AMERICA'S UNDERCLASS AND CRIME: THE INFLUENCE OF MACROECONOMIC FACTORS

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Throughout America there has been a growing concern over criminal activity. Until the 1990's there was a consistent increasing trend in the crime rate that has been interspersed with a pattern of fall offs since the late 1960's. Crime is an activity with great economic importance. Not only does it produce negative effects on economic activity such as higher prices due to theft, crime also reduces the quality of life for citizens within society who must deal with its physical and emotional consequences. Though the net social benefit of criminal activity is negative there do exist some social benefits such as new jobs in crime prevention from increased government expenditure on crime. The determinants of crime are often viewed in both theoretical and empirical terms. Many theories have been formed to explain the trends evidenced in the crime rate primarily including cost benefit analyses. This paper will discuss possible benefits and costs a person may face when opting to participate in criminal activity and attempt to discover a relation between the underclass, specifically income disparity in terms of the standard deviation of income, and crime. All data was obtained from the US Census Bureau, the Bureau of Economic Analysis, the Bureau of Labor Statistics, the Bureau of Justice Statistics, The Administration for Children and Families Statistics, and the Federal Reserve. An ordinary least squares time-series analysis of the index crime rate in comparison to the possible decision factors will be employed to determine significance.

In this paper, section II covers a brief and selective review of previous literature on determinants of criminal activity. Section III imparts both the theory behind the data chosen and the hypothesis. The regression and an analysis are presented in section IV followed by conclusions in section V.

I. LITERATURE REVIEW

The majority of research done in investigating the determinants of the crime rate looks at factors such as inflation, income and unemployment. Many also employ cost-benefit analyses. In a study on crime in England and Wales, Wong (1995) attempted to derive a model based on incentives. He included variables such as unemployment, primary school enrollment rate, real wage, per capita income and average imprisonment to attempt identification of poverty and prosperity induced crime. Wong's results showed a positive correlation for unemployment, a weak negative correlation for income and his education variable was negative but insignificant. An empirical study was performed by Becsi (1999) relating quality of life as a reflection of variables such as the unemployment rate, personal income, police expenditure, education and the state population share of prisoners to crime. The results presented a relation between crime and both personal income and unemployment.

Crutchfield and Pitchford (1997) performed a study based primarily on work. Significant results in their model were a positive relation with crime for time out of the labor force, unemployment and poverty. They concluded that it is most likely the stability of good work that prevents crime. Conversely, Grant and Martinez (1997) hypothesized that possible class linkages, other than the sense of alienation associated with unemployment, may have a relation to crime. Their research focused on variables including union activity, population statistics, police expenditure, inflation, unemployment, aid to families with dependant children (AFDC) payments and an underclass variable. Grant and Martinez's underclass variable included the poverty rate, the percent of the population that is black and the percent of households headed by

females. Unemployment and the underclass variable were positively correlated in their model, while inflation was insignificant and AFDC payments were negatively correlated. Devine, Sheley and Smith's (1988) study also resulted in a positive correlation of crime with inflation and unemployment.

Gary Becker (1968) presented a model based on costs and benefits. His approach was formed from the usual analysis of expected utility; that a person will commit an offence if they presume their utility will be greater than if they used their time and resources in some other manner. Every criminal or potential criminal faces benefits, physical and psychological, from crime and costs in terms of law-enforcement. Total cost of a crime includes two factors; the probability of being caught and the punishment faced if caught. Becker's work concentrates mostly on determining policies related to the costs of illegal behavior. Similar to Becker, Isaac Ehrlich (1973) proposed that crime could yield an increase in wealth or psychic well-being. Further, he was able to define a relation between crime and income inequality. Ehrlich investigates employment as an indicator of the availability of income in a society while Becker analyzes opportunity costs as well as explicit costs and benefits. Ann Dryden Witte (1980), in a study of individuals released from North Carolina's prisons, focused on variables of deterrence and individuals traits of prisoners. Her results included a negative correlation with unemployment and with the probability of being caught. Loftin and McDowall (1982) performed a study on the relation of crime and the police force in Detroit. Their study, while general, presented results contrary to theory. There existed no statistically significant relation between the two variables. In Mixon and Mixon's (1996) study, cheating among college students was representative of crime. The probability of being caught cheating symbolized the costs of criminal activity. The study analyzed both costs and benefits and found them to motivate crime the same as any other economic activity.

Inequality was found to be significant and positively correlated to crime by Bourguignon (2000) and Fajnzylber, Lederman, and Loayza (2002). Bourguignon's study included income inequality, police expenditure and punishment among other variables. His main conclusion was that income inequality could be a foremost economic determinant of crime. Fajnzylber, Lederman, and Loayza performed an empirical cross-country analysis to examine an effect between income inequality and crime. Income inequality was measured by the Gini index and found to be significant within and between countries.

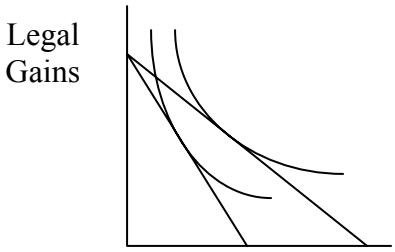
Similar, to these theories this paper attempts to assess the determinants of crime by analyzing its associated benefits. However, less emphasis is placed on the costs of criminal activity. Variables analogous to those in previous research and variables found to be historically significant are pooled with new variables and employed in an ordinary least squares regression.

