Econometrics Term Project

To statistically examine the impact of various crimes on the GSDP(Gross state Domestic Product) growth rate taking into account various crimes between 2001-11

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Objective

India is a Union of States and is governed by a written Constitution which was adopted by the Constituent Assembly on 26 November 1949 and came into force on 26 January 19501. It consists of 28 States and 8 union Territories. Due to its colonial heritage, India follows the Anglo-Saxon common law system. Article 14 of the Constitution provides for equality before the law. Article 21 guarantees protection of life and personal liberty. Article 20 provides protection against double jeopardy Article 39-A mandates the State to secure equal justice for all. Article 50 provides for separation of the judiciary from the executive in the public services of the State.

Our Objective is to statistically examine the impact of various crimes on the GSDP(Gross state Domestic Product) growth rate taking into account various crimes between 2001-11.

Data Sources:

We have collected the crimes recorded in individual states from 2001 to 2011 from Ministry of Home Affairs reports on Crime in India, official database of Indian Government (www.data.gov.in) and other government sources like www.knowindia.gov.in, various government databases, reports and website to compile the data of crimes and their segregation over the years from the below mentioned sources. We have also collected the GDP Data for individual state over the period of time from the Ministry of Statistics and Programme Implementation website (http://www.mospi.gov.in).

Classification of Crimes:

The Criminal Procedure Code classifies all the crimes into two categories:

(i) Cognizable and (ii) Non-cognizable

A Cognizable offence or case is defined as the one which an officer in-charge of a police station may investigate without the order of a magistrate and effect arrest without warrant. The Police have a direct responsibility to take immediate action on the receipt of a complaint or of credible information in such crimes, visit the scene of the crime, investigate the facts, apprehend the offender and arraign him before a Court of law having jurisdiction over the matter. Cognizable crimes are broadly categorised as those falling either under the 'Indian Penal Code (IPC)' or under the 'Special and Local Laws (SLL)'. As many as 53,44,538 Cognizable crimes were reported in the country during 2001 comprising 17.69 lakh cases registered under the IPC and 35.75 lakh cases registered under the SLL. In terms of percentage, 59.23 per cent of total cases (IPC + SLL) during 2011 were reported under Special and Local Laws and rest of the cases (41.47%) under the Indian Penal Code (IPC).

Non-Cognizable crimes are defined as those which cannot be investigated by police without the order of a competent magistrate. The Police do not initiate investigation in Non-Cognizable crimes except with magisterial permission.

Broad classification of crimes:

1. Murder / Homicide: Murder, attempt to commit murder, Culpable homicide not amounting to murder.
2. Rape: Rape, Custodial Rape, Other Rapes
3. Kidnapping & Abduction: Kidnapping & Abduction, Kidnapping and Abduction of Women and Girls, Kidnapping and Abduction of Others.
4. Dacoity/Robbery/Theft: Dacoity, Preparation and assembly to commit Dacoity, Robbery, Burglary, Theft, Auto Theft, Other Theft.
5. Riots
6. Criminal Breach of Trusts
7. Cheating
8. Counterfeiting
9. Arson
10. Hurt/Grievous Hurt
11. Assault against women: Dowry death, Cruelty by husband or his relatives, Assault on woman with intent to outrage her modesty, Insult to the modesty of women and Importation of girls from foreign country;
12. Causing Death by Negligence
13. Other IPC crimes: Abetment of suicide, Exposure & Abandonment, Infanticide and foeticide etc.

Type of Data:

As we are considering the crime records for 31 states and UT's over the period of 11 years, it includes both cross sectional and time series dimensions. Hence this would be Panel Data.

The basic regression model for a Panel Data is

$$y_{it} = b_{0it} + b_{1it} * x_{1it} + b_{2it} * x_{2it} + \ldots\ldots\ldots + b_{kit} * x_{kit} + error_{it}$$

where y_{it} is the dependent variable for i^{th} cross sectional unit at t^{th} time unit.

b_{kit} is the coefficient of k^{th} independent variable in the model related to i^{th} cross sectional unit and t^{th} time unit.

$error_{it}$ is the error term related to i^{th} cross sectional unit at t^{th} time unit.

