FINAL PROJECT

Group – 9

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1. INTRODUCTION

There has always been some doubt about the idea of more guns, less crime. In response to rising crime rates and escalating mass shootings, more and more people began to believe that allowing citizens to carry concealed handguns would curb crime.
Many states in the United States have enacted laws that permit the carry of weapons known as right-to-carry laws(RTC) also referred to as shall-issue laws. Those who meet the requirements for a Shall-issue law are given permits to carry concealed handguns. The applicant must be over the age of 18, not have a significant criminal record, and have no history of mental illness. Additionally, he or she should have taken a firearm safety course (if required by law). When these criteria are met, the issuing authority has no discretion in granting licenses.

Many people believe laws allowing citizens to carry concealed handguns have reduced crime. A number of politicians support greater gun freedom because they believe gun control laws rob law-abiding citizens of their weapons, while would-be criminals ignore those guns, leaving victims defenseless. The National Rifle Association (NRA) also holds this view, advocating more freedom in carrying guns.

It is often argued that there is no definitive answer to the question of whether gun ownership and criminal activity are related. Increased gun ownership may reduce crime by discouraging criminals from committing crimes when victims possess guns. In the alternative, guns may increase the likelihood that any confrontation will cause a victim to die, thus increasing the rate of crime.

Moreover, It is possible that criminals might think twice before attacking, thus opting for property crimes or other crimes that do not directly affect the victims. In this case, we can argue that more guns do lead to fewer crimes. On the other hand, it is rare for people to use guns as a means of defense against criminals. The opportunistic nature and element of surprise of aggressors make it impossible for even trained professionals to successfully repel such attacks. A study has also identified that most firearms used in crime are obtained either during burglaries or from the secondhand market. Due to the RTC laws, the ease with which criminals can acquire a gun might also increase as the rate of gun ownership in the general population increases.

The effects of concealed carry laws have been thoroughly investigated and tested by many different theories and scenarios, but none of them has yet been able to put an end to this debate leaving it up for speculation.

This project will analyze a dataset spanning states from 1977 to 1999, integrating economic concepts and statistical techniques, in order to answer the question, “Can shall-issue laws reduce crime?”.

2. ECONOMIC THEORY

Studying the dataset:

We will analyze a balanced panel dataset of 50 states over a 23-year period. There are 1173 observations in all, and the dataset contains no null values.

Variable	Definition
vio	violent crime rate (incidents per 100,000 members of the population)
rob	robbery rate (incidents per 100,000)
mur	murder rate (incidents per 100,000)
shall	= 1 if the state has a shall-carry law in effect in that year = 0 otherwise
incarc_rate	incarceration rate in the state in the previous year (sentenced prisoners per 100,000 residents; value for the previous year)
density	population per square mile of land area, divided by 1000
avginc	real per capita personal income in the state, in thousands of dollars
pop	state population, in millions of people
pm1029	percent of state population that is male, ages 10 to 29
pw1064	percent of state population that is white, ages 10 to 64
pb1064	percent of state population that is black, ages 10 to 64
stateid	ID number of states (Alabama = 1, Alaska = 2, etc.)
year	Year (1977-1999)

Any econometric problem is solved by a theory that is drawn from the real world of economics. Here we see variables like vio, rob, and mur representing violent crime rates. If we look in-depth and understand the theory, we can see that America maintains two databases to keep track of crimes: 1. NCVS and 2. UCR reporting crime rate. Among the violent crimes that are committed, there are murders, rapes, robberies, assaults, and gang crimes. As we can see from the dataset, we have data related to both murder and robbery as well as the overall violent rate.

The econometric problem we are trying to solve in the report makes it more appropriate to use violent crime rates as dependent variables. Therefore, we won't consider Mur and Rob since they do not appear relevant for our model.