II. DATA AND HYPOTHESIS

Economists are constantly making the assumption that all people are rational; accordingly, people should only behave in rational ways. Support of this assumption is seen in cost-benefit theory that dictates an individual will only choose an action if its marginal benefit outweighs its marginal cost. Applied to crime it is possible to generate a list of costs and benefits that may exist for participating in criminal behavior. While property crime is often thought of as more responsive to economic conditions; violent crime is often committed as a by-product to property crime (Becsi). This allows the assumption to be made in this paper that a portion of violent crime is directly linked to property crime and thus it is possible to use the same variables to determine both (Bourguignon). Benefits can be psychological or physical. Figure 1

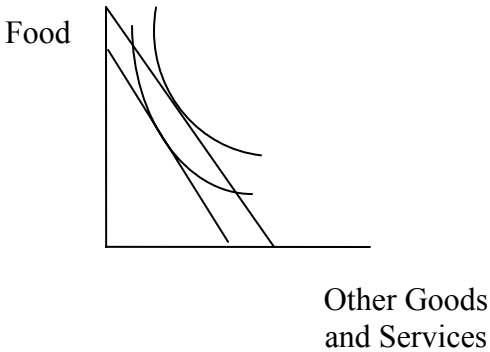
shows the effect in terms of utility as criminal gains become relatively less expensive compared to legal gains. To measure this effect, the prison population variable is included as a deterrence measure. If the prison population is decreasing, the relative cost of crime in terms of possible prison sentences can be seen as decreasing. As costs decrease relative to the benefits of crime it is rational to participate in criminal activity. The prison population is thus expected to be negatively correlated with crime. Similarly if the cost increase to an individual they would be less likely to participate in crime. Another measure that can be used is the gross domestic product (GDP). When the quality of an individual's life is increased, the marginal benefit of crime can be expected to decrease thus decreasing that individual's willingness to participate in criminal activity. GDP, a measure of the nation's total output, is used to express the quality of life in America in aggregate terms. As GDP rises, the total wealth of the nation increases and a higher standard of living is a possible result reflecting increasing quality of life. Thus, as GDP increases crime should decrease.

Figure 1: The Effect of a Decrease in Cost of Illegal Gains



Physical benefits, however, are easier to quantify. The major assumption in data selection, and the hypothesis of this paper, is that the less resources[1] an individual has available to them, the more likely that person is to partake in criminal activity. In other terms, individuals with extremely limited resources, typically the underclass, are more likely to supplement their budgets through illegal means. They are accordingly capable of obtaining a higher level of utility (Figure 2).

Figure 2: The Effect of a Budget Increase from Illegal Gains



Measures of limited resources include: income disparity, the poverty rate, temporary aid to needy families receipts (TANF), the discount rate, and educational attainment. When a minority of the population holds the majority of the wealth greater inequality occurs. To measure this effect an income disparity[2] variable is used. The variable was obtained by taking the average of the mean income of each fifth of the population and determining the standard deviation for each year. Income disparity is a measure of the allocation of wealth in the nation; the higher the standard deviation the greater the disparity. A large gap in wealth indicates that there are more people with a lower income and thus more people who could possibly gain from criminal activity. It is assumed that the cost to low income individuals, in terms of lost income, is less than the physical benefit, in terms of goods, for criminal activity. Therefore the greater the disparity the more likely people are to participate. Similarly, the poverty rate, a measure of the percent of the population that lives below the poverty level is used to represent the lower costs and increased benefits in American society of crime. A higher rate is also representative of a greater number of people in poverty (with fewer resources).

A way to increase the availability of resources over time is through educational attainment. People who achieve higher levels of education are expected to have greater quantities of resources available to them. To represent educational attainment the percent of the population over 25 years of age that has completed four or more years of high school and the percent of the population over 25 years of age that has completed four or more years college are included as variables. Loans are a means of obtaining resources, a means of supplementing income. Also loans are used to finance education. When more people are obtaining higher levels of education as previously discussed one would expect crime to decrease. If more people are taking out loans the interest rate should decrease due to an increase in demand. Thus low interest rates could imply that more people are supplementing their income or improving their education and thus increasing the cost of criminal activity. The discount rate, being the basis of all interest rates, is used to measure the ability of obtaining loans. A higher interest rate indicates less obtainable loans. A decrease in the benefit of crime would be expected for other options used to supplement income. Temporary aid to needy families (TANF) is a program that supplements the income of families presented with a period of hardship. When aid is in greater use families have an improved availability to obtain resources and the need to commit crime for physical benefit should decrease.

Traditionally significant variables included in the regression are per capita income, unemployment, inflation and the population. A person's resources should increase as per capita income increases, decreasing the benefit of criminal activity. People who are unemployed have very limited or non-existent resources, in particular income. The benefit of crime to the unemployed is greater than that of the employed. As unemployment increases it is expected that the benefit from criminal behavior will also increase. Inflation decreases the value of current resources. As the value of resources decrease the benefit of criminal activity is anticipated to increase as well. The population of the United States is included as a control variable. It is expected that the number of deviants in a nation will increase as the population increases.

The dependant variable in the model is the index crime rate. Index crimes include murder, non-negligent manslaughter, forcible rape, robbery, aggravated assault, burglary, larceny-theft and motor vehicle theft[3].