Assumptions:

- 2001 was considered as a base year for states GSDP.
- Population was available only for years 2001,2011. So a linear increase in population is assumed between 2001 ans 2011 to calculate per capita crime rate.

- 2001 year was excluded from the data as the growth rate was calculated from 2002.
- Inflation was taken into account as it has a significant effect on Growth rate.
- Data for 3 states was not available, so they were excluded from the data.

Data cleaning:

- Data for various crimes is collected from the database and grouped together based on the nature of the crime and various laws applicable to that.
- All the other crimes that come under IPC were put under separate categories.
- Per Capita crime rate is calculated by dividing the crime numbers by population of the state.
- Percentage growth rate of nominal GSDP of states is calculated on a yearly basis.

Dependent variable

Financial Growth is the dependent variable and it is characterized as GDP growth. GDP is the financial estimation of the apparent multitude of finished goods and services produced by all the resident producers inside the country,usually calculated on yearly basis, and which incorporates any product taxes and excludes the subsidies in the value of the goods. Gross domestic product growth is the yearly rate development pace of GDP, The data is obtained from The Government of India database which is considered as a dependable one and which gives an enormous number of perceptions, over a huge timeframe.

Independent Variables

The variables Murder, attempt to commit murder, Culpable homicide not amounting to murder, Rape, Custodial Rape, Other Rapes, Kidnapping & Abduction, Kidnapping and Abduction of Women and Girls, Kidnapping and Abduction of Others, Dacoity, Preparation and assembly to commit Dacoity, Robbery, Burglary, Theft, Auto Theft, Other Theft, Riots, Criminal Breach of Trusts, Cheating, Counterfeiting, Arson, Hurt/Grievous Hurt, Dowry death, Cruelty by husband or his relatives, Assault on woman with intent to outrage her modesty, Insult to the modesty of women and Importation of girls from foreign country, Causing Death by Negligence, Other IPC crimes: Abetment of suicide, Exposure & Abandonment, Infanticide and foeticide etc. will be independent variables. Since GDP also depends on Inflation, it will also be an independent variable.

Pooled OLS method

In this method, we assume that there is no individuality between the States/UT's. We are pooling all the observations together for running the regression. We will apply a simple OLS method.

$$GDPgrowthrate_{it} = b_0 + b_1*Inflation_{it} + b_2*MurderHomicidepercapita_{it} + b_3*RAPEpercapita_{it} + b_4*KIDNAPPINGandABDUCTIONpercapita_{it} + b_5*DACOITYRobberyTheftpercapita_{it} + b_6*RIOTSpercapita_{it} + b_7*CRIMINALBREACHOFTRUSTpercapita_{it} + b_8*CHEATINGpercapita_{it} + b_9*COUNTERFIETINGpercapita_{it} + b_{10}*ARSONpercapita_{it} +$$

b_{11}*HURTGREVIOUSHURTpercapita $_{it}$ + b_{12}*ASSAULTONWOMENpercapita $_{it}$ + b_{13}*CAUSINGDEATHBYNEGLIGENCEpercapita $_{it}$ + b_{14}*OTHERIPCCRIMESpercapita $_{it}$ + error $_{t}$

Upon running the regression, the following output was obtained

```
Balanced Panel: n = 31, T = 10, N = 310

Residuals:
      Min.    1st Qu.     Median    3rd Qu.       Max.
-0.4649632 -0.0469904 -0.0093784  0.0387444  0.6813443

Coefficients:
                                   Estimate  Std. Error t-value  Pr(>|t|)
(Intercept)                        0.124908    0.022258  5.6119 4.614e-08 ***
Inflation                          0.488718    0.199019  2.4556  0.014640 *
MurderHomicidepercapita         -218.066270  207.469289 -1.0511  0.294083
RAPEpercapita                    800.881199  442.672529  1.8092  0.071438 .
KIDNAPPINGandABDUCTIONpercapita   17.203091  411.180222  0.0418  0.966656
DACOITYRobberyTheftpercapita     -25.546557   21.179380 -1.2062  0.228707
RIOTSpercapita                   245.719729  151.705064  1.6197  0.106361
CRIMINALBREACHOFTRUSTpercapita   720.577410  801.078070  0.8995  0.369115
CHEATINGpercapita                187.368187  154.486516  1.2128  0.226159
COUNTERFIETINGpercapita         -140.964234 2254.096069 -0.0625  0.950178
ARSONpercapita                   -88.266622  782.209243 -0.1128  0.910232
HURTGREVIOUSHURTpercapita        -50.224686   49.923080 -1.0060  0.315220
ASSAULTONWOMENpercapita         -315.997960  115.204385 -2.7429  0.006462 **
CAUSINGDEATHBYNEGLIGENCEpercapita 232.918092  128.286416  1.8156  0.070445 .
OTHERIPCCRIMESpercapita           15.620714   17.693172  0.8829  0.378027
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    2.751
Residual Sum of Squares: 2.5139
R-Squared:      0.086178
Adj. R-Squared: 0.04281
F-statistic: 1.98714 on 14 and 295 DF, p-value: 0.018576
```

