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Incarceration Rates and Single Motherhood

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Incarceration Rates and Single Motherhood
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Abstract

Traditionally, the family unit consists of a mother, a father, and one or more children. There are many instances throughout the United States where this traditional family structure is not found. One of these situations, the single motherhood situation, occurs when a father figure is absent and the mother has to provide for her children on her own. Could the lack of a father figure in a child's life cause them to be more likely to break the law and become incarcerated? Is there a causation between a state's single motherhood rate and their incarceration rate, or are the two merely just correlated? Do a state's urban percentage, political affiliation, and poverty rate have an impact on incarceration rates? These are the questions that this research study seeks to address.

Keywords: incarceration rate, single motherhood, poverty, unemployment, states

JEL Codes: demographic data, family structure, labor economics, economic geography

Introduction

In the United States, the justice system is always a topic of debate among political rivals. There are always questions concerning why certain states have high incarceration rate while others have low ones. If a firm theory can be proven as to why incarceration rates can differ so widely, policy makers might be able to remedy this issue. Possible causes for high incarceration rates may be high single motherhood rates, along with unemployment and poverty rates. Another question that a study similar to this might help to answer is the question of why America has high incarceration rates in comparison to similar countries such as Canada, Australia and the UK.

Many people consider inmates in correctional facilities to be dead weight on the economy, meaning that they are not contributing to the work being done nationwide at full capacity. If the causes to these incarceration rates can be determined, steps may be taken to minimize the amount of people in these prisons and correctional facilities. According to the Vera Institute of Justice, the average cost of an American inmate is \$31,000 USD a year¹. A deeper understanding of these issues can also grant insight into other situations, such as how single motherhood rates may be correlated with poverty rates and so on. Through mathematical insight and several points of data, these relationships have been investigated.

Data Overview

For this study, we are determining if there is a relationship between single motherhood rates and incarceration rates. We are implementing a cross-sectional model with fifty data points, one for each American state². The cross-sectional data for all but one of our variables is for the

¹ Based on 2015 data.

² It was also considered to include Canadian provinces, but the incarceration rates for the Canadian provinces were much too low to be included in this sample.

year 2017. The lone exception is that our data for percent of urban residents by state is from 2010 and was collected from the latest United States Census.