TABLE 1: Variables, Expected Signs and Sources

Variable	Description	Expected Sign	Source
UNEMPLOYMENT	Civilian Labor Force 16 years and older	+	Bureau of Labor Statistics
INFLATION	The annual percent change in CPI with the base year chained (1982-1984=100)	+	Bureau of Labor Statistics
INCOME	Per capita income in 2001 dollars	-	The Census Bureau
POPULATION	The population of the U.S.	+	The Census Bureau
GDP	GDP in billions of chained 1996 dollars	-	Bureau of Economic Analysis
HIGH SCHOOL	Percent of the population 25 years and over that have completed four years or more of high school	-	The Census Bureau
COLLEGE	Percent of the population 25 years and over that have completed four years or more of college	-	The Census Bureau
INCOME DISPARITY	A measure of income disparity	+	The Census Bureau
TANF	Total cases	-	The Administration for Children and Families
POVERTY RATE	The poverty rate for families	+	The Census Bureau
DISCOUNT RATE	The discount rate	+	The Federal Board of Governors
PRISON POPULATION	Total state and federal prison population	-	Bureau of Justice Statistics
CRIME	The index crime rate	N/A	FBI Uniform Crime Reports

Severe multicollinearity, an outcome that occurs when two or more independent variables represent the same effect on the dependant variable, is expected in the model. GDP is likely collinear with INFLATION, INCOME and INCOME DISPARITY since they all measure types of wealth in the economy. Other variables that could be multicollinear are POPULATION and PRISON POPULATION, INCOME and INCOME DISPARITY[4] and POVERTY RATE and TANF. Another complication that may exist is autocorrelation. (This consequence, most common in time series data, occurs when the error terms are correlated.) If either multicollinearity or autocorrelation exist, the model will need modification to produce the most accurate result.

III. THE REGRESSION

The original regression contained a high adjusted R^2 value and many insignificant variables at the 95% confidence level; $\alpha = .05$. (Table 2) Insignificant variables include UNEMPLOYMENT, POPULATION, GDP, HIGH SCHOOL, COLLEGE, TANF, and PRISON POPULATION. Together these indicate that multicollinearity may exist in the specification. A pair-wise correlation matrix is created to test for the multicollinearity. (Table 3)

TABLE 2: The Regression Output for the Original Specification

Multiple R	0.985
R Square	0.971
Adjusted R Square	0.953
Standard Error	166.322
Observations	32

ANOVA

	df	SS	MS	F	Sign. F
Regression	12	18077599.159	1506466.596	54.457	4.17E-12
Residual	19	525602.771	27663.303		
Total	31	18603201.931			

	Coefficients	Stand. Error	t Stat	P-value
Intercept	-7641.233	4264.741	-1.791	0.089
UNEMPLOYMENT	7.025	59.195	0.118	0.906
INFLATION	146.879	25.211	5.825	0.000
INCOME	1.210	0.334	3.616	0.001
POPULATION	0.000	0.000	0.555	0.584
GDP	-1.541	0.819	-1.881	0.075
HIGH SCHOOL	111.181	106.493	1.044	0.309
COLLEGE	-261.120	180.245	-1.448	0.163
INCOME DISPARITY	-0.341	0.092	-3.706	0.001
TANF	0.000	0.000	-0.450	0.657
POVERTY RATE	248.316	97.684	2.542	0.019
0DISCOUNT RATE	-112.518	32.370	-3.475	0.002
PRISON POPULATION	0.003	0.001	1.834	0.082

TABLE 3: Correlation Matrix for the Original Specification

	UNEMPLOYMENT	INFLATION	INCOME	POPULATION
INFLATION	0.194	1		
INCOME	0.100	-0.389	1	
POPULATION	0.144	-0.459	0.978	1
GDP	0.031	-0.465	0.982	0.990
HIGH SCHOOL	0.276	-0.354	0.975	0.981
COLLEGE	0.222	-0.385	0.981	0.988
INCOME DISPARITY	-0.049	-0.512	0.970	0.971
TANF	0.490	-0.079	0.636	0.644
POVERTY RATE	0.457	-0.379	0.249	0.398
DISCOUNT RATE	0.423	0.711	-0.133	-0.181
PRISON POPULATION	-0.06	-0.536	0.919	0.954

Table 3 Continued

	GDP	HIGH SCHOOL	COLLEGE	INCOME DISPARITY
HIGH SCHOOL	0.959	1		
COLLEGE	0.973	0.995	1	
INCOME DISPARITY	0.989	0.926	0.943	1
TANF	0.596	0.710	0.654	0.564
POVERTY RATE	0.302	0.401	0.394	0.256
DISCOUNT RATE	-0.234	-0.063	-0.084	-0.301
PRISON POPULATION	0.974	0.888	0.913	0.976

Table 3 Continued

	TANF	POVERTY RATE	DISCOUNT RATE
POVERTY RATE	0.240	1	
DISCOUNT RATE	-0.093	0.020	1
PRISON POPULATION	0.530	0.303	-0.357

There is extreme correlation (greater than .5) between INFLATION and DISCOUNT RATE, INFLATION and PRISON POPULATION, and TANF and PRISON POPULATION.

