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# The compensation of Wrongly convicted Exonerees Cases Analysis

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# Summary

Researchers in the United States have identified over 2,000 individuals who were wrongly convicted of crimes that they did not commit since 1989. For the wrongfully convicted exonerees, there are two basic ways to look for the compensation. One is state claim compensation which requires state have such state statues and the exonerees had served in prison. And the other way is civil right claim. It require exonerees to show that the state, country, municipality or officer engaged in a form of misconduct and the amount of compensation have not limitation.

The dataset contians 1900 individual case with 35 variables. This paper is going to explore the relationship between different factors and the likelihood of filing and prevailing state claim or civil right compensation and to find the influences of factors on the civil right compensation amount per years lost. The paper contains three part of analysis: data preprocessing, simple inquiries and complex inquiries.

In the data preprocessing part, this paper will first clean and correct the dataset and then add some auxiliary variables to make the analysis more convenient. According to the pre-requirement of state claim method and civil right method, the dataset is separated into 5 sub-datasets with 1509 exonerees being able to file the state claim compensation, 1900 exonerees being able to file civil right compensation, 703 exonerees being able to receive state claim compensation, 802 exonerees receiving civil right compensation and 403 exonerees prevailing the money of civil right compensation.

In the simple inquires part, it can be found that there were 1717 incarcerate exonerees in the 1900 total exonerees. Most of exonerees were male and black or Caucasian. Male exonerees were more likely to seek or receive compensation. Black exonerees had higher probability to seek and receive compensation rather than Caucasian and Hispanic. Most of exonerees would not use CIU when they sought compensation but this factor would help exonerees gain the state claim compensation more easily. Most of exonerees who did not plead guilty would more likely to seek compensation. In the contrast, exonerees with guilty plea were more likely to receive the compensation. Exonerees tended to ask innocence organization (IO) to help them win the compensation. It worked when they sought state claim compensation but unfortunately it would not help them win the civil right award. And if they were wrongly convicted by the DNA analysis, the possibility of seeking and receiving compensation would be high. However Death penalty has little influence on seeking and receiving compensation. When it comes to crime factor, the more serious the crime exonerees had, the higher the probability they would seek compensation. But this factor would only help them win the state claim compensation not the civil right compensation. As for the average civil right compensation amount exonerees received per year lost, the value of amount were even and just a few variables would influence the amount.

In the complex inquires part, there are a lot of factors which will influence the likelihood of filing and prevailing state claim or civil right claim. According to above analysis, it can be conclude that Race, Sex, State, State, Guilty Plea, IO, Crime, Year Exonerate DNA, FC, MWID will influence the likelihood of filing state claim. The variable Race, Sex, State, color State, CIU, Guilty Plea, IO, Crime, DNA, FC, P_FA, OM will influence the likelihood of filing civil right claim. The variables Crime, Year Exonerated, DNA, MWID, and ILD will influence the likelihood of prevailing state claim. And the Variables State, color State, Guilty Plea, Year Exonerated, DNA, FC, P_FA, ILD will influence the likelihood of prevailing civil right.

# 1. Introduction

## 1.1 Background

Researchers in the United States have identified over 2,000 individuals who were wrongly convicted of crimes that they did not commit since 1989. For the wrongfully convicted exonerees, there are two basic way to look for the compensation. First, 33 states have state statues which permit exonerees to request compensation from a state court or state administrative body. However there are two limitation on this compensation. One is that the state do not have such state statues, the other one is that the exonerees had not served in prison. The amount of award is limited and different on different states. Second, the exonerees can also look for civil right compensation. This method can be applied by any exoneree even if they have not been incarcerated. Exonerees need to show that the state, county, municipality or officer engaged in a form of misconduct that caused the wrongful conviction. Notice that if the plaintiff shows misconduct, there is no cap on any award.

Not every exoneree is actually incarcerated. A substantial number serve no time in prison, often because the crime they were alleged to have committed was a minor one. Such people are never entitled to state statutory compensation, but sometimes file civil rights or tort claims. Besides, not everyone who is incarcerated seeks compensation. Some seek only state statutory compensation while some seek only a remedy under a civil rights or torts theory. Some seek both. And many who seek compensation are denied it.

This paper is interested in what kinds of factors will influence those wrongly convicted exonerees seeking and receiving state claim compensation or civil right compensation.

## 1.2 Data and variable Description

The original dataset contains 1900 observations with 35 variables such as Race, Sex,Year of exonerated,State claim made or non statutory case filed and so on. The following table 1 explains the meaning of some important variables which will appear later in this paper.

Tabela 1: The meaning of variables

| **Variable** | **Meaning** |
|---|---|
| Sex | Male and Female |
| Race | Asian, Black, Caucasian, Hispanic,Native American, Other |
| State of Conviction | The state where exonerees belong to |
| CIU | The exoneration was the result of work by a Conviction Integrity Unit |
| Guilty Plea | The exoneree pled guilty to the crime |
| IO | The exoneree was helped by an innocence organization |
| Worst Crime | murder,sexual assault,drugs,child sexual abuse,robbery |
| Death Penalty | The exoneree is death penalty |
| DNA | The defendant exonerated by DNA analysis |
| FC | A false confession a contributing factor to the conviction |
| MWID | A mistaken witness ID a contributing factor to the conviction |
| F/MFE | False or misleading forensic evidence a contributing factor to the conviction |
| P/FA | Perjury or a false allegation a contributing factor to the conviction |
| State Claim Made | A state statutory claim made |
| State Award | The state claim granted |
| Non-Statutory Claim Filed | A non-statutory claim |
| civil right Award | The exoneree recover money by verdict or settlement |
| civil right Amount | The amount of recovery |
| No Time | The exoneree serve no time in prison |
| Years Lost | The number of years lost to wrongful conviction |

## 1.3 Data Problem

This paper is going to explore the relationship between factors and their likelihood of filing and prevailing a state claim or civil right claim, and to find the influence of each factor on the civil right compensation amount per years

lost. This paper will begin with simple exploration with description statistics summary and then using statistics test or model to further minding the relationship. This paper contains three steps.

(1)Data processing: clean and deal with erroneous data and get the correct dataset.

(2)Simple Inquiries: find the basic summary of each observation.

(3)Complex Inquiries: find the relationship between different factors and get the result.

## 1.4 Mainly Analysis Method

### 1.4.1 Contingency Table

A chi square test can be conducted on contingency tables to test whether a relationship exists between variables. These effects are defined as relationships between rows and columns. A small chi square value means that there is little connection between the categorical variables while a large chi square value indicates that there is a definite correlation between the two variables. We usually use p value to represent the significance of variable.

### 1.4.2 Two-way ANOVA Table

The two-way ANOVA compares the mean differences between groups that have been split in two independent variables (called factors). The primary purpose of a two-way ANOVA is to understand whether there is an interaction between the two independent variables on the dependent variable. The two-way ANOVA table uses the F test as criterion.

### 1.4.3 Logistics Regression

Logistic regression is the appropriate regression analysis to conduct when the dependent variable is binary. Logistic regression, a predictive analysis like all other regression analysis, is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. Mathematically, logistic regression estimates a multiple linear regression function defined as:

$$\log(\tfrac{p}{1-p}) = \beta_0 + \beta_1 x_1 + ... + \beta_n x_n$$

which p represent the probability when response variable value equal to 1.

# 2. Data Preprocessing

## 2.1 Missing value or Error value

The original dataset contains a lot of erroneous observations such as that there are exonerees received compensation while the state award equal to 0. There are a lot of this kind of mistake. To make sure the following analysis is right, the first step is to look through the original dataset and to correct those errors.

## 2.2 Adding Auxiliary Variables

To make the analysis more convenient and precise, it is reasonable to add some auxiliary variables.

(1)Time: divide the exoneration years into periods of time. Starting with 1990 and dividing every 5 years into a group, there are 7 time periods, including 1990 and before, 1990 to 1995, 1996 to 2000, 2001 to 2005, 2006 to 2010, 2011 to 2015 and 2016 after.

(2)Geographic Area: divide the state into four area: south, east, midwest and west.

(3)Political Area: divide the state into two area: blue and red.

## 2.3 Separate Dataset

The dataset contains 1900 individual cases with 1888 individual exonerees and 12 duplicate ones (according to their last name, first name, race, sex and state). When analyzing the likelihood of filing and prevailing state claim or civil right, separating the dataset into different sub-datasets makes the process more convinient.

Firstly, from the background, note that if the state does no have state statute that permitting exoneree to ask for state compensation or if exonerees had not been served in prison, they could not bring up the state claim. So when analyzing the likelihood of filing state claim, the total number of wrongly convicted cases are not 1900 but 1509. The result comes from deleting the observation when variable 'state statute' equal to 'N' (no state statues) and the variable 'NO TIME' equal to 1 ( never served in prison).

Secondly, when analyzing the likelihood of filing civil right, because there is no limitation, the total number of observation is still 1900.