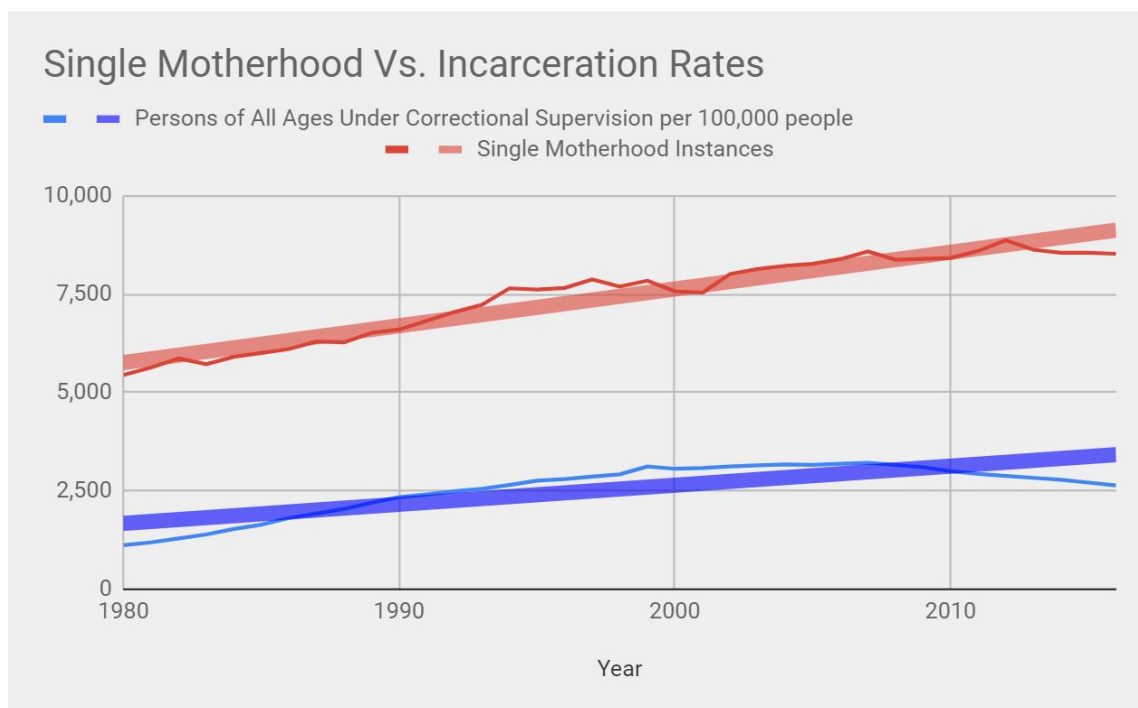


Figure 1, Single motherhood instances compared to nationwide incarceration rates. Note: The term ‘under correctional supervision’ refers to incarceration and parole. Data provided by the Census Bureau and The BJS.

We have assigned incarceration rate as our dependent (Y) variable that we are trying to explain using multiple independent variables. Incarceration rate data for 2017 was provided by the Bureau of Justice Statistics. “The main source for annual prisoner counts is the National Prisoner Statistics (NPS) program data collection, which began in 1926 under a mandate from Congress to collect statistics on prisoners. NPS distinguishes between custody and jurisdiction prison populations (see Terms and Definitions for more information). Imprisonment rates refer to the number of persons under the jurisdiction, or legal authority, of state or federal correctional officers per 100,000 U.S. residents. When prison populations are combined with local jail counts,

they are referred to as the incarcerated population, and the incarceration rate is the number of persons in prison or jail per 100,000 U.S. residents” (Bureau of Justice Statistics [BJS], 2018).

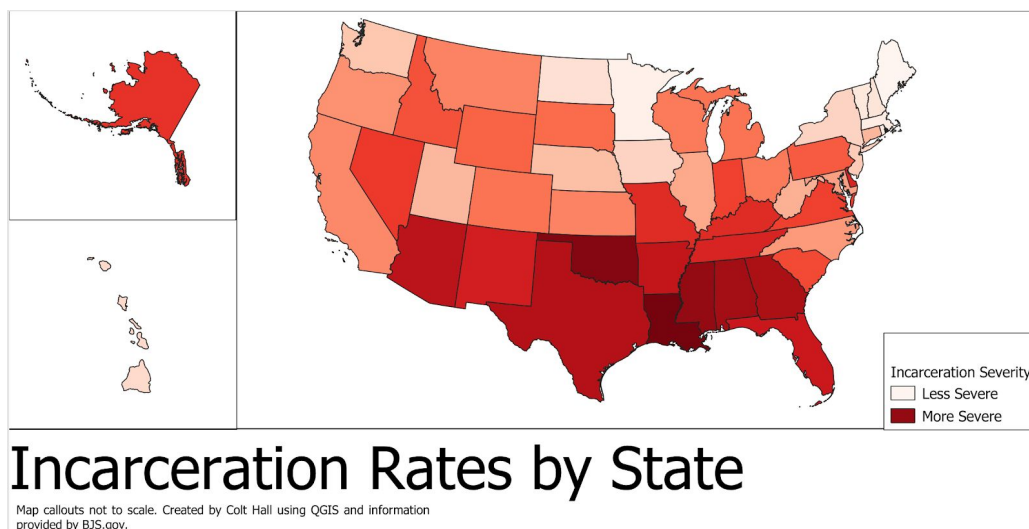


Figure 2, Incarceration rates by state.

After extensive research and analysis of possible explanatory variables to be included in our model, we chose to include six distinct independent variables. These six variables, one of which is a dummy variable, will provide us insight into how different demographics affect incarceration rates across the country. While there are certainly many more variables that could possibly impact incarceration rates than the ones that we chose to incorporate into our model, we felt that our six included variables would be sufficient for this estimation.

The first of six variables that we chose to include in our model is single motherhood rate. This is our explanatory variable and our first “X” variable. We expect this number to have a positive impact on our dependent variable. Single motherhood rate is measured in by the percentage of single households led by a single mother with children under the age of eighteen living in the household in the United States in 2017, by state (Statista, 2018). This data, retrieved

from Statista.com, was collected by the United States Census Bureau. “For most single mothers, a constant battle persists between finding the time and energy to raise their children and the demands of working to supply an income to house and feed their families. The pressures of a single income and the high costs of childcare mean that the risk of poverty for these families is a tragic reality. Comparison of the overall United States poverty rate since 1990 with that of the poverty rate for families with a female householder shows that poverty is much more prevalent in the latter” (Statista, 2018). We thought that a child raised in a single mother situation might have different psychological impacts upon them than a child raised in a traditional two parent household.