We have run the regression for 31 states across 10 years (2002 - 2011). The coefficient of each variable is given in the estimate column. The R squared value of the model is 0.086178 or 8.618%. The p value of the model is 0.018576 which is less than 0.05 significance from which we can infer that the model is fit. The individual p values of the variables are given in the last column from which we can say that inflation and Assault On Women per capita are significant which effect the GDP growth rate.

Fixed Effects Model

In this method we consider the heterogeneity among the States/UT's. In this model the individual intercepts of the variables change over the time but the intercept remains constant.

$GDPgrowthrate_{it} = b_0 + \lambda_t + b_{1it}*Inflation_{it} + b_{2it}*MurderHomicidepercapita_{it} + b_{3it}*RAPEpercapita_{it} + b_{4it}*KIDNAPPINGandABDUCTIONpercapita_{it} + b_{5it}*DACOITYRobberyTheftpercapita_{it} + b_{6it}*RIOTSpercapita_{it} + b_{7it}*CRIMINALBREACHOFTRUSTpercapita_{it} + b_{8it}*CHEATINGpercapita_{it} + b_{9it}*COUNTERFIETINGpercapita_{it} + b_{10it}*ARSONpercapita_{it} + b_{11it}*HURTGREVIOUSHURTpercapita_{it} + b_{12it}*ASSAULTONWOMENpercapita_{it} + b_{13it}*CAUSINGDEATHBYNEGLIGENCEpercapita_{it} + b_{14it}*OTHERIPCCRIMESpercapita_{it} + error_{it}$

```
Balanced Panel: n = 31, T = 10, N = 310

Residuals:
      Min.    1st Qu.     Median    3rd Qu.       Max.
-0.4641434 -0.0376451 -0.0050367  0.0357662  0.5571486

Coefficients:
                                    Estimate  Std. Error t-value Pr(>|t|)
Inflation                          -0.033516    0.265681 -0.1262 0.899707
MurderHomicidepercapita          -613.027279  331.734773 -1.8479 0.065725 .
RAPEpercapita                    1198.344483  975.537429  1.2284 0.220389
KIDNAPPINGandABDUCTIONpercapita  1692.979131  957.621491  1.7679 0.078228 .
DACOITYRobberyTheftpercapita      -54.302468   43.001630 -1.2628 0.207771
RIOTSpercapita                    375.842459  387.067542  0.9710 0.332434
CRIMINALBREACHOFTRUSTpercapita   -453.674970 1484.733005 -0.3056 0.760180
CHEATINGpercapita                  68.301630  425.583757  0.1605 0.872618
COUNTERFIETINGpercapita          -593.164992 2746.770674 -0.2159 0.829193
ARSONpercapita                     27.235507 1126.326604  0.0242 0.980727
HURTGREVIOUSHURTpercapita         -24.488363  130.777911 -0.1873 0.851607
ASSAULTONWOMENpercapita          -380.771101  269.901698 -1.4108 0.159483
CAUSINGDEATHBYNEGLIGENCEpercapita 1318.942006  424.292574  3.1086 0.002085 **
OTHERIPCCRIMESpercapita            70.658060   44.120454  1.6015 0.110462
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    2.4198
Residual Sum of Squares: 2.1489
R-Squared:      0.11195
Adj. R-Squared: -0.035501
F-statistic: 2.38616 on 14 and 265 DF, p-value: 0.0037962
```

After running fixed effects model regression, we have concluded that only causing death by negligence per capita is significant in the model. As the p-value is less 0.05, the model is not random and regression done is meaningful.