INCOME, POPULATION, GDP, HIGH SCHOOL, COLLEGE and INCOME DISPARITY are all correlated to every variable except POVERTY RATE and DISCOUNT RATE. To cure the model of multicollinearity superfluous variables were removed and correlated non-superfluous variables were combined (See Appendix A for the detailed process). The final specification includes UNEMPLOYMENT, INFLATION, INCOME, HS/C[5], INCOME DISPARITY, POVERTY RATE and DISCOUNT RATE. The regression output of this specification is shown in Table 4 and the correlation matrix in Table 5.

Table 4: The Regression Output for the Final Specification

Regression Statistics	
Multiple R	0.982
R Square	0.965
Adjusted R Square	0.955
Standard Error	164.335
Observations	32

ANOVA

	Df	SS	MS	F	Sign. F
Regression	7	17955056.917	2565008.131	94.979	6.20E-16
Residual	24	648145.013	27006.042		
Total	31	18603201.931			

	Coefficients	Stand. Error	t Stat	P-value
Intercept	-8322.799	3259.793	-2.553	0.017
UNEMPLOYMENT	114.774	34.005	3.375	0.002
INFLATION	156.943	18.955	8.279	0.000
INCOME	0.911	0.124	7.332	0.000
HS/C	822.065	399.032	2.060	0.050
INCOME DISPARITY	-0.276	0.039	-7.047	0.000
POVERTY RATE	260.092	50.887	5.111	0.000
DISCOUNT RATE	-110.570	22.994	-4.808	0.000

Table 5: Correlation Matrix for the Final Specification

	UNEMPLOYMENT	INFLATION	INCOME	HS/C
INFLATION	0.194	1		
INCOME	0.100	-0.389	1	
HS/C	-0.320	0.290	-0.957	1
INCOME DISPARITY	-0.049	-0.512	0.970	-0.886
POVERTY RATE	0.457	-0.379	0.249	-0.389
DISCOUNT RATE	0.423	0.711	-0.133	-0.027

Table 5 Continued

	INCOME DISPARITY	POVERTY RATE	DISCOUNT RATE
POVERTY RATE	0.256	1	
DISCOUNT RATE	-0.301	0.020	1

While there still exists multicollinearity in the model it is significantly less than that which existed in the original specification. The standard errors of the estimators, nonetheless, are large. The Durbin-Watson test for autocorrelation, most common in time-series data, was performed. The d-statistic was calculated using the formula:

$$\sum_{2}^{t}(e_t - e_{t-1})^{\wedge}2 \Big/ \sum_{1}^{t}(e_t)^{\wedge}2$$

The d-statistic for this specification is 1.64, the upper critical value is 2.018 and the lower critical value is 0.950. Since the d-statistic falls in between the upper and lower critical values the test is inconclusive and autocorrelation can not be proven in the model. Thus autocorrelation is not corrected for. (The Durbin-Watson test is shown in detail in Appendix B[6].) The average of the residuals is calculated by dividing the sum of the residuals by the total number of residuals:

$$\frac{1.47^{E-10}}{32} \cong 0$$

	RESIDUALS
UNEMPLOYMENT	-1.41134E-13
INFLATION	-4.72673E-14
INCOME	-8.39119E-14
HS/C	-1.91157E-13
INCOME DISPARITY	-4.25323E-14
POVERTY RATE	-5.0718E-13
DISCOUNT RATE	-2.67895E-14

There is minimum error. To detect any correlation between the independent variables and the residuals a pair-wise correlation can be done. The assumptions for multicollinearity, heteroskedasticity, autocorrelation, minimum error and independent variable-residual correlation have all been accounted for. The model is BLUE.

IV. RESULTS AND CONCLUSION

After the regressions were completed and tests ran for multicollinearity and autocorrelation it was possible to determine the significance of the retained variables. All variables in the final regression were deemed significant.

The Final Specification: *-8322.7998 + 114.7743*UNEMPLOYMENT + 156.9430*INFLATION + 0.9118*Income + 822.0650*HS/C – 0.2768 INCOME DISPARITY + 260.0926*POVERTY RATE – 110.5701*DISCOUNT RATE.*

Many variables were removed from the original specification to reduce the effect of multicollinearity. Although it was still extremely present in the final specification the retained variables were kept due to theoretical importance. However, the variables that remained significantly collinear, all except UNEMPLOYMENT, were each removed from the specification and then re-entered because of a significant decrease in the adjusted R^2 value indicating they were not superfluous. (See Appendix A) The probability of a type II error is large. UNEMPLOYMENT, INFLATION and POVERTY RATE were all positively correlated to CRIME as expected. Thus it can be ascertained that an increase in unemployment, inflation or the poverty rate in America will promote an increase in the crime rate.

Unexpectedly though, HS/C and INCOME were positively correlated to CRIME while INCOME DISPARITY and DISCOUNT RATE were negatively correlated. There could be a number of reasons for the unexpected signs in the variables including bad hypothesizing or neglections in the regression. For instance, it could be argued that the variables should have been lagged since it is likely that the economic conditions in one year will affect people's behavior in the next. The HS/C variable may have been more accurate if either or both original variables were offset by two to four years since the individuals who have completed school may not gain the resource benefits immediately. Also the original variables contain overlapping data and it is possible that if lagged one could have been insignificant or removed altogether.

