq\_annual\_avg\_estabs -0.008561663 1.0000000000  
## lq\_annual\_avg\_emplvl 0.026649023 0.1062468607  
## lq\_total\_annual\_wages 0.024412708 0.1145212304  
## lq\_taxable\_annual\_wages 0.034423746 0.0407523568  
## lq\_annual\_contributions 0.029963467 0.0355421652  
## lq\_annual\_avg\_wkly\_wage 0.762985263 -0.0101973798  
## lq\_avg\_annual\_pay 0.762965569 -0.0101978946  
## oty\_annual\_avg\_estabs\_chg 0.009674282 -0.0001719184  
## oty\_annual\_avg\_estabs\_pct\_chg -0.007475172 0.0020199649  
## oty\_annual\_avg\_emplvl\_chg 0.009110887 -0.0002033500  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.063574281 -0.0013310460  
## oty\_total\_annual\_wages\_chg 0.014829885 -0.0002030880  
## oty\_total\_annual\_wages\_pct\_chg 0.014558936 -0.0001710462  
## oty\_taxable\_annual\_wages\_chg 0.010674335 -0.0002023640  
## oty\_taxable\_annual\_wages\_pct\_chg 0.011151363 -0.0002401246  
## oty\_annual\_contributions\_chg -0.008880968 0.0001811165  
## oty\_annual\_contributions\_pct\_chg 0.012917266 -0.0002401905  
## oty\_annual\_avg\_wkly\_wage\_chg 0.338190377 -0.0011435317  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.015910854 -0.0001740132  
## oty\_avg\_annual\_pay\_chg 0.338189072 -0.0011441296  
## oty\_avg\_annual\_pay\_pct\_chg 0.016436035 -0.0001799642  
## lq\_annual\_avg\_emplvl  
## annual\_avg\_estabs -2.573698e-05  
## annual\_avg\_emplvl 1.848801e-05  
## total\_annual\_wages 4.228200e-05  
## taxable\_annual\_wages 1.796888e-05  
## annual\_contributions 1.667518e-05  
## annual\_avg\_wkly\_wage 2.664900e-02  
## avg\_annual\_pay 2.664902e-02  
## lq\_annual\_avg\_estabs 1.062469e-01  
## lq\_annual\_avg\_emplvl 1.000000e+00  
## lq\_total\_annual\_wages 9.032182e-01  
## lq\_taxable\_annual\_wages 2.638993e-01  
## lq\_annual\_contributions 2.173727e-01  
## lq\_annual\_avg\_wkly\_wage 3.589109e-02  
## lq\_avg\_annual\_pay 3.588629e-02  
## oty\_annual\_avg\_estabs\_chg 1.766933e-04  
## oty\_annual\_avg\_estabs\_pct\_chg 4.820487e-05  
## oty\_annual\_avg\_emplvl\_chg 4.532012e-07  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.052968e-03  
## oty\_total\_annual\_wages\_chg 5.585496e-05  
## oty\_total\_annual\_wages\_pct\_chg 2.384916e-04  
## oty\_taxable\_annual\_wages\_chg 1.939965e-05  
## oty\_taxable\_annual\_wages\_pct\_chg 1.922866e-04  
## oty\_annual\_contributions\_chg -1.888375e-05  
## oty\_annual\_contributions\_pct\_chg 2.554902e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 3.828788e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 3.463134e-04  
## oty\_avg\_annual\_pay\_chg 3.823981e-03  
## oty\_avg\_annual\_pay\_pct\_chg 3.601937e-04  
## lq\_total\_annual\_wages  
## annual\_avg\_estabs -5.054296e-05  
## annual\_avg\_emplvl -8.991811e-06  
## total\_annual\_wages 9.279886e-06  
## taxable\_annual\_wages -7.378696e-06  
## annual\_contributions -8.464126e-06  
## annual\_avg\_wkly\_wage 2.441248e-02  
## avg\_annual\_pay 2.441271e-02  
## lq\_annual\_avg\_estabs 1.145212e-01  
## lq\_annual\_avg\_emplvl 9.032182e-01  
## lq\_total\_annual\_wages 1.000000e+00  
## lq\_taxable\_annual\_wages 3.302446e-01  
## lq\_annual\_contributions 2.635839e-01  
## lq\_annual\_avg\_wkly\_wage 3.605785e-02  
## lq\_avg\_annual\_pay 3.605320e-02  
## oty\_annual\_avg\_estabs\_chg 6.307813e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 3.041628e-04  
## oty\_annual\_avg\_emplvl\_chg -2.278975e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.366544e-03  
## oty\_total\_annual\_wages\_chg 2.131995e-05  
## oty\_total\_annual\_wages\_pct\_chg 2.201220e-04  
## oty\_taxable\_annual\_wages\_chg -8.215396e-06  
## oty\_taxable\_annual\_wages\_pct\_chg 1.515235e-04  
## oty\_annual\_contributions\_chg -2.783002e-06  
## oty\_annual\_contributions\_pct\_chg 1.420367e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 4.326751e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 3.523293e-04  
## oty\_avg\_annual\_pay\_chg 4.322269e-03  
## oty\_avg\_annual\_pay\_pct\_chg 3.664123e-04  
## lq\_taxable\_annual\_wages  
## annual\_avg\_estabs 0.0001280650  
## annual\_avg\_emplvl 0.0001762700  
## total\_annual\_wages 0.0002028038  
## taxable\_annual\_wages 0.0002705183  
## annual\_contributions 0.0002418934  
## annual\_avg\_wkly\_wage 0.0344239066  
## avg\_annual\_pay 0.0344237459  
## lq\_annual\_avg\_estabs 0.0407523568  
## lq\_annual\_avg\_emplvl 0.2638993252  
## lq\_total\_annual\_wages 0.3302445797  
## lq\_taxable\_annual\_wages 1.0000000000  
## lq\_annual\_contributions 0.8498554538  
## lq\_annual\_avg\_wkly\_wage 0.0551532682  
## lq\_avg\_annual\_pay 0.0551513410  
## oty\_annual\_avg\_estabs\_chg 0.0004339986  
## oty\_annual\_avg\_estabs\_pct\_chg -0.0001634154  
## oty\_annual\_avg\_emplvl\_chg 0.0002317044  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0059316149  
## oty\_total\_annual\_wages\_chg 0.0002540708  
## oty\_total\_annual\_wages\_pct\_chg 0.0004846174  
## oty\_taxable\_annual\_wages\_chg 0.0003303864  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0010476052  
## oty\_annual\_contributions\_chg -0.0001704925  
## oty\_annual\_contributions\_pct\_chg 0.0027459607  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0044964536  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0004112763  
## oty\_avg\_annual\_pay\_chg 0.0044960839  
## oty\_avg\_annual\_pay\_pct\_chg 0.0004288754  
## lq\_annual\_contributions  
## annual\_avg\_estabs 6.820105e-05  
## annual\_avg\_emplvl 1.144750e-04  
## total\_annual\_wages 1.335527e-04  
## taxable\_annual\_wages 1.795278e-04  
## annual\_contributions 1.778258e-04  
## annual\_avg\_wkly\_wage 2.996352e-02  
## avg\_annual\_pay 2.996347e-02  
## lq\_annual\_avg\_estabs 3.554217e-02  
## lq\_annual\_avg\_emplvl 2.173727e-01  
## lq\_total\_annual\_wages 2.635839e-01  
## lq\_taxable\_annual\_wages 8.498555e-01  
## lq\_annual\_contributions 1.000000e+00  
## lq\_annual\_avg\_wkly\_wage 4.969348e-02  
## lq\_avg\_annual\_pay 4.969073e-02  
## oty\_annual\_avg\_estabs\_chg 3.095544e-04  
## oty\_annual\_avg\_estabs\_pct\_chg -3.730961e-05  
## oty\_annual\_avg\_emplvl\_chg 1.354558e-04  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.610962e-03  
## oty\_total\_annual\_wages\_chg 1.607856e-04  
## oty\_total\_annual\_wages\_pct\_chg 4.051675e-04  
## oty\_taxable\_annual\_wages\_chg 2.726897e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 9.984711e-04  
## oty\_annual\_contributions\_chg -8.275078e-05  
## oty\_annual\_contributions\_pct\_chg 5.831921e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.973134e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 4.082155e-04  
## oty\_avg\_annual\_pay\_chg 3.972459e-03  
## oty\_avg\_annual\_pay\_pct\_chg 4.255312e-04  
## lq\_annual\_avg\_wkly\_wage lq\_avg\_annual\_pay  
## annual\_avg\_estabs 0.008710513 0.008711500  
## annual\_avg\_emplvl 0.009420326 0.009421189  
## total\_annual\_wages 0.009500181 0.009500954  
## taxable\_annual\_wages 0.009227069 0.009227644  
## annual\_contributions 0.009183180 0.009183647  
## annual\_avg\_wkly\_wage 0.762985694 0.762965830  
## avg\_annual\_pay 0.762985263 0.762965569  
## lq\_annual\_avg\_estabs -0.010197380 -0.010197895  
## lq\_annual\_avg\_emplvl 0.035891092 0.035886286  
## lq\_total\_annual\_wages 0.036057854 0.036053197  
## lq\_taxable\_annual\_wages 0.055153268 0.055151341  
## lq\_annual\_contributions 0.049693484 0.049690734  
## lq\_annual\_avg\_wkly\_wage 1.000000000 0.999995950  
## lq\_avg\_annual\_pay 0.999995950 1.000000000  
## oty\_annual\_avg\_estabs\_chg 0.007964215 0.007964651  
## oty\_annual\_avg\_estabs\_pct\_chg -0.016153058 -0.016156864  
## oty\_annual\_avg\_emplvl\_chg 0.008935153 0.008935962  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.067716063 0.067718324  
## oty\_total\_annual\_wages\_chg 0.009364843 0.009365926  
## oty\_total\_annual\_wages\_pct\_chg 0.013208962 0.013209330  
## oty\_taxable\_annual\_wages\_chg 0.009078553 0.009079288  
## oty\_taxable\_annual\_wages\_pct\_chg 0.013415448 0.013415269  
## oty\_annual\_contributions\_chg -0.008474295 -0.008473749  
## oty\_annual\_contributions\_pct\_chg 0.016380660 0.016377048  
## oty\_annual\_avg\_wkly\_wage\_chg 0.146514021 0.146499891  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.015980124 0.015979543  
## oty\_avg\_annual\_pay\_chg 0.146511308 0.146497684  
## oty\_avg\_annual\_pay\_pct\_chg 0.016528158 0.016527664  
## oty\_annual\_avg\_estabs\_chg  
## annual\_avg\_estabs 9.470161e-01  
## annual\_avg\_emplvl 9.138888e-01  
## total\_annual\_wages 9.131838e-01  
## taxable\_annual\_wages 9.151000e-01  
## annual\_contributions 9.189017e-01  
## annual\_avg\_wkly\_wage 9.674155e-03  
## avg\_annual\_pay 9.674282e-03  
## lq\_annual\_avg\_estabs -1.719184e-04  
## lq\_annual\_avg\_emplvl 1.766933e-04  
## lq\_total\_annual\_wages 6.307813e-05  
## lq\_taxable\_annual\_wages 4.339986e-04  
## lq\_annual\_contributions 3.095544e-04  
## lq\_annual\_avg\_wkly\_wage 7.964215e-03  
## lq\_avg\_annual\_pay 7.964651e-03  
## oty\_annual\_avg\_estabs\_chg 1.000000e+00  
## oty\_annual\_avg\_estabs\_pct\_chg 7.093236e-03  
## oty\_annual\_avg\_emplvl\_chg 9.292865e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.025404e-03  
## oty\_total\_annual\_wages\_chg 9.211880e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.024419e-04  
## oty\_taxable\_annual\_wages\_chg 9.013644e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 3.938296e-04  
## oty\_annual\_contributions\_chg -7.812147e-01  
## oty\_annual\_contributions\_pct\_chg 2.698927e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 1.275496e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 8.820686e-05  
## oty\_avg\_annual\_pay\_chg 1.274969e-03  
## oty\_avg\_annual\_pay\_pct\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg  
## annual\_avg\_estabs -3.675062e-04  
## annual\_avg\_emplvl -4.780059e-04  
## total\_annual\_wages -4.566917e-04  
## taxable\_annual\_wages -4.743376e-04  
## annual\_contributions -4.656916e-04  
## annual\_avg\_wkly\_wage -7.475844e-03  
## avg\_annual\_pay -7.475172e-03  
## lq\_annual\_avg\_estabs 2.019965e-03  
## lq\_annual\_avg\_emplvl 4.820487e-05  
## lq\_total\_annual\_wages 3.041628e-04  
## lq\_taxable\_annual\_wages -1.634154e-04  
## lq\_annual\_contributions -3.730961e-05  
## lq\_annual\_avg\_wkly\_wage -1.615306e-02  
## lq\_avg\_annual\_pay -1.615686e-02  
## oty\_annual\_avg\_estabs\_chg 7.093236e-03  
## oty\_annual\_avg\_estabs\_pct\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.138907e-01  
## oty\_total\_annual\_wages\_chg -2.672994e-04  
## oty\_total\_annual\_wages\_pct\_chg 1.543635e-02  
## oty\_taxable\_annual\_wages\_chg -2.239930e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.189892e-02  
## oty\_annual\_contributions\_chg 7.700292e-04  
## oty\_annual\_contributions\_pct\_chg 1.958854e-02  
## oty\_annual\_avg\_wkly\_wage\_chg 1.806866e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 7.567398e-04  
## oty\_avg\_annual\_pay\_chg 1.806449e-03  
## oty\_avg\_annual\_pay\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg  
## annual\_avg\_estabs 9.848161e-01  
## annual\_avg\_emplvl 9.821288e-01  
## total\_annual\_wages 9.746165e-01  
## taxable\_annual\_wages 9.867493e-01  
## annual\_contributions 9.853402e-01  
## annual\_avg\_wkly\_wage 9.110906e-03  
## avg\_annual\_pay 9.110887e-03  
## lq\_annual\_avg\_estabs -2.033500e-04  
## lq\_annual\_avg\_emplvl 4.532012e-07  
## lq\_total\_annual\_wages -2.278975e-05  
## lq\_taxable\_annual\_wages 2.317044e-04  
## lq\_annual\_contributions 1.354558e-04  
## lq\_annual\_avg\_wkly\_wage 8.935153e-03  
## lq\_avg\_annual\_pay 8.935962e-03  
## oty\_annual\_avg\_estabs\_chg 9.292865e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.807178e-03  
## oty\_total\_annual\_wages\_chg 9.815811e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.063543e-04  
## oty\_taxable\_annual\_wages\_chg 9.767026e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 4.426258e-04  
## oty\_annual\_contributions\_chg -8.572621e-01  
## oty\_annual\_contributions\_pct\_chg 5.005389e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 7.647589e-04  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 5.394112e-05  
## oty\_avg\_annual\_pay\_chg 7.638574e-04  
## oty\_avg\_annual\_pay\_pct\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg  
## annual\_avg\_estabs 0.0005993884  
## annual\_avg\_emplvl 0.0003325045  
## total\_annual\_wages 0.0003107054  
## taxable\_annual\_wages 0.0004477687  
## annual\_contributions 0.0004836003  
## annual\_avg\_wkly\_wage 0.0635740801  
## avg\_annual\_pay 0.0635742812  
## lq\_annual\_avg\_estabs -0.0013310460  
## lq\_annual\_avg\_emplvl 0.0020529681  
## lq\_total\_annual\_wages 0.0013665438  
## lq\_taxable\_annual\_wages 0.0059316149  
## lq\_annual\_contributions 0.0046109622  
## lq\_annual\_avg\_wkly\_wage 0.0677160631  
## lq\_avg\_annual\_pay 0.0677183237  
## oty\_annual\_avg\_estabs\_chg 0.0040254039  
## oty\_annual\_avg\_estabs\_pct\_chg 0.1138907430  
## oty\_annual\_avg\_emplvl\_chg 0.0048071782  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.0000000000  
## oty\_total\_annual\_wages\_chg 0.0021446051  
## oty\_total\_annual\_wages\_pct\_chg 0.0813343520  
## oty\_taxable\_annual\_wages\_chg 0.0022657179  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0601069631  
## oty\_annual\_contributions\_chg 0.0019402235  
## oty\_annual\_contributions\_pct\_chg 0.1097278601  
## oty\_annual\_avg\_wkly\_wage\_chg -0.0135281227  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0028411488  
## oty\_avg\_annual\_pay\_chg -0.0135267362  
## oty\_avg\_annual\_pay\_pct\_chg 0.0029341643  
## oty\_total\_annual\_wages\_chg  
## annual\_avg\_estabs 9.802549e-01  
## annual\_avg\_emplvl 9.853406e-01  
## total\_annual\_wages 9.939038e-01  
## taxable\_annual\_wages 9.857033e-01  
## annual\_contributions 9.876977e-01  
## annual\_avg\_wkly\_wage 1.482985e-02  
## avg\_annual\_pay 1.482988e-02  
## lq\_annual\_avg\_estabs -2.030880e-04  
## lq\_annual\_avg\_emplvl 5.585496e-05  
## lq\_total\_annual\_wages 2.131995e-05  
## lq\_taxable\_annual\_wages 2.540708e-04  
## lq\_annual\_contributions 1.607856e-04  
## lq\_annual\_avg\_wkly\_wage 9.364843e-03  
## lq\_avg\_annual\_pay 9.365926e-03  
## oty\_annual\_avg\_estabs\_chg 9.211880e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -2.672994e-04  
## oty\_annual\_avg\_emplvl\_chg 9.815811e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.144605e-03  
## oty\_total\_annual\_wages\_chg 1.000000e+00  
## oty\_total\_annual\_wages\_pct\_chg 2.081526e-04  
## oty\_taxable\_annual\_wages\_chg 9.811283e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 3.310573e-04  
## oty\_annual\_contributions\_chg -8.523860e-01  
## oty\_annual\_contributions\_pct\_chg 3.328761e-04  
## oty\_annual\_avg\_wkly\_wage\_chg 4.238939e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 1.992161e-04  
## oty\_avg\_annual\_pay\_chg 4.238406e-03  
## oty\_avg\_annual\_pay\_pct\_chg 2.071458e-04  
## oty\_total\_annual\_wages\_pct\_chg  
## annual\_avg\_estabs 4.995590e-05  
## annual\_avg\_emplvl 3.614739e-05  
## total\_annual\_wages 4.241368e-05  
## taxable\_annual\_wages 4.556067e-05  
## annual\_contributions 4.938001e-05  
## annual\_avg\_wkly\_wage 1.456017e-02  
## avg\_annual\_pay 1.455894e-02  
## lq\_annual\_avg\_estabs -1.710462e-04  
## lq\_annual\_avg\_emplvl 2.384916e-04  
## lq\_total\_annual\_wages 2.201220e-04  
## lq\_taxable\_annual\_wages 4.846174e-04  
## lq\_annual\_contributions 4.051675e-04  
## lq\_annual\_avg\_wkly\_wage 1.320896e-02  
## lq\_avg\_annual\_pay 1.320933e-02  
## oty\_annual\_avg\_estabs\_chg 3.024419e-04  
## oty\_annual\_avg\_estabs\_pct\_chg 1.543635e-02  
## oty\_annual\_avg\_emplvl\_chg 3.063543e-04  
## oty\_annual\_avg\_emplvl\_pct\_chg 8.133435e-02  
## oty\_total\_annual\_wages\_chg 2.081526e-04  
## oty\_total\_annual\_wages\_pct\_chg 1.000000e+00  
## oty\_taxable\_annual\_wages\_chg 1.696696e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 5.649533e-03  
## oty\_annual\_contributions\_chg 1.215768e-04  
## oty\_annual\_contributions\_pct\_chg 1.027751e-02  
## oty\_annual\_avg\_wkly\_wage\_chg 3.123220e-02  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 8.740225e-01  
## oty\_avg\_annual\_pay\_chg 3.122798e-02  
## oty\_avg\_annual\_pay\_pct\_chg 8.741519e-01  
## oty\_taxable\_annual\_wages\_chg  
## annual\_avg\_estabs 9.712103e-01  
## annual\_avg\_emplvl 9.807860e-01  
## total\_annual\_wages 9.800598e-01  
## taxable\_annual\_wages 9.837473e-01  
## annual\_contributions 9.822547e-01  
## annual\_avg\_wkly\_wage 1.067443e-02  
## avg\_annual\_pay 1.067433e-02  
## lq\_annual\_avg\_estabs -2.023640e-04  
## lq\_annual\_avg\_emplvl 1.939965e-05  
## lq\_total\_annual\_wages -8.215396e-06  
## lq\_taxable\_annual\_wages 3.303864e-04  
## lq\_annual\_contributions 2.726897e-04  
## lq\_annual\_avg\_wkly\_wage 9.078553e-03  
## lq\_avg\_annual\_pay 9.079288e-03  
## oty\_annual\_avg\_estabs\_chg 9.013644e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -2.239930e-04  
## oty\_annual\_avg\_emplvl\_chg 9.767026e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.265718e-03  
## oty\_total\_annual\_wages\_chg 9.811283e-01  
## oty\_total\_annual\_wages\_pct\_chg 1.696696e-04  
## oty\_taxable\_annual\_wages\_chg 1.000000e+00  
## oty\_taxable\_annual\_wages\_pct\_chg 9.878633e-04  
## oty\_annual\_contributions\_chg -8.193021e-01  
## oty\_annual\_contributions\_pct\_chg 1.127843e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 1.542510e-03  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 1.042345e-04  
## oty\_avg\_annual\_pay\_chg 1.541665e-03  
## oty\_avg\_annual\_pay\_pct\_chg 1.084494e-04  
## oty\_taxable\_annual\_wages\_pct\_chg  
## annual\_avg\_estabs 0.0001093593  
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## total\_annual\_wages 0.0002302964  
## taxable\_annual\_wages 0.0001356876  
## annual\_contributions 0.0001258211  
## annual\_avg\_wkly\_wage 0.0111513651  
## avg\_annual\_pay 0.0111513627  
## lq\_annual\_avg\_estabs -0.0002401246  
## lq\_annual\_avg\_emplvl 0.0001922866  
## lq\_total\_annual\_wages 0.0001515235  
## lq\_taxable\_annual\_wages 0.0010476052  
## lq\_annual\_contributions 0.0009984711  
## lq\_annual\_avg\_wkly\_wage 0.0134154478  
## lq\_avg\_annual\_pay 0.0134152686  
## oty\_annual\_avg\_estabs\_chg 0.0003938296  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0118989234  
## oty\_annual\_avg\_emplvl\_chg 0.0004426258  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0601069631  
## oty\_total\_annual\_wages\_chg 0.0003310573  
## oty\_total\_annual\_wages\_pct\_chg 0.0056495328  
## oty\_taxable\_annual\_wages\_chg 0.0009878633  
## oty\_taxable\_annual\_wages\_pct\_chg 1.0000000000  
## oty\_annual\_contributions\_chg 0.0006658204  
## oty\_annual\_contributions\_pct\_chg 0.3580519080  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0030797901  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0010483198  
## oty\_avg\_annual\_pay\_chg 0.0030801375  
## oty\_avg\_annual\_pay\_pct\_chg 0.0010907424  
## oty\_annual\_contributions\_chg  
## annual\_avg\_estabs -8.631331e-01  
## annual\_avg\_emplvl -8.713379e-01  
## total\_annual\_wages -8.650946e-01  
## taxable\_annual\_wages -8.914731e-01  
## annual\_contributions -8.767926e-01  
## annual\_avg\_wkly\_wage -8.880963e-03  
## avg\_annual\_pay -8.880968e-03  
## lq\_annual\_avg\_estabs 1.811165e-04  
## lq\_annual\_avg\_emplvl -1.888375e-05  
## lq\_total\_annual\_wages -2.783002e-06  
## lq\_taxable\_annual\_wages -1.704925e-04  
## lq\_annual\_contributions -8.275078e-05  
## lq\_annual\_avg\_wkly\_wage -8.474295e-03  
## lq\_avg\_annual\_pay -8.473749e-03  
## oty\_annual\_avg\_estabs\_chg -7.812147e-01  
## oty\_annual\_avg\_estabs\_pct\_chg 7.700292e-04  
## oty\_annual\_avg\_emplvl\_chg -8.572621e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.940223e-03  
## oty\_total\_annual\_wages\_chg -8.523860e-01  
## oty\_total\_annual\_wages\_pct\_chg 1.215768e-04  
## oty\_taxable\_annual\_wages\_chg -8.193021e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 6.658204e-04  
## oty\_annual\_contributions\_chg 1.000000e+00  
## oty\_annual\_contributions\_pct\_chg 2.856920e-03  
## oty\_annual\_avg\_wkly\_wage\_chg -4.245500e-04  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg -4.229288e-05  
## oty\_avg\_annual\_pay\_chg -4.236233e-04  
## oty\_avg\_annual\_pay\_pct\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg  
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## annual\_avg\_emplvl 0.0002590830  
## total\_annual\_wages 0.0002173006  
## taxable\_annual\_wages -0.0002760370  
## annual\_contributions -0.0002263964  
## annual\_avg\_wkly\_wage 0.0129169703  
## avg\_annual\_pay 0.0129172664  
## lq\_annual\_avg\_estabs -0.0002401905  
## lq\_annual\_avg\_emplvl 0.0002554902  
## lq\_total\_annual\_wages 0.0001420367  
## lq\_taxable\_annual\_wages 0.0027459607  
## lq\_annual\_contributions 0.0058319213  
## lq\_annual\_avg\_wkly\_wage 0.0163806603  
## lq\_avg\_annual\_pay 0.0163770479  
## oty\_annual\_avg\_estabs\_chg 0.0002698927  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0195885383  
## oty\_annual\_avg\_emplvl\_chg 0.0005005389  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.1097278601  
## oty\_total\_annual\_wages\_chg 0.0003328761  
## oty\_total\_annual\_wages\_pct\_chg 0.0102775060  
## oty\_taxable\_annual\_wages\_chg 0.0011278428  
## oty\_taxable\_annual\_wages\_pct\_chg 0.3580519080  
## oty\_annual\_contributions\_chg 0.0028569203  
## oty\_annual\_contributions\_pct\_chg 1.0000000000  
## oty\_annual\_avg\_wkly\_wage\_chg 0.0067594232  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0021717370  
## oty\_avg\_annual\_pay\_chg 0.0067616347  
## oty\_avg\_annual\_pay\_pct\_chg 0.0022588086  
## oty\_annual\_avg\_wkly\_wage\_chg  
## annual\_avg\_estabs 0.0010065842  
## annual\_avg\_emplvl 0.0010830695  
## total\_annual\_wages 0.0016905700  
## taxable\_annual\_wages 0.0011842396  
## annual\_contributions 0.0012674451  
## annual\_avg\_wkly\_wage 0.3381904895  
## avg\_annual\_pay 0.3381903768  
## lq\_annual\_avg\_estabs -0.0011435317  
## lq\_annual\_avg\_emplvl 0.0038287882  
## lq\_total\_annual\_wages 0.0043267512  
## lq\_taxable\_annual\_wages 0.0044964536  
## lq\_annual\_contributions 0.0039731338  
## lq\_annual\_avg\_wkly\_wage 0.1465140209  
## lq\_avg\_annual\_pay 0.1464998910  
## oty\_annual\_avg\_estabs\_chg 0.0012754958  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0018068656  
## oty\_annual\_avg\_emplvl\_chg 0.0007647589  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0135281227  
## oty\_total\_annual\_wages\_chg 0.0042389392  
## oty\_total\_annual\_wages\_pct\_chg 0.0312322004  
## oty\_taxable\_annual\_wages\_chg 0.0015425105  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0030797901  
## oty\_annual\_contributions\_chg -0.0004245500  
## oty\_annual\_contributions\_pct\_chg 0.0067594232  
## oty\_annual\_avg\_wkly\_wage\_chg 1.0000000000  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0385049283  
## oty\_avg\_annual\_pay\_chg 0.9999989966  
## oty\_avg\_annual\_pay\_pct\_chg 0.0396159688  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg  
## annual\_avg\_estabs 7.399823e-05  
## annual\_avg\_emplvl 7.942909e-05  
## total\_annual\_wages 9.600913e-05  
## taxable\_annual\_wages 8.360450e-05  
## annual\_contributions 8.696442e-05  
## annual\_avg\_wkly\_wage 1.591191e-02  
## avg\_annual\_pay 1.591085e-02  
## lq\_annual\_avg\_estabs -1.740132e-04  
## lq\_annual\_avg\_emplvl 3.463134e-04  
## lq\_total\_annual\_wages 3.523293e-04  
## lq\_taxable\_annual\_wages 4.112763e-04  
## lq\_annual\_contributions 4.082155e-04  
## lq\_annual\_avg\_wkly\_wage 1.598012e-02  
## lq\_avg\_annual\_pay 1.597954e-02  
## oty\_annual\_avg\_estabs\_chg 8.820686e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 7.567398e-04  
## oty\_annual\_avg\_emplvl\_chg 5.394112e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.841149e-03  
## oty\_total\_annual\_wages\_chg 1.992161e-04  
## oty\_total\_annual\_wages\_pct\_chg 8.740225e-01  
## oty\_taxable\_annual\_wages\_chg 1.042345e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.048320e-03  
## oty\_annual\_contributions\_chg -4.229288e-05  
## oty\_annual\_contributions\_pct\_chg 2.171737e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.850493e-02  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 1.000000e+00  
## oty\_avg\_annual\_pay\_chg 3.850112e-02  
## oty\_avg\_annual\_pay\_pct\_chg 9.999939e-01  
## oty\_avg\_annual\_pay\_chg  
## annual\_avg\_estabs 0.0010058930  
## annual\_avg\_emplvl 0.0010825502  
## total\_annual\_wages 0.0016901249  
## taxable\_annual\_wages 0.0011836422  
## annual\_contributions 0.0012671092  
## annual\_avg\_wkly\_wage 0.3381888738  
## avg\_annual\_pay 0.3381890717  
## lq\_annual\_avg\_estabs -0.0011441296  
## lq\_annual\_avg\_emplvl 0.0038239814  
## lq\_total\_annual\_wages 0.0043222691  
## lq\_taxable\_annual\_wages 0.0044960839  
## lq\_annual\_contributions 0.0039724586  
## lq\_annual\_avg\_wkly\_wage 0.1465113082  
## lq\_avg\_annual\_pay 0.1464976841  
## oty\_annual\_avg\_estabs\_chg 0.0012749692  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0018064489  
## oty\_annual\_avg\_emplvl\_chg 0.0007638574  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0135267362  
## oty\_total\_annual\_wages\_chg 0.0042384059  
## oty\_total\_annual\_wages\_pct\_chg 0.0312279792  
## oty\_taxable\_annual\_wages\_chg 0.0015416652  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0030801375  
## oty\_annual\_contributions\_chg -0.0004236233  
## oty\_annual\_contributions\_pct\_chg 0.0067616347  
## oty\_annual\_avg\_wkly\_wage\_chg 0.9999989966  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 0.0385011231  
## oty\_avg\_annual\_pay\_chg 1.0000000000  
## oty\_avg\_annual\_pay\_pct\_chg 0.0396125653  
## oty\_avg\_annual\_pay\_pct\_chg  
## annual\_avg\_estabs 7.706793e-05  
## annual\_avg\_emplvl 8.275358e-05  
## total\_annual\_wages 9.998311e-05  
## taxable\_annual\_wages 8.710981e-05  
## annual\_contributions 9.060670e-05  
## annual\_avg\_wkly\_wage 1.643703e-02  
## avg\_annual\_pay 1.643604e-02  
## lq\_annual\_avg\_estabs -1.799642e-04  
## lq\_annual\_avg\_emplvl 3.601937e-04  
## lq\_total\_annual\_wages 3.664123e-04  
## lq\_taxable\_annual\_wages 4.288754e-04  
## lq\_annual\_contributions 4.255312e-04  
## lq\_annual\_avg\_wkly\_wage 1.652816e-02  
## lq\_avg\_annual\_pay 1.652766e-02  
## oty\_annual\_avg\_estabs\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.934164e-03  
## oty\_total\_annual\_wages\_chg 2.071458e-04  
## oty\_total\_annual\_wages\_pct\_chg 8.741519e-01  
## oty\_taxable\_annual\_wages\_chg 1.084494e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.090742e-03  
## oty\_annual\_contributions\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg 2.258809e-03  
## oty\_annual\_avg\_wkly\_wage\_chg 3.961597e-02  
## oty\_annual\_avg\_wkly\_wage\_pct\_chg 9.999939e-01  
## oty\_avg\_annual\_pay\_chg 3.961257e-02  
## oty\_avg\_annual\_pay\_pct\_chg 1.000000e+00