Random Effects Model

In this model we assume that the unobserved variables are not systematically related to the the observed variables that are included in the model.

$$y_{it} = \beta_0 + \beta_1 x_{it1} + \ldots + \beta_k x_{itk} + a_i + u_{it}, \quad \text{Cov}(x_{itj}, a_i) = 0, \quad t = 1, 2, \ldots, T; j = 1, 2, \ldots, k.$$

GDPgrowthrate $_{it}$ = b_0 + b_{1it}*Inflation $_{it}$ + b_{2it}*MurderHomicidepercapita $_{it}$ + b_{3it}*RAPEpercapita $_{it}$ + b_{4it}*KIDNAPPINGandABDUCTIONpercapita $_{it}$ + b_{5it}*DACOITYRobberyTheftpercapita $_{it}$ + b_{6it}*RIOTSpercapita $_{it}$ + b_{7it}*CRIMINALBREACHOFTRUSTpercapita $_{it}$ + b_{8it}*CHEATINGpercapita $_{it}$ + b_{9it}*COUNTERFIETINGpercapita $_{it}$ + b_{10it}*ARSONpercapita $_{it}$ + b_{11it}*HURTGREVIOUSHURTpercapita $_{it}$ + b_{12it}*ASSAULTONWOMENpercapita $_{it}$ + b_{13it}*CAUSINGDEATHBYNEGLIGENCEpercapita $_{it}$ + b_{14it}*OTHERIPCCRIMESpercapita $_{it}$ + α_t + error $_{it}$

```
Balanced Panel: n = 31, T = 10, N = 310

Effects:
                     var   std.dev share
idiosyncratic 0.0081091 0.0900504 0.933
individual    0.0005848 0.0241816 0.067
theta: 0.2378

Residuals:
      Min.    1st Qu.     Median    3rd Qu.       Max.
-0.4592641 -0.0468804 -0.0069686  0.0366117  0.6584133
```

```
Residuals:
      Min.    1st Qu.     Median    3rd Qu.       Max.
-0.4592641 -0.0468804 -0.0069686  0.0366117  0.6584133

Coefficients:
                                    Estimate  Std. Error z-value  Pr(>|z|)
(Intercept)                         0.126996    0.025046  5.0705 3.968e-07 ***
Inflation                           0.443507    0.201327  2.2029   0.02760 *
MurderHomicidepercapita          -308.582531  232.383482 -1.3279   0.18421
RAPEpercapita                     884.183028  518.842092  1.7041   0.08835 .
KIDNAPPINGandABDUCTIONpercapita   216.706508  473.253116  0.4579   0.64702
DACOITYRobberyTheftpercapita      -25.803813   24.173497 -1.0674   0.28577
RIOTSpercapita                    251.622934  182.750670  1.3769   0.16855
CRIMINALBREACHOFTRUSTpercapita    507.225759  913.653728  0.5552   0.57878
CHEATINGpercapita                 182.122827  186.522276  0.9764   0.32886
COUNTERFIETINGpercapita          -177.443896 2365.035405 -0.0750   0.94019
ARSONpercapita                    -55.302122  854.700858 -0.0647   0.94841
HURTGREVIOUSHURTpercapita         -60.150034   59.122856 -1.0174   0.30898
ASSAULTONWOMENpercapita          -329.336106  136.855188 -2.4065   0.01611 *
CAUSINGDEATHBYNEGLIGENCEpercapita 281.191101  156.510047  1.7966   0.07239 .
OTHERIPCCRIMESpercapita            19.774683   20.834818  0.9491   0.34256
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    2.6122
Residual Sum of Squares: 2.4018
R-Squared:      0.08057
Adj. R-Squared: 0.036936
Chisq: 25.8511 on 14 DF, p-value: 0.027038
```

From the regression we can conclude that the inflation and Assault on Women per capita are significant. The p value of the model is 0.027 which is less than 0.05, hence the model is fit.

