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# An Analysis of Costs and Solutions to High Recidivism Rates in Florida

Aarush Santoshi[1], Sophia Li[1], Sofia Krivitsky[1], Matthew Diomidous[1] and Krassimir Penev[1#]

[1]Bergen County Academies
[#]Advisor

## ABSTRACT

Recidivism affects a significant portion of convicted offenders. It represents the culmination of many factors like social isolation, a lack of work opportunities, and drug abuse. This project evaluates the risks and costs of recidivism in Florida's correctional facilities in terms of the physical cost of incarceration and the social cost that imprisonment has on communities. We derive and analyze data from six main sources: past recidivism trends from the Florida Department of Corrections, data of police employment, data of median income data, drug arrest data, and data of unemployment trends. We then evaluate the feasibility of measures involving drug rehabilitation, educational programs, police employment increases to discourage recidivism and facilitate reentry into society by using symbolic regression to calculate future trends. The R-squared values ranged from 65.4% to 97.3%. A primary component analysis (PCA) was performed with post hoc Kaiser–Meyer–Olkin, which yielded a value < 0.6, and Bartlett's Sphericity, which yielded a value <<< 0.0001, tests, suggesting a substantial correlation. A Monte Carlo analysis was then performed to predict the total instances of recidivism through 2024. This research showed that increasing police efficiency and investing in drug rehabilitation services should be prioritized by the state of Florida.

## Introduction

High rates of recidivism impacts the lives of offenders who are unable to break out of the cycle of repeat offending, as well as greatly impact public safety. The recidivism rates have ranged over the prior five years between 21-25% in Florida [1]. 86% of inmates housed in Florida prisons will one day be released back into Florida counties, and the state that is responsible for addressing the likelihood that said inmate will return to the prison system. More importantly, it is important to deal with the issue as soon as possible for the safety of the public and those charged with ensuring public safety due to any criminal activity produced by released prisoners [2]. In this report, we focused our analysis on the rate of recidivism in Florida in 2024 to predict risks associated with recidivism in 2024 as well as provide recommendations to decrease these rates.

Initially, we created a model to predict the recidivism rate and instances of recidivism in each county of Florida for the year 2024. To achieve this, we identified several parameters that were closely associated with the recidivism rate and incorporated them into our model. These parameters included unemployment rates, drug usage rates, median household income, police staffing, and the year itself. Using symbolic regression techniques, we generated an equation that established the relationship between these parameters and the recidivism rate. To predict the future values of each parameter, we utilized multiple regression techniques. In our final step, we conducted a Monte Carlo simulation to factor in the probabilistic nature of recidivism rates when forecasting the number of repeat offenses in the future. Our analysis led us to predict that the rate of recidivism in Florida will increase in 2024 compared to the previous years. Specifically, our model projects a mean amount of recidivism of 440,900 instances with a standard deviation of 161,776.

With recidivism rates predicted, we set out to quantify the risk associated with recidivism in 2024. Using the symbolic regression model, we identified a term, $\alpha$, which combined the two factors with the greatest inter-county variability as determined by standard deviation calculations and existing literature. This term was used to quantify the risk of recidivism in each county; the counties were then, based on their score, designated as high risk, low risk, or intermediate risk.

Based on our analysis, we created policy recommendations for the Florida state government that will work to decrease recidivism rates. Our policy change focused on three of the causes of recidivism: drug arrests, unemployment, and police employment. We recommend that Florida spend money on drug addiction treatments. We also recommended the government to supply employment subsidies and educational programs within the prison in order to decrease unemployment. Finally, we recommend increasing the salary for police in order to increase police employment as well. Together, these strategies will effectively decrease recidivism in Florida.

## Background Information

Over the past 20 years, recidivism rates have stayed consistently high, with very small advances in reducing them [3]. In 2022, re-arrest rates were still highest in the first year after release and almost 90% of re-arrests were within three years of the prisoner's release [4].

Recidivism, the act of reoffending after release from prison, is multifactorial including correlations with social factors such as lack of social interactions during incarceration and a change in social life after release. Other factors include unemployment and economic struggles, drug arrests, and police employment [5]. In fact, overall crime rates in Florida cities are 2.6 times higher than the national average [6]. In Florida, the recidivism rate is about 25% within 3 years of a state prisoner's release. Within 5 years that number jumps to about 35% [7]. Additionally, the Florida Department of Corrections (FDC) is the third largest state prison system in the country as it has a budget of $2.7 billion, approximately 80,000 inmates incarcerated, and nearly 146,000 offenders on probation [7]. Florida's police and correctional expenditure is the highest in the country, with 7.4% spent per total government spending [8].

## Problem Statement

Recidivism affects a major portion of convicted offenders. It represents the culmination of many factors like social isolation, a lack of work opportunities, and drug abuse. In this project, we evaluate the risks and costs of recidivism in the United States' correctional facilities in terms of the physical cost of incarceration and the social cost that imprisonment has on communities. We then evaluate the feasibility of measures involving drug rehabilitation and educational programs to discourage recidivism and facilitate reentry into society.