Thirdly, when analyzing the likelihood of receiving state claim or civil right, the amount of observation are no longer 1900. The total number of observation should be based on the situation that exoneree already filed state claim or civil right. In this case, the total number of receiving state claim is 703 and the total number of receiving civil right is 802.

In the end, when analyzing the question of civil right amount per year lost, the dataset should be based on the observation in which exoneree successfully gained the civil right reward. In this case, the total number of observation is 408.

The result is shown in the following table 2.

Tabela 2: Summary of each sub-dataset

| **sub-dataset** | **total number of observation** |
|---|---|
| filing state claim | 1509 |
| filing civil right | 1900 |
| receiving state claim | 703 |
| receiving civil right | 802 |
| amount civil right per year | 403 |

# 3. Simple Inquiries

## 3.1 The number of Incarcerated Exonerees

To answer the simple question 1,2,3, the analysis depends on variable 'Years Lost'. With different conditions of variable 'Years Lost', it is easy to find that there are 183 exonerees never served in prison and 1717 exonerees served in prison Among those who served in prison, 181 of them served less than or equal to one year and other 1536 served more than one year.The following figure 1 visualize the result.

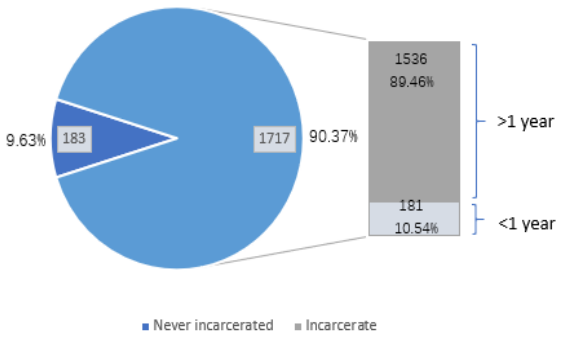


*Figure 1:Summary of Incarceration*

## 3.2 Gender Effect

### 3.2.1 Gender Effect in Incarceration

To answer simple question 4,5,6 on different gender, the analysis depends on variable 'Sex','No time'. There were 180 female exonerees, 9.47% of total, and 1720 male exonerees, 90.53% of total. For 1717 cases of incarceration, in

130 cases, exonerees were female, which was 7.57% of incarcerated exonerees and in 1587 cases, exonerees were male, which was 92.45% of incarcerated exonerees. The result is shown in the following figure 2.

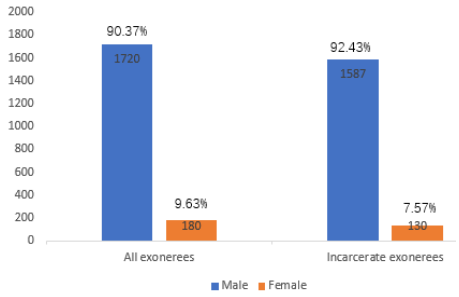


*Figure 2:Summary of Incarcerated or All Exonerees in Different Gender*

### 3.2.2 Gender Effect in Compensation Statute

To answer simple question 7, 8 on different gender, the analysis depends on variable 'Sex','state statute'. From the figure 3, it shows that there were 158 female exonerees, 9.45% of total exonerees with compensation statute and 1518 male exonerees, 90.55% of total exonerees with compensation statute. 22 female and 204 male exonerees could not seek state compensation. In 1717 incarcerated cases, 130 of them its exonerees are female, which is 7.57% ,and 1587 of them its exonerees are male, which is 92.45% of 1717 incarcerated exonerees can file the state compensation. There were still 191 incarcerated male exonerees and 17 incarcerated female exonerees who could not file the state compensation.

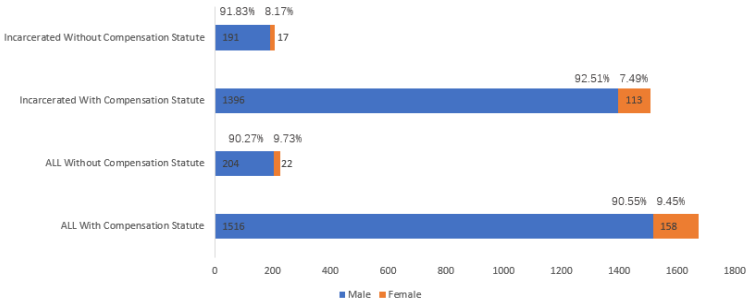


*Figure 3:Summary of Incarcerated or All Exonerees in Different Gender*

### 3.2.3 Gender Effect in Years Lost

To answer simple question 9 in different sex,the analysis depends on variable 'Sex','Years Lost'.From the figure 4, it displays that the average years lost of female was 4.48 and male was 9.53.

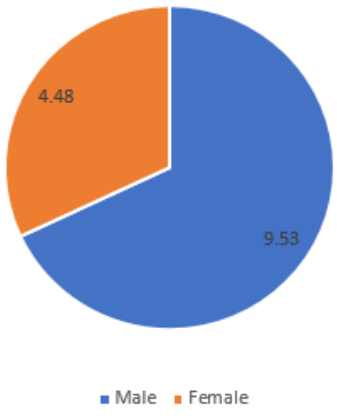


*Figure 4:Average Years Lost in Different Gender*

### 3.2.4 Gender Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 10,11 in different sex,the analysis depends on variable 'Sex','state claim','non statutory case filed','state award' and 'award for plaintiff'. In figure 5, the number above the bar chart represents the percentage of male or female seeking or receiving state claim compensation or civil right compensation. About 50% of male exonerees sought state claim compensation and civil right compensation while about 35% of female did the same. It is obvious that male exonerees were more likely to seek state claim compensation and civil right compensation than female exonerees.

However, with regard to percentage of receiving state claim compensation and civil right compensation, the different between each gender is not that obvious. Both male and female exonerees had higher percentage of receiving state claim compensation than civil right compensation.Around 80% of exonerees could get the state compensation but just around 50 % of exonerees could get the civil right compensation.

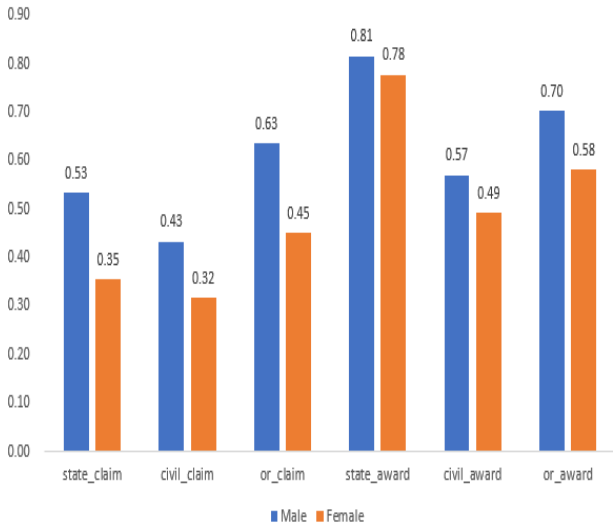


*Figure 5:The Percentage of Male or Female Seeking or Receiving Compensation*

## 3.3 Race Effect

### 3.3.1 Race Effect in Incarceration

To answer simple question 4,5,6 on different races, the analysis depends on variable 'Race','No time'. There were 921 Black exonerees, 48.47% of total, 723 Caucasian exonerees, 38.05% of total and 222 Hispanic exonerees, 11.68% of total. In 1717 cases of incarceration, 865 cases its exonerees are black, which was 50.38% of incarcerated exonerees and Caucasian contains 638 cases which is 37.16% of incarcerated exonerees and Hispanic contained 185 cases which was 10.77% of incarcerated exonerees.The result is shown in the following figure 6.

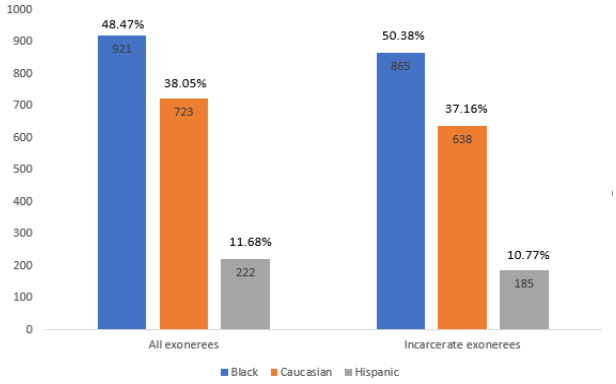


*Figure 6:Summary of Incarcerated or All Exonerees in Different Race*

### 3.3.2 Race Effect in Compensation Statute

To answer simple question 7, 8 on different Race, the analysis depends on variable 'Race','state statute'.From the figure 7, it shows that there were 837 Black exonerees which is 51.86% of total exonerees with compensation statute and there were 602 Caucasian exonerees which was 35.34% of total exonerees with compensation statute and there were 207 Hispanic exonerees which is 11.34% of total exonerees with compensation statute. And 84 Black, 119 Caucasian and 15 Hispanic exonerees could not seek state compensation. In 1717 cases of incarceration, 782 cases its exoneree was black, which was 50.06% of incarcerated exonerees, 533 cases its exoneree was Caucasian, which was 36% of incarcerated exonerees, and 171 cases its exoneree was Hispanic, which was 12.38% of incarcerated exonerees could file the state compensation. Also there were still 83 incarcerated Black exonerees, 104 incarcerated Caucasian exonerees and 14 incarcerated Hispanic exonerees could not file the state compensation.

