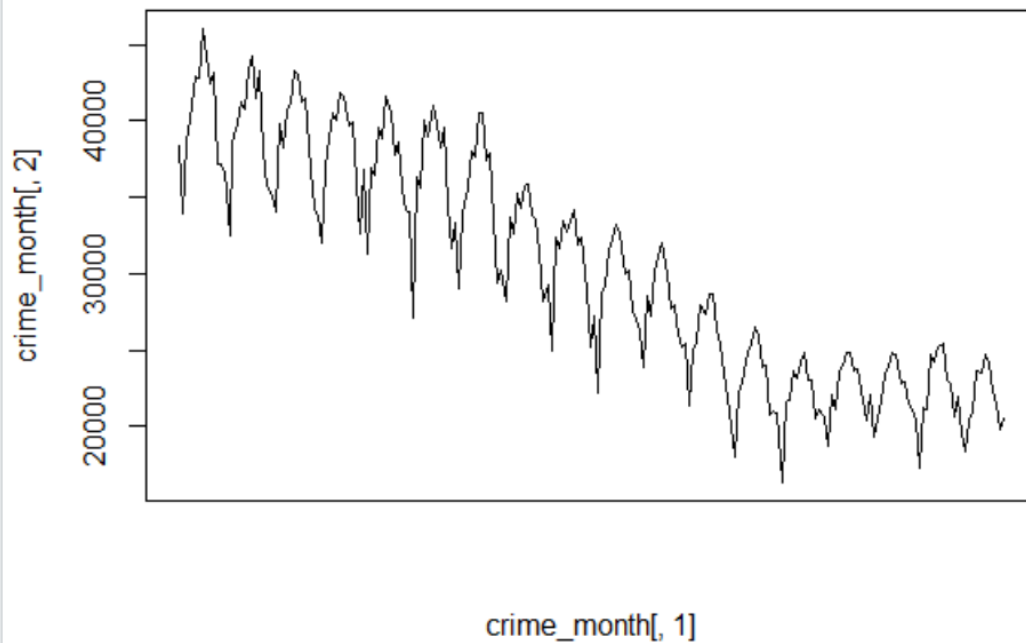


Exercise 2.1 Calculate total crime per month and plot the time series of crime.

```
> head(crime_month)
      Group.1      x
1 2002-01-01 38405
2 2002-02-01 33909
3 2002-03-01 38583
4 2002-04-01 40032
5 2002-05-01 42913
6 2002-06-01 42834
> |
```



2.2 Merge the two datasets by districts-units and period.

```
> head(m2)
  mu      month unit period tot_pop tot_white tot_black tot_hisp p50_inc crime_type crimes
1 2005-01-01ss1 2005-01-01 1 1 38472 22608 4953 2543 91084.91 drug 1
2 2005-01-01ss1 2005-01-01 1 1 38472 22608 4953 2543 91084.91 drug 188
3 2005-01-01ss1 2005-01-01 1 1 38472 22608 4953 2543 91084.91 other 62
4 2005-01-01ss1 2005-01-01 1 1 38472 22608 4953 2543 91084.91 other 302
5 2005-01-01ss1 2005-01-01 1 1 38472 22608 4953 2543 91084.91 property 624
6 2005-01-01ss1 2005-01-01 1 1 38472 22608 4953 2543 91084.91 property 160
```

#2.3 Construct a panel data of unit over time with the following variables

```
> head(m3)
  mu      month unit      tc      vc      pc      inc      white      black      hisp
1 2005-01-01ss1 2005-01-01 1 0.040263048 0.005510501 0.020378457 91084.91 0.58764816 0.1287430 0.06610002
2 2005-01-01ss10 2005-01-01 10 0.011901816 0.003762510 0.003924613 29147.49 0.03586755 0.3373888 0.61905656
3 2005-01-01ss11 2005-01-01 11 0.031884018 0.008651667 0.007711869 26337.89 0.02479407 0.8434408 0.11737796
4 2005-01-01ss12 2005-01-01 12 0.018846924 0.004912072 0.008636937 52560.59 0.31138978 0.1741782 0.41249536
5 2005-01-01ss13 2005-01-01 13 0.007464259 0.001931926 0.004057045 61949.53 0.51589448 0.1838842 0.24804173
6 2005-01-01ss14 2005-01-01 14 0.010347193 0.002504153 0.005578559 61849.46 0.41737535 0.0722320 0.46087158
```

#3 #Panel Data: Introduction

#with intercept

```
-----
              Estimate
(Intercept)  5.068e-01
tenure       -4.394e-06
tc           -2.334e-02
inc          2.613e-08
black        -7.643e-03
hisp         -5.229e-03
white        -1.275e-02
---
```

Without intercept

```
Coefficients:
              Estimate
tenure  4.023e-05
tc      8.478e-01
inc     2.831e-07
black   4.761e-01
hisp    5.011e-01
white   5.384e-01
```