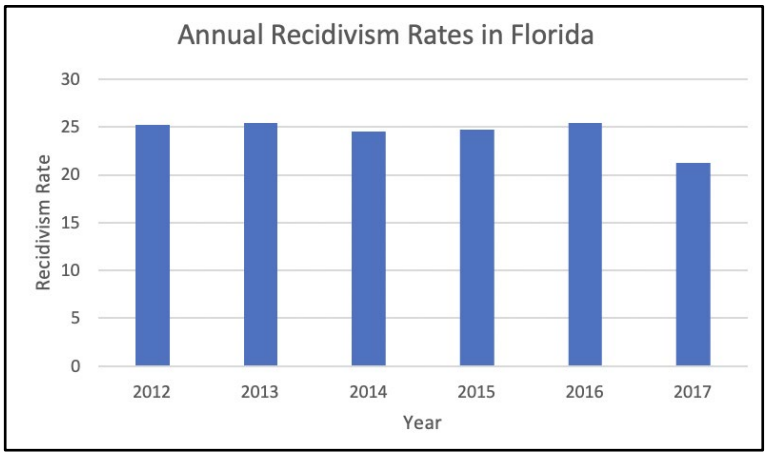



Figure 1: Annual Recidivism Rates in Florida, 2012-2017

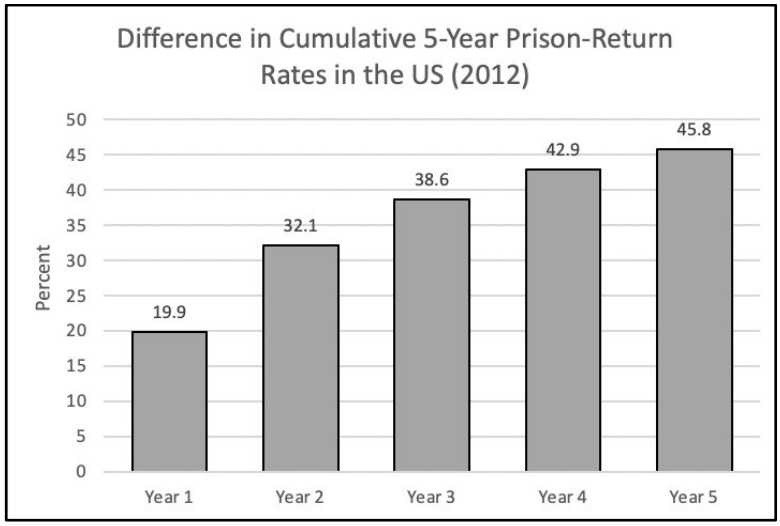



Figure 2: Annual U.S. Recidivism Rates, 2012-2016

As shown in figure 1, the recidivism rate in Florida has been mostly stagnant from 2012 to 2017 until it decreased in 2017. Although it is difficult to justify this for a single reason because human behavior varies, some literature attributes this to fewer re-released inmates in Florida being supervised less in comparison to other states that release their inmates to parole [9]. Additionally, the median age in all Florida citizens has risen from 40.8 in 2012 to 41.8 in 2017 [10]. Although there may not be a direct correlation, the Council on Criminal Justice asserts that as age increases, re-arrest rates begin to decrease.

Recidivism increases the longer the offender is out of prison, as shown in Figure 2 which examines the same group of inmates over a five-year period. Because of this increasing problem and people falling into the cycle, we believe that dealing with recidivism should be a priority for the government. Our paper seeks to find numerical correlations between the parameters noted and recidivism in order to recommend solutions to significantly reduce recidivism rates.

## Data Methodology

We derive and analyze data from 6 main sources: past recidivism trends from the Florida Department of Corrections, data of police employment, data of median income data, drug arrest data (combined from two sources), and data of

unemployment trends. We identified data for a multitude of variables in order to determine the sensitivity of each component in how they affect outcomes. These sources are relevant to both finding the relationship between recidivism rates and noted parameters and calculating future trends for such parameters to predict recidivism rates and provide our recommendations.

*Florida Department of Corrections (FDC) Prison Recidivism Data Report [10]*

- As this paper is focused on recidivism in the state of Florida, we derive recidivism and re-arrest data from the FDC annual recidivism data reports, providing a credible source with original data. These datasets provide us with annual totals for total returned inmates and total released inmates in each county of Florida within a 36-month period of being released from 2012 to 2018. The data was already totaled and compiled from individual cases in Florida. This 6 year period is useful for modeling the change in recidivism rates in time. We use the data from the FDC to measure the rate of recidivism each year and model/compare it to the other parameters presented below. This information was used to find the associated parameters that should be targeted in order to define the frequency of the risk to be able to minimize it. It also will allow us to predict future trends of recidivism rates.

*Criminal Justice Agency Profile (CJAP) Statewide Police Department Agency Report [11]*

- The number of police on patrol has an effect on the number of offenders arrested. As noted by the Office of Justice Programs, an increase in aggressive police patrol techniques, which is correlated with police employment per person, produce high arrest rates. We derived police employment data from the CJAP as it was an important parameter to note when analyzing arrest rates [12]. These datasets provide us with annual totals of officer counts in each police department of Florida and the ratio per 1000 residents (in 2012-2018). To match our other analyzed datasets, we used Excel to combine department totals into county totals (based on the location of the police department as listed by the CJAP). We use this data to determine exactly how officer counts influence recidivism and arrest rates in our regression model by examining past historical trends. There were some counties, notably Baker, Citrus, Glades, Lafayette, Liberty, Union, Wakulla, that were missing data within the CJAP Agency Report on police employment. To combat this, the median police ratio per 1000 residents was used to replace the missing data. To exclude/delete these counties from the data would introduce unwanted biases that could cause fluctuations in the models.

