ST662— Topics in Data Analytics

Project 4: Firearms Background Checks

1. Introduction

National Instant Criminal Background Check System created by the Federal Bureau of Investigation is responsible to determine whether a prospective buyer is eligible to buy firearms in the United States. Before ringing up the sale, cashiers call in a check to the FBI or to other designated agencies to ensure that each customer does not have a criminal record or isn't otherwise ineligible to make a purchase. More than 100 million such checks have been made in the last decade, leading to more than 700,000 denials.

The data used in the report represents the number of background checks initiated through the NICS. They do not represent the number of firearms sold. Based on varying state laws and purchase scenarios, a one-to-one correlation cannot be made between a firearm background check and a firearm sale.

The report aims to analyse the rate of change in total firearms background checks over time across different states in the United States. It covers the impact of various factors such as Elections, unexpected events, latest laws, and political intervention on the rate of change in total background checks over time. Finally, it offers insights on the expected number of background checks across states over the next 12 months.

2. Data Overview

2.1 Data collection

The dataset consists of 30 columns, containing the total background checks by month, state and type from November 1998 to February 2022 across the 50 states and 5 inhabited territories of America. Each column of the data represents the type of transaction submitted by the NICS. To name a few transaction types – Permit, Pre-Pawn, Redemption, etc. In addition, each type of transaction is broken down by the type of firearm—handgun, long gun, and other. This report focuses on the aggregated background checks received from all types. Further information on each type of transaction can be found in the NICS data page[1]. This report only covers the analysis by considering the total background checks aggregated over all the transactions. Individual transaction-based analysis is beyond the scope of this report

2.2 Data cleaning and manipulation

The total background checks are an aggregate of checks from all the transaction types; however, the Permit transaction accounts for more than 95% of the total background checks. Regarding data sanity check, there are no duplicate records in any of the months. Data consists of 55 records for every month, each of which represents the total checks in a state. The data does not have extreme outliers in background checks or gaps in time. The data is consistent and contains 55 records for every month without gaps. A number of transaction types have significant missing values.

There are 15 transaction types in figure-1 that have more than 20% missing values in the column. Zeros are imputed for transaction types with more than 20% missing values, whereas the median is imputed for transactions with fewer than 20% missing values. Because the mean would be

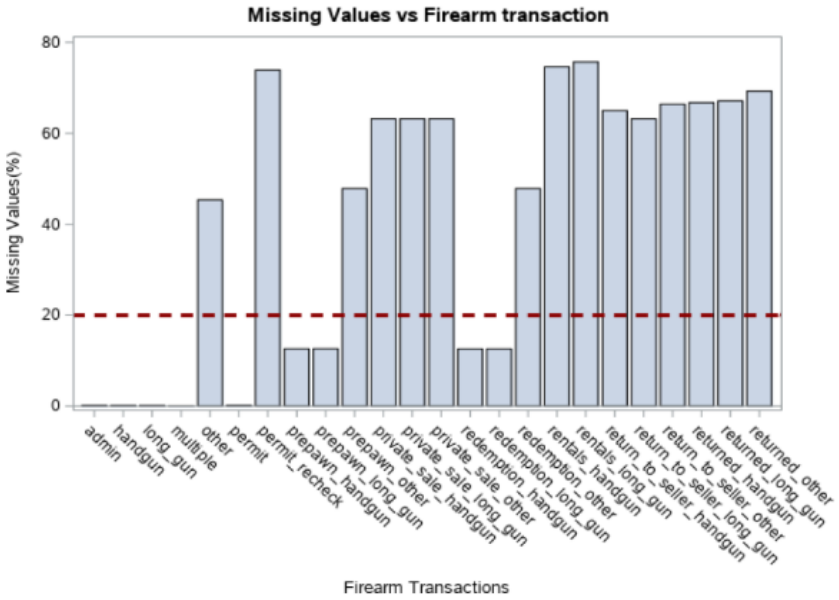

Figure 1: Missing values across different columns

prone to outliers, the median was chosen over the mean. However, this wouldn't hinder our analysis at an aggregate level as Permit type accounts for more than 95% of the aggregated total checks.