3. EXPLORATORY DATA ANALYSIS

Before coming up with our hypotheses and models, we will perform some exploratory analysis in order to get a better sense of the data and how it is correlated, its trend, etc.

```
. do "C:\Users\AXH210~1\AppData\Local\Temp\577\STD229c_000000.tmp"

. summarize

    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
        year |      1,173          88    6.636079         77         99
         vio |      1,173    503.0747    334.2772         47     2921.8
         mur |      1,173    7.665132     7.52271         .2       80.6
         rob |      1,173    161.8202      170.51        6.4     1635.1
 incarc_rate |      1,173    226.5797    178.8881         19       1913
-------------+---------------------------------------------------------
      pb1064 |      1,173    5.336217    4.885688   .2482066   26.97957
      pw1064 |      1,173    62.94543    9.761527   21.78043   76.52575
      pm1029 |      1,173    16.08113    1.732143   12.21368   22.35269
         pop |      1,173    4.816341    5.252115    .402753   33.14512
      avginc |      1,173     13.7248    2.554543   8.554884   23.64671
-------------+---------------------------------------------------------
     density |      1,173    .3520382    1.355472   .0007071   11.10212
     stateid |      1,173    28.96078    15.68352          1         56
       shall |      1,173    .2429668    .4290581          0          1
```

Violent crime rates are higher than robbery and murder rates, on average, over 23 years and 51 states. Violence has a smaller standard deviation than murder and robbery, relative to their mean. Violence is less skewed than murder and robbery. Despite the high incarceration rate, the total crime rate (violence and robberies) remains lower.

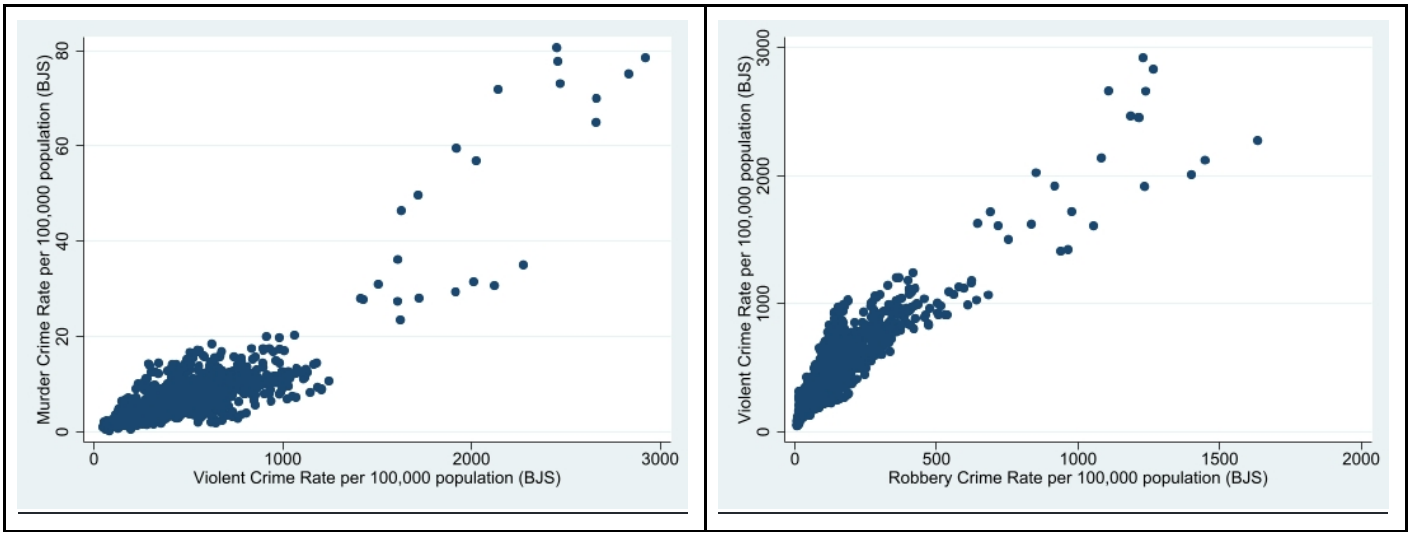
Panel Data

```
. xtset stateid year
Panel variable: stateid (strongly balanced)
 Time variable: year, 77 to 99
         Delta: 1 unit
```

Correlation between the main variables:

The below graphs show a strong correlation between the variables - murder rate (mur), violent crime rate (vio), and robbery rate (rob). It makes sense that murder rates, robbery rates, and violent crime rates are related. It is almost certain that an increase in robberies will also result in an increase in murders and violent crimes, since both robbery and murder rise together.

```
             |      mur      vio      rob
-------------+---------------------------
         mur |   1.0000
         vio |   0.8265   1.0000
         rob |   0.7976   0.9071   1.0000
```



It is important to note that murder, violence, and robbery are highly correlated (positive relationship), particularly murder and robbery. Murder and violence have high incarceration rates, but robbery doesn't. Due to the very small number of shall-carry laws in this dataset, the number of shall-carry law records may not be accurate.