*Florida Department of Health (FDH) Median Household Income Data [13]*

- The Office of Justice Systems asserts that community characteristics impact the rate of recidivism; one major community characteristic is household income and community wealth. Thus, we incorporated the FDH median household income data for all years we analyzed the FDC recidivism rates [14]. The data provide us with median household income data within all counties of Florida and in all of Florida for the years analyzed with the FDC data (2012-2018). We use this data to determine exactly how household income and economic factors influence recidivism in our regression model.

*Florida Department of Health & Florida Department of Law Enforcement (FDLE) Drug Arrest Data [15, 16]*

- Offenders with substance abuse disorders are at an increased risk for reoffending than offenders without [17]. Thus, we analyzed FDH drug arrest data to model the correlation between substance abuse and recidivism rates. This data set provides us with total drug arrests and rate in all counties of Florida and in all of Florida from 2014-2018. The years of 2012-2013 were supplemented with arrest data from the FDLE, which we condensed department totals to county totals. Drug arrest was defined under "Drug/Narcotics" [18]. We use this data to determine exactly how drug arrests and substance abuse correlate with recidivism in our regression model.

*Florida Department of Health Unemployment Rate [19]*

- Unemployment remains high among the previously-incarcerated, even for non-violent crimes. This unemployment is noted by the Center for Justice Research to contribute to recidivism and reoffending. We analyzed FDH unemployment rates to model correlation between unemployment rates and recidivism rates. The data provide us with unemployment rate data within all counties of Florida and in all of Florida for the years analyzed with the FDC data (2012-2018). We use this data to determine exactly how unemployment correlates with recidivism in our regression model.

## Assumptions and Limitations

- *The rate of recidivism is influenced by a variety of factors, including drug arrest rates, household income, unemployment rates, police employment, and the year.* Higher drug arrest rates may contribute to recidivism by creating a cycle of addiction and criminal activity. Lower household incomes can limit access to resources and opportunities that could help individuals successfully re-enter society after being incarcerated. Higher unemployment rates may push individuals towards criminal behavior to make ends meet. Finally, higher levels of police employment may lead to increased arrest and incarceration rates, which can further entrench individuals in the criminal justice system. Although it may not seem obvious at first, the year may also have an impact on recidivism due to other factors. The year can affect recidivism because criminal justice policies, societal attitudes towards crime, and economic conditions can vary over time.
- *Drug arrest rates are reflective of proportions of drug users.* Individuals who are addicted to drugs are more likely to engage in criminal activity to support their addiction, which increases the likelihood of being arrested for drug-related offenses. Once incarcerated, drug addicts may struggle to overcome their addiction without appropriate treatment, which can lead to a cycle of recidivism as they are released back into society. Furthermore, drug addiction can also impair an individual's ability to maintain employment, which can contribute to financial instability and a greater risk of criminal activity.
- *Police Officers were employed for the full year in data provided by the CJAP.* The data provided by the CJAP only provides information on police employment by year and does not account for any variations in staffing levels throughout the year. Although there may be fluctuations in the number of police officers due to hiring, retirements, or other factors, we assume that these changes are negligible and do not significantly impact our analysis.
- *Data smoothing will not present any biases.* Data smoothing techniques are designed to reduce the impact of random fluctuations or noise in the data, while preserving the underlying trend or pattern. Data smoothing can help to identify long-term trends or patterns that may not be immediately apparent in the raw data, by filtering out short-term fluctuations or random variations that can obscure the signal. However, data smoothing can present slight biases if it is not appropriate for the data. In our data smoothing process, we assume

that the smoothing technique and parameters we have chosen are appropriate for the data and will not introduce any biases, despite the potential for smoothing to remove or distort important information.

## Mathematical Methodology

In this section, we aim to construct a model that can derive the rate of recidivism in each county of Florida. Our first step is to employ a symbolic regression algorithm to construct a mathematical equation that establishes a correlation between different variables and the rate of recidivism for each year. After obtaining the mathematical function through symbolic regression, we apply regression techniques to forecast future trends for the relevant variables. This allows us to predict potential changes in the rate of recidivism in each county over time.

Variables

| Variable | Description |
|---|---|
| P | Police Ratio per 1,000 people |
| I | Median Household Income |
| T | Time (Years after 2012) |
| U | Unemployment rate |
| D | Drug arrests rate per 100,000 people |

## Results

### *Correlations with Recidivism Rates*

Our model for predicting recidivism rates is developed using symbolic regression, a regression method that establishes complex correlations between multiple input variables and an output variable. In our case, the output variable is the rate of recidivism in each county within each year. The algorithm uses decision trees to evaluate the best possible mathematical function that fits the data. Our recidivism rate prediction model is based on the symbolic regression method, which involves evaluating all possible function structures and corresponding parameters or constants to establish a complex correlation between the variables and the rate of recidivism. Our dataset analysis on recidivism rates and the relevant variables in our assumptions did not reveal any apparent correlations. Moreover, multiple parameters contribute to determining the rate of recidivism, which further complicates the prediction process. Therefore, we chose to use symbolic regression to construct a complex function that could capture the intricate relationship between the variables and the rate of recidivism. This was necessary as conventional regression techniques may not have been sufficient to identify such complex relationships. Our model is based on the most optimal fitting function identified by the algorithm, providing reliable predictions of the recidivism rate for each county in each year.