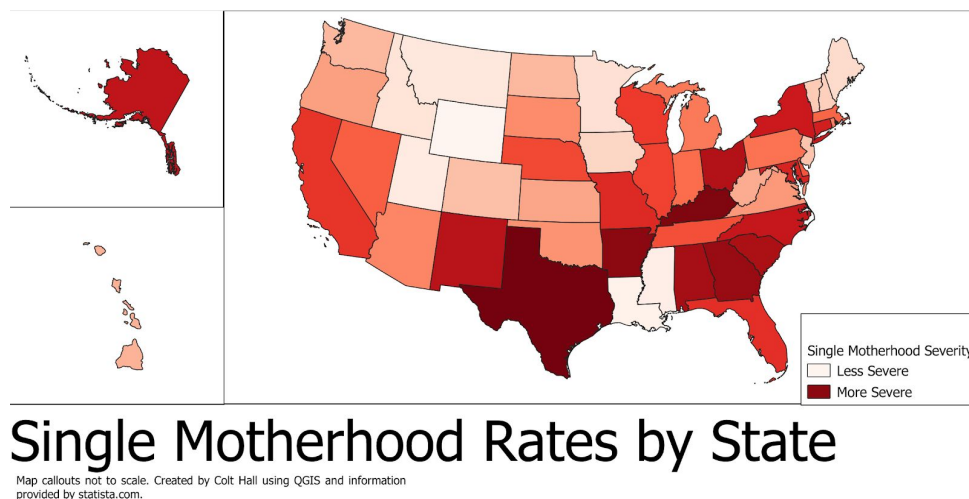


Figure 3, Single motherhood rates by state.

Since statistics show that there is a direct correlation between single motherhood rates and poverty rates, we felt that it would be appropriate to include poverty rates in our model. This is our second “X” variable. We expect poverty rates to have a positive impact on our dependent variable. Data regarding poverty rates was retrieved from the United States Census Bureau for

2017 and is measured in percentage for each state. The data that we have collected is a supplemental poverty measure. “Each year, the U.S. Census Bureau counts people in poverty with two measures. Both the official and supplemental poverty measures are based on estimates of the level of income needed to cover basic needs. Those who live in households with earnings below those incomes are considered to be in poverty. Both the official and supplemental poverty measures are annual estimates based on a sampling of U.S. households. In 2017, the Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC) was sent to about 95,000 U.S. households across the 50 states and the District of Columbia. Since this is a household survey, the sample excludes many who might otherwise be considered to be in poverty. The sample excludes those who are homeless and not living in shelters. It also excludes military personnel who do not live with at least one civilian adult, as well as people in institutions such as prisons, long-term care hospitals and nursing homes. The official poverty measure has been used to estimate the national poverty rate from 1959 onward. The measure is used to create income thresholds that determine how many people are in poverty. Income thresholds by the official poverty measure are established by tripling the inflation-adjusted cost of a minimum food diet in 1963 and adjusting for family size, composition and the age of the householder. The supplemental poverty measure provides a more complex statistical understanding of poverty by including money income from all sources, including government programs, and an estimate of real household expenditures. This information is valuable, but this measure’s thresholds are not the basis for government program income eligibility. The measure was developed by a 2010 government technical working group. In 2011, its first year of use, it showed that 16 percent of Americans lived in poverty during 2010, compared to 15.1 percent

from the official poverty measure. This measure also shows the effect that a number of safety net programs have on poverty rates. In 2016, for example, Social Security reduced poverty overall by 8.1 percent. Refundable tax credits reduced poverty by about 2.5 percent, with the largest reduction among children under 18 years of age. Importantly, the supplemental poverty measure showed a wider variation of poverty from state to state. For example, it found that over a three-year average from 2014-17 California had a poverty rate of 14.5 percent by the official measure. By the supplemental measure California poverty was 20.4 percent, which was second highest in the nation” (UC Davis, 2017). While the traditional measure of poverty would be an acceptable data source for this research study, we believe the supplemental measure is a better measure because of its comprehensiveness.

