DRIVERS OF CRIME IN THE UNITED STATES: INVESTIGATING HOW POVERTY AND DEMOGRAPHIC FACTORS INFLUENCE CRIME RATE

Abbreviated title: Drivers of US Crime

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I. INTRODUCTION

Recent studies have looked at a broad spectrum of causes of crime. Paul-Phillipe Pare & Richard Felson (2014)[1] investigated whether poverty and income inequality were one of the main drivers of homicide across nations. They found that for a given poverty level income inequality did not have any influence on homicide rates. However, poverty by itself affected the likelihood of criminal behavior.

A study by Steven D. Levitt (2004)[2] aimed to understand significant drops in crime in the United States in the 1990's. He found that there were 4 main factors leading to reduced crime rates. They were increased levels of incarceration, more police, the decline of narcotics and the legalization of abortion.

Similarly, David J. Vinkers et. al. (2011)[3] investigated relationships between mental health and the type of crimes committed. He concluded that mental health did play a significant role in the type of crimes committed. However, there is skepticism in the study findings. For instance, one major criteria for sample selection were that defendants had to have psychiatric assessment performed with court orders. Thus, there is potential for selection bias—resulting in an overestimation of the frequency of mental disorders.

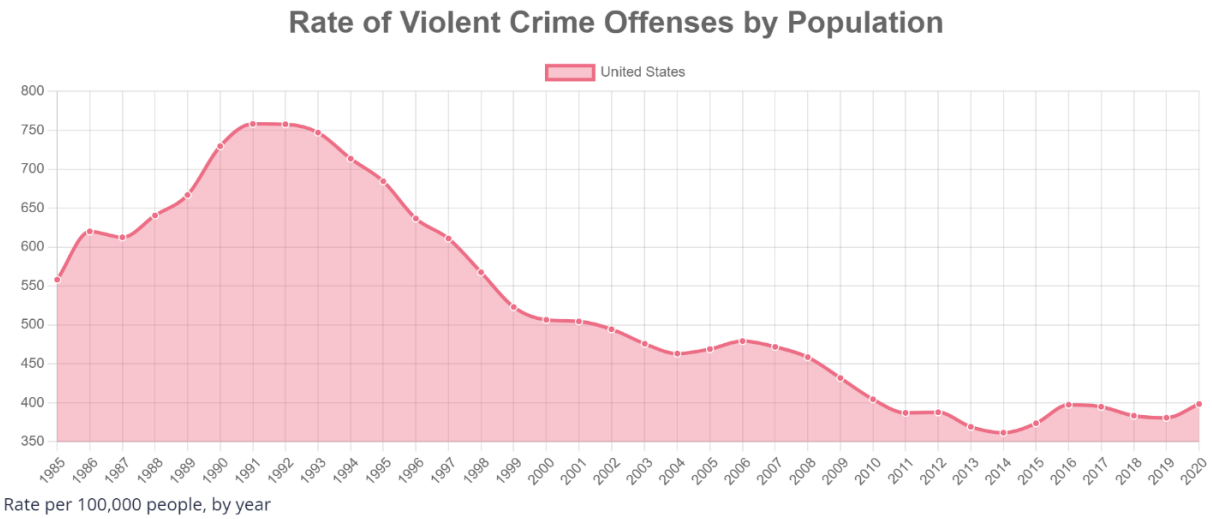

Figure 1. Rate of violent Crime offences by population in the United States (Federal Bureau of Investigation) [FBI]

Figure 1 shows a drastic decrease in US crimes in the years from 1990 to 2014. However, a recent trend indicated increases in the crime rate. Considering findings of previous studies, our study investigated how certain economic and demographic factors can influence crime rates in United States in the year of 2017. We hypothesized that poverty would be the most significant factor influencing crime levels in US. We also explored certain demographic factors to determine whether they have significant impacts on crime rates (see **Figure 2**) as seen from the below breakdown of crimes from the U.S Federal Bureau of investigation (FBI)