(Eq. 1)
Return Rate = f(Median Household Income) = 25.65 + 3.02*I + 460.16*$I^2$ - 42.16*$I^2$ - 89.7*$I^3$ - 400.07*$I^5$

Note that Incomes were normalized by subtracting the mean and then dividing by the Standard Deviation. This was done since the original values had a large scale/offset. Any values substituted into I should be subtracted by the mean 45,277.43 and divided by the standard deviation, 8401.09.

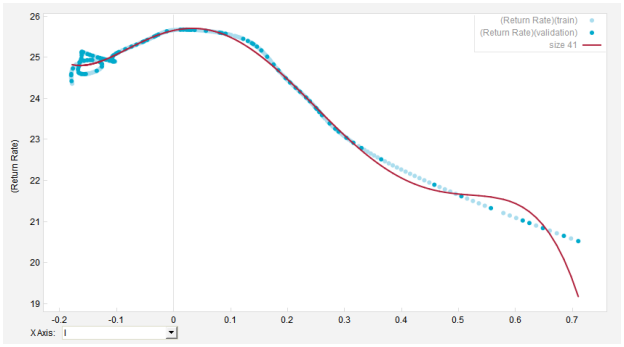



Figure 3 Recidivism rate as a function of Median Household Income

- The data generally shows that as the Median Household Income in a county increase (as seen when the normalized data values get further away from the mean), the recidivism rate will decrease. It is reasonable to expect that an increase in median household income would lead to a decrease in the recidivism rate, as higher income levels are associated with better access to resources, education, and employment opportunities.

## *Drug Arrests Rate per 100000 people:*

(Eq. 2)
Return Rate = f(Drug Arrests) = 8.8 + 0.041*(Drug Arrests) - 2.51e-5*(Drug Arrests)$^2$

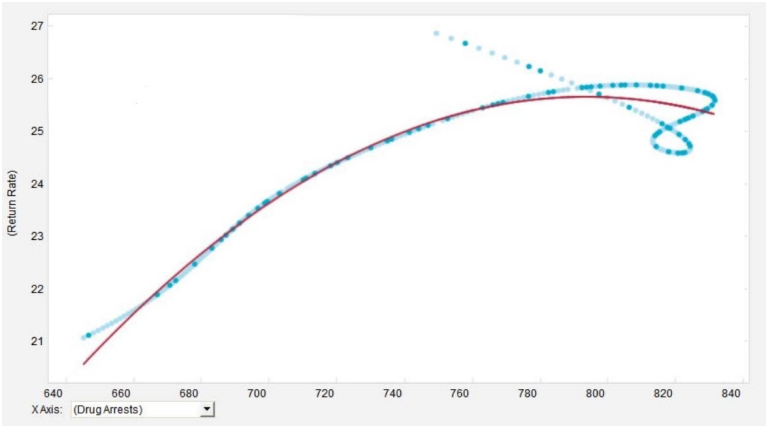



Figure 4 Recidivism rate as a function of Drug Arrests per 100000 people

- The data suggests that in counties with a higher drug arrests rate per 100,000 people, there will be a higher recidivism rate. This result could be expected since drug-related offenses often indicate a higher likelihood of addiction or substance abuse, which can lead to repeated criminal behavior and an increased risk of recidivism.

(Eq. 3)
Return Rate = f(Police Ratio per 1000) = $969.08/(\text{Police Ratio}) + 52.85*(\text{Police Ratio})^2 - 618.85 - 1.90*(\text{Police Ratio})^4$

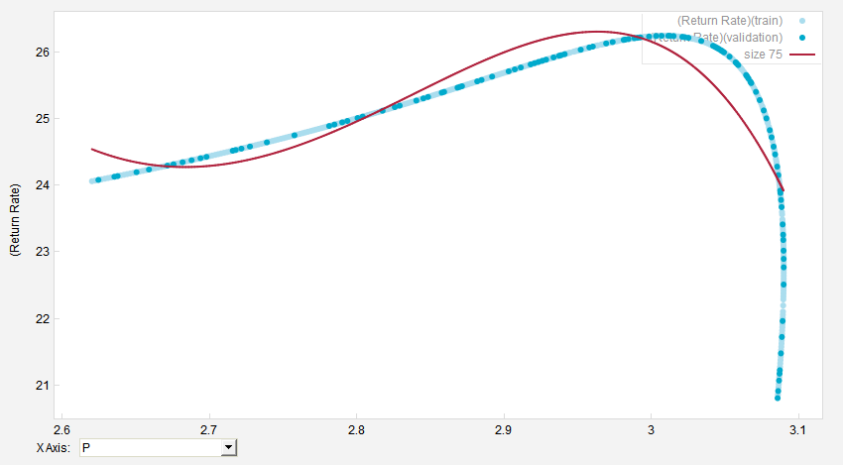



Figure 5 Recidivism rate as a function of police ratio per 1000 people

- Aside from a sharp decline at the end of the graph which is most likely due to outliers, the graph shows a strong positive correlation. This finding may be expected since a higher police presence may lead to more arrests and convictions, increasing the number of individuals in the criminal justice system. This increased involvement with the criminal justice system could potentially result in a higher likelihood of recidivism.