Test for suitable model

Pooled OLS Model

Command-

pooltest(GDPgrowthrate~Inflation+MurderHomicidepercapita+RAPEpercapita+KIDNAPPINGandABDUCTIONpercapita+DACOITYRobberyTheftpercapita+RIOTSpercapita+CRIMINALBREACHOFTRUSTpercapita+CHEATINGpercapita,data=pdata, model= "within")

```
        F statistic

data:  GDPgrowthrate ~ Inflation + MurderHomicidepercapita + RAPEpercapita +  ...
F = 0.80979, df1 = 240, df2 = 31, p-value = 0.8079
alternative hypothesis: unstability
```

In this model our Null Hypothesis (H0) is that the model is stable and our Alternate Hypothesis (Ha) is that model is unstable. From the results the p value of the model is 0.8079 which is greater than 0.05 hence we fail to reject the null hypothesis. Hence, the model is Stable.

Selection of Pooled OLS or Fixed Effect Model

Command - pFtest(femethod,pooledmethod)

```
        F test for individual effects

data:  GDPgrowthrate ~ Inflation + MurderHomicidepercapita + RAPEpercapita +  ...
F = 1.5005, df1 = 30, df2 = 265, p-value = 0.05052
alternative hypothesis: significant effects
```

In this test our Null Hypothesis (H0) is that the pooled model is consistent and our Alternate Hypothesis (Ha) is fixed effect model is consistent. From the results the p value of the model is 0.050 which is approximately equal to 0.05 hence we reject the null hypothesis. Hence, the fixed effect model is consistent.

Testing the presence of individual and time effects:

$$GDPgrowthrate_{it} = b_0 + b_{1it*}Inflation_{it} + b_{2it}*MurderHomicidepercapita_{it} + b_{3it}*RAPEpercapita_{it} + b_{4it}*KIDNAPPINGandABDUCTIONpercapita_{it} + b_{5it}*DACOITYRobberyTheftpercapita_{it} + b_{6it}*RIOTSpercapita_{it} + b_{7it}*CRIMINALBREACHOFTRUSTpercapita_{it} + b_{8it}*CHEATINGpercapita_{it} + b_{9it}*COUNTERFIETINGpercapita_{it} + b_{10it}*ARSONpercapita_{it} + b_{11it}*HURTGREVIOUSHURTpercapita_{it} + b_{12it}*ASSAULTONWOMENpercapita_{it} + b_{13it}*CAUSINGDEATHBYNEGLIGENCEpercapita_{it} + b_{14it}*OTHERIPCCRIMESpercapita_{it} + \boldsymbol{\alpha}_i + \boldsymbol{\lambda}_t + error_{it}$$

```
        Lagrange Multiplier Test - two-ways effects (Gourieroux, Holly and Monfort) for
        balanced panels

data:  GDPgrowthrate ~ Inflation + MurderHomicidepercapita + RAPEpercapita +  ...
chibarsq = 32.671, df0 = 0.00, df1 = 1.00, df2 = 2.00, w0 = 0.25, w1 = 0.50, w2 =
0.25, p-value = 2.557e-08
alternative hypothesis: significant effects
```

In this test the Null Hypothesis (H0) is that there is no significant individual and time effects and our Alternate Hypothesis (Ha) is that there are significant individual and time effects. From the results the p value of the model is less than 0.05 hence we reject the null hypothesis. Hence, there is a significant effect of individual and time effects on the model.

Hausman Test

Through this test we can select which model is to be followed, is it fixed effect model or random effect model

Command- phtest(femethod,remethod)

```
        Hausman Test

data:  GDPgrowthrate ~ Inflation + MurderHomicidepercapita + RAPEpercapita +  ...
chisq = 14.207, df = 14, p-value = 0.4344
alternative hypothesis: one model is inconsistent
```

In this test our Null Hypothesis (H0) is that the random effect model is consistent and our Alternate Hypothesis (Ha) is fixed effect model is consistent. From the results the p value of the model is 0.4344 which is greater than 0.05 hence we fail to reject the null hypothesis. Hence, the random effect model is consistent.

Test for Stationarity

We have performed the unit root test on each independent variable and found that the variables are stationary.