3. Analysis

3.1 Total Background Checks over time

Figure-2 represents the total background checks over the years 1998-2022. The number of background checks has been consistently increasing since 2006

Notice that 2012, 2016 and 2020 experienced an unexpected increase in background checks from their preceding year. Interestingly, those are the election years and it is fair to assume that elections have a major role in these spikes. We also notice an unusual increase in checks around the San Bernardino mass shooting which tells us that unforeseen events also have an impact on the number of checks. Excluding the unusual events, there is an evident upward trend in the checks. To add a bit more granularity, we see a seasonal pattern with more background checks at the end of the year and lower checks in the middle of the year. This could possibly be owing to the end-of-year festivities like Thanksgiving and Christmas attracting larger crowds, resulting in increased demand for ammunition for safety. Finally, there is a sharp drop in background checks around March 2021, which could be explained by enhanced background check legislation enacted in March 2021.

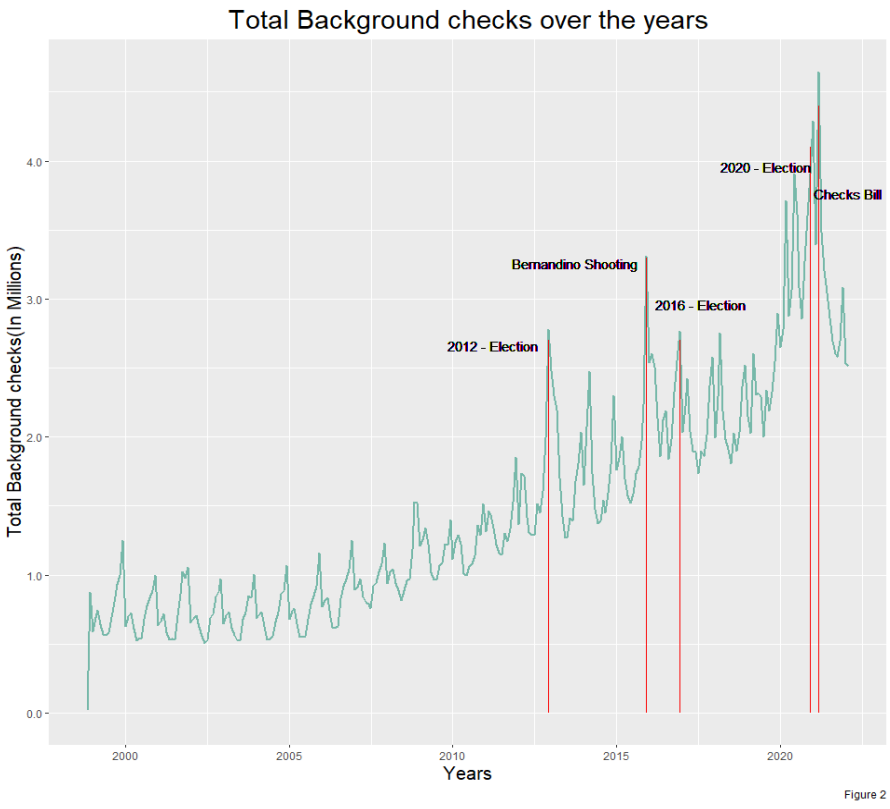

Figure 2: Total Background Checks over Years

3.2 Top 6 states with highest checks

Looking at a deeper state-level analysis, we have considered 6 states with the highest background checks to visualize the inter-state trends over the years. From Figure-3, it is evident that all the states have had a similar increasing trend over the years except **Kentucky and Illinois**.