One possibility for the positive sign for INCOME and negative sign for INCOME DISPARITY could be that as per capita income has increased it has done so disproportionately causing the upper-class to become significantly richer compared to the middleclass and underclass. Combining these two variables makes it possible to see that the overall correlation is positive (-0.2768+0.9118=.635) which indicates that income disparity may actually have a

greater effect than indicated. Another possibility for the negative correlation of INCOME DISPARITY could be that as the upper-class has earned more income they have improved security in their neighborhoods reducing crime.

Other deterrence variables could have been included in the model such as police expenditures, sentencing rates or government expenditure on crime prevention. Also, a drug activity variable could have been included since the costs of drug possession often reflects the costs of crime and drug prohibition has been found to be positively correlated to crime (Miron, 2001). These may have provided a more accurate representation of the costs of criminal activity. Another consideration that may have provided for a more accurate specification would be to differentiate between property crime and violent crime. Property crime may be more cost-benefit oriented than violent crime which is sometimes considered to be more passion oriented.

This paper alone is not conclusive enough to state the exact determinants of crime accurately. It does, however, serve as a foundation for continued, more in depth research and for other research that may combine a variety of additional variables. The research conducted here has its limitations yet provides insight into possible determinants of criminal activity, specifically income factors, in the United States. Continued the study could become conclusive. Criminal activity is indeed most likely motivated by benefits received from committing crime and the underclass receives the greatest benefits. It is safe to derive the conclusion from this paper that improvements in socio-economic standards in the United States would decisively reduce the crime rate.

APPENDIX A: MULTICOLLINEARITY

GDP is removed without a significant change in the adjusted R^2 . This cures an exceptional amount of the multicollinearity in the model.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9831
R Square	0.9665
Adjusted R Square	0.9480
Standard Error	176.5700
Observations	32

	UNEMPLOYMENT	*INFLATION*	*INCOME*	*POPULATION*	*HIGH SCHOOL*
INFLATION	0.194752845	1			
INCOME	0.100795127	-0.389649939	1		
POPULATION	0.144475362	-0.459557908	0.978534556	1	
HIGH SCHOOL	0.276714807	-0.354029028	0.97590872	0.98153873	1
COLLEGE	0.222267581	-0.385374519	0.981389458	0.988716212	0.99544279
INCOME DISPARITY	-0.049232696	-0.51252365	0.970025344	0.971833206	0.926563876
TANF	0.490948595	-0.079015062	0.636098886	0.644536707	0.710686789
POVERTY RATE	0.457466764	-0.379579783	0.249660142	0.398631561	0.401545319
DISCOUNT RATE	0.423118782	0.711221274	-0.13325343	-0.181113446	-0.063167663
PRISON POPULATION	-0.06610768	-0.536094665	0.919405556	0.95484626	0.888880472

	COLLEGE	INCOME DISPARITY	TANF	POVERTY RATE	DISCOUNT RATE
INCOME DISPARITY	0.943762783	1			
TANF	0.654569544	0.564980324	1		
POVERTY RATE	0.394014531	0.256781388	0.240815853	1	
DISCOUNT RATE	-0.084839882	-0.301958271	-0.093607157	0.020921477	1
PRISON POPULATION	0.913533929	0.976678506	0.530856484	0.303101394	-0.357478428

Population is removed increasing the adjusted R^2 signifying that is a superfluous variable. Multicollinearity is decreased again.

Regression Statistics	
Multiple R	0.9831
R Square	0.9664
Adjusted R Square	0.9504
Standard Error	172.4563
Observations	32

	UNEMPLOYMENT	*INFLATION*	*INCOME*	*HIGH SCHOOL*
INFLATION	0.194752845	1		
INCOME	0.100795127	-0.389649939	1	
HIGH SCHOOL	0.276714807	-0.354029028	0.97590872	1
COLLEGE	0.222267581	-0.385374519	0.981389458	0.99544279
INCOME DISPARITY	-0.049232696	-0.51252365	0.970025344	0.926563876
TANF	0.490948595	-0.079015062	0.636098886	0.710686789
POVERTY RATE	0.457466764	-0.379579783	0.249660142	0.401545319
DISCOUNT RATE	0.423118782	0.711221274	-0.13325343	-0.063167663
PRISON POPULATION	-0.06610768	-0.536094665	0.919405556	0.888880472

	COLLEGE	*INCOME DISPARITY*	*TANF*	*POVERTY RATE*	*DISCOUNT RATE*
INCOME DISPARITY	0.943762783	1			
TANF	0.654569544	0.564980324	1		
POVERTY RATE	0.394014531	0.256781388	0.240815853	1	
DISCOUNT RATE	-0.084839882	-0.301958271	-0.093607157	0.020921477	1
PRISON POPULATION	0.913533929	0.976678506	0.530856484	0.303101394	-0.357478428

TANF removed increasing the adjusted R^2 signifying that is a superfluous variable. Multicollinearity is decreased again

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9830
R Square	0.9662
Adjusted R Square	0.9524
Standard Error	168.9787
Observations	32

	UNEMPLOYMENT	*INFLATION*	*INCOME*	*HIGH SCHOOL*
INFLATION	0.194752845	1		
INCOME	0.100795127	-0.389649939	1	
HIGH SCHOOL	0.276714807	-0.354029028	0.97590872	1
COLLEGE	0.222267581	-0.385374519	0.981389458	0.99544279
INCOME DISPARITY	-0.049232696	-0.51252365	0.970025344	0.926563876
POVERTY RATE	0.457466764	-0.379579783	0.249660142	0.401545319
DISCOUNT RATE	0.423118782	0.711221274	-0.13325343	-0.063167663
PRISON POPULATION	-0.06610768	-0.536094665	0.919405556	0.888880472