(Eq. 4)
Return Rate = f(Unemployment Rate) = $27.97 + 0.81*U + -143.64/U + 40.81/U^3 + 8314.22/(232.64 + U^3 - U) - 0.05*U^2$

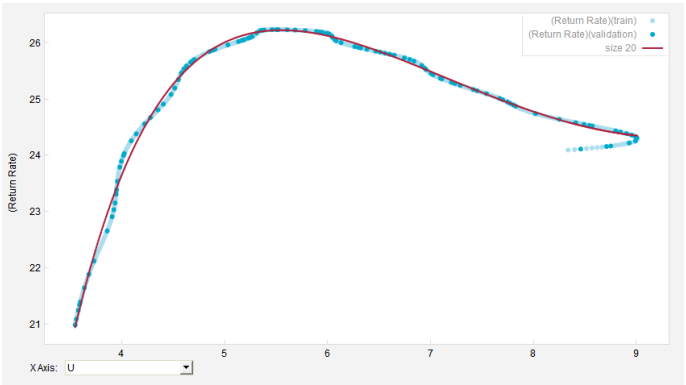



Figure 6 Recidivism rate as a function of unemployment rate

- According to our model, there is an initial positive correlation between unemployment rates and recidivism rates, with higher unemployment rates implying higher recidivism rates in a county. However, as confounding variables are taken into account, this correlation starts to diminish and eventually becomes negative.

## Cartesian Genetic Programming

The software used to create the Symbolic Regression, Eureqa, uses Cartesian Genetic Programming (CGP) as its primary algorithm for performing symbolic regression. CGP is a type of genetic programming that represents candidate solutions as directed acyclic graphs (DAGs) of nodes and connections.

The CGP algorithm begins by initializing a population of random DAGs, each representing a possible solution. Each node in the population represents a mathematical operator (addition, multiplication, etc.), and each connection represents the flow of data between nodes.

Next, the software evaluates the fit of each possible solution by comparing its output to the desired output for the given data. The function that does this also typically minimizes the error between the possible solution and the actual solution.

After evaluating the quality of each possible solution, the software applies genetic operators such as mutation and crossover to create new possible solutions. Mutation involves randomly changing a node in a solution, while crossover involves swapping portions of two possible solutions to create two new offspring solutions.

The software continues this process of evaluating a solution's quality and applying genetic operators over many generations, gradually improving the quality of possible solutions until a satisfactory solution is found. Overall, the use of Cartesian Genetic Programming allows the software to efficiently search through a large space of possible mathematical expressions to find the best fit for a given data set.

## Symbolic Regression

As previously mentioned, we utilized Eureqa, a powerful symbolic regression software, to analyze our data. With this software, we specified the ratio of training and testing sets, as well as the number of generations for the decision tree algorithm. To strike a balance between model complexity and accuracy, we chose to use an 80:20 training to testing ratio with 15 decision tree generations to ensure that our model will be able to maintain a balance between accuracy and simplicity.

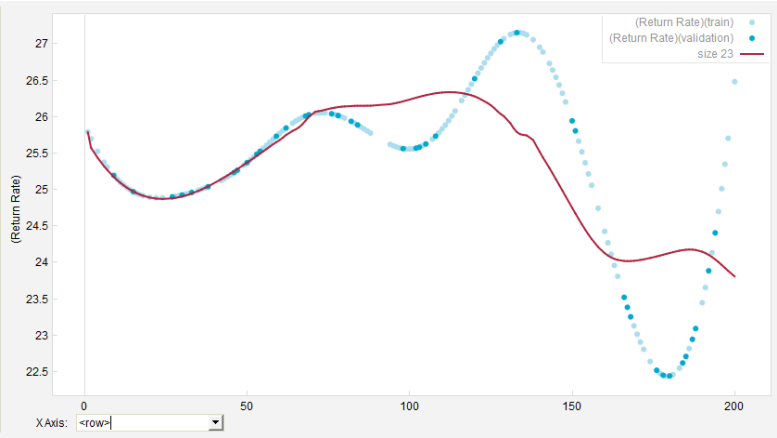



Figure 7 (Each x-value is for the row of the data)

With the data above, we returned the following equation:

(Eq. 5)

(Return Rate) = 1739.35*P + 15812.34/P + 0.095*P*D - 10540.47 - 0.767*U*T - 2.42e-9*I^2 - 0.000234*D^2

The model received an $R^2$ value of 0.789, meaning that our model is able to predict the testing values with great precision.