Correlation Between incarc_ rate and other variables

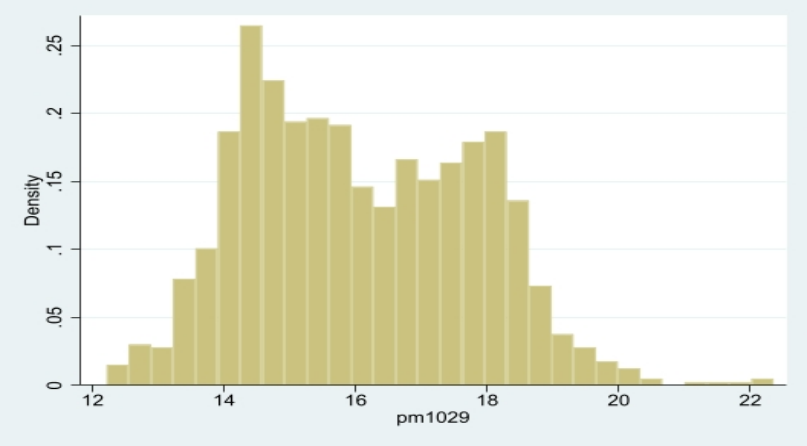
	vio	mur	rob	incarc~e
vio	1.0000			
mur	0.8265	1.0000		
rob	0.9071	0.7976	1.0000	
incarc_rate	0.7027	0.7096	0.5668	1.0000

Correlation between log Vio and other Variables:

	logvio	pb1064	pw1064	pm1029	pop	avginc
logvio	1.0000					
pb1064	0.4830	1.0000				
pw1064	-0.4716	-0.9820	1.0000			
pm1029	-0.1437	0.0162	-0.0126	1.0000		
pop	0.4194	0.0581	-0.0654	-0.0975	1.0000	
avginc	0.3629	0.2627	-0.1912	-0.5279	0.2152	1.0000

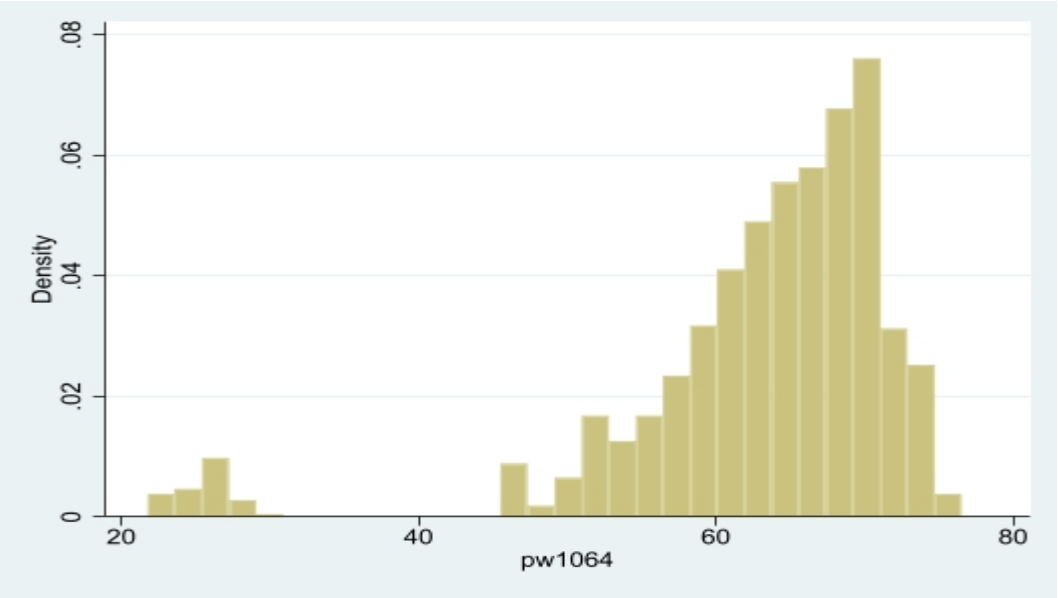
Histograms for multiple variables:

Histogram for PM1029



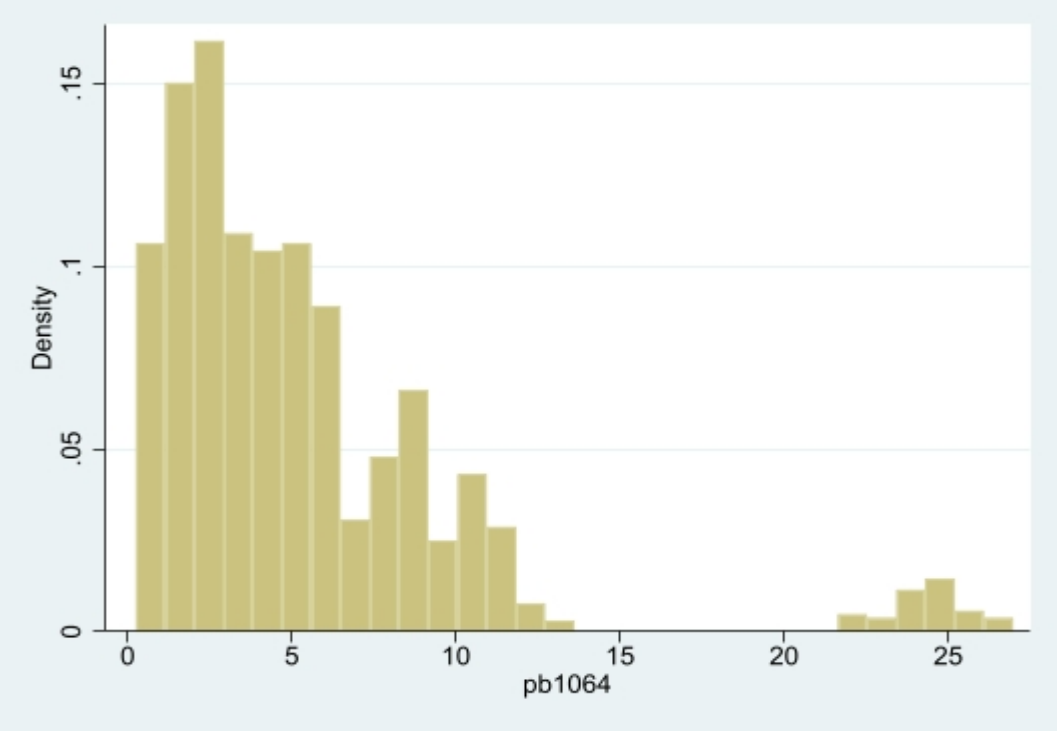
The percent of the state population that is male, ages 10 to 29, increases gradually with an increase in population density that is equal to or less than 14.66%, while density decreases for percentages that exceed 14.66%.

Histogram of PW1064



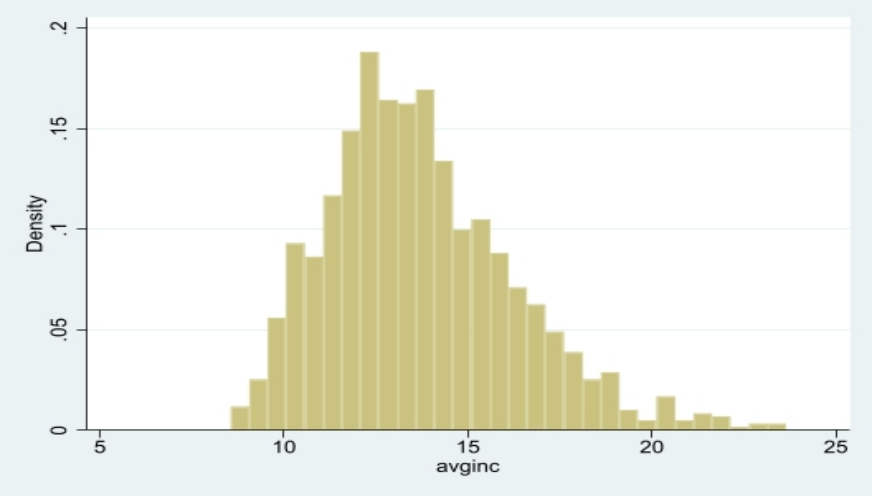
There is a skewed distribution to the left. Whites, ages 10 to 64, make up more than 44% of the state's population. The percentage can exceed 70% in some areas.