#Exercise 4

#Panel Data: More controls

```
Coefficients:
      Estimate factor(unit)8 6.443e-01 factor(month)2010-02-01 3.341e-03
tenure -3.667e-06 factor(unit)9 6.311e-01 factor(month)2010-03-01 -9.070e-03
tc -6.000e-01 factor(month)2007-02-01 2.688e-01 factor(month)2010-04-01 6.835e-03
inc -4.522e-08 factor(month)2007-03-01 5.459e-03 factor(month)2010-05-01 -3.666e-03
black -7.815e-02 factor(month)2007-04-01 -4.482e-03 factor(month)2010-06-01 -6.040e-03
hisp -1.434e-01 factor(month)2007-05-01 9.708e-03 factor(month)2010-07-01 -1.367e-02
white -1.729e-01 factor(month)2007-06-01 -1.514e-02 factor(month)2010-08-01 9.654e-03
factor(unit)1 6.447e-01 factor(month)2007-07-01 -2.428e-03 factor(month)2010-09-01 2.027e-03
factor(unit)10 6.296e-01 factor(month)2007-08-01 -9.282e-03 factor(month)2010-10-01 -2.743e-03
factor(unit)11 6.073e-01 factor(month)2007-09-01 2.826e-03 factor(month)2010-11-01 -9.360e-03
factor(unit)12 6.375e-01 factor(month)2007-10-01 5.442e-03 factor(month)2010-12-01 -5.077e-03
factor(unit)13 6.427e-01 factor(month)2007-11-01 3.148e-03 factor(month)2011-01-01 -8.490e-03
factor(unit)14 6.622e-01 factor(month)2007-12-01 -8.606e-03 factor(month)2011-02-01 -5.744e-03
factor(unit)15 5.969e-01 factor(month)2008-01-01 -1.592e-02 factor(month)2011-03-01 -4.794e-03
factor(unit)16 6.617e-01 factor(month)2008-02-01 -8.111e-03 factor(month)2011-04-01 -1.478e-03
factor(unit)17 6.397e-01 factor(month)2008-03-01 -7.140e-03 factor(month)2011-05-01 -7.965e-04
factor(unit)18 6.526e-01 factor(month)2008-04-01 7.855e-03 factor(month)2011-06-01 -5.277e-05
factor(unit)19 6.603e-01 factor(month)2008-05-01 1.881e-02 factor(month)2011-07-01 3.844e-03
factor(unit)2 5.968e-01 factor(month)2008-06-01 9.715e-04 factor(month)2011-08-01 -2.397e-04
factor(unit)20 6.355e-01 factor(month)2008-07-01 4.697e-05 factor(month)2011-09-01 -1.157e-02
factor(unit)21 5.913e-01 factor(month)2008-08-01 1.097e-03 factor(month)2011-10-01 1.026e-02
factor(unit)22 6.225e-01 factor(month)2008-09-01 9.332e-03 factor(month)2011-11-01 -7.203e-03
factor(month)2008-10-01 -3.433e-03 factor(month)2011-12-01 5.203e-05
factor(month)2008-11-01 -1.710e-03 factor(month)2012-01-01 -1.070e-02
factor(month)2008-12-01 1.069e-02 factor(month)2012-02-01 2.731e-03
factor(month)2009-01-01 -6.240e-03 factor(month)2012-03-01 1.799e-03
factor(month)2010-04-01 6.835e-03 factor(month)2016-03-01 -1.459e-02
factor(month)2010-05-01 -3.666e-03 factor(month)2016-04-01 9.746e-03
factor(month)2010-06-01 -6.040e-03 factor(month)2016-05-01 9.780e-03
factor(month)2010-07-01 -1.367e-02 factor(month)2016-06-01 -5.268e-03
factor(month)2010-08-01 9.654e-03 factor(month)2016-07-01 -1.088e-02
factor(month)2010-09-01 2.027e-03 factor(month)2016-08-01 -1.938e-02
factor(month)2010-10-01 -2.743e-03 factor(month)2016-09-01 -1.692e-03
factor(month)2010-11-01 -9.360e-03 factor(month)2016-10-01 2.942e-03
factor(month)2010-12-01 -5.077e-03 factor(month)2016-11-01 -1.412e-02
factor(month)2011-01-01 -8.490e-03 factor(month)2016-12-01 -1.301e-02
factor(month)2011-02-01 -5.744e-03 factor(month)2017-01-01 -7.456e-05
factor(month)2011-03-01 -4.794e-03 factor(month)2017-02-01 -5.915e-03
factor(month)2011-04-01 -1.478e-03 factor(month)2017-03-01 6.010e-03
factor(month)2011-05-01 -7.965e-04 factor(month)2017-04-01 -5.728e-03
factor(month)2011-06-01 -5.277e-05 factor(month)2017-05-01 8.370e-03
factor(month)2011-07-01 3.844e-03 factor(month)2017-06-01 -1.221e-02
factor(month)2011-08-01 -2.397e-04 factor(month)2017-07-01 -6.187e-03
factor(month)2011-09-01 -1.157e-02 factor(month)2017-08-01 -2.645e-03
factor(month)2011-10-01 1.026e-02 factor(month)2017-09-01 -8.596e-03
factor(month)2011-11-01 -7.203e-03 factor(month)2017-10-01 -9.805e-03
factor(month)2011-12-01 5.203e-05 factor(month)2017-11-01 -1.685e-02
```

#Exercise 5

#between estimator

```
Coefficients:
      Estimate
(Intercept) 9.361e-01
tenure      1.064e-05
tc         -1.197e+00
inc        1.470e-06
black     -3.028e-01
hisp     -4.093e-01
white     -8.167e-01
```

#within

```
Coefficients:
      Estimate
tenure_within 1.088e-04
tc_within    4.847e-01
inc_within   -3.845e-07
black_within -6.888e-02
hisp_within  -5.323e-02
```

#first different

```
Coefficients:
      Estimate
(Intercept) 1.252e-02
tenure      1.355e-04
tc         2.745e-01
inc       -7.910e-07
black     -2.565e-02
hisp     -3.495e-02
white     2.325e-02
```

#compare three beta

#between:1.064e-05

#within:1.088e-04

#first difference:1.355e-04

#The between estimator is smaller than the other two

#GMM

```
> b
      tc      inc    white    black    hisp    tenure
beta[1:6] -0.5999852 -4.522429e-08 -0.1728725 -0.07815301 -0.1433608 -3.667273e-06
> |
```