	COLLEGE	*INCOME DISPARITY*	*POVERTY RATE*	*DISCOUNT RATE*
INCOME DISPARITY	0.943762783	1		
POVERTY RATE	0.394014531	0.256781388	1	
DISCOUNT RATE	-0.084839882	-0.301958271	0.020921477	1
PRISON POPULATION	0.913533929	0.976678506	0.303101394	-0.357478428

PRISON POPULATION is removed increasing the adjusted R^2 signifying that is a superfluous variable. Multicollinearity is decreased again.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9826
R Square	0.9655
Adjusted R Square	0.9535
Standard Error	167.0294
Observations	32

	UNEMPLOYMENT	*INFLATION*	*INCOME*	*HIGH SCHOOL*
INFLATION	0.194752845	1		
INCOME	0.100795127	-0.389649939	1	
HIGH SCHOOL	0.276714807	-0.354029028	0.97590872	1
COLLEGE	0.222267581	-0.385374519	0.981389458	0.99544279
INCOME DISPARITY	-0.049232696	-0.51252365	0.970025344	0.926563876
POVERTY RATE	0.457466764	-0.379579783	0.249660142	0.401545319
DISCOUNT RATE	0.423118782	0.711221274	-0.13325343	-0.063167663

	COLLEGE	*INCOME DISPARITY*	*POVERTY RATE*
INCOME DISPARITY	0.943762783	1	
POVERTY RATE	0.394014531	0.256781388	1
DISCOUNT RATE	-0.084839882	-0.301958271	0.020921477

HIGH SCHOOL is removed decreasing the adjusted R^2 and only slightly decreases the multicollinearity signifying that is not a superfluous variable.

Regression Statistics	
Multiple R	0.9812
R Square	0.9628
Adjusted R Square	0.9519
Standard Error	169.8092
Observations	32

	UNEMPLOYMENT	*INFLATION*	*INCOME*
INFLATION	0.194752845	1	
INCOME	0.100795127	-0.389649939	1
COLLEGE	0.222267581	-0.385374519	0.981389458
INCOME DISPARITY	-0.049232696	-0.51252365	0.970025344
POVERTY RATE	0.457466764	-0.379579783	0.249660142
DISCOUNT RATE	0.423118782	0.711221274	-0.13325343

	COLLEGE	*INCOME DISPARITY*	*POVERTY RATE*
INCOME DISPARITY	0.943762783	1	
POVERTY RATE	0.394014531	0.256781388	1
DISCOUNT RATE	-0.084839882	-0.301958271	0.020921477

COLLEGE is removed decreasing the adjusted R^2 and only slightly decreases the multicollinearity signifying that is not a superfluous variable.

Regression Statistics	
Multiple R	0.9793
R Square	0.9590
Adjusted R Square	0.9471
Standard Error	178.2295
Observations	32

	UNEMPLOYMENT	*INFLATION*	*INCOME*	*HIGH SCHOOL*
INFLATION	0.194752845	1		
INCOME	0.100795127	-0.389649939	1	
HIGH SCHOOL	0.276714807	-0.354029028	0.97590872	1
INCOME DISPARITY	-0.049232696	-0.51252365	0.970025344	0.926563876
POVERTY RATE	0.457466764	-0.379579783	0.249660142	0.401545319
DISCOUNT RATE	0.423118782	0.711221274	-0.13325343	-0.063167663

	INCOME DISPARITY	*POVERTY RATE*	*DISCOUNT RATE*
POVERTY RATE	0.256781388	1	
DISCOUNT RATE	-0.301958271	0.020921477	1

The two variables HIGH SCHOOL and COLLEGE are combined to create the HS/C variable. The variable represents the percent of people over 25 years of age that completed four or more years of high school divided by the percent of people over 25 year of age that completed four or more years of college and reduces the multicollinearity and increase the adjusted R^2 value as seen in the final specification.

INCOME is removed decreasing the adjusted R^2 and only slightly decreases the multicollinearity signifying that is not a superfluous variable.

Regression Statistics	
Multiple R	0.9419
R Square	0.8871
Adjusted R Square	0.8600
Standard Error	289.8225
Observations	32

	UNEMPLOYMENT	*INFLATION*	*HS/C*	*INCOME DISPARITY*	*POVERTY RATE*
INFLATION	0.194752845	1			
HS/C	-0.320729692	0.290483352	1		
INCOME DISPARITY	-0.049232696	-0.51252365	-0.88600272	1	
POVERTY RATE	0.457466764	-0.37957978	-0.38996869	0.256781388	1
DISCOUNT RATE	0.423118782	0.711221274	-0.02751337	-0.301958271	0.020921477

INCOME DISPARITY is removed decreasing the adjusted R^2 and only slightly decreases the multicollinearity signifying that is not a superfluous variable.