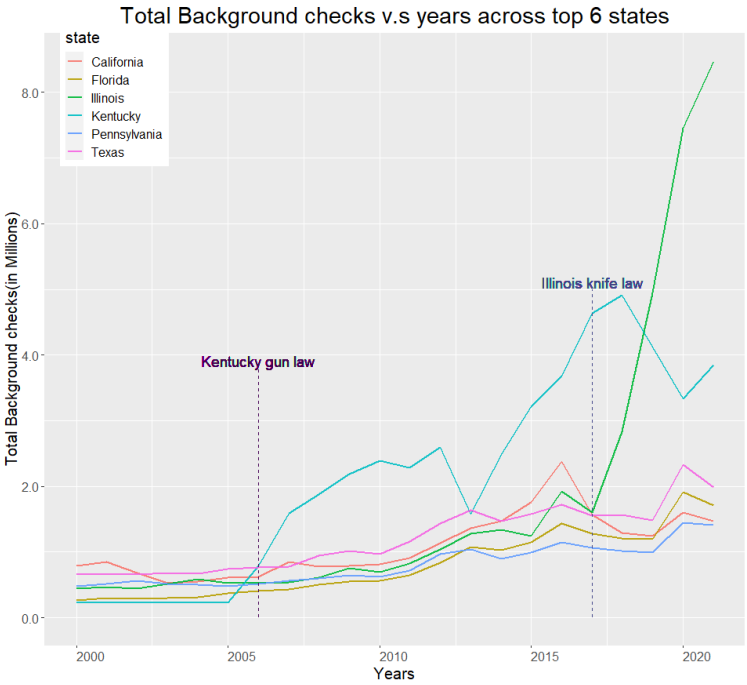

Figure 3: Effect of Inter-state laws on rate of change of checks

In Kentucky, the number of checks increased drastically since 2005 around the same time when the gun law was implemented in the state which required the department to operate a program for the training of applicants for a concealed deadly weapons license. Similarly in Illinois, there was an increase in the number of the background checks since 2016 around the time of the introduction of the knife law which regulated all the sales of deadly weapons in the state. Due to these patterns, it is safe to claim that the inter-state laws also have an effect on the rate of change in total background checks over the years.

3.3 Political Intervention on background checks

As firearms are inherently a political topic, we were curious to see how the background checks would vary based on ruling parties. For simplicity, the states have been split into red, blue, and swing states based on 2020 results. From figure 4, it is evident that the number of background checks in the red states has always been higher than in the blue and swing states. Times of uncertainty and instability demonstrate greater volatility in the change of background checks in the blue states than in the red and swing states. The slope defining the rate of change seems to be increasing rapidly for the red states from 2005 to 2015, whereas the rate of change for the blue states increased rapidly between the years 2015 and 2020. Surprisingly we notice an opposing trend in the red and blue states post-March 2021, which could be explained by the new background check legislation enacted in March.