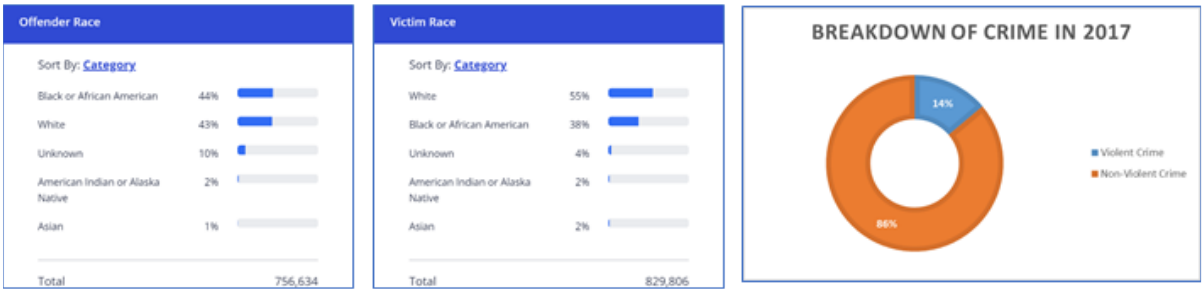

Figure 2. Relationship between Crime and Demographics (Federal Bureau of Investigation) [FBI]

Our model expands previous work on US crime rates by adding the effects of poverty and demographics (e.g., age, education level, and gender) on crime rates. We also investigated whether capital punishment results in lower crime rates in a county.

II. SUMMARY OF FINDINGS

We found that the percentage of the population under the poverty level in the US was not significantly correlated to crime rates. Once we incorporated demographics into our model, we found that gender was not statistically significant. Alternatively, the percentage of old aged population and the race characteristics appeared to correlate with crime rates. These results deviated from our initial assumptions, i.e., we expected poverty to play a significant role. Our findings set the foundation for further research which we intend to pursue in future.

III. ECONOMETRIC MODEL AND ESTIMATES

Our empirical models for the population are summarized in equation 1 & 2 below:

$$Yi = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \varepsilon \quad \textbf{(1)}$$

$Yi = Crime\ rate\ (per\ capita)$

$X1 = Poverty\%\ (all\ population\ poverty\ rate)$

$X2 = \%of\ educated\ adults\ (adults\ with\ a\ college\ degree\ or\ higher)$

$X3 = Log\ per\ capita\ income$

$X4 = Unemployment\ rate$

$X5 = Capital\ Punishment\ (whether\ capital\ punishment\ is\ legal\ in\ a\ state)$

$$Yi = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \varepsilon \quad \textbf{(2)}$$

$Yi = Crime\ rate\ (per\ capita)$

$X1 = Poverty\%\ (all\ population\ poverty\ rate)$

$X2 = \%of\ educated\ adults\ (adults\ with\ a\ college\ degree\ or\ higher)$

$X3 = Log\ per\ capita\ income$

$X4 = Unemployment\ rate$

$X5 = Capital\ Punishment\ (whether\ capital\ punishment\ is\ legal\ in\ a\ state)$

$X6 = \%of\ males\ in\ a\ county$

$X7 = \%of\ old\ population\ (aged\ 60\ and\ above)$

$X8 = \%\ \text{of African Americans}$

When determining which functional form to use for our econometric model, we identified that the US per-capita income had a high spread. Therefore, we felt it was necessary to use the log form of this variable to compress data in order to enable the statistical analysis to be valid: mainly to deal with possible heteroskedasticity issues as this was averaged data.

In order for our econometric model to be able to allow causality, we had to ensure that "ceteris paribus" holds for all other factors that could have an influence on US crime rate. Therefore, factors such as police presence, mental health status, opportunities to commit a crime and all other possible factors were held constant across all US counties before performing our econometric analysis.