The result of correlation shows that

oty\_annual\_avg\_emplvl\_chg is highly correlative with oty\_total\_annual\_wages\_chg and oty\_taxable\_annual\_wages\_chg and their correlation value is larger than 0.97.

Oty\_annual\_ave\_wkly\_wage\_chg is highly correlative with oty\_avg\_annual\_pay\_chg which has the correlation value 0.9999989966. I will remove one of them.

Oty\_annual\_avg\_wkly\_wag \_pct\_chg is highly correlative with oty\_avg\_annual\_pay\_pct\_chg which has the correlation value 0.9999939.

So for this part of data, I will keep both oty\_avg\_annual\_pay\_chg, and oty\_avg\_annual\_pay\_pct\_chg and remove oty\_annual\_ave\_wkly\_wage\_chg and oty\_annual\_avg\_wkly\_wag \_pct\_chg

Now, I will analysis all keep\_data together.

data.keep = data.frame(keep\_data[,c(1:5,7:12, 14:24, 27,28)])  
cor(data.keep)

## annual\_avg\_estabs annual\_avg\_emplvl  
## annual\_avg\_estabs 1.000000e+00 9.833765e-01  
## annual\_avg\_emplvl 9.833765e-01 1.000000e+00  
## total\_annual\_wages 9.793355e-01 9.946181e-01  
## taxable\_annual\_wages 9.872725e-01 9.894928e-01  
## annual\_contributions 9.845771e-01 9.844440e-01  
## avg\_annual\_pay 9.459412e-03 1.011361e-02  
## lq\_annual\_avg\_estabs -2.104964e-04 -2.098775e-04  
## lq\_annual\_avg\_emplvl -2.573698e-05 1.848801e-05  
## lq\_total\_annual\_wages -5.054296e-05 -8.991811e-06  
## lq\_taxable\_annual\_wages 1.280650e-04 1.762700e-04  
## lq\_annual\_contributions 6.820105e-05 1.144750e-04  
## lq\_avg\_annual\_pay 8.711500e-03 9.421189e-03  
## oty\_annual\_avg\_estabs\_chg 9.470161e-01 9.138888e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -3.675062e-04 -4.780059e-04  
## oty\_annual\_avg\_emplvl\_chg 9.848161e-01 9.821288e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 5.993884e-04 3.325045e-04  
## oty\_total\_annual\_wages\_chg 9.802549e-01 9.853406e-01  
## oty\_total\_annual\_wages\_pct\_chg 4.995590e-05 3.614739e-05  
## oty\_taxable\_annual\_wages\_chg 9.712103e-01 9.807860e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 1.093593e-04 2.247588e-04  
## oty\_annual\_contributions\_chg -8.631331e-01 -8.713379e-01  
## oty\_annual\_contributions\_pct\_chg -2.322915e-04 2.590830e-04  
## oty\_avg\_annual\_pay\_chg 1.005893e-03 1.082550e-03  
## oty\_avg\_annual\_pay\_pct\_chg 7.706793e-05 8.275358e-05  
## total\_annual\_wages taxable\_annual\_wages  
## annual\_avg\_estabs 9.793355e-01 9.872725e-01  
## annual\_avg\_emplvl 9.946181e-01 9.894928e-01  
## total\_annual\_wages 1.000000e+00 9.863994e-01  
## taxable\_annual\_wages 9.863994e-01 1.000000e+00  
## annual\_contributions 9.854710e-01 9.953382e-01  
## avg\_annual\_pay 1.351023e-02 1.049509e-02  
## lq\_annual\_avg\_estabs -2.083437e-04 -2.056437e-04  
## lq\_annual\_avg\_emplvl 4.228200e-05 1.796888e-05  
## lq\_total\_annual\_wages 9.279886e-06 -7.378696e-06  
## lq\_taxable\_annual\_wages 2.028038e-04 2.705183e-04  
## lq\_annual\_contributions 1.335527e-04 1.795278e-04  
## lq\_avg\_annual\_pay 9.500954e-03 9.227644e-03  
## oty\_annual\_avg\_estabs\_chg 9.131838e-01 9.151000e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -4.566917e-04 -4.743376e-04  
## oty\_annual\_avg\_emplvl\_chg 9.746165e-01 9.867493e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 3.107054e-04 4.477687e-04  
## oty\_total\_annual\_wages\_chg 9.939038e-01 9.857033e-01  
## oty\_total\_annual\_wages\_pct\_chg 4.241368e-05 4.556067e-05  
## oty\_taxable\_annual\_wages\_chg 9.800598e-01 9.837473e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 2.302964e-04 1.356876e-04  
## oty\_annual\_contributions\_chg -8.650946e-01 -8.914731e-01  
## oty\_annual\_contributions\_pct\_chg 2.173006e-04 -2.760370e-04  
## oty\_avg\_annual\_pay\_chg 1.690125e-03 1.183642e-03  
## oty\_avg\_annual\_pay\_pct\_chg 9.998311e-05 8.710981e-05  
## annual\_contributions avg\_annual\_pay  
## annual\_avg\_estabs 9.845771e-01 0.009459412  
## annual\_avg\_emplvl 9.844440e-01 0.010113610  
## total\_annual\_wages 9.854710e-01 0.013510228  
## taxable\_annual\_wages 9.953382e-01 0.010495089  
## annual\_contributions 1.000000e+00 0.010986865  
## avg\_annual\_pay 1.098687e-02 1.000000000  
## lq\_annual\_avg\_estabs -2.055741e-04 -0.008561663  
## lq\_annual\_avg\_emplvl 1.667518e-05 0.026649023  
## lq\_total\_annual\_wages -8.464126e-06 0.024412708  
## lq\_taxable\_annual\_wages 2.418934e-04 0.034423746  
## lq\_annual\_contributions 1.778258e-04 0.029963467  
## lq\_avg\_annual\_pay 9.183647e-03 0.762965569  
## oty\_annual\_avg\_estabs\_chg 9.189017e-01 0.009674282  
## oty\_annual\_avg\_estabs\_pct\_chg -4.656916e-04 -0.007475172  
## oty\_annual\_avg\_emplvl\_chg 9.853402e-01 0.009110887  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.836003e-04 0.063574281  
## oty\_total\_annual\_wages\_chg 9.876977e-01 0.014829885  
## oty\_total\_annual\_wages\_pct\_chg 4.938001e-05 0.014558936  
## oty\_taxable\_annual\_wages\_chg 9.822547e-01 0.010674335  
## oty\_taxable\_annual\_wages\_pct\_chg 1.258211e-04 0.011151363  
## oty\_annual\_contributions\_chg -8.767926e-01 -0.008880968  
## oty\_annual\_contributions\_pct\_chg -2.263964e-04 0.012917266  
## oty\_avg\_annual\_pay\_chg 1.267109e-03 0.338189072  
## oty\_avg\_annual\_pay\_pct\_chg 9.060670e-05 0.016436035  
## lq\_annual\_avg\_estabs lq\_annual\_avg\_emplvl  
## annual\_avg\_estabs -0.0002104964 -2.573698e-05  
## annual\_avg\_emplvl -0.0002098775 1.848801e-05  
## total\_annual\_wages -0.0002083437 4.228200e-05  
## taxable\_annual\_wages -0.0002056437 1.796888e-05  
## annual\_contributions -0.0002055741 1.667518e-05  
## avg\_annual\_pay -0.0085616629 2.664902e-02  
## lq\_annual\_avg\_estabs 1.0000000000 1.062469e-01  
## lq\_annual\_avg\_emplvl 0.1062468607 1.000000e+00  
## lq\_total\_annual\_wages 0.1145212304 9.032182e-01  
## lq\_taxable\_annual\_wages 0.0407523568 2.638993e-01  
## lq\_annual\_contributions 0.0355421652 2.173727e-01  
## lq\_avg\_annual\_pay -0.0101978946 3.588629e-02  
## oty\_annual\_avg\_estabs\_chg -0.0001719184 1.766933e-04  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0020199649 4.820487e-05  
## oty\_annual\_avg\_emplvl\_chg -0.0002033500 4.532012e-07  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0013310460 2.052968e-03  
## oty\_total\_annual\_wages\_chg -0.0002030880 5.585496e-05  
## oty\_total\_annual\_wages\_pct\_chg -0.0001710462 2.384916e-04  
## oty\_taxable\_annual\_wages\_chg -0.0002023640 1.939965e-05  
## oty\_taxable\_annual\_wages\_pct\_chg -0.0002401246 1.922866e-04  
## oty\_annual\_contributions\_chg 0.0001811165 -1.888375e-05  
## oty\_annual\_contributions\_pct\_chg -0.0002401905 2.554902e-04  
## oty\_avg\_annual\_pay\_chg -0.0011441296 3.823981e-03  
## oty\_avg\_annual\_pay\_pct\_chg -0.0001799642 3.601937e-04  
## lq\_total\_annual\_wages  
## annual\_avg\_estabs -5.054296e-05  
## annual\_avg\_emplvl -8.991811e-06  
## total\_annual\_wages 9.279886e-06  
## taxable\_annual\_wages -7.378696e-06  
## annual\_contributions -8.464126e-06  
## avg\_annual\_pay 2.441271e-02  
## lq\_annual\_avg\_estabs 1.145212e-01  
## lq\_annual\_avg\_emplvl 9.032182e-01  
## lq\_total\_annual\_wages 1.000000e+00  
## lq\_taxable\_annual\_wages 3.302446e-01  
## lq\_annual\_contributions 2.635839e-01  
## lq\_avg\_annual\_pay 3.605320e-02  
## oty\_annual\_avg\_estabs\_chg 6.307813e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 3.041628e-04  
## oty\_annual\_avg\_emplvl\_chg -2.278975e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.366544e-03  
## oty\_total\_annual\_wages\_chg 2.131995e-05  
## oty\_total\_annual\_wages\_pct\_chg 2.201220e-04  
## oty\_taxable\_annual\_wages\_chg -8.215396e-06  
## oty\_taxable\_annual\_wages\_pct\_chg 1.515235e-04  
## oty\_annual\_contributions\_chg -2.783002e-06  
## oty\_annual\_contributions\_pct\_chg 1.420367e-04  
## oty\_avg\_annual\_pay\_chg 4.322269e-03  
## oty\_avg\_annual\_pay\_pct\_chg 3.664123e-04  
## lq\_taxable\_annual\_wages  
## annual\_avg\_estabs 0.0001280650  
## annual\_avg\_emplvl 0.0001762700  
## total\_annual\_wages 0.0002028038  
## taxable\_annual\_wages 0.0002705183  
## annual\_contributions 0.0002418934  
## avg\_annual\_pay 0.0344237459  
## lq\_annual\_avg\_estabs 0.0407523568  
## lq\_annual\_avg\_emplvl 0.2638993252  
## lq\_total\_annual\_wages 0.3302445797  
## lq\_taxable\_annual\_wages 1.0000000000  
## lq\_annual\_contributions 0.8498554538  
## lq\_avg\_annual\_pay 0.0551513410  
## oty\_annual\_avg\_estabs\_chg 0.0004339986  
## oty\_annual\_avg\_estabs\_pct\_chg -0.0001634154  
## oty\_annual\_avg\_emplvl\_chg 0.0002317044  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0059316149  
## oty\_total\_annual\_wages\_chg 0.0002540708  
## oty\_total\_annual\_wages\_pct\_chg 0.0004846174  
## oty\_taxable\_annual\_wages\_chg 0.0003303864  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0010476052  
## oty\_annual\_contributions\_chg -0.0001704925  
## oty\_annual\_contributions\_pct\_chg 0.0027459607  
## oty\_avg\_annual\_pay\_chg 0.0044960839  
## oty\_avg\_annual\_pay\_pct\_chg 0.0004288754  
## lq\_annual\_contributions lq\_avg\_annual\_pay  
## annual\_avg\_estabs 6.820105e-05 0.008711500  
## annual\_avg\_emplvl 1.144750e-04 0.009421189  
## total\_annual\_wages 1.335527e-04 0.009500954  
## taxable\_annual\_wages 1.795278e-04 0.009227644  
## annual\_contributions 1.778258e-04 0.009183647  
## avg\_annual\_pay 2.996347e-02 0.762965569  
## lq\_annual\_avg\_estabs 3.554217e-02 -0.010197895  
## lq\_annual\_avg\_emplvl 2.173727e-01 0.035886286  
## lq\_total\_annual\_wages 2.635839e-01 0.036053197  
## lq\_taxable\_annual\_wages 8.498555e-01 0.055151341  
## lq\_annual\_contributions 1.000000e+00 0.049690734  
## lq\_avg\_annual\_pay 4.969073e-02 1.000000000  
## oty\_annual\_avg\_estabs\_chg 3.095544e-04 0.007964651  
## oty\_annual\_avg\_estabs\_pct\_chg -3.730961e-05 -0.016156864  
## oty\_annual\_avg\_emplvl\_chg 1.354558e-04 0.008935962  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.610962e-03 0.067718324  
## oty\_total\_annual\_wages\_chg 1.607856e-04 0.009365926  
## oty\_total\_annual\_wages\_pct\_chg 4.051675e-04 0.013209330  
## oty\_taxable\_annual\_wages\_chg 2.726897e-04 0.009079288  
## oty\_taxable\_annual\_wages\_pct\_chg 9.984711e-04 0.013415269  
## oty\_annual\_contributions\_chg -8.275078e-05 -0.008473749  
## oty\_annual\_contributions\_pct\_chg 5.831921e-03 0.016377048  
## oty\_avg\_annual\_pay\_chg 3.972459e-03 0.146497684  
## oty\_avg\_annual\_pay\_pct\_chg 4.255312e-04 0.016527664  
## oty\_annual\_avg\_estabs\_chg  
## annual\_avg\_estabs 9.470161e-01  
## annual\_avg\_emplvl 9.138888e-01  
## total\_annual\_wages 9.131838e-01  
## taxable\_annual\_wages 9.151000e-01  
## annual\_contributions 9.189017e-01  
## avg\_annual\_pay 9.674282e-03  
## lq\_annual\_avg\_estabs -1.719184e-04  
## lq\_annual\_avg\_emplvl 1.766933e-04  
## lq\_total\_annual\_wages 6.307813e-05  
## lq\_taxable\_annual\_wages 4.339986e-04  
## lq\_annual\_contributions 3.095544e-04  
## lq\_avg\_annual\_pay 7.964651e-03  
## oty\_annual\_avg\_estabs\_chg 1.000000e+00  
## oty\_annual\_avg\_estabs\_pct\_chg 7.093236e-03  
## oty\_annual\_avg\_emplvl\_chg 9.292865e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.025404e-03  
## oty\_total\_annual\_wages\_chg 9.211880e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.024419e-04  
## oty\_taxable\_annual\_wages\_chg 9.013644e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 3.938296e-04  
## oty\_annual\_contributions\_chg -7.812147e-01  
## oty\_annual\_contributions\_pct\_chg 2.698927e-04  
## oty\_avg\_annual\_pay\_chg 1.274969e-03  
## oty\_avg\_annual\_pay\_pct\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg  
## annual\_avg\_estabs -3.675062e-04  
## annual\_avg\_emplvl -4.780059e-04  
## total\_annual\_wages -4.566917e-04  
## taxable\_annual\_wages -4.743376e-04  
## annual\_contributions -4.656916e-04  
## avg\_annual\_pay -7.475172e-03  
## lq\_annual\_avg\_estabs 2.019965e-03  
## lq\_annual\_avg\_emplvl 4.820487e-05  
## lq\_total\_annual\_wages 3.041628e-04  
## lq\_taxable\_annual\_wages -1.634154e-04  
## lq\_annual\_contributions -3.730961e-05  
## lq\_avg\_annual\_pay -1.615686e-02  
## oty\_annual\_avg\_estabs\_chg 7.093236e-03  
## oty\_annual\_avg\_estabs\_pct\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.138907e-01  
## oty\_total\_annual\_wages\_chg -2.672994e-04  
## oty\_total\_annual\_wages\_pct\_chg 1.543635e-02  
## oty\_taxable\_annual\_wages\_chg -2.239930e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.189892e-02  
## oty\_annual\_contributions\_chg 7.700292e-04  
## oty\_annual\_contributions\_pct\_chg 1.958854e-02  
## oty\_avg\_annual\_pay\_chg 1.806449e-03  
## oty\_avg\_annual\_pay\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg  
## annual\_avg\_estabs 9.848161e-01  
## annual\_avg\_emplvl 9.821288e-01  
## total\_annual\_wages 9.746165e-01  
## taxable\_annual\_wages 9.867493e-01  
## annual\_contributions 9.853402e-01  
## avg\_annual\_pay 9.110887e-03  
## lq\_annual\_avg\_estabs -2.033500e-04  
## lq\_annual\_avg\_emplvl 4.532012e-07  
## lq\_total\_annual\_wages -2.278975e-05  
## lq\_taxable\_annual\_wages 2.317044e-04  
## lq\_annual\_contributions 1.354558e-04  
## lq\_avg\_annual\_pay 8.935962e-03  
## oty\_annual\_avg\_estabs\_chg 9.292865e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -7.158087e-06  
## oty\_annual\_avg\_emplvl\_chg 1.000000e+00  
## oty\_annual\_avg\_emplvl\_pct\_chg 4.807178e-03  
## oty\_total\_annual\_wages\_chg 9.815811e-01  
## oty\_total\_annual\_wages\_pct\_chg 3.063543e-04  
## oty\_taxable\_annual\_wages\_chg 9.767026e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 4.426258e-04  
## oty\_annual\_contributions\_chg -8.572621e-01  
## oty\_annual\_contributions\_pct\_chg 5.005389e-04  
## oty\_avg\_annual\_pay\_chg 7.638574e-04  
## oty\_avg\_annual\_pay\_pct\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg  
## annual\_avg\_estabs 0.0005993884  
## annual\_avg\_emplvl 0.0003325045  
## total\_annual\_wages 0.0003107054  
## taxable\_annual\_wages 0.0004477687  
## annual\_contributions 0.0004836003  
## avg\_annual\_pay 0.0635742812  
## lq\_annual\_avg\_estabs -0.0013310460  
## lq\_annual\_avg\_emplvl 0.0020529681  
## lq\_total\_annual\_wages 0.0013665438  
## lq\_taxable\_annual\_wages 0.0059316149  
## lq\_annual\_contributions 0.0046109622  
## lq\_avg\_annual\_pay 0.0677183237  
## oty\_annual\_avg\_estabs\_chg 0.0040254039  
## oty\_annual\_avg\_estabs\_pct\_chg 0.1138907430  
## oty\_annual\_avg\_emplvl\_chg 0.0048071782  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.0000000000  
## oty\_total\_annual\_wages\_chg 0.0021446051  
## oty\_total\_annual\_wages\_pct\_chg 0.0813343520  
## oty\_taxable\_annual\_wages\_chg 0.0022657179  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0601069631  
## oty\_annual\_contributions\_chg 0.0019402235  
## oty\_annual\_contributions\_pct\_chg 0.1097278601  
## oty\_avg\_annual\_pay\_chg -0.0135267362  
## oty\_avg\_annual\_pay\_pct\_chg 0.0029341643  
## oty\_total\_annual\_wages\_chg  
## annual\_avg\_estabs 9.802549e-01  
## annual\_avg\_emplvl 9.853406e-01  
## total\_annual\_wages 9.939038e-01  
## taxable\_annual\_wages 9.857033e-01  
## annual\_contributions 9.876977e-01  
## avg\_annual\_pay 1.482988e-02  
## lq\_annual\_avg\_estabs -2.030880e-04  
## lq\_annual\_avg\_emplvl 5.585496e-05  
## lq\_total\_annual\_wages 2.131995e-05  
## lq\_taxable\_annual\_wages 2.540708e-04  
## lq\_annual\_contributions 1.607856e-04  
## lq\_avg\_annual\_pay 9.365926e-03  
## oty\_annual\_avg\_estabs\_chg 9.211880e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -2.672994e-04  
## oty\_annual\_avg\_emplvl\_chg 9.815811e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.144605e-03  
## oty\_total\_annual\_wages\_chg 1.000000e+00  
## oty\_total\_annual\_wages\_pct\_chg 2.081526e-04  
## oty\_taxable\_annual\_wages\_chg 9.811283e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 3.310573e-04  
## oty\_annual\_contributions\_chg -8.523860e-01  
## oty\_annual\_contributions\_pct\_chg 3.328761e-04  
## oty\_avg\_annual\_pay\_chg 4.238406e-03  
## oty\_avg\_annual\_pay\_pct\_chg 2.071458e-04  
## oty\_total\_annual\_wages\_pct\_chg  
## annual\_avg\_estabs 4.995590e-05  
## annual\_avg\_emplvl 3.614739e-05  
## total\_annual\_wages 4.241368e-05  
## taxable\_annual\_wages 4.556067e-05  
## annual\_contributions 4.938001e-05  
## avg\_annual\_pay 1.455894e-02  
## lq\_annual\_avg\_estabs -1.710462e-04  
## lq\_annual\_avg\_emplvl 2.384916e-04  
## lq\_total\_annual\_wages 2.201220e-04  
## lq\_taxable\_annual\_wages 4.846174e-04  
## lq\_annual\_contributions 4.051675e-04  
## lq\_avg\_annual\_pay 1.320933e-02  
## oty\_annual\_avg\_estabs\_chg 3.024419e-04  
## oty\_annual\_avg\_estabs\_pct\_chg 1.543635e-02  
## oty\_annual\_avg\_emplvl\_chg 3.063543e-04  
## oty\_annual\_avg\_emplvl\_pct\_chg 8.133435e-02  
## oty\_total\_annual\_wages\_chg 2.081526e-04  
## oty\_total\_annual\_wages\_pct\_chg 1.000000e+00  
## oty\_taxable\_annual\_wages\_chg 1.696696e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 5.649533e-03  
## oty\_annual\_contributions\_chg 1.215768e-04  
## oty\_annual\_contributions\_pct\_chg 1.027751e-02  
## oty\_avg\_annual\_pay\_chg 3.122798e-02  
## oty\_avg\_annual\_pay\_pct\_chg 8.741519e-01  
## oty\_taxable\_annual\_wages\_chg  
## annual\_avg\_estabs 9.712103e-01  
## annual\_avg\_emplvl 9.807860e-01  
## total\_annual\_wages 9.800598e-01  
## taxable\_annual\_wages 9.837473e-01  
## annual\_contributions 9.822547e-01  
## avg\_annual\_pay 1.067433e-02  
## lq\_annual\_avg\_estabs -2.023640e-04  
## lq\_annual\_avg\_emplvl 1.939965e-05  
## lq\_total\_annual\_wages -8.215396e-06  
## lq\_taxable\_annual\_wages 3.303864e-04  
## lq\_annual\_contributions 2.726897e-04  
## lq\_avg\_annual\_pay 9.079288e-03  
## oty\_annual\_avg\_estabs\_chg 9.013644e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -2.239930e-04  
## oty\_annual\_avg\_emplvl\_chg 9.767026e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.265718e-03  
## oty\_total\_annual\_wages\_chg 9.811283e-01  
## oty\_total\_annual\_wages\_pct\_chg 1.696696e-04  
## oty\_taxable\_annual\_wages\_chg 1.000000e+00  
## oty\_taxable\_annual\_wages\_pct\_chg 9.878633e-04  
## oty\_annual\_contributions\_chg -8.193021e-01  
## oty\_annual\_contributions\_pct\_chg 1.127843e-03  
## oty\_avg\_annual\_pay\_chg 1.541665e-03  
## oty\_avg\_annual\_pay\_pct\_chg 1.084494e-04  
## oty\_taxable\_annual\_wages\_pct\_chg  
## annual\_avg\_estabs 0.0001093593  
## annual\_avg\_emplvl 0.0002247588  
## total\_annual\_wages 0.0002302964  
## taxable\_annual\_wages 0.0001356876  
## annual\_contributions 0.0001258211  
## avg\_annual\_pay 0.0111513627  
## lq\_annual\_avg\_estabs -0.0002401246  
## lq\_annual\_avg\_emplvl 0.0001922866  
## lq\_total\_annual\_wages 0.0001515235  
## lq\_taxable\_annual\_wages 0.0010476052  
## lq\_annual\_contributions 0.0009984711  
## lq\_avg\_annual\_pay 0.0134152686  
## oty\_annual\_avg\_estabs\_chg 0.0003938296  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0118989234  
## oty\_annual\_avg\_emplvl\_chg 0.0004426258  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0601069631  
## oty\_total\_annual\_wages\_chg 0.0003310573  
## oty\_total\_annual\_wages\_pct\_chg 0.0056495328  
## oty\_taxable\_annual\_wages\_chg 0.0009878633  
## oty\_taxable\_annual\_wages\_pct\_chg 1.0000000000  
## oty\_annual\_contributions\_chg 0.0006658204  
## oty\_annual\_contributions\_pct\_chg 0.3580519080  
## oty\_avg\_annual\_pay\_chg 0.0030801375  
## oty\_avg\_annual\_pay\_pct\_chg 0.0010907424  
## oty\_annual\_contributions\_chg  
## annual\_avg\_estabs -8.631331e-01  
## annual\_avg\_emplvl -8.713379e-01  
## total\_annual\_wages -8.650946e-01  
## taxable\_annual\_wages -8.914731e-01  
## annual\_contributions -8.767926e-01  
## avg\_annual\_pay -8.880968e-03  
## lq\_annual\_avg\_estabs 1.811165e-04  
## lq\_annual\_avg\_emplvl -1.888375e-05  
## lq\_total\_annual\_wages -2.783002e-06  
## lq\_taxable\_annual\_wages -1.704925e-04  
## lq\_annual\_contributions -8.275078e-05  
## lq\_avg\_annual\_pay -8.473749e-03  
## oty\_annual\_avg\_estabs\_chg -7.812147e-01  
## oty\_annual\_avg\_estabs\_pct\_chg 7.700292e-04  
## oty\_annual\_avg\_emplvl\_chg -8.572621e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 1.940223e-03  
## oty\_total\_annual\_wages\_chg -8.523860e-01  
## oty\_total\_annual\_wages\_pct\_chg 1.215768e-04  
## oty\_taxable\_annual\_wages\_chg -8.193021e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 6.658204e-04  
## oty\_annual\_contributions\_chg 1.000000e+00  
## oty\_annual\_contributions\_pct\_chg 2.856920e-03  
## oty\_avg\_annual\_pay\_chg -4.236233e-04  
## oty\_avg\_annual\_pay\_pct\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg  
## annual\_avg\_estabs -0.0002322915  
## annual\_avg\_emplvl 0.0002590830  
## total\_annual\_wages 0.0002173006  
## taxable\_annual\_wages -0.0002760370  
## annual\_contributions -0.0002263964  
## avg\_annual\_pay 0.0129172664  
## lq\_annual\_avg\_estabs -0.0002401905  
## lq\_annual\_avg\_emplvl 0.0002554902  
## lq\_total\_annual\_wages 0.0001420367  
## lq\_taxable\_annual\_wages 0.0027459607  
## lq\_annual\_contributions 0.0058319213  
## lq\_avg\_annual\_pay 0.0163770479  
## oty\_annual\_avg\_estabs\_chg 0.0002698927  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0195885383  
## oty\_annual\_avg\_emplvl\_chg 0.0005005389  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.1097278601  
## oty\_total\_annual\_wages\_chg 0.0003328761  
## oty\_total\_annual\_wages\_pct\_chg 0.0102775060  
## oty\_taxable\_annual\_wages\_chg 0.0011278428  
## oty\_taxable\_annual\_wages\_pct\_chg 0.3580519080  
## oty\_annual\_contributions\_chg 0.0028569203  
## oty\_annual\_contributions\_pct\_chg 1.0000000000  
## oty\_avg\_annual\_pay\_chg 0.0067616347  
## oty\_avg\_annual\_pay\_pct\_chg 0.0022588086  
## oty\_avg\_annual\_pay\_chg  
## annual\_avg\_estabs 0.0010058930  
## annual\_avg\_emplvl 0.0010825502  
## total\_annual\_wages 0.0016901249  
## taxable\_annual\_wages 0.0011836422  
## annual\_contributions 0.0012671092  
## avg\_annual\_pay 0.3381890717  
## lq\_annual\_avg\_estabs -0.0011441296  
## lq\_annual\_avg\_emplvl 0.0038239814  
## lq\_total\_annual\_wages 0.0043222691  
## lq\_taxable\_annual\_wages 0.0044960839  
## lq\_annual\_contributions 0.0039724586  
## lq\_avg\_annual\_pay 0.1464976841  
## oty\_annual\_avg\_estabs\_chg 0.0012749692  
## oty\_annual\_avg\_estabs\_pct\_chg 0.0018064489  
## oty\_annual\_avg\_emplvl\_chg 0.0007638574  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0135267362  
## oty\_total\_annual\_wages\_chg 0.0042384059  
## oty\_total\_annual\_wages\_pct\_chg 0.0312279792  
## oty\_taxable\_annual\_wages\_chg 0.0015416652  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0030801375  
## oty\_annual\_contributions\_chg -0.0004236233  
## oty\_annual\_contributions\_pct\_chg 0.0067616347  
## oty\_avg\_annual\_pay\_chg 1.0000000000  
## oty\_avg\_annual\_pay\_pct\_chg 0.0396125653  
## oty\_avg\_annual\_pay\_pct\_chg  
## annual\_avg\_estabs 7.706793e-05  
## annual\_avg\_emplvl 8.275358e-05  
## total\_annual\_wages 9.998311e-05  
## taxable\_annual\_wages 8.710981e-05  
## annual\_contributions 9.060670e-05  
## avg\_annual\_pay 1.643604e-02  
## lq\_annual\_avg\_estabs -1.799642e-04  
## lq\_annual\_avg\_emplvl 3.601937e-04  
## lq\_total\_annual\_wages 3.664123e-04  
## lq\_taxable\_annual\_wages 4.288754e-04  
## lq\_annual\_contributions 4.255312e-04  
## lq\_avg\_annual\_pay 1.652766e-02  
## oty\_annual\_avg\_estabs\_chg 9.179510e-05  
## oty\_annual\_avg\_estabs\_pct\_chg 7.902904e-04  
## oty\_annual\_avg\_emplvl\_chg 5.620483e-05  
## oty\_annual\_avg\_emplvl\_pct\_chg 2.934164e-03  
## oty\_total\_annual\_wages\_chg 2.071458e-04  
## oty\_total\_annual\_wages\_pct\_chg 8.741519e-01  
## oty\_taxable\_annual\_wages\_chg 1.084494e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 1.090742e-03  
## oty\_annual\_contributions\_chg -4.419315e-05  
## oty\_annual\_contributions\_pct\_chg 2.258809e-03  
## oty\_avg\_annual\_pay\_chg 3.961257e-02  
## oty\_avg\_annual\_pay\_pct\_chg 1.000000e+00