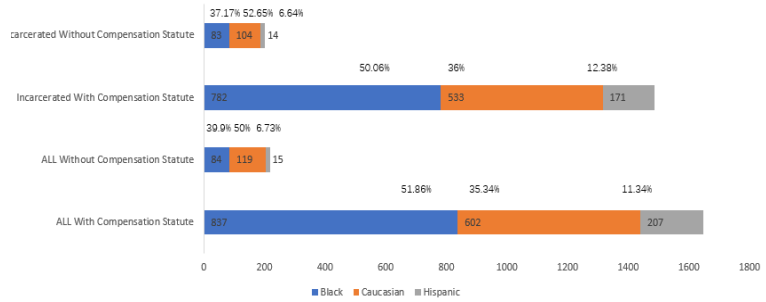


*Figure 7:Summary of Incarcerated or All Exonerees in Different Race*

### 3.3.3 Race Effect in Years Lost

To answer simple question 9 in different sex,the analysis depends on variable 'Sex','Years Lost'.From the figure 8, it displays that the average years lost of Black was 10.63,Caucasian was 7.7759 and Hispanic was 6.791.

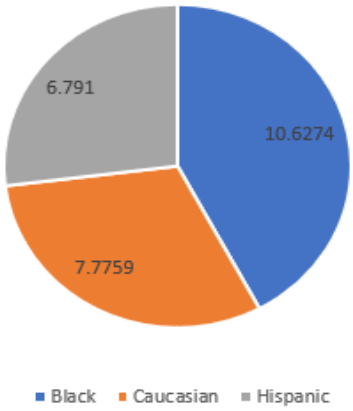


*Figure 8:Average Years Lost in Different Race*

### 3.3.4 Race Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 12,13,14 in different Race, the analysis depends on variable 'Race','state claim','non statutory case filed','state award' and 'award for plaintiff'. fig In figure 9, the number above the bar chart represents the percentage of different race seeking or receiving state claim compensation or civil right compensation. Black had higher percentage of seeking and receiving compensation than other races.The percentage of seeking and receiving state compensation was higher than seeking and receiving civil right compensation.

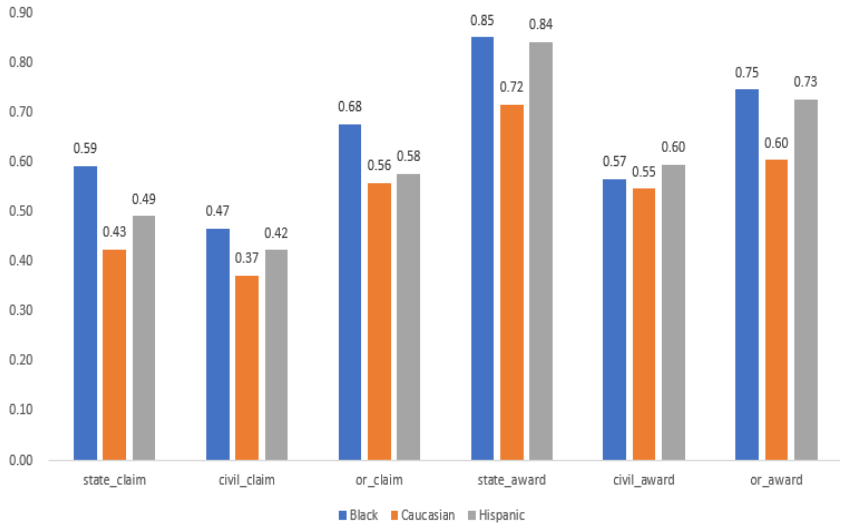


*Figure 9:The Percentage of Different Race Seeking or Receiving Compensation*

## 3.4 CIU Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 15 in different value of CIU, the analysis depends on variable 'CIU','state claim','non statutory case filed','state award' and 'award for plaintiff'. CIU here stands for conviction integrity unit, which is an organization aiming at helping exonerees. The number above the bar chart in figure 10 represents the percentage of different CIU seeking or receiving state claim compensation or civil right compensation. It indicates that in different groups of CIU, exoneree had the same probability to file the state claim Moreover, if they asked CIU for help, they were more likely to get the state award. However, the possibility of bringing up civil right was different, compared with the likelihood of wining state claim compensation, CIU cannot help them increase the possibility of receiving the civil right compensation. Thus, it is reasonable that exonerees were less likely to use CIU when they wanted to file civil right.

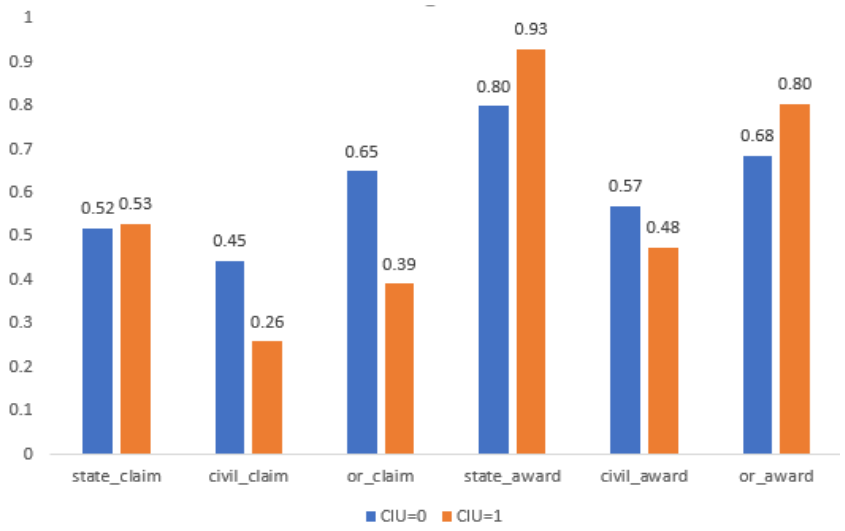


*Figure 10:The Percentage Different CIU Seeking or Receiving Compensation*

## 3.5 Guilty Pleas Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 16 in different value of Guilty pleas,the analysis depends on variable 'Guilty pleas','state claim','non statutory case filed','state award' and 'award for plaintiff'.Guilty plea means that the person actually plead

guilty to the crime that they had not committed. The number above the bar chart in figure 11 represents the percentage of different Guilty plea seeking or receiving state claim compensation or civil right compensation. The guilty plea is a significant influence of the percentage of exonerees filing state claim or civil right. Exonerees were less likely to look for compensation if they already plead the guilty. And it will also affects the result of receiving the civil right award. The exonerees who was forced to plea the guilty has 20% more probability to receive the civil right. However, it would not affect the result of state claim award. Whether they plead guilty or not, they had almost same probability to receive state claim compensation.

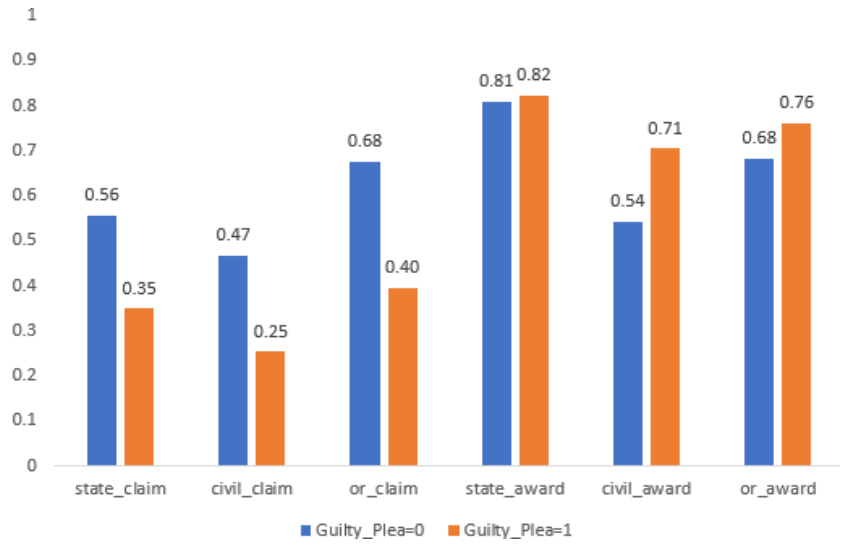


*Figure 11:The Percentage of Different Guilty pleas seeking or receiving compensation*

## 3.6 IO Effect in Percentage of Seeking or Receiving Compensation

To answer simple question 17 in different value of IO,the analysis depends on variable 'IO','state claim','non statutory case filed','state award' and 'award for plaintiff'. An IO is an innocence organization in which their lawyers may have helped the person get freed. The number above the bar chart in figure 12 represents the percentage of different Guilty plea seeking or receiving state claim compensation or civil right compensation. From the figure 12, it is obvious that the percentage of exonerees used IO is greater than that did not use IO. In both seeking state claim compensation cases or civil right compensation cases, exonerees tended to ask IO for help. However, IO can help them win the state claim compensation but not the civil right compensation.