### Principal Component Analysis (PCA)

In order to condense our large set of data, understand the impact of our variables, and visualize the dimensionally reduced data, we conducted a principal component analysis. PCA allows us to identify the main axes of variance within a data set and allows for easy data exploration to understand the key variables in the data. The principal components of the data were determined by computing the eigenvectors and eigenvalues of the covariance matrix. Prior to performing PCA, rows of the data table containing null values due to a lack of data were removed; we deliberately chose not to replace the missing data with other statistical values so as not to introduce excessive bias. The PCA was conducted in R.

*Sampling Adequacy*: First, we conducted a Kaiser–Meyer–Olkin (KMO) test to determine how suited data is for factor analysis; our program returned a KMO of 0.6. A KMO value greater than 0.5 suggests there is substantial correlation in the data. We also performed Bartlett's Test of Sphericity, which compares an observed correlation matrix to the identity matrix. We received Bartlett's value or 1.5e-14; a value less than 0.0001 suggests correlation and adequate reliability of the factor analysis. These tests demonstrate that the data reduction technique can compress the data in a meaningful and reliable manner.

## Results

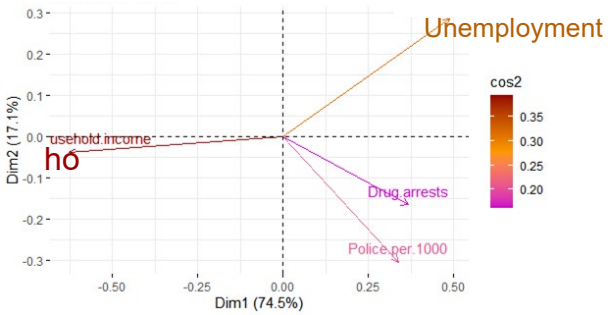
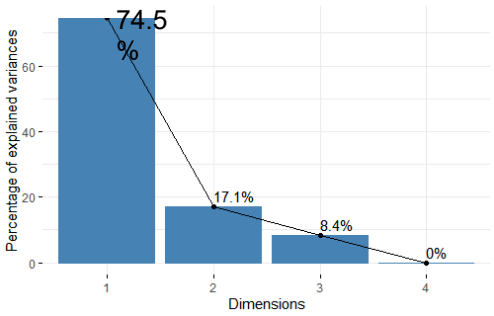



Figure 8: Biplot using Principal Component Analysis of Modeled variables

After conducting a PCA, we create a biplot to better visualize the variables of our model in order to determine the principal components. Both the length of the vector and cos2 value are used in our analysis. A high cos2 indicates a good representation of the variable on the principal component. Therefore, the visualized plot demonstrates that the Median household income is a good representation as a principal component, and can be modeled as a linear combination of the initial variables.




| Dimension | Variable |
|---|---|
| 1 | Unemployment Rate |
| 2 | Police Employment per 1000 |
| 3 | Median Household Income |
| 4 | Drug Arrest rate |

Figure 9: Scree Plot using Principal Component Analysis of Modeled Variables

### Monte Carlo Simulation

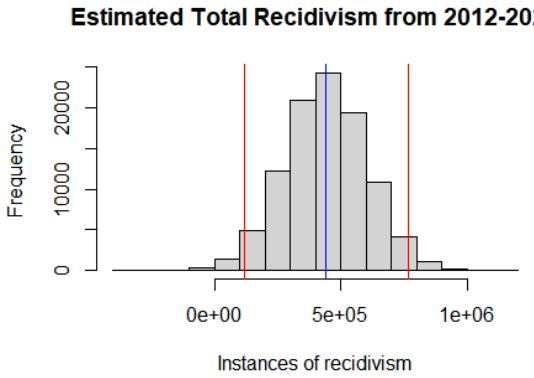



Figure 7 Projection of Recidivism in 2023-2024 as per our Monte Carlo simulation

Table 1 Projected Instances of Recidivism in 2023-2024

| | **Projected Instances of recidivism** |
|---|---|
| $\mu - 2\sigma$ | 117348 |
| $\mu$ | 440900 |
| $\mu + 2\sigma$ | 764572 |

## Risk Analysis

### Overview

Recidivism is harmful to both the communities the offender affects, monetary costs to prison systems, and any rehabilitation or crime reduction efforts made. In addition to costs to the FDC, Florida's prison system, and economic productivity, recidivism also caused non-monetary costs including pain and suffering from affected parties, increase in crime rates, and the mental health of prisoners in general. In addition, within the general population, there is thus a large nonmonetary need for crime reduction and citizen safety. We seek to find potential risk due to the multifactorial effects of recidivism and continued crime.

We also analyze the distribution of recidivism to identify counties that experience disproportionately high rates of recidivism. To extend our analysis further, we compare risks associated with current recidivism rates with our time period of 2012-2018 and symbolically model risks associated with recidivism for future years.

### Expected Cost of Recidivism

To establish and analyze the severity of recidivism in Florida, we associate monetary costs to each case of reoffence by types of crime. We derive these monetary costs below (including intangible costs) from Miller *et al.*'s Cost Benefit

Analysis. These costs include monetary values of quality of life, adjudication and sanctioning, property losses, productivity losses (of both victim and perpetrator), mental health care, and judicial system costs. In addition, we derived annual costs per prisoner in all public prison facilities in Florida to determine the additional cost of housing an inmate that recidivism causes.