Histogram of PB1064



The distribution is skewed right. The percent of the state's population that is black, aged 10 to 64, is generally below 15%.

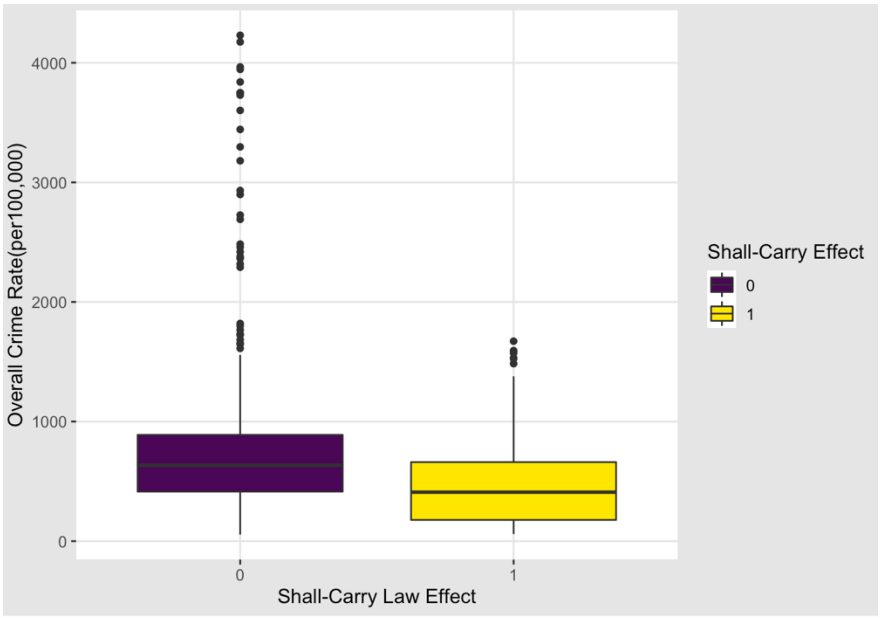
Histogram of Avginc



For people with real per capita personal incomes equal to or less than $12500, real per capita personal income increases with an increase in population density, but for those with per capita personal incomes higher than $12500, it decreases.

Neither the percentage of men in the age group 10-29 nor the average income show any skewness, so no transformation is required.

Box Plot of the Shall-Carry Law



By observing the boxplot above, we can see that crime rates are lower in states where Shall-Carry Laws are implemented than in states without the law. Taking all of this into consideration, we can see that the Shall-Carry Law has a considerable effect on overall crime rates.

4. MODELS

Here, we begin our analysis by running different models considering ln(violence) as the dependent variable.

In our dataset, we found a high correlation between three dependent variables, such as violence rate(vio), murder rate(mur) and robbery rate(rob). Due to such a strong correlation between these variables, we have concluded that these variables behave similarly under the influence of the explanatory variables.

We are primarily interested in identifying the impact of the shall carry law on the overall crime rate in the US as well as understanding how the incarceration rate affects the overall crime rate in the US. We are also interested in determining which control variables have a significant effect on the overall crime rate of the US.

We have run various models that are appropriate for panel data frameworks to understand the significance and magnitude of various explanatory/control variables that affect crime rates in the US.