Regression Statistics	
Multiple R	0.9450
R Square	0.8931
Adjusted R Square	0.8674
Standard Error	282.0978
Observations	32

	UNEMPLOYMENT	*INFLATION*	*HS/C*	*INCOME*	*POVERTY RATE*
INFLATION	0.194752845	1			
HS/C	-0.320729692	0.290483352	1		
INCOME	0.100795127	-0.38964993	-0.95769927	1	
POVERTY RATE	0.457466764	-0.37957978	-0.38996869	0.249660142	1
DISCOUNT RATE	0.423118782	0.71122127	-0.02751337	-0.13325343	0.020921477

DISCOUNT RATE is removed decreasing the adjusted R^2 and only slightly decreases the multicollinearity signifying that is not a superfluous variable.

Regression Statistics	
Multiple R	0.9425
R Square	0.8882
Adjusted R Square	0.8667
Standard Error	282.7839
Observations	32

	UNEMPLOYMENT	*INFLATION*	*HS/C*	*INCOME*
INFLATION	0.194752845	1		
HS/C	-0.320729692	0.290483352	1	
INCOME	0.100795127	-0.389649939	-0.957699273	1
POVERTY RATE	0.457466764	-0.379579783	-0.389968691	0.249660142

INFLATION is removed decreasing the adjusted R^2 and only slightly decreases the multicollinearity signifying that is not a superfluous variable.

Regression Statistics	
Multiple R	0.8974
R Square	0.8053
Adjusted R Square	0.7679
Standard Error	373.1973
Observations	32

	UNEMPLOYMENT	*HS/C*	*INCOME*	*POVERTY RATE*
HS/C	-0.320729692	1		
INCOME	0.100795127	-0.9576992	1	
POVERTY RATE	0.457466764	-0.3899686	0.249660142	1
DISCOUNT RATE	0.423118782	-0.0275133	-0.13325343	0.020921477

POVERTY RATE is removed decreasing the adjusted R^2 and only slightly decreases the multicollinearity signifying that is not a superfluous variable.

Regression Statistics	
Multiple R	0.9429
R Square	0.8890
Adjusted R Square	0.8677
Standard Error	281.7818
Observations	32

	UNEMPLOYMENT	*INFLATION*	*HS/C*	*INCOME*
INFLATION	0.194752845	1		
HS/C	-0.320729692	0.290483352	1	
INCOME	0.100795127	-0.38964993	-0.9576992	1
DISCOUNT RATE	0.423118782	0.711221274	-0.0275133	-0.1332534

APPENDIX B

Durbin Watson Test

Residuals	$(e_t-e_{t-1})^2$	$(e_t)^2$
-106.6890586	35202.91	11382.56
80.93532067	97.73	6550.53
71.04927871	707.41	5048.00
97.64648057	5195.80	9534.84
25.56459648	10950.17	653.55
-79.07848153	19305.61	6253.41
-218.0230961	31472.31	47534.07
-40.61873263	1307.86	1649.88
-76.78311733	192182.39	5895.65
361.6030045	96007.63	130756.73
51.75202504	46749.75	2678.27
-164.4648763	31251.81	27048.70
12.31694943	23265.34	151.71
-140.2128419	91644.51	19659.64
162.5155997	5483.19	26411.32
88.46703612	28631.59	7826.42
-80.74167292	46359.49	6519.22
-296.05421	22453.56	87648.10
-146.2090853	96967.74	21377.10
165.1873455	42109.70	27286.86
-40.01913076	3541.55	1601.53

19.49178104	35840.95	379.93		$(e_t-e_{t-1})^2$	$(e_t)^2$
208.8088484	1562.61	43601.14			
169.2789577	19165.72	28655.37	Sum	1065019.93	648145.01
30.83864182	52479.32	951.02			
-198.2450169	56981.74	39301.09	d statistic	1.64	
40.46347035	77.82	1637.29			
49.28477842	18452.99	2428.99			
185.1265581	24015.94	34271.84			
30.15579894	9824.67	909.37			
-68.96368154	15730.12	4755.99			
-194.3834698		37784.93			

Upper and lower critical values were determined with k=7 and n=31. dL= 0.950, dU= 2.018 Since the d-statistic for the model fell in between the upper and lower critical values no conclusion can be drawn for the existence of autocorrelation.

The Park Test for Heteroskedasticity

The Park Test for heteroskedasticity was performed by regressing the natural log of the squared residuals on each variable in the model. None of the variables were significant therefore heteroskedasticity does not exist in the model.

	Coefficients	*t Stat*	*P-value*
Intercept	7.78384	3.562038	0.001252
UNEMPLOYMENT	0.629902	0.523394	0.604545

	Coefficients	*t Stat*	*P-value*
Intercept	11.37164	0.694952	0.492433
INCOME DISPARITY	-0.23771	-0.15004	0.881737

	Coefficients	*t Stat*	*P-value*
Intercept	8.599897	0.524218	0.603979
INCOME	0.032694	0.019326	0.984709

	Coefficients	*t Stat*	*P-value*
Intercept	6.636247	0.948724	0.350342
POVERTY RATE	0.973344	0.326341	0.746432

	Coefficients	*t Stat*	*P-value*
Intercept	7.829626	4.92306	2.89E-05
DISCOUNT RATE	0.599595	0.695874	0.491864

	Coefficients	*t Stat*	*P-value*
Intercept	10.15004	0.675896	0.504284
CRIME	-0.14491	-0.08213	0.935088

	Coefficients	*t Stat*	*P-value*
Intercept	9.323404	10.16489	3.12E-11
INFLATION	-0.26873	-0.46864	0.642714