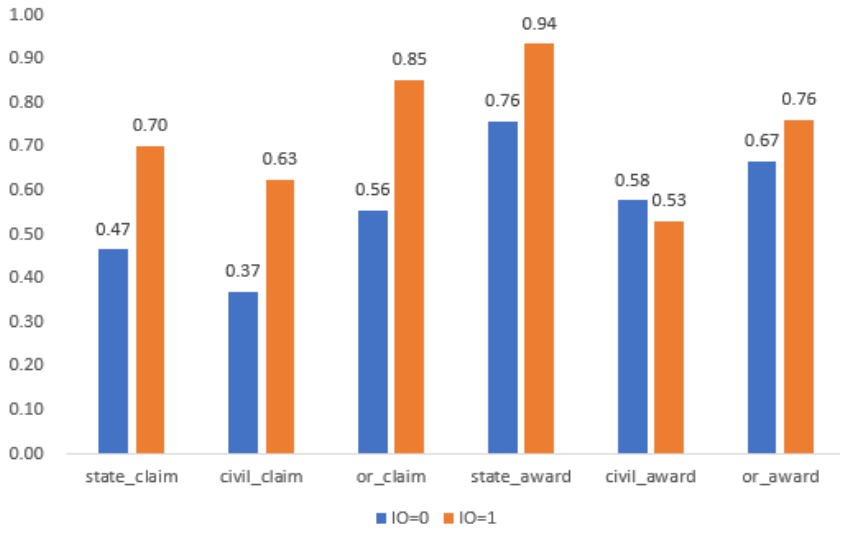


*Figure 12:The Percentage of Different IO Seeking or Receiving Compensation*

## 3.7 DNA Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 18 in different value of DNA, the analysis depends on variable 'DNA','state claim','non statutory case filed','state award' and 'award for plaintiff'. DNA is an analysis method to convince guilty. The number above the bar chart in figure 13 represents the percentage of different DNA analysis results seeking or receiving state claim compensation or civil right. If exonerees were misjudged by the DNA analysis, they had higher possibility to seek and receive both state claim compensation and civil right compensation.

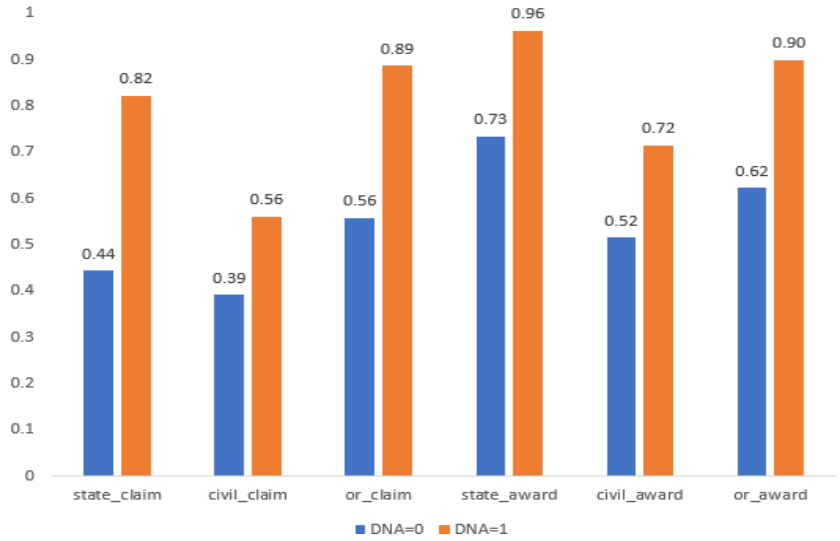


*Figure 13: The Percentage of exonerees of Different DNA results Seeking or Receiving Compensation*

## 3.8 Death Penalty Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 19 in different value of Death penalty, the analysis depends on variable 'Death penalty','state claim','non statutory case filed','state award' and 'award for plaintiff'.The number above the bar chart in figure 14 represents the different percentage of seeking or receiving state claim compensation or civil right between exonerees of death penalty and non-death-penalty. The death penalty factor would not affect the result of filing state claim or prevailing state claim compensation, but it will affect the percentage of exonerees seeking the civil right. The death penalty exonerees were more likely to file civil right compensation. However, the factor has no influence on the result of receiving civil right compensation.

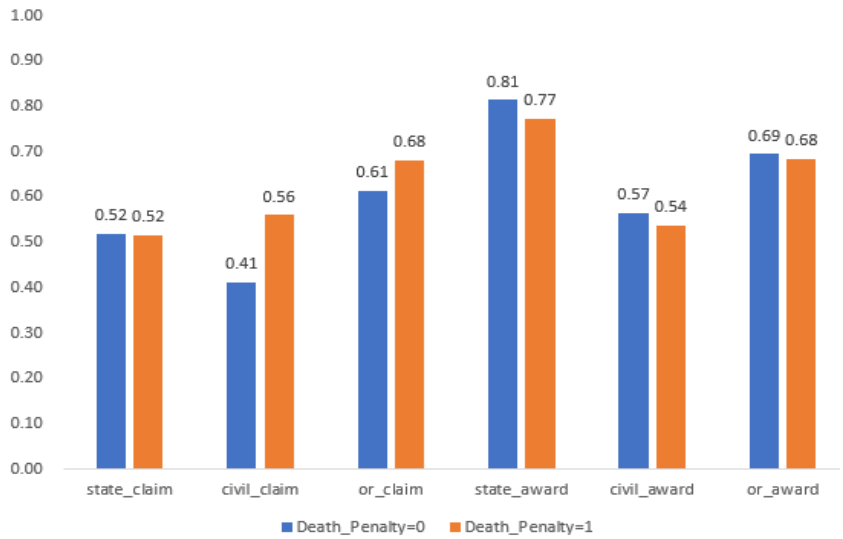


*Figure 14:The Percentage Different Death penalty Seeking or Receiving Compensation*

## 3.9 Crime Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 20 in different kinds of crime,the analysis depends on variable 'crime','state claim','non statutory case filed','state award' and 'award for plaintiff'. There are six kinds of crime: murder, sexual assault, drugs, child sexual abuse, robbery and other. The kind of crimes significantly affects the percentage of exoneree filing state claim or civil right Different kinds of crime have different probability to bring up the compensation. It can be observed that that murder and sexual assault exonerees were more likely to seek and receive state compensation, while drug exonerees were less likely to seek and receive state claim compensation. However, exonerees of all crimes were not willing to seek civil right compensation except for those of murder. With regard to receiving compensation, the crime factor will only influence the likelihood of receiving state claim recover but not the civil right one. The percentage of receiving civil right compensation is even with half half probability.

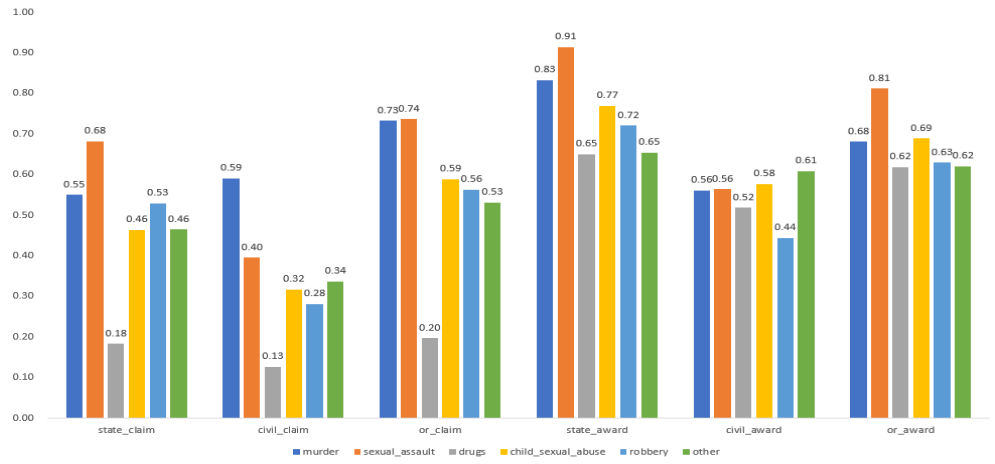


*Figure 15:The Percentage of Different Crime Seeking or Receiving Compensation*

## 3.10 Tag Effect in Percentage of seeking or receiving state or civil right compensation

To answer simple question 21 in different kinds of tag,the analysis depends on variable 'tag','state claim','non statutory case filed','state award' and 'award for plaintiff'.In general, the percentage of seeking and receiving civil right compensation are similar between all exonerees and incarcerated exonerees except for the tag MWID. The rest of tags have same pattern of seeking and receiving compensation. The figure 16 shows that exonerees with tag FC have higher percentage of seeking and receiving civil right compensation compared with other tags. Also, exonerees with the tag P_FA have the lowest percentage of seeking and receiving compensation. It is interesting to find that exonerees with tag f_MFE have low percentage of seeking compensation but have higher percentage of receiving compensation.