In order to achieve these goals, we run three models to estimate the relationship between the shall carry law, the incarceration rate, and other control variables as explanatory variables for the dependent variable overall crime rate. Based on the dependent and explanatory variables, the following three models have been run:

1. Pooled OLS with Robust Standard Errors
2. Fixed Effects Model with Robust Standard Errors
3. Fixed Effects Model with Time Fixed Effects

Model-1: Pooled OLS with Robust Standard Errors

```
. reg logvio shall incarc_rate pb1064 pw1064 pm1029 pop avginc density, vce(cluster stateid)

Linear regression                               Number of obs     =      1,173
                                                F(8, 50)          =      62.13
                                                Prob > F          =     0.0000
                                                R-squared         =     0.5643
                                                Root MSE          =     .42769

                                (Std. err. adjusted for 51 clusters in stateid)
------------------------------------------------------------------------------
             |               Robust
      logvio | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -.3683869    .113937    -3.23   0.002    -.5972361   -.1395378
 incarc_rate |   .0016126   .0005999     2.69   0.010     .0004076    .0028177
      pb1064 |   .0808526   .0713875     1.13   0.263    -.0625334    .2242386
      pw1064 |   .0312005     .03409     0.92   0.364    -.0372713    .0996723
      pm1029 |   .0088709   .0340964     0.26   0.796    -.0596137    .0773554
         pop |   .0427098    .011729     3.64   0.001     .0191515    .0662681
      avginc |   .0012051   .0240808     0.05   0.960    -.0471626    .0495728
     density |   .0266885   .0414909     0.64   0.523    -.0566485    .1100255
       _cons |   2.981738   2.166513     1.38   0.175    -1.369831    7.333307
------------------------------------------------------------------------------
```

The coefficient of *shall* equals to -0.3683, which indicates that the shall-issue laws help reduce violent crime by 36%.

Model-2: Fixed Effects Model with Robust Standard Errors

```
. xtreg logvio shall incarc_rate pb1064 pw1064 pm1029 pop avginc density, fe vce(cluster stateid)

Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.2178                                         min =         23
     Between = 0.0033                                         avg =       23.0
     Overall = 0.0001                                         max =         23

                                                F(8,50)           =      34.10
corr(u_i, Xb) = -0.3687                         Prob > F          =     0.0000

                                (Std. err. adjusted for 51 clusters in stateid)
------------------------------------------------------------------------------
             |               Robust
      logvio | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -.0461415   .0417616    -1.10   0.275    -.1300223    .0377392
 incarc_rate |   -.000071   .0002504    -0.28   0.778    -.0005739    .0004318
      pb1064 |   .1042804   .0326849     3.19   0.002     .0386308    .1699301
      pw1064 |   .0408611   .0134585     3.04   0.004     .0138289    .0678932
      pm1029 |  -.0502725   .0206949    -2.43   0.019    -.0918394   -.0087057
         pop |   .0115247    .014224     0.81   0.422    -.0170452    .0400945
      avginc |  -.0092037   .0129649    -0.71   0.481    -.0352445     .016837
     density |  -.1722901   .1376129    -1.25   0.216    -.4486936    .1041135
       _cons |   3.866017   .7701057     5.02   0.000     2.319214    5.412819
-------------+----------------------------------------------------------------
     sigma_u |  .68024951
     sigma_e |  .16072287
         rho |  .94712779   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

The absolute value of the coefficient *shall* is 0.0461, the coefficient is not statistically or different from 0. There is a large reduction in the coefficient from the Pooled OLS method. This model is more credible as it takes care of the unobserved characteristics that can vary from state to state, but can be constant over time.

Model-3: Fixed Effects Model with Time Fixed Effects

```
. xtreg logvio shall incarc_rate pb1064 pw1064 pm1029 pop avginc density i.year, fe vce(cluster
stateid)

Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.4180                                         min =         23
     Between = 0.0419                                         avg =       23.0
     Overall = 0.0009                                         max =         23

                                                F(30,50)          =      56.86
corr(u_i, Xb) = -0.2929                         Prob > F          =     0.0000