Estimated Unit Cost per crime for all types of crime is quantified by Miller *et al.*, which is derived by a weighted average of different unit costs*. Because this is a weighted average, we use this value as and assume that in a year, this average cost will be representative in the annual total. It was estimated that it cost on average $17,532 per offense.

Quality of life accounted for 67% of the costs. The largest monetary cost components (adjudication, property losses, productivity losses) accounted for 7% of the total. Health and mental health care account for about 4.5% of costs.

Using our projected number of reoffenders from our Monte Carlo simulation from Section 4.3.5, we calculate total cost of imprisonment per year:

| | **Projected total accumulated cost of crime (from recidivism)** |
|---|---|
| $\mu - 2\sigma$ | $2,057,345,136 |
| $\mu$ | $7,729,858,800 |
| $\mu + 2\sigma$ | $13,404,476,304 |

Based on the FDC's Annual Report (2017-2018), the estimated cost per prisoner was $59.57 per inmate per day average for all facilities (excluding private) [20]. This accumulates to $21743.05 annually per prisoner. Though this value is a generalization, as inmate costs will depend on type of crime, facility conditions, etc., it can still be used to accurately model risk and the average monetary cost per inmate annually (which is another primary cost of recidivism to the FDC). However, because our simulation projects total incidences of recidivism over the 2012-2024 in Florida, the average sentence length is needed to determine incarceration costs per crime. According to the dataset from Measures for Justice, the median sentence length in Florida is 23.93 months, or 1.99 years. [23] Thus, the average cost per prisoner per instance of recidivism is projected to be around **$43359.27**. It is important to note that this is a generalization as there is a lack of data for specific incarceration costs. We also assume that the average 4-year period of incarceration is contained within the 2012-2024 time period. We note that further research could be conducted with more specific data.

Using our projected number of reoffenders from our model, we calculate total cost to imprisonment per year:

| | **Total cost of Imprisonment per year** |
|---|---|
| $\mu - 2\sigma$ | $5,088,123,620 |
| $\mu$ | $19,117,102,143 |
| $\mu + 2\sigma$ | $5103,606,790 |

(The projected amount * 66751.16)

## Distributions and Quantification of Risk

### *Quantifying Risk*

Although we have identified the characteristic risk for the state of Florida as a whole, it is important to recognize variations in factors that lead to disparities in the rate of recidivism in different areas of the state. Florida has 67 counties which vary in racial and ethnic composition, proximity to major cities, and average socioeconomic status. These three factors are all related to the prevalence of unemployment and drug addiction, variables which we have already established to be closely related to the occurrence of recidivism.

For our analysis, we focus on the term $\alpha = 0.095D - 2.42e\text{-}9*I^2$ from the symbolic regression equation. Given that the geographic distribution of police stations is relatively consistent across the state when considering population density, drug rates, unemployment, and median income emerge as stronger risk factors for recidivism. Drug arrests are disproportionately higher in counties with notable urban centers, leading to significant cross-county variability (the second term in the symbolic regression equation containing D was not considered because of its relatively small coefficient). Median household income has a greater cross-country variability as compared to unemployment when considering the standard deviations of the two datasets, which is why we chose to focus on it for this location distribution analysis. As drug arrests and median income are already adjusted for population (the former being a rate, the latter being a statistical measure), there is no need to apply any corrections to $\alpha$.

### *Distribution of Risk by Location*

After applying this formula to the counties, we designated counties with risk values below the first quartile (less than or equal to 46.86, n = 17) as low risk, counties with risk values above the third quartile (greater than or equal to 90.32, n = 17) as high risk, and those between the first and third quartile (n = 33) as moderate risk. The lowest risk county was Union County, with a risk score of 32.08. The highest risk county was Bay County, with a risk score of 157.41. Qualitatively, the counties with the greatest risk prediction scores were concentrated in the northern part of the state, especially the Northwest district.

# Discussion

We now propose recommendations for the Florida state government and the Florida Department of Correction to aid in reducing recidivism rates. These recommendations will focus on three of four variables identified above: drug arrests, unemployment, and police staffing. These recommendations both target recidivism at its source—in prisons—as well as remedying outside factors.

## Drug Arrests

Evidently, drug arrest counts are relatively sporadic, with the most recent years even demonstrating an increase in drug arrests (Figure 8). Despite national attention to this issue, little gain has been demonstrated throughout these years. Eq. 2 and Figure 4 depict the strong positive correlation between the two factors. In addition, we quantify risk within the counties of Florida in terms of this drug arrest count, and thus it plays a large role in recidivism risk. Ultimately, we propose two areas of target: drug rehabilitation within prisons and strategies to reduce societal drug addiction.