names(data.keep)

## [1] "annual\_avg\_estabs" "annual\_avg\_emplvl"   
## [3] "total\_annual\_wages" "taxable\_annual\_wages"   
## [5] "annual\_contributions" "avg\_annual\_pay"   
## [7] "lq\_annual\_avg\_estabs" "lq\_annual\_avg\_emplvl"   
## [9] "lq\_total\_annual\_wages" "lq\_taxable\_annual\_wages"   
## [11] "lq\_annual\_contributions" "lq\_avg\_annual\_pay"   
## [13] "oty\_annual\_avg\_estabs\_chg" "oty\_annual\_avg\_estabs\_pct\_chg"   
## [15] "oty\_annual\_avg\_emplvl\_chg" "oty\_annual\_avg\_emplvl\_pct\_chg"   
## [17] "oty\_total\_annual\_wages\_chg" "oty\_total\_annual\_wages\_pct\_chg"   
## [19] "oty\_taxable\_annual\_wages\_chg" "oty\_taxable\_annual\_wages\_pct\_chg"  
## [21] "oty\_annual\_contributions\_chg" "oty\_annual\_contributions\_pct\_chg"  
## [23] "oty\_avg\_annual\_pay\_chg" "oty\_avg\_annual\_pay\_pct\_chg"

Although total\_annual\_wages has highly correlation with oty\_annual\_avg\_emplvl\_chg and oty\_total\_annual\_wages\_chg which the correlation values of them are larger than 0.97, they are not perfect correlative. So I will not remove other variables.

My final data contains 24 variables. I will run PCA on these 24 variables.

### Use princomp() function to do PCA

BLS.fit.A <- princomp(formula = ~., data.keep, cor = TRUE, na.action = na.exclude)  
BLS.fit.A

## Call:  
## princomp(x = data.keep, cor = TRUE, formula = ~., na.action = na.exclude)  
##   
## Standard deviations:  
## Comp.1 Comp.2 Comp.3 Comp.4 Comp.5 Comp.6   
## 3.08705570 1.56530382 1.39151230 1.35381442 1.18230254 1.16297916   
## Comp.7 Comp.8 Comp.9 Comp.10 Comp.11 Comp.12   
## 1.04062139 0.98585752 0.95975899 0.91655791 0.79878707 0.50039267   
## Comp.13 Comp.14 Comp.15 Comp.16 Comp.17 Comp.18   
## 0.45939720 0.38751857 0.36306651 0.34963971 0.30446548 0.17573751   
## Comp.19 Comp.20 Comp.21 Comp.22 Comp.23 Comp.24   
## 0.13410903 0.12681133 0.11426607 0.08387802 0.04800662 0.02502383   
##   
## 24 variables and 3569127 observations.

summary(BLS.fit.A)

## Importance of components:  
## Comp.1 Comp.2 Comp.3 Comp.4 Comp.5  
## Standard deviation 3.0870557 1.5653038 1.39151230 1.35381442 1.1823025  
## Proportion of Variance 0.3970797 0.1020907 0.08067944 0.07636723 0.0582433  
## Cumulative Proportion 0.3970797 0.4991704 0.57984981 0.65621704 0.7144603  
## Comp.6 Comp.7 Comp.8 Comp.9  
## Standard deviation 1.16297916 1.04062139 0.98585752 0.95975899  
## Proportion of Variance 0.05635502 0.04512054 0.04049646 0.03838072  
## Cumulative Proportion 0.77081536 0.81593590 0.85643236 0.89481308  
## Comp.10 Comp.11 Comp.12 Comp.13  
## Standard deviation 0.91655791 0.79878707 0.50039267 0.459397204  
## Proportion of Variance 0.03500327 0.02658587 0.01043303 0.008793575  
## Cumulative Proportion 0.92981635 0.95640222 0.96683525 0.975628825  
## Comp.14 Comp.15 Comp.16 Comp.17  
## Standard deviation 0.38751857 0.363066514 0.349639707 0.304465481  
## Proportion of Variance 0.00625711 0.005492387 0.005093664 0.003862468  
## Cumulative Proportion 0.98188594 0.987378323 0.992471986 0.996334454  
## Comp.18 Comp.19 Comp.20 Comp.21  
## Standard deviation 0.17573751 0.1341090324 0.1268113327 0.1142660713  
## Proportion of Variance 0.00128682 0.0007493847 0.0006700464 0.0005440306  
## Cumulative Proportion 0.99762127 0.9983706584 0.9990407048 0.9995847354  
## Comp.22 Comp.23 Comp.24  
## Standard deviation 0.0838780192 0.0480066249 2.502383e-02  
## Proportion of Variance 0.0002931468 0.0000960265 2.609134e-05  
## Cumulative Proportion 0.9998778822 0.9999739087 1.000000e+00

names(BLS.fit.A)

## [1] "sdev" "loadings" "center" "scale" "n.obs" "scores"   
## [7] "call"

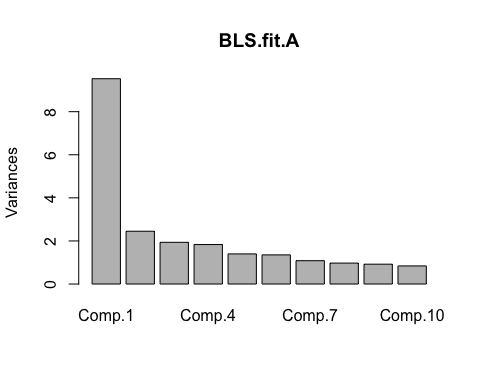
#to plot the screeplot  
screeplot(BLS.fit.A)  
  
#to use biplot  
#biplot(BLS.fit.A)  
  
#However, it takes a very long time for the biplot to execute, and I am unable to determine the result.   
  
library('ggbiplot')

## Loading required package: ggplot2

## Loading required package: plyr

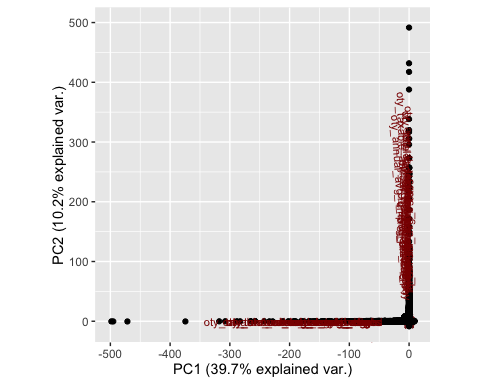
## Loading required package: scales

## Loading required package: grid



library('ggplot2')  
ggbiplot(BLS.fit.A, labers = rownames(data.keep), obs.scale = 1, var.scale = 1) + xlim(-500, 10) + ylim(-10,500)

## Warning: Removed 28 rows containing missing values (geom\_point).



### Answer for questions:

1. What proportion of the total variation in the data is explained by each of the principal components?

* Using the summary(BLS.fit.A), it is easy to get the proportion of the total variation in the data is explained by each of the principal components. For example, Compnent 1 explains 16.92% of the variation and Compnent 2 explains 15.31% and Component 1 to Component 10 can expalin 94.55% of the variation.

1. What happens when you plot a screeplot?

* I use screeplot() function to plot. The x axis is component and y axis is variances. The plot shows 10 components and its variances. It can find that component 1 has the largest variances.

1. Based on the variation explained for each of these components, which, if any, components would you use? Why?

* I plan to use first 11 components because these componnets can explain 95% of variance.

1. Is there evidence of clustering in the data by creating biplots of the each of the components plotted against one another? Why or why not?

* Yes, there is evidence of clustering in the data by creating biplots of components plotted against one another.
* There are 11 components, I made biplot with component 1 and component 2. In the biplot, some variables are in the same direction with PC1 and some variables are in the same direction with PC2. That means the variables in the same directions have high correlation and can be culstered. And there are also many wage data which have very high correlation value.
* Also, if the biplot function could be executed, there will be some vectors with direction and length on the plot. The vectors will present the equality of correlation and the proportionality of standard deviations of the variables. If the variables were perfect fit, the cosine of the angle would be equal and the length of them were almost same.

1. Do any of the biplots reveal any interesting structure?

* Yes, the biplots reveal interesting structure. Biplots of the PCA components show the correlation of variables because PCA could let to reduce data by replace correlated variables to the new data set. In my biplots, there are one group of data in the same direction along the PC1 and the other group of data in the same direction along the PC2. These two groups data are clustered.

1. How many pcs are required to explain 75% of the variance in the data?

* According to the PCA result, 6 components are required to explain 75% of the variance in the data.