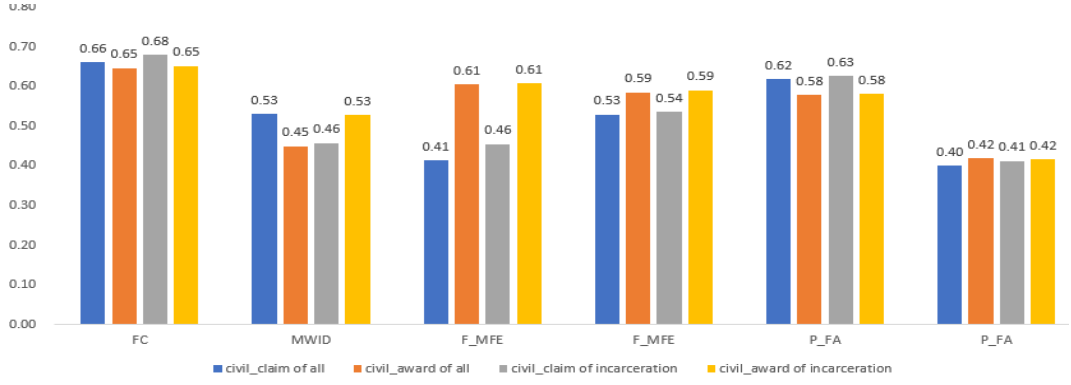


*Figure 16: The Percentage of Different Tags Seeking or Receiving Compensation*

## 3.11 Average Amount Received Per Year of Incarceration on Civil Rights

To answer simple question 22 in different kinds of variable,the analysis depends on variable 'non statutory amount','years lost' and so on. The figure 17 displays the average amount received of all or incarcerated on civil right compensation per year. It can be seen that there are no obvious difference between all exonerees and incarcerated exonerees. Hispanic exonerees received most money while female received least money per year.

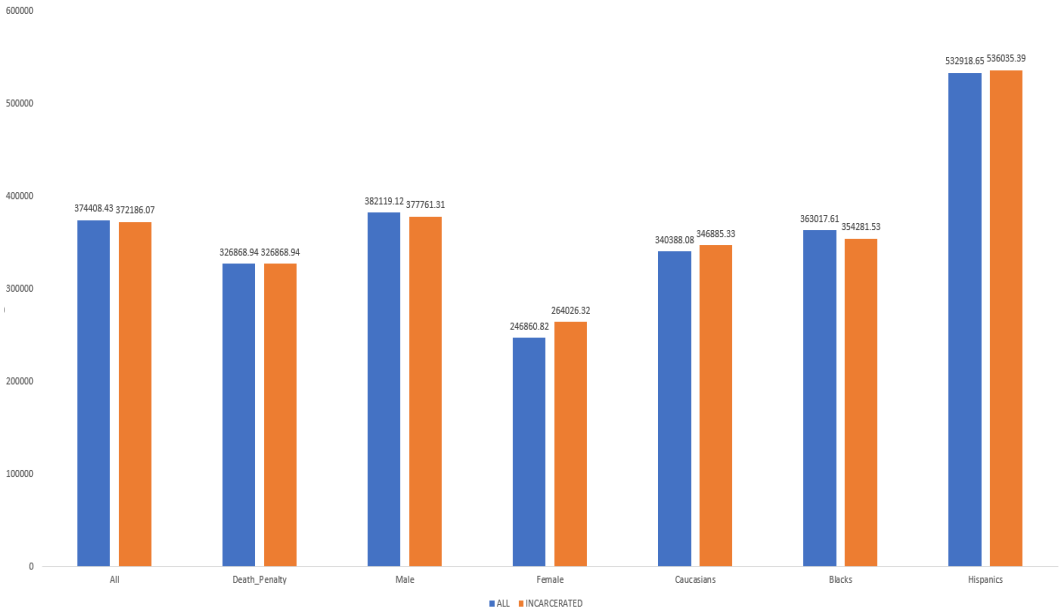


*Figure 17:The Average Amount Per Year of Civil Right*

# 4. Complex Inquiries

## 4.1 Gender Effect

To explore the relationship between race and the likelihood of filing and prevailing state claim or civil right compensation, this paper uses the method of chi square, contingency table, two-way ANOVA table, general linear regression and the logistic regression. In this complex inquiries part, since the dependent variables are different from simple part, this paper will add some new auxiliary variables mentioned in the part 2.2.

Firstly, for the complex question 1,2, table 3 shows the result of contingency table. By checking the p value of different likelihood, it can be observed that the p value of filing the state claim and civil right compensation are both smaller than 0.05, which means the variable race have significant impact on the likelihood. Different race have different likelihood of filing compensation. From the figure 9, we know that Black exonerees are most likely to file the compensation. However, when it comes to the likelihood of prevailing state claim or civil right compensation, the p values are both greater than 0.05, which means that races is not significantly influencing the likelihood of prevailing compensation. In other words, the likelihoods of prevailing compensation in different races are similar.

Tabela 3: P value of Filing and Prevailing compensation

| **Likelihood** | **chi square** | **p value** |
|---|---|---|
| filing state claim | 13.4139 | 0.002 |
| filing civil right | 9.0621 | 0.0026 |
| prevailing state claim | 0.0963 | 0.7563 |
| prevailing civil right | 2.655 | 0.1032 |

Secondly, for the complex question 3, table 4 shows the result of Anova table. When exploring the relationship between different races and the amount received in prevailing civil right, the p value 0.0773 is greater than 0.05. it can be concluded that there are no difference between race and the received amount. Race would not influence the

amount of civil right compensation. Two-way Anova table can test whether the relationship changes over time. The p value is 0.0695 still greater than 0.05, suggesting that even the time change, relationship between race and amount never change. From the figure 18, by visualize the result, it can be seen that the amount received per year in different race are similar even the time has changed.

Tabela 4: Anova table of Race Time and Amount received per year lost

| **Amount** | **F Value** | **p value** |
|---|---|---|
| Race and Amount | 2.58 | 0.0773 |
| Race, Time and Amount | 1.55 | 0.0695 |

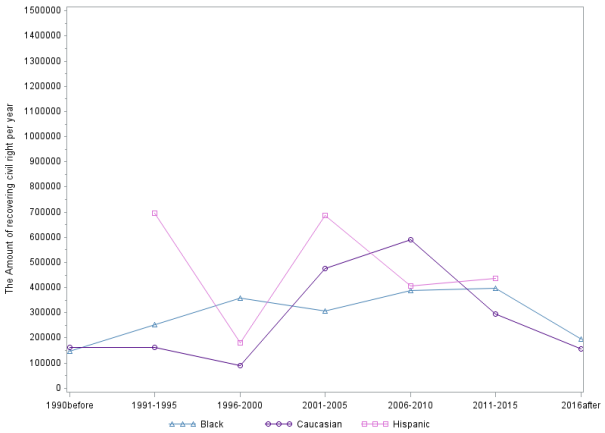


*Figure 18: The Relation between Time and Received Amount*

## 4.2 The Date of Exoneration Effect

Firstly,for the complex question 4,5, table 5 shows the result of logistic regression. By using the logistic regression, Not only the significance of exonerated date variable, but also the positive or negative relationship between exonerated data and the likelihood of filing and prevailing compensation are revealed. From the table 5, we can find that the p value of filing the state claim is smaller than 0.05, which means that the exonerated date has significant impact on the filing state claim. The figure 19 and the first plot show that exonerees were more likely to file state claim as year increased. The effect is positive. However, the p value of filing civil right is greater than 0.05 implying that the likelihood of filing civil right would not change when exonerated date change. It can also be proved by the second figure. The curve go straight without trend.

With regard to the likelihood of prevailing state claim or civil right, the p values of this two likelihood are smaller than 0.05. It can be concluded that the likelihood would change when exoneration year change while the effects on prevailing state claim or civil right are different. From the third and fourth plot in figure 19, we see that the effect of exonerated date on prevailing state compensation is positive while the effect on prevailing civil right compensation is negative.