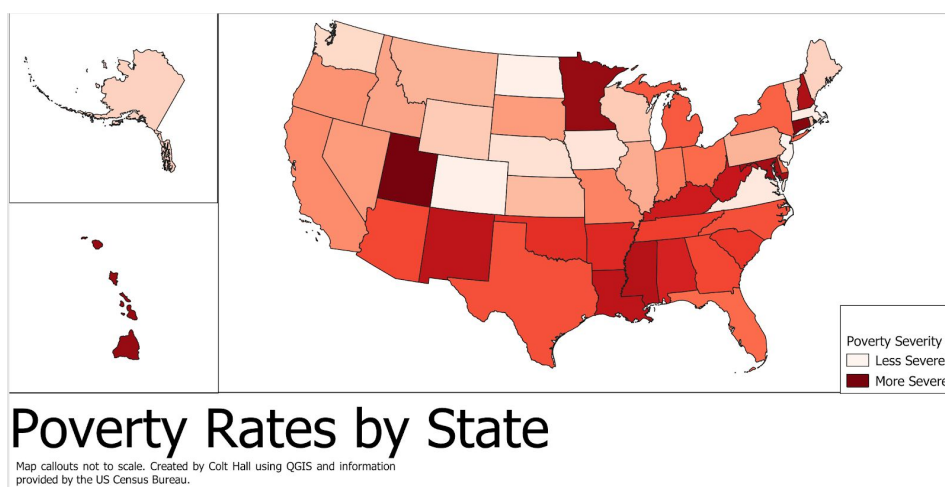


Figure 4, Poverty rates by state.

Our third independent variable for our model is unemployment. This data is measured in percentage for each state and was retrieved from the United States Bureau of Labor Statistics. We expect this variable to have a positive impact on our dependent variable because unemployment often leads to poverty, which we believe leads to higher incarceration rates.

There is also more motivation for an unemployed individual to commit a crime when the crime has financial benefit.

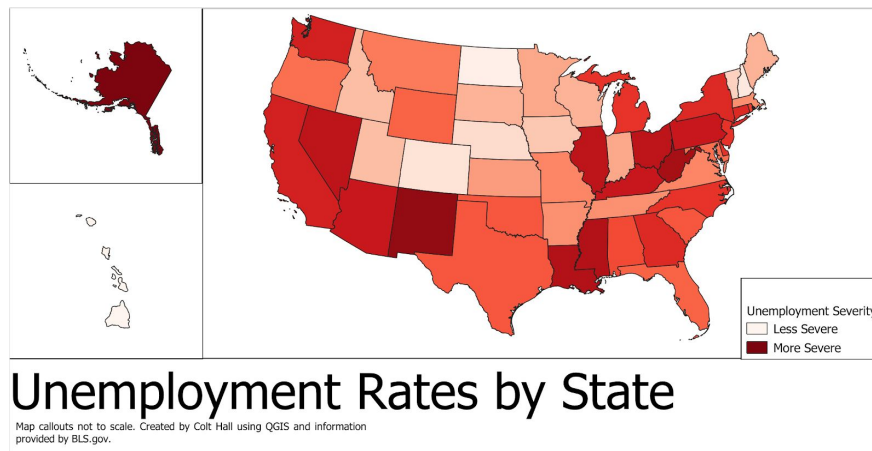


Figure 5, Unemployment rates by state.

Our fourth variable that we chose to include is a dummy variable involving a state's political alignment during the 2016 presidential election. For this binary variable, we assigned the number one to states who voted for Hillary Clinton and the number zero to states who voted for Donald Trump in the presidential election. This data was retrieved from Politico.com. We do not know if this variable will impact incarceration rates positively, negatively, or not at all. We have added it because we know that it has a relationship with population density, since the Democrats tend to be the most prominent in big cities and Republicans tend to be more prominent in rural environments.

Our fifth variable is population by state. This data involves numerical values ranging from 579,315 in Wyoming to 39,536,653 in California in 2017. This data was retrieved from WorldPopulationReview.com. We are unsure as to whether population will have a positive or

negative impact on incarceration rates. This variable was later omitted from most regressions because it has shown to produce too much collinearity between the variables.