### Use prcomp() function to do PCA

BLS.fit.B <- prcomp(data.keep, retx = TRUE, center = TRUE, scale. = TRUE)  
BLS.fit.B

## Standard deviations:  
## [1] 3.08705570 1.56530382 1.39151230 1.35381442 1.18230254 1.16297916  
## [7] 1.04062139 0.98585752 0.95975899 0.91655791 0.79878707 0.50039267  
## [13] 0.45939720 0.38751857 0.36306651 0.34963971 0.30446548 0.17573751  
## [19] 0.13410903 0.12681133 0.11426607 0.08387802 0.04800662 0.02502383  
##   
## Rotation:  
## PC1 PC2 PC3  
## annual\_avg\_estabs -3.214662e-01 0.0005566104 -0.0019470775  
## annual\_avg\_emplvl -3.216463e-01 0.0004516538 -0.0016079320  
## total\_annual\_wages -3.212420e-01 0.0002539476 -0.0006289710  
## taxable\_annual\_wages -3.227829e-01 0.0004182548 -0.0015900563  
## annual\_contributions -3.221383e-01 0.0003973943 -0.0014373282  
## avg\_annual\_pay -4.373090e-03 -0.1159528718 0.4841458997  
## lq\_annual\_avg\_estabs 8.092431e-05 -0.1000369453 -0.0341512784  
## lq\_annual\_avg\_emplvl -5.326263e-05 -0.4912167024 -0.0815728823  
## lq\_total\_annual\_wages -4.214992e-05 -0.5143160817 -0.0855751076  
## lq\_taxable\_annual\_wages -1.473525e-04 -0.4881598370 -0.0555229820  
## lq\_annual\_contributions -1.154198e-04 -0.4625585930 -0.0527870971  
## lq\_avg\_annual\_pay -3.745020e-03 -0.1254167217 0.4504466055  
## oty\_annual\_avg\_estabs\_chg -3.034637e-01 0.0002937030 -0.0013533515  
## oty\_annual\_avg\_estabs\_pct\_chg -1.202158e-04 0.0001466007 0.0125034579  
## oty\_annual\_avg\_emplvl\_chg -3.207585e-01 0.0004849734 -0.0016698711  
## oty\_annual\_avg\_emplvl\_pct\_chg -5.702361e-04 -0.0166059629 0.1137039218  
## oty\_total\_annual\_wages\_chg -3.211539e-01 0.0001141945 0.0002228358  
## oty\_total\_annual\_wages\_pct\_chg -6.897495e-05 -0.0117666012 0.4736750397  
## oty\_taxable\_annual\_wages\_chg -3.181766e-01 0.0003351812 -0.0012027434  
## oty\_taxable\_annual\_wages\_pct\_chg -1.049979e-04 -0.0057218388 0.0440617702  
## oty\_annual\_contributions\_chg 2.875035e-01 -0.0004597870 0.0019327921  
## oty\_annual\_contributions\_pct\_chg -3.615439e-06 -0.0083364807 0.0528290617  
## oty\_avg\_annual\_pay\_chg -7.780595e-04 -0.0457050275 0.2787873675  
## oty\_avg\_annual\_pay\_pct\_chg -6.182701e-05 -0.0116550560 0.4709127889  
## PC4 PC5 PC6  
## annual\_avg\_estabs -0.0017038780 1.491577e-04 -5.300009e-05  
## annual\_avg\_emplvl -0.0013444049 4.273854e-05 -2.379150e-05  
## total\_annual\_wages -0.0003963015 2.389390e-04 5.418882e-05  
## taxable\_annual\_wages -0.0013262942 3.652140e-04 -9.991843e-05  
## annual\_contributions -0.0011885459 3.274647e-04 -7.375222e-05  
## avg\_annual\_pay 0.4566065888 6.131548e-02 2.638320e-02  
## lq\_annual\_avg\_estabs -0.0311796249 8.182173e-03 1.771198e-01  
## lq\_annual\_avg\_emplvl -0.0653766659 3.117184e-02 4.854342e-01  
## lq\_total\_annual\_wages -0.0683794215 2.837017e-02 4.407077e-01  
## lq\_taxable\_annual\_wages -0.0372648364 -3.274315e-02 -4.933871e-01  
## lq\_annual\_contributions -0.0352763756 -3.722959e-02 -5.374401e-01  
## lq\_avg\_annual\_pay 0.4295855228 4.598725e-02 1.158538e-02  
## oty\_annual\_avg\_estabs\_chg -0.0016236835 -1.906507e-03 1.213180e-05  
## oty\_annual\_avg\_estabs\_pct\_chg -0.0197370396 -1.412438e-01 1.092708e-02  
## oty\_annual\_avg\_emplvl\_chg -0.0017839322 -1.338996e-03 -8.516755e-06  
## oty\_annual\_avg\_emplvl\_pct\_chg 0.0135650889 -3.041635e-01 1.919407e-02  
## oty\_total\_annual\_wages\_chg 0.0001350595 -1.455610e-04 1.470891e-04  
## oty\_total\_annual\_wages\_pct\_chg -0.5237493221 2.042502e-02 -4.427479e-03  
## oty\_taxable\_annual\_wages\_chg -0.0011794201 -1.255844e-03 -3.000546e-05  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0179386430 -6.489989e-01 4.823379e-02  
## oty\_annual\_contributions\_chg 0.0013337914 -2.999551e-03 2.352357e-04  
## oty\_annual\_contributions\_pct\_chg 0.0180451072 -6.698646e-01 4.511291e-02  
## oty\_avg\_annual\_pay\_chg 0.2154740062 6.856555e-02 2.742398e-02  
## oty\_avg\_annual\_pay\_pct\_chg -0.5219493834 4.801807e-02 -5.886794e-03  
## PC7 PC8 PC9  
## annual\_avg\_estabs 0.0007496661 2.104952e-05 -1.688325e-04  
## annual\_avg\_emplvl 0.0013487432 3.185786e-05 4.517001e-05  
## total\_annual\_wages 0.0014130866 -5.052175e-05 -1.942079e-04  
## taxable\_annual\_wages 0.0012229706 1.236916e-05 2.240342e-05  
## annual\_contributions 0.0011489999 -1.379158e-06 -2.718839e-05  
## avg\_annual\_pay 0.0026228905 -6.338874e-03 6.689222e-02  
## lq\_annual\_avg\_estabs -0.0060564691 -9.722493e-01 1.026649e-01  
## lq\_annual\_avg\_emplvl -0.0001257045 1.470594e-01 -1.322261e-02  
## lq\_total\_annual\_wages 0.0004159349 1.323371e-01 -1.491345e-02  
## lq\_taxable\_annual\_wages 0.0025054884 -3.712803e-02 -1.180910e-02  
## lq\_annual\_contributions 0.0038747679 -5.014943e-02 -1.316628e-02  
## lq\_avg\_annual\_pay -0.0174343024 2.248502e-02 2.702544e-01  
## oty\_annual\_avg\_estabs\_chg -0.0067979586 -2.219831e-04 -3.317327e-03  
## oty\_annual\_avg\_estabs\_pct\_chg -0.7273019421 -3.587233e-02 -4.932610e-01  
## oty\_annual\_avg\_emplvl\_chg -0.0015602734 1.663562e-04 1.758032e-03  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.5926318253 3.068949e-02 4.064807e-01  
## oty\_total\_annual\_wages\_chg 0.0005065344 -2.666023e-04 -1.406831e-03  
## oty\_total\_annual\_wages\_pct\_chg 0.0026082320 3.611738e-03 2.570939e-02  
## oty\_taxable\_annual\_wages\_chg 0.0004205609 -2.225698e-06 2.942036e-04  
## oty\_taxable\_annual\_wages\_pct\_chg 0.2619187933 -5.972153e-03 -9.097852e-02  
## oty\_annual\_contributions\_chg -0.0025355809 -6.636714e-05 1.795409e-05  
## oty\_annual\_contributions\_pct\_chg 0.1836309992 -3.923781e-03 -3.819812e-02  
## oty\_avg\_annual\_pay\_chg 0.1157734415 -9.412343e-02 -7.015565e-01  
## oty\_avg\_annual\_pay\_pct\_chg 0.0604616855 6.551588e-04 -1.048722e-02  
## PC10 PC11 PC12  
## annual\_avg\_estabs 1.522251e-04 -1.559356e-04 -8.785143e-02  
## annual\_avg\_emplvl -2.389627e-04 -6.460282e-04 -2.064765e-02  
## total\_annual\_wages -3.135633e-04 -6.290669e-04 -4.242277e-02  
## taxable\_annual\_wages -9.249799e-05 -2.340414e-05 4.901486e-02  
## annual\_contributions -2.398562e-05 -1.361209e-04 -7.822754e-03  
## avg\_annual\_pay -1.107412e-01 -4.306542e-03 -1.300016e-02  
## lq\_annual\_avg\_estabs -2.293325e-02 -1.902277e-05 2.947307e-05  
## lq\_annual\_avg\_emplvl 5.746742e-03 -1.141014e-03 -2.185042e-04  
## lq\_total\_annual\_wages 6.971875e-03 -5.513521e-04 1.764401e-04  
## lq\_taxable\_annual\_wages 9.976112e-03 4.793653e-03 -4.243811e-05  
## lq\_annual\_contributions 1.032009e-02 2.682452e-04 -9.948276e-05  
## lq\_avg\_annual\_pay -2.791319e-01 -1.560122e-02 1.116686e-02  
## oty\_annual\_avg\_estabs\_chg -1.335868e-03 -9.899036e-05 -3.316030e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -4.531000e-01 -2.035885e-02 3.187070e-03  
## oty\_annual\_avg\_emplvl\_chg 2.814270e-03 8.835300e-05 -8.967368e-02  
## oty\_annual\_avg\_emplvl\_pct\_chg 5.997103e-01 1.123592e-01 4.869742e-03  
## oty\_total\_annual\_wages\_chg 2.525038e-03 -2.879811e-04 -1.035491e-01  
## oty\_total\_annual\_wages\_pct\_chg -8.788888e-03 3.293429e-03 4.548422e-04  
## oty\_taxable\_annual\_wages\_chg 1.404242e-03 -6.257408e-04 -1.963439e-01  
## oty\_taxable\_annual\_wages\_pct\_chg -1.479904e-01 6.894635e-01 -7.745930e-04  
## oty\_annual\_contributions\_chg 2.681718e-03 -2.547738e-03 -9.055111e-01  
## oty\_annual\_contributions\_pct\_chg -1.023835e-02 -7.146446e-01 3.484818e-03  
## oty\_avg\_annual\_pay\_chg 5.643043e-01 2.268123e-02 5.067232e-03  
## oty\_avg\_annual\_pay\_pct\_chg -5.923002e-02 -8.016695e-03 -7.278574e-04  
## PC13 PC14 PC15  
## annual\_avg\_estabs -0.0065514052 2.366190e-06 -1.207776e-01  
## annual\_avg\_emplvl -0.0031299539 -2.586613e-04 1.668260e-01  
## total\_annual\_wages 0.0084373178 -1.756132e-04 1.907706e-01  
## taxable\_annual\_wages -0.0005058449 -7.395728e-05 1.253050e-01  
## annual\_contributions 0.0003278732 -1.757356e-04 1.182709e-01  
## avg\_annual\_pay 0.7224177945 3.359937e-03 -6.885622e-03  
## lq\_annual\_avg\_estabs -0.0021044414 1.772194e-04 -2.128124e-05  
## lq\_annual\_avg\_emplvl 0.0064334533 -1.572382e-01 -1.336931e-03  
## lq\_total\_annual\_wages -0.0031351668 1.106985e-01 1.396952e-03  
## lq\_taxable\_annual\_wages 0.0035810045 6.969124e-01 5.012797e-04  
## lq\_annual\_contributions 0.0108943461 -6.908514e-01 -5.449506e-04  
## lq\_avg\_annual\_pay -0.6648995371 -5.736613e-03 5.133226e-03  
## oty\_annual\_avg\_estabs\_chg -0.0118192835 8.786150e-04 -8.408001e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -0.0057981768 7.063413e-05 6.977360e-03  
## oty\_annual\_avg\_emplvl\_chg -0.0080407367 1.570729e-05 2.640799e-02  
## oty\_annual\_avg\_emplvl\_pct\_chg -0.0055563887 -1.085794e-03 1.044800e-03  
## oty\_total\_annual\_wages\_chg 0.0096262173 -1.171077e-05 1.519875e-01  
## oty\_total\_annual\_wages\_pct\_chg 0.0146147399 2.633649e-04 1.778309e-03  
## oty\_taxable\_annual\_wages\_chg -0.0036719798 -4.005710e-04 3.348339e-01  
## oty\_taxable\_annual\_wages\_pct\_chg 0.0003746388 -1.281228e-03 2.947643e-05  
## oty\_annual\_contributions\_chg -0.0145387017 -2.355216e-04 2.202401e-01  
## oty\_annual\_contributions\_pct\_chg 0.0041170934 3.259728e-03 -1.349195e-03  
## oty\_avg\_annual\_pay\_chg -0.1866269471 -7.007219e-04 1.046653e-03  
## oty\_avg\_annual\_pay\_pct\_chg -0.0079402411 -1.817990e-04 -1.843841e-03  
## PC16 PC17 PC18  
## annual\_avg\_estabs -7.503044e-04 0.0004336497 1.598060e-01  
## annual\_avg\_emplvl 1.095621e-04 -0.0003300130 -2.781875e-01  
## total\_annual\_wages 4.263950e-04 -0.0002190199 -5.915198e-01  
## taxable\_annual\_wages 2.049140e-04 -0.0003190922 2.277867e-01  
## annual\_contributions 1.594534e-04 -0.0001901554 2.116932e-01  
## avg\_annual\_pay 8.316366e-03 0.0058982376 1.017828e-02  
## lq\_annual\_avg\_estabs 1.814641e-07 -0.0063223496 -2.545812e-07  
## lq\_annual\_avg\_emplvl 6.142420e-04 -0.6815839255 1.185654e-05  
## lq\_total\_annual\_wages -5.861537e-04 0.7059752308 4.259774e-05  
## lq\_taxable\_annual\_wages 4.233360e-04 -0.1593066747 -6.682322e-06  
## lq\_annual\_contributions -2.105777e-04 0.1075920481 4.723535e-05  
## lq\_avg\_annual\_pay -1.355454e-02 -0.0020667951 -7.242780e-03  
## oty\_annual\_avg\_estabs\_chg -2.413428e-03 0.0014031718 -1.118614e-01  
## oty\_annual\_avg\_estabs\_pct\_chg 3.481594e-03 -0.0002908781 8.396173e-04  
## oty\_annual\_avg\_emplvl\_chg 2.815993e-04 -0.0000251917 5.327383e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 6.321323e-02 0.0007831348 -2.231863e-03  
## oty\_total\_annual\_wages\_chg 8.535418e-04 -0.0001131983 -3.396713e-01  
## oty\_total\_annual\_wages\_pct\_chg -7.069349e-01 -0.0005548320 3.240244e-05  
## oty\_taxable\_annual\_wages\_chg 7.485704e-04 -0.0007454729 1.960530e-01  
## oty\_taxable\_annual\_wages\_pct\_chg -3.924065e-05 0.0001264197 -1.395926e-04  
## oty\_annual\_contributions\_chg -2.416875e-04 -0.0001995506 1.334276e-02  
## oty\_annual\_contributions\_pct\_chg -1.317610e-03 -0.0002933210 2.449006e-04  
## oty\_avg\_annual\_pay\_chg -6.598990e-03 -0.0020355940 -9.654063e-04  
## oty\_avg\_annual\_pay\_pct\_chg 7.042214e-01 0.0005616321 2.953125e-05  
## PC19 PC20 PC21  
## annual\_avg\_estabs -3.977583e-01 1.931787e-01 6.627651e-01  
## annual\_avg\_emplvl -4.669036e-01 3.787889e-01 -2.220308e-01  
## total\_annual\_wages -6.800754e-02 -2.123880e-02 3.087559e-03  
## taxable\_annual\_wages 1.254993e-01 1.337710e-01 1.834122e-01  
## annual\_contributions 3.574164e-01 -2.109174e-01 3.710381e-01  
## avg\_annual\_pay -4.675329e-03 6.161954e-03 -1.225392e-03  
## lq\_annual\_avg\_estabs -2.574059e-06 5.450675e-06 4.418383e-06  
## lq\_annual\_avg\_emplvl -1.375875e-04 -9.668155e-05 1.378946e-04  
## lq\_total\_annual\_wages 1.428091e-04 1.167709e-04 -1.326418e-04  
## lq\_taxable\_annual\_wages -1.540635e-04 7.581959e-05 1.298270e-04  
## lq\_annual\_contributions -7.316083e-05 -6.145385e-05 -4.483239e-05  
## lq\_avg\_annual\_pay 3.500642e-03 -4.880968e-03 9.265974e-04  
## oty\_annual\_avg\_estabs\_chg 1.947700e-01 7.814983e-02 -1.642114e-01  
## oty\_annual\_avg\_estabs\_pct\_chg -1.404712e-03 -6.400962e-04 1.127498e-03  
## oty\_annual\_avg\_emplvl\_chg -4.312859e-01 -4.015610e-01 -4.469146e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg 5.028916e-04 1.904521e-03 2.568579e-03  
## oty\_total\_annual\_wages\_chg 1.478581e-01 -6.214006e-01 1.846258e-02  
## oty\_total\_annual\_wages\_pct\_chg 9.270911e-05 -2.698629e-04 -2.053099e-04  
## oty\_taxable\_annual\_wages\_chg 4.706218e-01 4.491546e-01 -3.149029e-01  
## oty\_taxable\_annual\_wages\_pct\_chg -2.790570e-04 -1.986017e-04 1.292389e-04  
## oty\_annual\_contributions\_chg -9.133137e-02 -3.264396e-02 1.179520e-01  
## oty\_annual\_contributions\_pct\_chg 7.873980e-05 -2.144135e-04 2.798718e-04  
## oty\_avg\_annual\_pay\_chg 1.934048e-04 3.385216e-04 2.004938e-04  
## oty\_avg\_annual\_pay\_pct\_chg -1.185601e-04 2.589646e-04 1.623617e-04  
## PC22 PC23 PC24  
## annual\_avg\_estabs 4.194797e-01 1.948518e-01 -6.875400e-03  
## annual\_avg\_emplvl -3.492357e-01 -1.221156e-02 5.079261e-01  
## total\_annual\_wages -9.069318e-02 9.691229e-02 -6.970920e-01  
## taxable\_annual\_wages -1.267285e-01 -8.517027e-01 -1.306588e-01  
## annual\_contributions -6.155922e-01 3.703662e-01 1.064502e-01  
## avg\_annual\_pay -1.997162e-03 7.196074e-04 9.795443e-04  
## lq\_annual\_avg\_estabs -3.133955e-07 1.094550e-06 6.612957e-07  
## lq\_annual\_avg\_emplvl 5.159729e-05 3.918850e-05 -1.891779e-05  
## lq\_total\_annual\_wages -4.340785e-05 -3.876586e-05 1.449048e-05  
## lq\_taxable\_annual\_wages -1.491386e-05 1.080308e-04 7.799707e-06  
## lq\_annual\_contributions -2.660788e-06 -6.874434e-05 -3.494897e-06  
## lq\_avg\_annual\_pay 1.846363e-03 -4.997523e-04 -6.076465e-04  
## oty\_annual\_avg\_estabs\_chg -7.388122e-02 -4.206181e-02 6.346432e-03  
## oty\_annual\_avg\_estabs\_pct\_chg 5.176996e-04 2.856579e-04 -3.531704e-05  
## oty\_annual\_avg\_emplvl\_chg -1.758480e-02 7.724541e-02 -2.262993e-01  
## oty\_annual\_avg\_emplvl\_pct\_chg -8.472752e-04 -1.888691e-04 1.988379e-04  
## oty\_total\_annual\_wages\_chg 3.769593e-01 -1.450355e-01 4.196230e-01  
## oty\_total\_annual\_wages\_pct\_chg 1.414731e-04 -1.853397e-05 5.672533e-05  
## oty\_taxable\_annual\_wages\_chg 3.681721e-01 2.272856e-01 6.509705e-03  
## oty\_taxable\_annual\_wages\_pct\_chg -1.873854e-04 -8.139675e-05 4.109765e-06  
## oty\_annual\_contributions\_chg -1.241227e-01 -9.742706e-02 -1.558649e-02  
## oty\_annual\_contributions\_pct\_chg 2.508136e-05 -3.920970e-05 -2.158300e-06  
## oty\_avg\_annual\_pay\_chg -6.816395e-04 2.372957e-04 -1.215288e-03  
## oty\_avg\_annual\_pay\_pct\_chg -1.363607e-04 2.131849e-05 -5.434234e-05