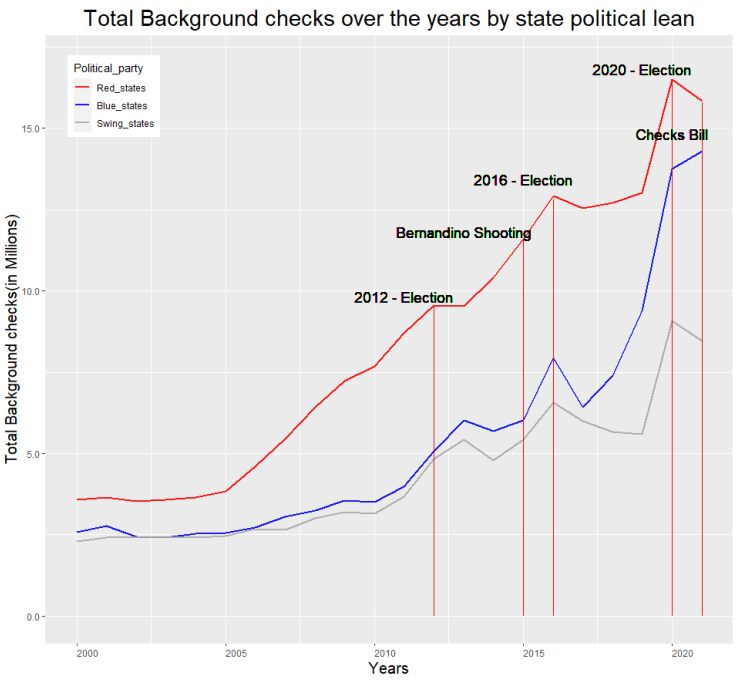

Figure 4: Total background checks by political parties over the years

3.4 Impact of enhanced Checks law on the future

Figure 5 depicts the forecast of expected total checks for the next 12 months by the political parties based on the current pattern. As the data displays a seasonality and trend component along with increasing variance over time in the number of checks, applying a multiplicative decomposition using the Holt-Winters model would account for the pattern observed. The grey dotted line is the prediction boundary for the forecast of checks from April 2022 to April 2023, as determined by using this model. As a result of the tougher law enacted in March 2021, we expect to see a declining trend in the number of checks through the end of the year. Regardless of the parties, the seasonal trend would cause a surge in checks at the end of the year. Finally, despite the current news of the blue states catching up, the predicted checks for the red states appear to remain greater than the blue and swing states.

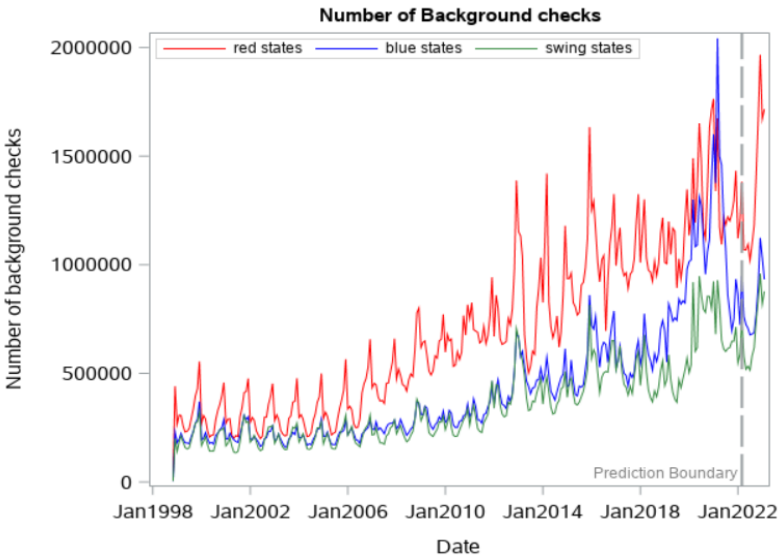

Figure 5: Next 12 months forecast of total checks by political parties

4. Summary

From the analysis, we observe a seasonality and trend pattern of total background checks over the years. Uncertain events such as the Bernardino mass shooting and elections drive variability in the rate of change of checks over time. The inter-state laws such as the gun law in Kentucky and the knife law in Illinois also influence the rate of change in total background checks in a state. With regards to states' political lean, red states have always had higher background checks than the blue and swing states. While the Blue states show greater volatility in the year-to-year increase of checks, red states have been consistently increasing the background checks over time regardless of uncertain times. Although we see a huge rise in the number of checks during the recent period, the most recent law in March 2021 on stricter rules for the issuance of firearms has contributed to the decrease in checks post-March 2021. The forecast of total checks shows a decreasing trend until the end of the year regardless of the political parties. Due to the seasonality, the total checks are expected to rise at the end of the year 2022.

5. Conclusion

The rate at which overall background checks change over time is influenced by a number of factors. **Elections, unforeseen occurrences, interstate regulations, and states' political lean** all have an impact on the rate of change of overall background checks across the United States. The report also provides insights on how the total checks would vary in the next 12 months due to the recent enhanced law of Firearms checks in March 2021.

References:

FBI NICS Firearm Background Check repository - https://github.com/BuzzFeedNews/nics-firearm-background-checks

Bipartisan Background Checks Act of 2021 - https://www.congress.gov/bill/117th-congress/house-bill/8/text

FBI latest news on Firearms Background Checks - https://www.fbi.gov/services/cjis/nics