Our sixth and final independent variable is the percentage of urban residents by state. According to Iowa State University, urban population percentages are not directly comparable over time due to changes in definitions and criteria for delineating urban areas. From 1950-1990, the urban definition included all population in ‘urbanized areas’ (densely settled territory with specific population thresholds), and incorporated places or Census Designated Places (CDPs) with population of 2,500 or more located outside of urbanized areas. For 2000-2010, the urban definition included all population in urbanized areas and urban clusters, each with their own population size and density thresholds (iastate.edu, 2018). We expect that the higher the percentage of urban residents, the higher the incarceration rate will be. Our reasoning behind this is that crime is more likely to occur in areas that have a higher population density, like a major city in the United States, than in areas that have a lower population density like rural Wyoming. This data is measured as a percentage and was collected in 2010 during the latest census. This variable was later omitted in some regressions because of its close relationship to population, and the fact that this data is from 2010 while the other data points are from 2017.

In conclusion, our model centers around our dependent variable, incarceration rates in the United States, and how those rates might be impacted by single motherhood rates, our independent variable. We have included a five additional independent variables in our model that we believe will provide insight into this topic. Those variables are poverty rates, unemployment rates, population, urban/rural breakdown, and our politics dummy variable. With these trends

being accounted for, lawmakers and reformers in the United States can gain insight into some of the factors that go into high and low incarceration rates.

| | Incar. Rate | Single Mother Rate | Poverty Rate | Unemp. Rate | Politics (Dummy) | Population | Urban % |
|-----------------|--------------------|---------------------------|---------------------|--------------------|-------------------------|-------------------|----------------|
| Mean | 0.79% | 7.22% | 13.06% | 4.16% | 0.4 | 6,500,504 | 73.6% |
| Median | 0.79% | 7.31% | 12.90% | 4.25% | 0 | 4,569,261 | 73.8% |
| Minimum | 0.35% | 0.67% | 7.70% | 2.40% | 0 | 579,315 | 38.7% |
| Maximum | 1.42% | 11.24% | 19.80% | 7.20% | 1 | 39,536,653 | 95.0% |
| St. Dev. | 0.26% | 1.71% | 2.90% | 0.93% | 0.49 | 7,271,446 | 14.42% |

Figure 6, The table of summary statistics.

Methodology

Below is our theoretical model as well as chart summarizing the data that we have compiled. In this theoretical model, incarceration rate is abbreviated by (IR) and is our independent (Y) variable, single motherhood rate is abbreviated by (SMR) and is our explanatory variable (X1), poverty rate is abbreviated by (PR) and is our independent variable (X2), unemployment rate is abbreviated by (UR) and is our independent variable (X3) , political affiliation is abbreviated by (PA) and is our independent variable (X4), population is abbreviated by (POP) and is our independent variable (X5), and urban percentage is abbreviated by (UP) and is our independent variable (X6), and (ui) is our error term. The intercept (B0) is the expected value of our Y variable when all of the X variables equal zero.

$$(I) IR = B0 + B1(SMR) + B2(PR) + B3 (UR) + B4(PA) + B5(POP) + B6 (UP) + ui$$

$$(II) IR = B0 + B1(SMR) + B2(PR) + B3 (UR) + B4(PA) + B5(POP) + ui$$

$$(III) IR = B0 + B1(SMR) + B2(PR) + B3 (UR) + B4(PA) + B5 (UP) + ui$$

We chose to use the ordinary least squares (OLS) linear regression model in analyzing the relationship between our independent and dependent variables. There are several reasons, both practical and theoretical, why we prefer this model to other models such as probit and logit. First, “OLS has become the common language for regression analysis throughout economics, finance, and the social sciences more generally. Presenting results using OLS means that you are ‘speaking the same language’ as other economists and statisticians” (Stock & Watson, 2017, p.119-121). Theoretically speaking, the OLS model is desirable because it is an unbiased and consistent estimator of the population. In a good theoretical model, the observations are tightly clustered around the estimated regression line with very few outliers. This means that the regressors account for much of the variation in the dependent variable, producing a R^2 that is close to one.