To test for heteroskedasticity in our model (even after taking the log form of the per capita income), we used BP and Whites tests. The results were statistically significant and had to reject the null hypothesis of homogeneity. To avoid OLS estimates being biased, we used robust standard errors for all statistical results.

IV. DATA

The primary focus of this research paper is to understand the Crime per capita (reported as a percentage). In our analysis we considered total crime consisting of Violent Crime (murder/ rape/ assault/ robbery) and Property Crime (burglary/ larceny/ vehicle theft). The focus was on 2017 as it was a period when crime followed an increasing trend. The analysis is done at the county level, using data from the Federal Bureau of Investigation (FBI). The FBI used the Summary Reporting System (SRS) and National Incident-Based Reporting System (NIBRS) that collated data from

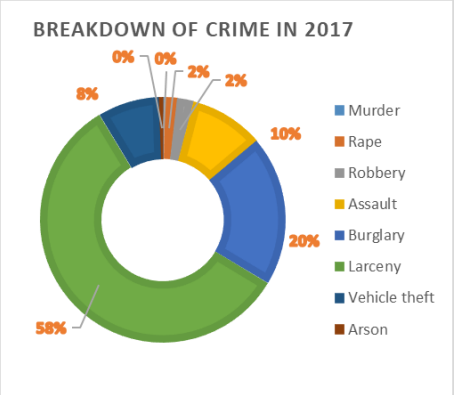

Figure 3. Types of Crime (Federal Bureau of Investigation) [FBI]

16,427 (out of 18,473) law enforcement agencies (each voluntarily reported data to the FBI). We collected data across counties in 2017.

We extracted these data from the United States Census Bureau. For Poverty, we took the SAIPE estimates (Small area income and Poverty Estimate). Data was available for 3,143 counties.

For Education level, we have used the educational attainment for adults (aged 25 and older) for the U.S., States, and counties, 1970-2019 by the Census Bureau. For our analysis, we have considered if an adult has completed a college, associate degree or higher, we considered them as educated and took this as a percentage of total adults. There was data for 3,223 counties.

Per capita income in 2017 was collected from the Bureau of Economic Analysis (BEA). The Average per capita incomes are reported by each county. We collect data for 2017 unemployment rates from the Bureau of Labor Statistics (BLS). The BLS provides statistics on the size of the labor force for each county, which is split between employed and unemployed. From there we take the unemployment rate as a % of unemployed over total labor force. Information is available for 3,219 counties.

We also incorporated Capital Punishment as a dummy variable in the model. 1 indicates when a county has legalized the death penalty and 0 indicates otherwise. This database is created using information from Death Penalty Information Center (DPIC), a non-profit organization. Demographic statistics were also incorporated into the analysis when creating the advanced model. These are estimated statistics provided by the US Census Bureau for 2017 based on the last census. Racial and gender demographics are directly obtainable. We have done some classification to the age group demographics, ages 29 and below were classified as “Young”, between 30-59 years are “Middle-age”, and individuals over 60 Years are classified as “Old-age”.