Command- checkMurderHomicidepercapita = data.frame(split(crimedata$MurderHomicidepercapita, crimedata$STATEUT))

purtest(checkMurderHomicidepercapita, pmax = 2, exo = "intercept", test = "levinlin")

Output - Levin-Lin-Chu Unit-Root Test (ex. var.: Individual Intercepts)

data: checkMurderHomicidepercapita
z = -14.427, p-value < 2.2e-16
alternative hypothesis: stationarity

Test for Autocorrelation

We have found presence of serial correlation in the idiosyncratic errors of regression.

Command-

pdwtest(GDPgrowthrate~Inflation+MurderHomicidepercapita+RAPEpercapita+KIDNAPPINGandABDUCTIONpercapita+DACOITYRobberyTheftpercapita+RIOTSpercapita+CRIMINALBREACHOFTRUSTpercapita+CHEATINGpercapita+COUNTERFIETINGpercapita+ARSONpercapita+HURTGREVIOUSHURTpercapita+ASSAULTONWOMENpercapita+CAUSINGDEATHBYNEGLIGENCEpercapita+OTHERIPCCRIMESpercapita,data = pdata,model = "random")

```
        Durbin-Watson test for serial correlation in panel models

data:  GDPgrowthrate ~ Inflation + MurderHomicidepercapita + RAPEpercapita +     KIDNAPPINGandAB
DUCTIONpercapita + DACOITYRobberyTheftpercapita +     RIOTSpercapita + CRIMINALBREACHOFTRUSTperc
apita + CHEATINGpercapita +     COUNTERFIETINGpercapita + ARSONpercapita + HURTGREVIOUSHURTperca
pita +     ASSAULTONWOMENpercapita + CAUSINGDEATHBYNEGLIGENCEpercapita +     OTHERIPCCRIMESperca
pita
DW = 2.0911, p-value = 0.5826
alternative hypothesis: serial correlation in idiosyncratic errors
```

In this test our Null Hypothesis (H0) is that there is no autocorrelation in error term and our Alternate Hypothesis (Ha) is there is autocorrelation in error term. From the results the p value of the model is 0.5826 which is greater than 0.05 hence we fail to reject the null hypothesis. Hence, there is no autocorrelation in error terms.

Test for Heteroskedasticity

After doing the Breusch-Pagan test, we have found the presence of heteroskedasticity in the dataset.

Command-

bptest(GDPgrowthrate~Inflation+MurderHomicidepercapita+RAPEpercapita+KIDNAPPINGandABDUCTIONpercapita+DACOITYRobberyTheftpercapita+RIOTSpercapita+CRIMINALBREACHOFTRUSTpercapita+CHEATINGpercapita+COUNTERFIETINGpercapita+ARSONpercapita+HURTGREVIOUSHURTpercapita+ASSAULTONWOMENpercapita+CAUSINGDEATHBYNEGLIGENCEpercapita+OTHERIPCCRIMESpercapita, data = pdata, studentize = F)

```
        Breusch-Pagan test

data:  GDPgrowthrate ~ Inflation + MurderHomicidepercapita + RAPEpercapita +     KIDNAPPINGandAB
DUCTIONpercapita + DACOITYRobberyTheftpercapita +     RIOTSpercapita + CRIMINALBREACHOFTRUSTperc
apita + CHEATINGpercapita +     COUNTERFIETINGpercapita + ARSONpercapita + HURTGREVIOUSHURTperca
pita +     ASSAULTONWOMENpercapita + CAUSINGDEATHBYNEGLIGENCEpercapita +     OTHERIPCCRIMESperca
pita
BP = 111.38, df = 14, p-value < 2.2e-16
```

In this test our Null Hypothesis (H0) is that there is homoscedasticity and our Alternate Hypothesis (Ha) is there is heteroscedasticity. From the results the p value of the model is less than 0.05 hence we reject the null hypothesis. Hence, there is heteroscedasticity in the model.