Before running this model in GRETL, we anticipated poverty rate having the most significant impact on incarceration rates in the United States. This is because we believe that a majority of crimes committed in the United States occur in low-income areas. We also anticipated unemployment rate and single motherhood rates having a very significant impact on incarceration rates. Our reasoning for these two independent variables being important is very

similar to our reasoning for why poverty rates might have a significant impact on incarceration rates. We expect that incarceration rates will be higher in densely populated, urban areas around the United States but do not think that those variables will have as large of an impact on incarceration rates than poverty rates, unemployment rates, and single motherhood rates. As stated earlier, we do not know what kind of an impact state political affiliation will have on our dependent variable, but we were eager to find out.

Results & Interpretations

After inputting our data for our dependent variable and six independent variables into `getl`, we created an OLS regression model. We set incarceration rate as our dependent variable and set single mother rate, poverty rate, unemployment rate, population, urban percentage, and political affiliation as our regressors, along with the constant. We also included robust standard errors. Below is our resulting regression output.

```

Model 2: OLS, using observations 1-50
Dependent variable: IncarcerationRate
Heteroskedasticity-robust standard errors, variant HC1

-----
                coefficient    std. error    t-ratio    p-value
-----
const            -0.00252193    0.00170203   -1.482    0.1457
SingleMotherRate  0.0228553    0.0231809    0.9860    0.3297
PovertyRate      0.0455544    0.0137875    3.304     0.0019 ***
UnemploymentRate 0.0142855    0.0259271    0.5510    0.5845
PoliticalAffilia~ -0.00194926   0.000484829  -4.021    0.0002 ***
Population       -2.35623e-11  3.00565e-11  -0.7839   0.4374
PercentUrban     0.00435329   0.00167042   2.606     0.0125 **

Warning: data matrix close to singularity!

Mean dependent var  0.007944    S.D. dependent var  0.002589
Sum squared resid  0.000120    S.E. of regression  0.001670
R-squared           0.635157    Adjusted R-squared  0.584248
F(6, 43)           15.10511    P-value(F)          3.28e-09
Log-likelihood      252.5834    Akaike criterion    -491.1668
Schwarz criterion  -477.7826    Hannan-Quinn        -486.0700

Excluding the constant, p-value was highest for variable 4 (UnemploymentRate)
    
```

Figure 7, OLS model showing the first regression with all variables. Note the singularity error.

At first glance, this GRETTL output looked as expected. Three of our regressing variables were statistically significant, while the other three were not. Poverty rate had the second smallest p-value and was deemed significant at the 90%, 95%, and 99% levels. Neither single mother rate nor unemployment rate were significant at any of the three confidence levels. Upon further examination of our GRETTL output, we noticed a warning message saying, “data matrix close to singularity.” Essentially this meant that one or more of our regressors were too closely correlated with another regressor which skewed the results. We soon discovered that the independent variables “population” and “percent urban” were highly correlated. We then omitted “population” from our OLS regression, and no longer received a warning message.

The following table contains the regression results from six different OLS models. For the first five models, we regressed each independent variable individually against our dependent variable. For the sixth model, we included all five independent variables and regressed them against our dependent variable.

| Dependent Variable | Incarceration Rate | | | | | |
|------------------------------|--------------------|---------|---------|----------|---------|----------|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| Constant | .002 | -.000 | .003** | .009*** | .009*** | -.002 |
| Single Mother Rate | .078** | | | | | .021 |
| Poverty Rate | | .064*** | | | | .045*** |
| Unemployment Rate | | | .119*** | | | .015 |
| Political Affiliation | | | | -.003*** | | -.002*** |
| Percent Urban | | | | | -.001 | .004*** |
| <i>Measures of Fit</i> | | | | | | |
| SER | .002 | .001 | .002 | .002 | .003 | .002 |
| Adjusted R-squared | .252 | .495 | .166 | .255 | -.018 | .591 |

Figure 8, Final table of results.

As you might expect, we were very surprised by the results. Of the three regressing variables that we expected to be significant, only one was significant. Poverty rate had the second smallest p-value and was deemed significant at the 90%, 95%, and 99% levels. Neither single mother rate nor unemployment rate were significant at any of the three confidence levels when considered by model six. We were also extremely surprised by the fact that political affiliation and urban percentage were significant. While the coefficient was extremely small for the political affiliation variable (-0.2%), the p-value was lower than all of the other variables. The adjusted R-squared was .591.