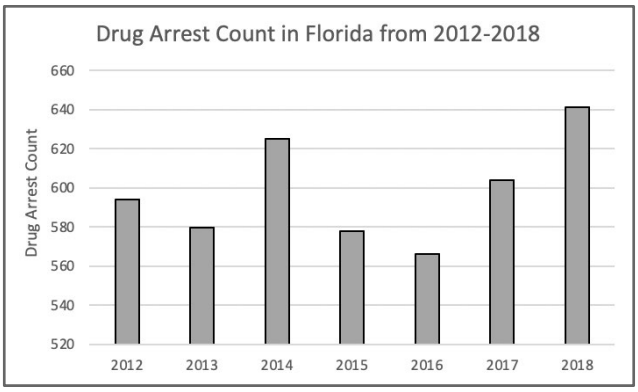



Figure 8 Drug Arrest Count in Florida from 2012-2018

### *Within Prisons*

Because recidivism at its root stems from the previously incarcerated and the conditions within their previous prison experience, we propose drug rehabilitation programs within the prison itself. Despite common misconceptions, prisons are not drug rehab centers and are not equipped to help individuals overcome substance abuse. However, previous studies by the American Psychological Association show after three years, only 27% of the prisoners involved in a San Diego prison's drug treatment program returned to prison, compared to a recidivism rate of 75% for those not involved in the treatment program [21]. As per the Washington State Institute for Public Policy, a residential drug rehabilitation program including aftercare costs $3,100 per inmate. However, this cost is offset by the potential $21743.05 per inmate annually saved if this program prevents recidivism (Net cost = $18643.05 annually).

Another proposal is to tighten security within prisons themselves, as 85% of the prison population has an active substance use disorder [22]. These substance abuse disorders arise from contraband trafficking sales within the prison population [23], and increased security is a strategy to tackle this issue. There are multiple possibilities: employing more correctional officers (CO), providing proper training, etc. To hire a CO in Florida costs $42084 per year [24, 25], however, an additional CO would be able to look over an additional 10+ inmates with greater caution than the original numbers. If this could prevent drug abuse within prisons, the prevention of recidivism would offset this cost. In addition, providing exhaustive training would be a relatively cheap, and cost-effective way to minimize drug usage, where informative, and descriptive classes are often free [26].

Therefore, we recommend the FDC that by implementing these tactics not only will incarceration and crime costs be saved, but the quality of life will also increase for the offenders if these strategies help mitigate their recidivism rate.

### *Outside of Prison*

We hope to target drug abuse outside of prison by improving access to prevention, treatment, and recovery services and targeting the availability of commonly abused and highly addictive drugs. We recommend the state of Florida implement more cheap, accessible drug rehabilitation centers. In our data, we observed Miami to face the highest drug arrest counts, yet standard inpatient addiction treatment facilities there, on average, cost between $14,000 and $27,000 for a 30-day program [27]. We recommend that the state of Florida provide government-funded rehabilitation programs to combat the cost of recidivism within the population already out of prison and to improve the health of the state as a whole.

### *Unemployment*

Dealing with unemployment is vital. Education is directly correlated with a person's ability to find a job. Unemployment can be reduced through employment subsidies. The government would provide tax cuts to encourage businesses to hire recently incarcerated prisoners [28]. The subsidies the government would be to businesses would be much less than the cost they would pay to keep the prisoner incarcerated. As seen in our correlation of figure 6, these employment strategies would provide increased incentive to incorporate the previously incarcerated (to a certain degree of safety), and would thus decrease recidivism rates and increase safety for the general population.

### *Within Prisons*

Furthermore, prisons can implement educational programs so that prisoners are more likely to obtain jobs after being released. Educational programs cost between $1400 and $1744 annually per prisoner while it costs $21743.05 per inmate annually [29]. Overall, it would be most effective to implement educational programs within prisoners so that jobs are more inclined to higher them post release; Thus, these offenders will not return to these facilities, expending even more money from the FDC.

### Police Employment

While measures must be taken to reduce Florida's unemployment rate and drug arrest rate, this should be carried out synchronously with increasing the size of the Florida Police Departments (FDC) to effectively decrease Florida's recidivism rates. Membership of the FDC has remained relatively constant within our stated time period (2012-2018).

The most straightforward method of increasing employment in any job is to increase pay. Increased pay also leads to increased productivity [30]. Officers face more risks in their job than almost any other profession, especially in areas of high crime and recidivism rates. To hire one police officer in the state of Florida would cost $149,362 annually, including salary, benefits (especially important to incentivize increased employment), and supervision [31]. However, just increasing the police force by one, in the case they are able to prevent just 4 cases of recidivism ($21743.05 per inmate annually + cost of crime), they would already equalize the cost. Increasing police force also would just benefit the safety of citizens in general, not just the recidivism rate. However, if the state of Florida is able to effectively implement training programs to increase the efficiency of the police force as a whole, this would be the most cost-effective strategy.

Overall, despite the cost benefit of these strategies recommended, they would also provide a better quality of life and increased safety to citizens of the state of Florida in general—an incentive to the general public to support these programs.

## Conclusion

Overall, our model predicted the rate of recidivism in Florida in 2024, as well as the risk that recidivism brings to the public and those charged with ensuring public safety. We analyzed the risks of recidivism in specific years and counties of Florida and provided recommendations for the Florida state government to incorporate in order to lower the recidivism rate. Ultimately, we concluded that Florida counties should take steps to increase the size and efficiency of their police forces, and that the state of Florida should work towards opening state-owned rehab centers for drug addicts, establish targeted tax-cuts and employment subsidies for businesses who employ formerly incarcerated individuals, and establish more educational and vocational programs within prisons to give inmates the skills necessary to secure a job and reintegrate into society once they are released.

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