Tabela 5: P value of Filing and Prevailing Compensation

| **Likelihood** | **chi square** | **p value** |
|---|---|---|
| filing state claim | 16.6819 | <0.0001 |
| filing civil right | 0.011 | 0.9166 |
| prevailing state claim | 13.2704 | 0.0003 |
| prevailing civil right | 10.4952 | 0.0012 |

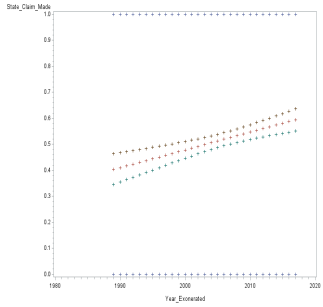

Figura 1: Filing state

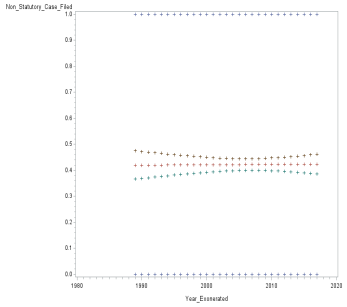

Figura 2: Filing civil

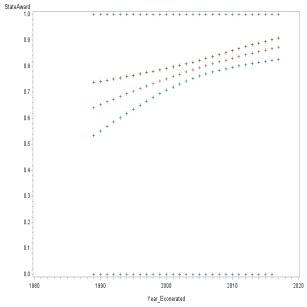

Figura 3: Prevailing state

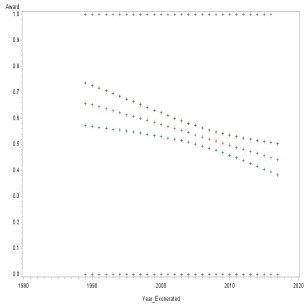

Figura 4: Prevailing civil

*Figure 19: The Relation between Time and Received Amount*

Secondly, for the complex question 6, table 6 shows the result of Anova table. When exploring the relationship between exonerated date and the amount received, the p value 0.1199 is greater than 0.05. We can say that there are no difference between exonerated date and the amount received. Year would not influence the amount of civil right compensation. From the figure 18 we know that the observation of amount is scatter. Thus this paper is going to use Loess method to smooth the curve and get the result (figure 20). The line goes almost straight without too much change.

Tabela 6: Anova table of Exonerated Date and Amount received per year lost

| **Amount** | **F Value** | **p value** |
|---|---|---|
| Exonerated Date and Amount | 1.7 | 0.1199 |

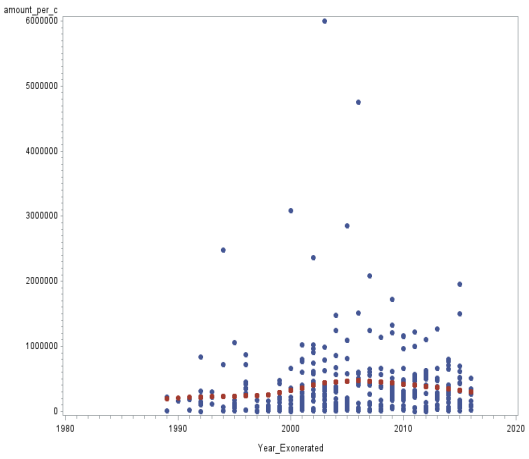


*Figure 20: The Relation between Exonerated Date and Received Amount*

## 4.3 Years Lost Effect

Firstly, for the complex question 4,5, table 7 shows the result of logistic regression. It can be found that the p value of filing the state claim and civil right are both smaller than 0.05, meaning that the years lost have significant impact on the filing state claim and civil right. From the figure 21 and the first and second plot it can be concluded that exonerees were more likely to file compensation as time change and the effect is positive.

With regard to the likelihood of prevailing state claim or civil right, years lost would only influence the likelihood of prevailing state claim compensation but not the civil right compensation. The p value of prevailing state claim is smaller than 0.05 with positive effect. Meanwhile, the p value of prevailing civil right greater than 0.05 indicates that it has no effect on prevailing civil right.

Tabela 7: P value of Filing and Prevailing Compensation

| **Likelihood** | **chi square** | **p value** |
|---|---|---|
| filing state claim | 154.0053 | <0.0001 |
| filing civil right | 241.316 | <0.0001 |
| prevailing state claim | 31.2479 | <0.0001 |
| prevailing civil right | 0.439 | 0.5076 |

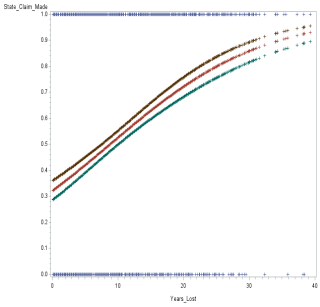

Figura 5: Filing state

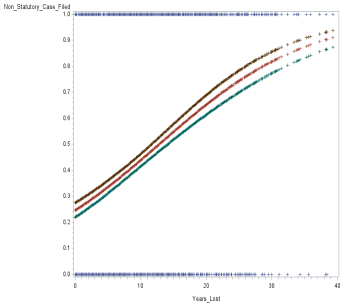

Figura 6: Filing civil

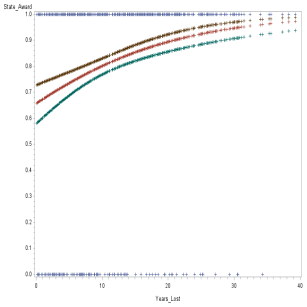

Figura 7: Prevailing state

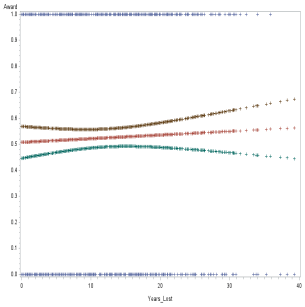

Figura 8: Prevailing civil

*Figure 21: The Relation between Time and Received Amount*

Secondly, for the complex question 9, table 8 and show the result of Regression. When exploring the relation between years lost and the amount received, the p value is 0.0016 smaller 0.05. It can be said that years lost would influence the result of reward amount. Through the method of linear regression, it estimates the parameter and get the model

$$Amount = -10776 yearslost + 510300$$

The impact of years lost is negative. The amount of civil right per year will decrease as the years lost increase.

Tabela 8: Regression result of Years Lost and Amount received per year lost

| **Amount** | **F Value** | **p value** |
|---|---|---|
| Years Lost and Amount | 10.13 | 0.0016 |

Tabela 9: Parameter Estimates of Years Lost and Amount received per year lost

| **Variable** | **parameter estimate** | **t Value** | **p value** |
|---|---|---|---|
| Intercept | 510300 | 10.05 | <.0001 |
| Years Lost | −10776 | −3.18 | 0.0016 |

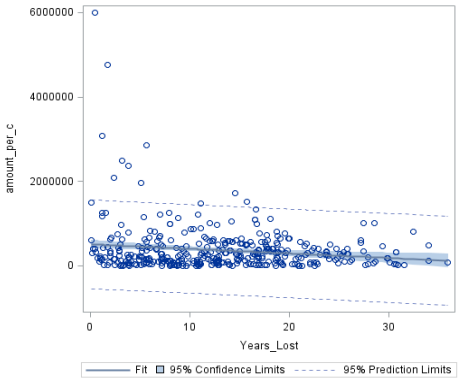


*Figure 21: The Relation between Years lostand Received Amount*

## 4.4 Gender Effect

For the complex question 10,11,12, p value of filing state claim and civil right claim are smaller than 0.05. It can be said that gender will influence the likelihood of filing compensation. From the simple part, it shows that male is more likely to filing compensation. However, with regard to the likelihood of prevailing compensation, both p value are greater than 0.05 which mean the there are no different between gender.

And when exploring the relationship between gender and received amount of civil right, from the table 11, the p value is 0.35 greater than 0.05. So gender would not significantly influence the amount.

Tabela 10: P value of Filing and Prevailing Compensation

| **Likelihood** | **chi square** | **p value** |
|---|---|---|
| filing state claim | 13.4139 | 0.0002 |
| filing civil right | 9.1621 | 0.0026 |
| prevailing state claim | 0.0963 | 0.7563 |
| prevailing civil right | 2.6555 | 0.1032 |

Tabela 11: Anova result of gender and Amount received per year lost

| **Amount** | **F Value** | **p value** |
|---|---|---|
| Gender and Amount | 0.85 | 0.3579 |

## 4.5 Geographic Area Effect

For the complex question 13,14,15, p value of filing and prevailing civil right compensation are smaller than 0.05 which mean geographic variable is significant to the likelihood. It can say that different geographic area have different likelihood of filing and prevailing civil right compensation.From the figure 22 which show the likelihood of different part to area, it can find that south part of unite state has smallest likelihood of filing civil right and same as prevailing civil right.

Tabela 12: P value of Filing and Prevailing Compensation

| **Likelihood** | **chi square** | **p value** |
|---|---|---|
| filing civil right | 177.7503 | <.0001 |
| prevailing civil right | 14.5903 | 0.0022 |

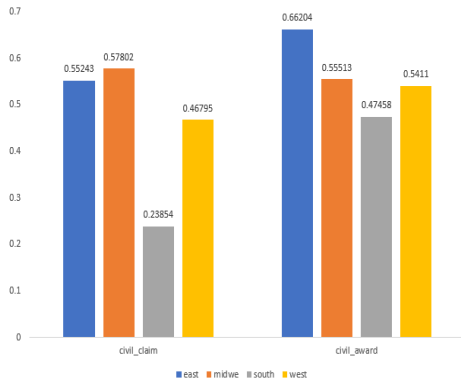


*Figure 22: The Likelihood of Civil Right Compensation in Different State*

As for the relationship between area and civil right compensation amount, table 13 shows the result of anova table. P value of area and amount is 0.0004 smaller than 0.05. So it can say that the area have significant impact on the compensation amount. And from the figure 23, it shows that Midwest can get more money than other area. South part of exonerees had least amount of compensation.