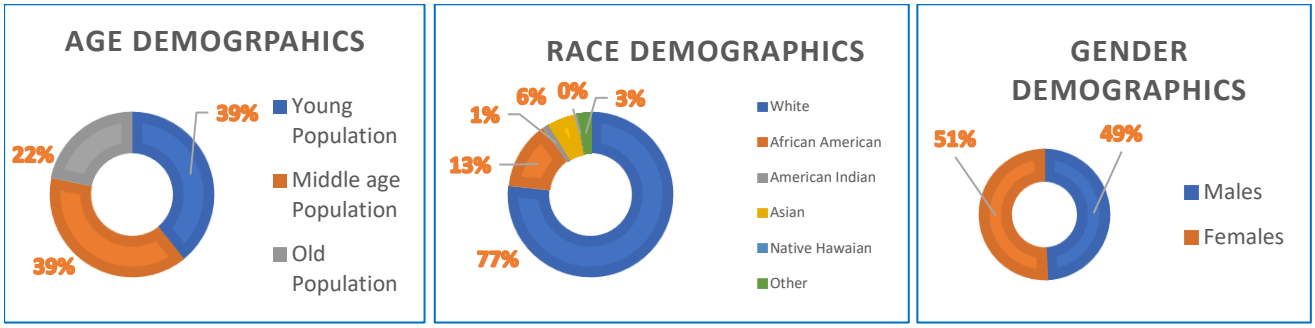

Figure 4. Demographics of US in 2017 (US Census Bureau)

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
Crime Rate	3142	0.00584	0.00629	0.000	0.000449	0.00852	0.0583
Poverty %	3142	0.154	0.0628	0.000	0.109	0.184	0.567
% of Educated adults	3142	52.793	10.710	6.283	44.956	60.027	91.618
Per capita income	3142	41572.736	12800.508	1.000	35189.000	45977.750	228049.000
Unemployment Rate	3142	4.589	1.663	0.000	3.500	5.300	19.700
Capital Punishment	3142	0.620	0.485	0.000	0.000	1.000	1.000
% of Males	3142	0.501	0.0225	0.429	0.490	0.506	0.732
% of Old people	3142	0.129	0.0283	0.0344	0.111	0.144	0.331
% of African Americans	3142	0.0929	0.145	0.000	0.00821	0.108	0.862
Log Per capita Income	3142	10.444	1.387	0.000	10.468	10.736	12.337

Table 1. Summary statistics of the dataset

V. RESULTS

	Dependent variable:			
	Crime_percentage			
	OLS		coefficient test	
	Basic OLS (1)	Advanced OLS (2)	RobostSE Basic OLS (3)	RobostSE Advanced OLS (4)
Poverty_percent	0.003	-0.003	0.003	-0.003
	(0.002)	(0.003)	(0.003)	(0.003)
	p = 0.198	p = 0.231	p = 0.219	p = 0.217
Educated_adults	-0.00004	-0.00004	-0.00004	-0.00004
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
	p = 0.003	p = 0.002	p = 0.004	p = 0.002
log_pcincome	0.0004	0.0004	0.0004	0.0004
	(0.0001)	(0.0001)	(0.00002)	(0.00003)
	p = 0.00001	p = 0.00000	p = 0.000	p = 0.000
Unemployment_rate	0.0002	0.0001	0.0002	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
	p = 0.029	p = 0.148	p = 0.030	p = 0.135
Capital_punishment	0.002	0.002	0.002	0.002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
	p = 0.000	p = 0.000	p = 0.000	p = 0.000
Male_percentage		0.001		0.001
		(0.005)		(0.005)
		p = 0.862		p = 0.870
Old_age_percentage		0.026		0.026
		(0.004)		(0.004)
		p = 0.000		p = 0.000
African_American_percentage		0.007		0.007
		(0.001)		(0.001)
		p = 0.000		p = 0.000
Constant	0.001	-0.002	0.001	-0.002
	(0.001)	(0.003)	(0.001)	(0.003)
	p = 0.244	p = 0.548	p = 0.159	p = 0.567
Observations	3142	3142		
R2	0.057	0.085		
F Statistic	37.700***	36.300***		
Note:				*p<0.1; **p<0.05; ***p<0.01
				Standard errors in parentheses

Table 2. Regression results

Based on the regression table above, we can interpret that poverty % is insignificant in both model 1 and model 2. Therefore, we are unable to comment on any implications it could have on crime. The percentage of educated adults is statistically significant at a p value of 5% in both models and has a negative relationship with crime rates. It indicates that as the percentage of educated adults increases by one unit, the crime rates in a county decrease by 0.00004 units.