Controlling for Heteroskedasticty and Autocorrelation

Command - coeftest(remethod,vcovHC(remethod,method = "arellano"))

Output -

```
t test of coefficients:

                                          Estimate  Std. Error
(Intercept)                               0.126996    0.018631
Inflation                                 0.443507    0.234897
MurderHomicidepercapita                -308.582531  130.895538
RAPEpercapita                           884.183028  559.461870
KIDNAPPINGandABDUCTIONpercapita         216.706508  336.891621
DACOITYRobberyTheftpercapita            -25.803813   16.760742
RIOTSpercapita                          251.622934  203.515068
CRIMINALBREACHOFTRUSTpercapita          507.225759  666.461232
CHEATINGpercapita                       182.122827  197.625011
COUNTERFIETINGpercapita                -177.443896 1716.375220
ARSONpercapita                          -55.302122  999.579213
HURTGREVIOUSHURTpercapita               -60.150034   39.607516
ASSAULTONWOMENpercapita                -329.336106  122.080629
CAUSINGDEATHBYNEGLIGENCEpercapita       281.191101  160.283615
OTHERIPCCRIMESpercapita                  19.774683   20.747778
                                        t value  Pr(>|t|)
(Intercept)                              6.8164 5.266e-11 ***
Inflation                                1.8881  0.059995 .
MurderHomicidepercapita                 -2.3575  0.019053 *
RAPEpercapita                            1.5804  0.115083
KIDNAPPINGandABDUCTIONpercapita          0.6433  0.520560
DACOITYRobberyTheftpercapita            -1.5395  0.124745
RIOTSpercapita                           1.2364  0.217299
CRIMINALBREACHOFTRUSTpercapita           0.7611  0.447221
CHEATINGpercapita                        0.9216  0.357512
COUNTERFIETINGpercapita                 -0.1034  0.917729
ARSONpercapita                          -0.0553  0.955917
HURTGREVIOUSHURTpercapita               -1.5187  0.129921
ASSAULTONWOMENpercapita                 -2.6977  0.007384 **
CAUSINGDEATHBYNEGLIGENCEpercapita        1.7543  0.080411 .
OTHERIPCCRIMESpercapita                  0.9531  0.341320
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

We find that Assault on Women Per Capita is significant based on the pe value. Further, Murder and Homicide per capita, Causing death by negligence and Inflation are significant for lower levels of confidence.

Conclusion

Based on the above analysis, we could include three types of crimes and inflation in our model without any loss of fit of the regression model for explaining GDP growth rate.

New Model

edithedremethod=
plm(GDPgrowthrate~Inflation+MurderHomicidepercapita+ASSAULTONWOMENpercapita+CAUSINGDEATHBYNEGLIGENCEpercapita,data=pdata, model="random")

Output-

```
Oneway (individual) effect Random Effect Model
   (Swamy-Arora's transformation)

Call:
plm(formula = GDPgrowthrate ~ Inflation + MurderHomicidepercapita +
    ASSAULTONWOMENpercapita + CAUSINGDEATHBYNEGLIGENCEpercapita,
    data = pdata, model = "random")

Balanced Panel: n = 31, T = 10, N = 310

Effects:
                     var   std.dev share
idiosyncratic 0.0081374 0.0902077 0.966
individual    0.0002823 0.0168016 0.034
theta: 0.1384

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-0.504284 -0.045069 -0.008924  0.033476  0.680464
```

```
Coefficients:
                                   Estimate  Std. Error z-value  Pr(>|z|)
(Intercept)                        0.142500    0.020453  6.9672 3.233e-12 ***
Inflation                          0.580089    0.186064  3.1177  0.001823 **
MurderHomicidepercapita         -229.084380  169.079709 -1.3549  0.175453
ASSAULTONWOMENpercapita         -165.439230   91.589973 -1.8063  0.070871 .
CAUSINGDEATHBYNEGLIGENCEpercapita 150.447533  117.043064  1.2854  0.198651
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares:    2.6657
Residual Sum of Squares: 2.5271
R-Squared:      0.052014
Adj. R-Squared: 0.039581
Chisq: 16.7347 on 4 DF, p-value: 0.0021763
```

The new model has a lesser value of R-squared which means that the new model is not better than the previous random effect model. The p-value of the regression model has improved. As the independent variables explain less than 10% of the change in explained variable which is GDP growth rate, so it is not giving concrete and actionable insights.