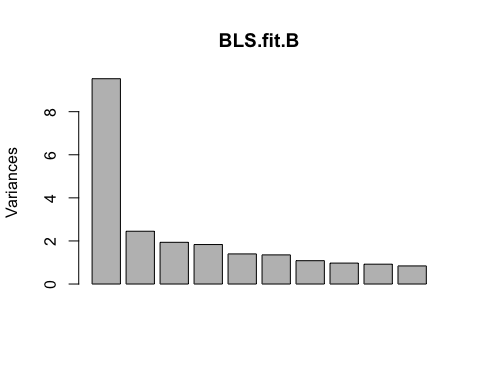
summary(BLS.fit.B)

## Importance of components:  
## PC1 PC2 PC3 PC4 PC5 PC6  
## Standard deviation 3.0871 1.5653 1.39151 1.35381 1.18230 1.16298  
## Proportion of Variance 0.3971 0.1021 0.08068 0.07637 0.05824 0.05636  
## Cumulative Proportion 0.3971 0.4992 0.57985 0.65622 0.71446 0.77082  
## PC7 PC8 PC9 PC10 PC11 PC12  
## Standard deviation 1.04062 0.9859 0.95976 0.9166 0.79879 0.50039  
## Proportion of Variance 0.04512 0.0405 0.03838 0.0350 0.02659 0.01043  
## Cumulative Proportion 0.81594 0.8564 0.89481 0.9298 0.95640 0.96684  
## PC13 PC14 PC15 PC16 PC17 PC18  
## Standard deviation 0.45940 0.38752 0.36307 0.34964 0.30447 0.17574  
## Proportion of Variance 0.00879 0.00626 0.00549 0.00509 0.00386 0.00129  
## Cumulative Proportion 0.97563 0.98189 0.98738 0.99247 0.99633 0.99762  
## PC19 PC20 PC21 PC22 PC23 PC24  
## Standard deviation 0.13411 0.12681 0.11427 0.08388 0.04801 0.02502  
## Proportion of Variance 0.00075 0.00067 0.00054 0.00029 0.00010 0.00003  
## Cumulative Proportion 0.99837 0.99904 0.99958 0.99988 0.99997 1.00000

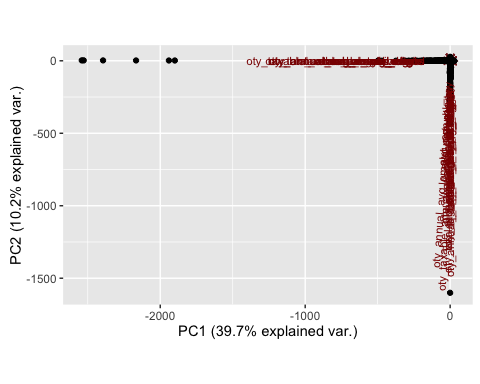
names(BLS.fit.B)

## [1] "sdev" "rotation" "center" "scale" "x"

#to plot the screeplot  
screeplot(BLS.fit.B)



#to use biplot  
#if to use biplot() function, it takes long time to run it  
#biplot(BLS.fit.B)  
  
ggbiplot(BLS.fit.B, labers = rownames(data.keep), obs.scale = 1, var.scale = 1, xlim = c(-500, 10), ylim = c(-10,500))



### Answer for questions:

1. What proportion of the total variation in the data is explained by each of the principal components?

* Using the summary(BLS.fit.B), it is easy to get the proportion of the total variation in the data is explained by each of the principal components. For example, Compnent 1 explains 39.71% of the variation and Compnent 2 explains 10.21% and Component 1 to Component 11 can expalin 95.640% of the variation.

1. What happens when you plot a screeplot?

* I use screeplot() function to plot. The x axis is component and y axis is variances. The plot shows 10 components and its variances. It can find that component 1 has the largest variances.

1. Based on the variation explained for each of these components, which, if any, components would you use? Why?

* I plan to use first 11 components because these componnets can explain 95% of variance.

1. Is there evidence of clustering in the data by creating biplots of the each of the components plotted against one another? Why or why not?

* Yes, there is evidence of clustering in the data by creating biplots of components plotted against one another.
* There are 11 components, I made biplot with component 1 and component 2. In the biplot, some variables are in the opposite direction with PC1 and some variables are in the opposite direction with PC2. That means the variables in the same directions have high correlation and can be culstered. And there are also many wage data which have very high correlation value.
* Also, if the biplot could execute, there will be some vectors with direction and length on the plot. The vectors will present the equality of correlation and the proportionality of standard deviations of the variables. If the variables were perfect fit, the cosine of the angle would be equal and the length of them were almost same.

1. Do any of the biplots reveal any interesting structure?

* Yes, the biplots reveal interesting structure. Biplots of the PCA components show the correlation of variables because PCA could let to reduce data by replace correlated variables to the new data set. In my biplots, there are one group of data in the same direction along the PC1 and the other group of data in the same direction along the PC2. These two groups data are clustered.

1. How many pcs are required to explain 75% of the variance in the data?

* According to the PCA result, 6 components are required to explain 75% of the variance in the data.