                                (Std. err. adjusted for 51 clusters in stateid)
------------------------------------------------------------------------------
             |               Robust
      logvio | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -.0279935   .0407168    -0.69   0.495    -.1097757    .0537886
 incarc_rate |    .000076   .0002079     0.37   0.716    -.0003416    .0004935
      pb1064 |   .0291862   .0495407     0.59   0.558    -.0703192    .1286916
      pw1064 |   .0092501   .0237564     0.39   0.699    -.0384659    .0569662
      pm1029 |   .0733254   .0524733     1.40   0.168    -.0320704    .1787211
         pop |  -.0047544   .0152294    -0.31   0.756    -.0353436    .0258347
      avginc |   .0009587   .0164931     0.06   0.954    -.0321688    .0340861
     density |   -.091555   .1238622    -0.74   0.463    -.3403396    .1572296
             |
        year |
          78 |   .0585261   .0161556     3.62   0.001     .0260767    .0909755
          79 |   .1639486   .0244579     6.70   0.000     .1148233    .2130738
          80 |   .2170759   .0334184     6.50   0.000     .1499531    .2841987
          81 |   .2172551   .0391956     5.54   0.000     .1385284    .2959819
          82 |   .1946328   .0465743     4.18   0.000     .1010856      .28818
          83 |    .158645   .0593845     2.67   0.010     .0393676    .2779223
          84 |   .1929883   .0770021     2.51   0.015     .0383251    .3476515
          85 |   .2444764   .0922217     2.65   0.011     .0592438    .4297091
          86 |   .3240904   .1089181     2.98   0.004     .1053219    .5428589
          87 |    .324365   .1249881     2.60   0.012      .073319    .5754111
          88 |   .3867412   .1397074     2.77   0.008     .1061305    .6673518
          89 |   .4422143   .1535358     2.88   0.006     .1338286    .7505999
          90 |   .5430478   .1960859     2.77   0.008     .1491976     .936898
          91 |   .5959456   .2040685     2.92   0.005     .1860618    1.005829
          92 |   .6275171   .2170306     2.89   0.006     .1915982    1.063436
          93 |   .6497414   .2246177     2.89   0.006     .1985834    1.100899
          94 |   .6354187   .2332437     2.72   0.009     .1669349    1.103903
          95 |   .6276831   .2423607     2.59   0.013     .1408874    1.114479
          96 |   .5713423   .2534067     2.25   0.029       .06236    1.080325
          97 |   .5501153   .2613516     2.10   0.040     .0251751    1.075055
          98 |   .4932904   .2746546     1.80   0.079    -.0583697     1.04495
          99 |   .4328776   .2862197     1.51   0.137    -.1420117    1.007767
             |
       _cons |   3.765525   1.152108     3.27   0.002     1.451448    6.079603
-------------+----------------------------------------------------------------
```

```
     sigma_u |   .6663043
     sigma_e |   .1400264
         rho |  .95770338   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

The absolute value of the coefficient *shall* is 0.0279, the coefficient is not statistically or different from 0. Time effects are jointly statistically significant.

5. SUMMARY

In our analysis, we utilized the Pooled OLS Model, Time and Fixed Effects Model, and Fixed Effects Model. We tested several models with the aim of removing any errors or problems we were experiencing at a particular model. By comparing various statistical tests between the models, we can now choose the best possible model for our analysis.

Ultimately, after analyzing the models, we came to the conclusion that the best model should include both the state fixed effects and time fixed effects.

Statistically, the incarceration rate was found to have a very significant impact on overall crime rates. Overall crime rates decreased with an increase in incarceration rates.

Our analysis found the incarceration rate to be extremely significant, which means it significantly impacted overall crime rates. This has a negative relationship with the overall crime rate which indicates there are many things that can be done to reduce crime by strengthening the laws and improving the policies.

6. CONCLUSION

There does not seem to be much effect of concealed weapons laws on the violent crime rate, robbery rate, or murder rate. Despite its negative coefficient, we could not find any evidence to show that the effect of the shall law on crime rates was substantial; thus, it is either insignificant or has no effect on crime rates.

In spite of the fact that the shall law seems to have a non-significant impact on overall crime, we might suspect that other variables, which could affect crime rates and shall issue laws, were not considered in the model. There can also be a case of simultaneous causality, since an increase in crime can lead to more laws being passed.