We then noted that Log per capita income is statistically significant at the 5% level in both models, indicating a positive relationship with crime. As log per capita income increases by one percent we expect an increase in the crime rates by 0. 000004.The Unemployment

rate is statistically significant at the 5% level in model 1 indicating a positive relationship with crime. Thus, an increase in the unemployment rate by one unit is associated with an increase in crime rates by 0.0002 in the base model.

However, unemployment rate is statistically insignificant in the model 2. This change is observed after the introduction of demographic variables into the model potentially indicating that demography might play a role in understanding crime than unemployment rates. Capital punishment is statistically significant at 5% level in both models. The estimate's positive value, however, was unexpected. This could be interpreted as areas with high crime have led to capital punishment being pursued to deter crime.

As we look at demographics in more detail, we note that the percentage of males is statistically insignificant, hence we are unable to comment on its implications on crime rate. The percentage of old age population is statistically significant and has a positive relationship with crime. Hence as the percentage of old population increases by one unit it results in an increase in the crime rate by 0.026. Percentage of African Americans is statistically significant at the 5% level and indicates a positive relationship with crime rates. Hence as the percentage of African Americans increase by one unit there is an increase in crime rates by 0.007

The R2 of model 1 was 0.057 and model 2 was 0.085 which indicates the model is not able to predict variations in crime very well. This is stemming from further variables which could play a significant role in understanding crime across the U.S.

	Dependent variable:	
	Crime_percentage	
	Basic OLS Beta Coeff	Advanced OLS Beta Coeff
	(1)	(2)
Poverty_percent	0.003	-0.003
	(0.002)	(0.003)
	p = 1.290	p = -1.200
Educated_adults	-0.00004	-0.00004
	(0.00001)	(0.00001)
	p = -2.990	p = -3.250
log_pcincome	0.0004	0.0004
	(0.0001)	(0.0001)
	p = 4.520	p = 5.090
Unemployment_rate	0.0002	0.0001
	(0.0001)	(0.0001)
	p = 2.200	p = 1.450
Capital_punishment	0.002	0.002
	(0.0002)	(0.0002)
	p = 8.310	p = 7.910
Male_percentage		0.001
		(0.005)
		p = 0.174
Old_age_percentage		0.026
		(0.004)
		p = 6.470
African_American_percentage		0.007
		(0.001)
		p = 8.180
Constant	0.001	-0.002
	(0.001)	(0.003)
	p = 1.170	p = -0.603
Observations	3142	3142
R2	0.057	0.085
F Statistic	37.700***	36.300***
Note:		*p<0.1; **p<0.05; ***p<0.01
		Standard errors in parentheses

Table 3. Table of Beta coefficients

To identify which variable will have the most impact on crime rates, we have calculated beta (β) coefficients as they allow direct comparisons.

From model 1 we identified:

- *Allowing capital punishment has the highest impact on crime rates*
- *Log per capita income has the second highest impact on crime rates*
- *From the advanced model with the inclusion of demographic information:*
- *African American as a % of population has the largest impact on crime rates*
- *Capital punishment has the second highest impact*

VI. CONCLUSION

We expected poverty to be the most significant factor that influences crime rates to increase. However, poverty was not a significant factor for crime rates. We also did not anticipate capital punishments to have a positive relationship with crime. We attribute this to the fact that increasing crime rates may have resulted in capital punishments being implemented as a deterrent of crime.

There could also be possible measurement errors in the form of underreported and unreported crimes either from the police or by citizens who do not wish to report crimes (e.g., incidents of sexual assault).

We also expect there to be possible bias in the estimates which could be resulting from omitted variables such as mental health characteristics of the population as this data is not readily available.

VII. FUTURE RESEARCH

We can expand our methodology to include a panel analysis, i.e., to incorporate multiple time periods to better capture additional trends. We can also analyze possible spatial dimensions which might have significant impacts on crime. Finally, additional factors such as mental health, Police presence and involvement levels can be incorporated into the model. We predict these factors will increase the R^2 value of the model by capturing additional variations in the data.

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