Tabela 13: Anova result of gender and Amount received per year lost

| Amount | F Value | p value |
|---|---|---|
| Area and Amount | 6.25 | 0.0004 |

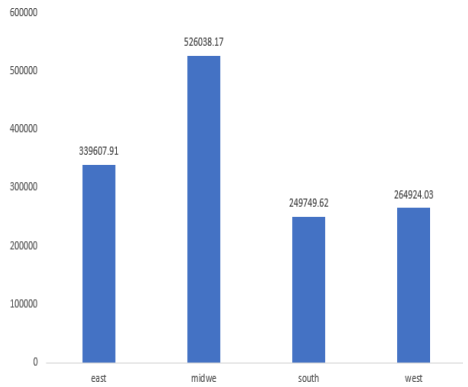


*Figure 23: The Average Civil Right Compensation Amount in Different State*

## 4.6 Political Area Effect

For the complex question 16,17,18, p value of filing and prevailing civil right compensation are both smaller than 0.05 which mean color area variable is significant to the likelihood. It can say that different color area had different probability of filing and prevailing civil right compensation.From the figure 24, it is obvious to find that blue state exonerees always had higher probability to file and prevail civil right compensation then red state.

Tabela 14: P value of Filing and Prevailing Compensation

| Likelihood | chi square | p value |
|---|---|---|
| filing civil right | 118.9846 | <.0001 |
| prevailing civil right | 21.1328 | <.0001 |

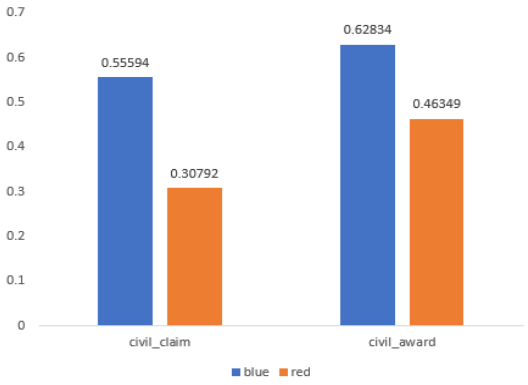


*Figure 24: The Likelihood of Civil Right Compensation in Different State*

From the table 15, it can find that the p value of area and amount is 0.21 greater than 0.05. So it can say that there are no significant different between blue state red state. When explored the exact average value of civil right compensation, it shows that the blue state compensation amount is a little higher than red state.

Tabela 15: Anova result of gender and Amount received per year lost

| Amount | F Value | p value |
|---|---|---|
| Area and Amount | 1.55 | 0.2132 |

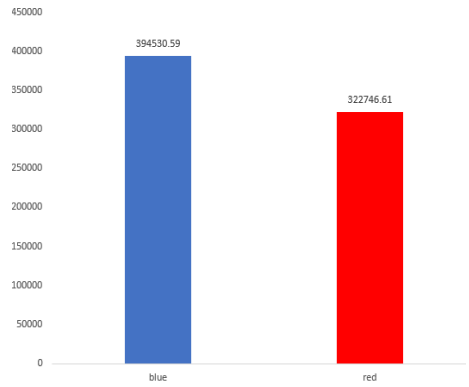


*Figure 22: The Average Civil Right Compensation Amount in Different State*

## 4.7 CIU Effect

For the complex question 19,20,21, from table 16, it can find that CIU would only influence the likelihood of filing civil right for the p value smaller than 0.05 and it would not affect the result of prevailing civil right compensation and the amount. Exonerees who did not use CIU would more likely to file civil right.

Tabela 16: The test result for the relation

| **variables** | **test** | **test value** | **p value** |
|---|---|---|---|
| filing civil right | Chi square | 29.0408 | <0.0001 |
| prevailing civil right | Chi square | 1.1505 | 0.2834 |
| CIU and Amount | F test | 0.04 | 0.8507 |

## 4.8 Guilty plea Effect

For the complex question 22,23,24,from the table 17 and the p value, it can show that the Guilty plea factor significant influence the likelihood of filing compensation. From the simple part, known that exonerees without pleading guilty were more likely to file both state claim and civil right compensation. However this factor would not affect the result of prevailing state claim. It would only influence the result of prevailing civil right compensation. The exoneree who plead guilty would more likely to prevailing compensation. And when it comes to the relationship between guilty plea and the amount. Since the p value is greater than 0.05, it would not change the result of amount.

Tabela 17: The test result for the relation

| **variables** | **test** | **test value** | **p value** |
|---|---|---|---|
| filing state claim | Chi square | 39.1443 | <0.0001 |
| filing civil right | Chi square | 58.6281 | <0.0001 |
| prevailing state claim | Chi square | 0.0024 | 0.9611 |
| prevailing civil right | Chi square | 12.1979 | 0.0004 |
| Guilty and Amount | F test | 0.09 | 0.7656 |

## 4.8 IO Effect

For the complex question 25,26,27,from the table 18 and the p value, it can show that the IO factor significant influence the likelihood of filing compensation. From the simple part, known that exonerees with IO are more likely to file both state claim and civil right compensation. However this factor would not affect the result of prevailing state claim and civil right.No matter whether exonerees with IO or not, they had similar probability to get the reward. And when it comes to the relationship between IO and the amount. Since the p value is greater than 0.05, it would not change the result of amount.

Tabela 18: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 58.3482 | <0.0001 |
| filing civil right | Chi square | 83.3509 | <0.0001 |
| prevailing state claim | Chi square | 61.6518 | 0.9611 |
| prevailing civil right | Chi square | 0.3071 | 0.5795 |
| IO and Amount | F test | 0.16 | 0.6904 |

## 4.9 Crime Effect

For the complex question 28,29,30,from the table 19 and the p value, it can show that the crime factor significant influence the likelihood of filing compensation. From the simple part, known that different kinds of exonerees have obviously different likelihood of filing compensation. And the p value also prove that it would affect the result of prevailing state claim. The worst crime they had, the highly probability they gain the compensation. However this factor would not affect the result of prevailing civil right compensation. Each crime have similar probability to get the civil right reward.And when it comes to the relationship between crime and the civil right compensation amount. Since the p value is greater than 0.05, it have no effect on compensation amount.

Tabela 19: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 88.4339 | <0.0001 |
| filing civil right | Chi square | 195.4974 | <0.0001 |
| prevailing state claim | Chi square | 34.7871 | <0.0001 |
| prevailing civil right | Chi square | 4.5455 | 0.4738 |
| Crime and Amount | F test | 2 | 0.0771 |

## 4.10 DNA Effect

For the complex question 31,32,33,from the table 20 and the p value, it can show that the DNA factor significantly influence both likelihood of filing and prevailing. From the simple part, known that exonerees who were wrongly convinced by DNA analysis had higher likelihood of filing compensation. And the p value also prove that it would affect the result of prevailing compensation.Similar to the situation of filing compensation, exonerees misjudged by DNA analysis were more likely to gain the compensation. However, when it comes to the relationship between crime and the civil right compensation amount. Since the p value is greater than 0.05, it have no effect on compensation amount.

Tabela 20: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 138.737 | <0.0001 |
| filing civil right | Chi square | 33.2426 | <0.0001 |
| prevailing state claim | Chi square | 61.1691 | <0.0001 |
| prevailing civil right | Chi square | 27.4729 | <0.0001 |
| DNA and Amount | F test | 1.52 | 0.2181 |

## 4.11 Death Penalty Effect

For the complex question 34,35,36,from the table 21 and the p value, it is obvious to see that Death penalty factor has little influence on filing state claim, prevailing state claim and civil right compensation. From the simple part, it shows that exonerees with or without death penalty had similar likelihood. But exonerees with death penalty were more likely to file civil right compensation. As for civil right compensation amount, death penalty have not influence on it.

Tabela 21: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 0.0057 | 0.9396 |
| filing civil right | Chi square | 9.6786 | 0.0019 |
| prevailing state claim | Chi square | 0.6711 | 0.4127 |
| prevailing civil right | Chi square | 0.3020 | 0.5826 |
| Death penalty and Amount | F test | 0.25 | 0.6208 |

## 4.12 Tag Effect

### 4.12.1 FC Tag

From the table 22 and the p value of each test, it can conclude that the FC factor would influence the probability of filing state claim and civil right and it would also influence the likelihood of prevailing civil right.Exonerees would more likely to file and prevail civil right compensation with the FC equal to 1. But it have not effect on civil right compensation amount.

Tabela 22: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 9.0939 | 0.0026 |
| filing civil right | Chi square | 63.05476 | <0.0001 |
| prevailing state claim | Chi square | 0.98781 | 0.3203 |
| prevailing civil right | Chi square | 8.2820 | 0.0040 |
| FC and Amount | F test | 3.8 | 0.0519 |

### 4.12.2 MWID Tag

From the table 23 and its p value of each test, it can conclude that MWID tag have influence on filing state claim and prevailing state claim. Exonerees would more likely to file and prevail state claim compensation when MVID value equal to 1. However the MWID factor would not influence the result of civil right compensation amount.