Referring to economic significance, all these coefficients are major when the used unit is taken into account. For example, the political alignment dummy variable. According to the regression, a given state has two tenths of a percent less of an incarceration rate if they are aligned with the Democratic Party. This could be explained by the Republican's 'war on crime' stance, that would result in stricter laws. This is economically significant because two tenths of a percent is still a large quantity of people. Percent of urban population is also economically significant because according to the regression, for every percent of a state's population being urban, 4/10ths of a percent of the population will be incarcerated according to this regression. 4/10ths of a percent of New York's population is 79,400 people, which means that for every percent of New York's population in an urban environment, 79,400 people would be incarcerated. That's an estimated \$2.46 billion USD cost a year to the government to take care of 79,400 inmates according to Vera Institute averages for 2015.

Some other regressions were performed with single motherhood rates as the dependent variable. Interestingly it seemed as though poverty rates were consistently statistically significant in the regressions. It cannot be determined if single motherhood causes poverty or if poverty causes single motherhood. When regressed together, it was found that percent urban and poverty both had statistical significance in explaining single motherhood rates. Therefore, single motherhood rates are correlated in some way with the other variables that go with incarceration rates.

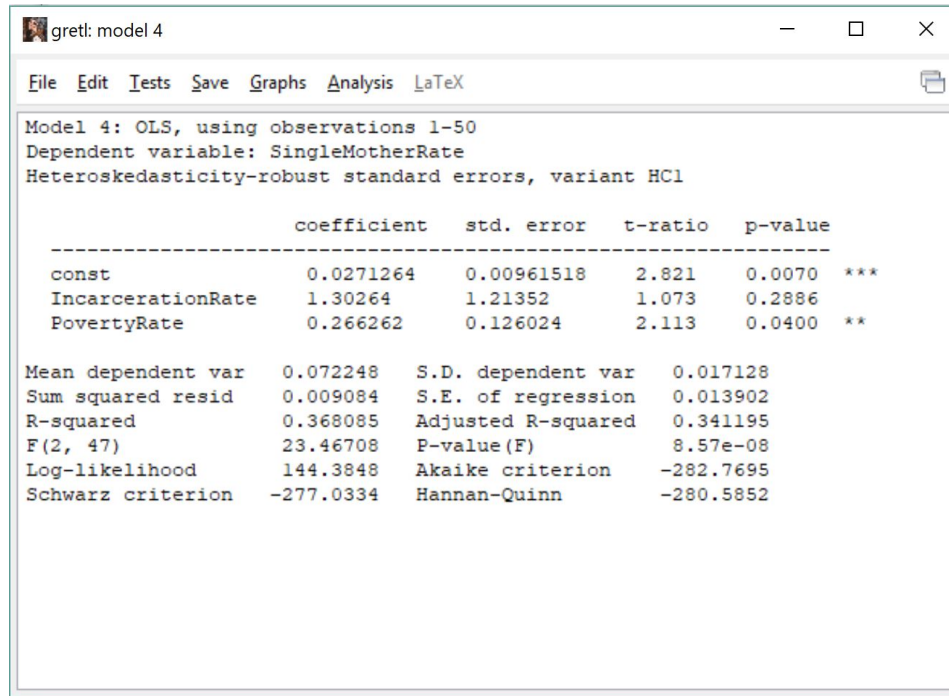


Figure 9, OLS regression showing that there is a relationship between single motherhood and poverty.

Conclusion

Incarceration is a complex and unique issue. It is hard to quantify the exact impact that incarceration rates have on any given American state. This study has revealed that political affiliation, percent urban population, and poverty rates have statistical significance on state incarceration rates, and that single motherhood rates do not. This was done by researching several data points and comparing them carefully.

Based on the results, it may be easy for one to discount single motherhood as a factor of incarceration rates. This conclusion cannot be made since there is evidence that single motherhood is related to poverty rates, where poverty rates have been proven to be related to incarceration rates. We cannot discount single motherhood as an important variable in incarceration rates because of its relationship to the other explanatory variables. It could be quite possible that incarceration rates and single motherhood rates are impacted similarly by poverty rates and the other listed factors.

Incarceration rates is not just an American issue. Although other high-income countries have lower incarceration rates than the US, inmates are still a detriment to the country's economy. Therefore, if this data can be carried over to other countries, lawmakers and reformers could be able to react accordingly. However, it cannot be assumed that this data can be carried over this easily, since laws are quite different throughout the world.

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