Tabela 23: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 69.5952 | <0.0001 |
| filing civil right | Chi square | 2.6602 | 0.1029 |
| prevailing state claim | Chi square | 8.0531 | 0.0045 |
| prevailing civil right | Chi square | 2.5362 | 0.1113 |
| MWID and Amount | F test | 0.14 | 0.7101 |

### 4.12.3 F_MFE Tag

From the table 24 and its p value of each test, it can conclude that F_MFE tag would not influence any likelihood and amount for all the p value is greater than 0.05.

Tabela 24: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 0.0427 | 0.8364 |
| filing civil right | Chi square | 0.2071 | 0.6490 |
| prevailing state claim | Chi square | 3.5885 | 0.0582 |
| prevailing civil right | Chi square | 3.073 | 0.0795 |
| F_MFE and Amount | F test | 1.01 | 0.3145 |

### 4.12.4 P_FA Tag

From the table 25 and its p value of each test, it can conclude that P_FA tag would influence on the likelihood of filing civil right and prevailing civil right. Exonerees would more likely to file and prevail civil right compensation when P_FA value equal to 1. However it would not influence the result of civil right compensation amount.

Tabela 25: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 0.6754 | 0.4112 |
| filing civil right | Chi square | 110.9329 | <0.0001 |
| prevailing state claim | Chi square | 2.4183 | 0.1199 |
| prevailing civil right | Chi square | 6.111 | 0.0134 |
| P_FA and Amount | F test | 0.28 | 0.5984 |

### 4.12.4 OM Tag

From the table 26 and its p value of each test, it can conclude that OM tag would only influence the likelihood of filing civil right. Exonerees would more likely to file civil right compensation when OM value equal to 1. However it would not influence the result of civil right compensation amount.

Tabela 26: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 0.1297 | 0.7187 |
| filing civil right | Chi square | 260.4381 | <0.0001 |
| prevailing state claim | Chi square | 0.9927 | 0.3191 |
| prevailing civil right | Chi square | 3.5286 | 0.0603 |
| OM and Amount | F test | 1.04 | 0.3087 |

### 4.12.4 ILD Tag

From the table 27 and its p value of each test, it can conclude that ILF tag would influence the likelihood of prevailing civil right. Exonerees would more likely to prevail state claim or civil right compensation when ILD value equal to 1. However it would not influence the result of civil right compensation amount.

Tabela 27: The test result for the relation

| variables | test | test value | p value |
|---|---|---|---|
| filing state claim | Chi square | 2.002 | 0.1571 |
| filing civil right | Chi square | 1.2158 | 0.2702 |
| prevailing state claim | Chi square | 4.1807 | 0.0409 |
| prevailing civil right | Chi square | 18.5183 | <0.0001 |
| ILD and Amount | F test | 0.29 | 0.5920 |

## 4.13 Logistics Regression

## 4.13.1 Logistics Regression in Likelihood of Filing State Claim

Instead of single variable analyzing, this paper will create a general logistic model to find out significant variables. In this part, this paper will use stepwise selection method to filter the variable. From the table 28, it shows the result of stepwise selection. By using the stepwise method, it choose 'Years Lost', 'Geographic Area', 'DNA', 'No Time', 'Exoneration Date', 'Color Area', Crime' as significant variables.The significant variables mean that they will influence the likelihood of filing state claim when they have different value.

Tabela 28: Summary of Stepwise Selection

| step | enter | remove | chi square | p value | variables |
|---|---|---|---|---|---|
| 1 | Years Lost | | 249.4001 | <.0001 | Years Lost |
| 2 | State | | 104.683 | <.0001 | State |
| 3 | DNA | | 102.2001 | < .0001 | DNA |
| 4 | No Time | | 60.1162 | <.0001 | No Time |
| 5 | MWID | | 15.124 | 0.0001 | MWID |
| 6 | Exoneration Date | | 28.6916 | <.0001 | Exoneration Date |
| 7 | color | | 6.9229 | 0.0085 | color |
| 8 | Crime | | 13.4401 | 0.0196 | Crime |

## 4.13.2 Logistics Regression in Likelihood of Filing Civil right

In this part, the stepwise selection choose 'OM','Years Lost','State','DNA','color area','Crime','P_FA','IO','time' this 9 variables as significant variable.Different value of those significant variable will cause the different value of likelihood.

Tabela 29: Summary of Stepwise Selection

| step | enter | remove | chi square | p value | variables |
|---|---|---|---|---|---|
| 1 | OM | | 259.9305 | <.0001 | OM |
| 2 | Years Lost | | 140.0661 | <.0001 | Years Lost |
| 3 | State | | 153.029 | <.0001 | State |
| 4 | DNA | | 27.2077 | <.0001 | DNA |
| 5 | color area | | 18.3375 | < .0001 | color area |
| 6 | Crime | | 22.675 | 0.0004 | Crime |
| 7 | P_FA | | 12.7644 | 0.0004 | P_FA |
| 8 | IO | | 10.5719 | 0.0011 | IO |
| 9 | Exoneration Date | | 13.2636 | 0.039 | Exoneration Date |

## 4.13.3 Logistic Regression in Likelihood of Prevailing State Claim

In this part, the stepwise selection choose 'IO','State','DNA','CIU','Exoneration Date' this 5 variables as significant variable.Different value of those significant variable will cause the different value of likelihood.

Tabela 30: Summary of Stepwise Selection

| step | enter | remove | chi square | p value | variables |
|---|---|---|---|---|---|
| 1 | DNA | | 53.7804 | <.0001 | DNA |
| 2 | IO | | 19.1529 | <.0001 | IO |
| 3 | State | | 15.0736 | 0.0018 | State |
| 4 | Exoneration Date | | 21.8947 | 0.0013 | Exoneration Date |
| 5 | CIU | | 4.2346 | 0.0396 | CIU |

## 4.13.4 Logistic Regression in Likelihood of Prevailing civil right

In this part, the stepwise selection choose 'Exoneration Date','State','DNA','color area','ILD','P_FA','Guilty Plea' this 7 variables as significant variable.Different value of those significant variable will cause the different value of likelihood.

Tabela 31: Summary of Stepwise Selection

| step | enter | remove | chi square | p value | variables |
|---|---|---|---|---|---|
| 1 | Exoneration Date | | 64.4259 | $< .0001$ | Exoneration Date |
| 2 | color | | 23.4274 | $< .0001$ | color |
| 3 | DNA | | 17.7953 | $< .0001$ | DNA |
| 4 | Guilty Plea | | 11.9616 | 0.0005 | Guilty Plea |
| 5 | ILD | | 9.5322 | 0.002 | ILD |
| 6 | P_FA | | 8.4101 | 0.0037 | P_FA |
| 7 | State | | 11.2487 | 0.0105 | State |

# 5. Conclusion

The dataset contains 1900 observations which 1717 exonerees were incarcerated. Most of exonerees were male and black or Caucasian. Male exonerees were more likely to sought or receive compensation. Black exonerees had higher probability to seek and receive compensation rahter than Caucasian and Hispanic. Most of exonerees would not use CIU when they sought compensation but this factor would help exonerees gain the state claim compensation more easily. It can see that most of exonerees who did not plead guilty would more likely to seek compensation. In the contrast, exonerees with guilty plea were more likely to receive the compensation. Exonerees tended to ask innocence organization (IO) for helping them win the compensation. It worked when they sought state claim compensation but unfortunately it would not help them win the civil right award. And if they were wrongly convinced by the DNA analysis, the possibility of seeking and receiving compensation would be high. However Death penalty has little influence on seeking and receiving compensation. While when it comes to crime factor, the more serious crime exonerees had, the higher probability they sought compensation. But this factor would only help them win the state claim compensation but not the civil right compensation. As for the average civil right compensation amount exonerees received per year lost, the value of amount were even and there are just a few variables would influence the amount. There are a lot of factors which will influence the likelihood of filing and prevailing state claim or civil right claim. According to above analysis, it can conclude that Race, Sex, State, State, Guilty Plea, IO, Crime, Year Exonerate DNA,FC, MWID will influence the likelihood of filing state claim. The variable Race, Sex, State, color State, CIU, Guilty Plea, IO, Crime, DNA, FC, P_FA, OM will influence the likelihood of filing civil right claim. The variables Crime, Year Exonerated, DNA, MWID and ILD will influence the likelihood of prevailing state claim. And the variables State, color State, Guilty Plea, Year Exonerated, DNA, FC, P_FA, ILD will influence the likelihood of prevailing civil right.

Tabela 32: Summary of Significant Variables

| Likelihood | variables |
|---|---|
| filing state claim | Race Sex State State Guilty Plea IO Crime Year Exonerated DNA FC MWID |
| filing civil right | Race Sex State State CIU Guilty Plea IO Crime DNA FC P_FA OM |
| prevailing state claim | Crime Year Exonerated DNA MWID ILD |
| prevailing civil right | State State Guilty Plea Year Exonerated DNA FC P_FA |