	Coefficients	*t Stat*	*P-value*
Intercept	9.675449	2.882255	0.007231
HS/C	-0.53982	-0.22687	0.822064

APPENDIX C

The derivation of INCOME DISPARITY

2000 Dollars	Lower 5th				Highest 5th	Top 5 percent	Mean Income	Standard Deviation of Income
1998	13,218	31,110	49,238	72,208	148,622	260,130	52399.33	44063.57
1997	12,901	30,229	47,694	69,937	143,682	251,466	50740.50	42560.66
1996	12,449	29,348	46,423	67,832	137,330	237,603	48897.00	40611.31
1995	12,649	29,143	45,628	66,760	134,125	230,026	48050.83	39529.44
1994	11,955	28,286	44,668	66,028	133,065	228,285	47333.67	39414.27
1993	11,455	27,512	43,598	64,629	130,581	225,379	46295.83	38760.14
1992	11,566	27,898	44,073	64,063	119,214	187,695	44469.00	34947.82
1991	12,056	28,618	44,405	64,403	118,322	183,084	44634.00	34493.06
1990	12,625	29,448	45,352	65,222	121,212	190,187	45643.17	35229.12
1989	12,762	29,691	46,126	66,363	124,954	200,165	46649.33	36415.34
1988	12,517	29,147	45,358	65,141	119,522	186,750	45280.83	34736.99
1987	12,406	29,038	45,090	64,533	117,936	184,622	44833.83	34237.22
1986	12,423	28,685	44,440	63,497	114,369	173,677	43902.33	33096.59
1985	12,076	27,712	42,785	61,329	108,991	162,876	42148.83	31487.98
1984	11,934	27,325	42,158	60,285	104,774	151,485	41079.33	30181.85
1983	11,529	26,527	40,814	58,168	100,857	145,417	39649.17	29021.94
1982	11,696	26,536	40,519	57,481	99,323	142,106	39259.17	28468.97
1981	12,375	26,911	41,159	57,787	96,960	135,485	39198.67	27556.72

1980	12,756	27,769	41,950	58,200	97,991	139,302	39777.67	27710.62
1979	13,263	28,675	43,245	59,537	102,118	151,159	41139.67	28849.40
1978	13,125	28,464	42,741	58,888	99,926	146,431	40524.00	28186.57
1977	12,633	27,004	40,613	56,023	94,380	137,592	38442.17	26582.53
1976	12,696	26,867	40,078	54,760	92,165	134,892	37761.00	25823.32
1975	12,394	26,201	38,958	53,341	89,889	131,860	36797.17	25182.35
1974	12,907	27,246	39,778	54,498	91,830	133,943	37709.83	25624.81
1973	12,672	27,449	40,331	55,118	94,567	142,717	38356.17	26530.36
1972	12,349	26,945	39,578	54,049	93,739	143,707	37776.67	26342.95
1971	11,842	25,778	37,716	51,078	87,976	134,141	35731.67	24626.24
1970	11,838	26,177	37,849	51,055	87,795	133,688	35785.67	24522.77
1969	12,008	26,518	37,946	50,833	87,058	133,715	35727.17	24205.27
1968	11,626	25,357	36,226	48,448	82,786	127,616	34073.83	22963.78
1967	10,795	24,140	34,698	46,535	82,169	130,005	33056.17	22990.95
1966	10,622	23,581	33,741	45,169	77,090	118,373	31700.50	21432.06

Data

Year	Crime	UNEMPLOYMENT	INFLATION	INCOME	POPULATION	GDP
1967	2989.71	3.84	3.1	11067	197,457,000	3,308.3
1968	3370.23	3.56	4.2	11,793	199,399,000	3,466.1
1969	3679.97	3.49	5.5	12,443	201,385,000	3,571.4
1970	3984.54	4.98	5.7	12,543	203,235,298	3,578.0
1971	4164.74	5.95	4.4	12,916	206,212,000	3,697.7
1972	3961.39	5.60	3.2	13,821	208,230,000	3,898.4
1973	4154.42	4.86	6.2	14,291	209,851,000	4,123.4
1974	4850.42	5.64	11	13,958	211,392,000	4,099.0
1975	5298.51	8.48	9.1	13,972	213,124,000	4,084.4
1976	5287.32	7.70	5.8	14,456	214,659,000	4,311.7
1977	5077.61	7.05	6.5	14,914	216,332,000	4,511.8
1978	5140.35	6.07	7.6	15,955	218,059,000	4,760.6
1979	5565.45	5.85	11.3	16,196	220,099,000	4,912.1
1980	5950.01	7.18	13.5	15,844	225,349,264	4,900.9
1981	5858.19	7.62	10.3	15,766	229,146,000	5,021.0
1982	5603.67	9.71	6.2	15,770	231,534,000	4,919.3
1983	5175.04	9.60	3.2	16,008	233,981,000	5,132.3
1984	5031.29	7.51	4.3	16,746	236,158,000	5,505.2
1985	5207.09	7.19	3.6	17,280	238,740,000	5,717.1
1986	5480.37	7.00	1.9	17,983	241,077,000	5,912.4
1987	5550.00	6.18	3.6	18,465	243,400,000	6,113.3
1988	5664.24	5.49	4.1	18,868	245,807,000	6,368.4
1989	5741.00	5.26	4.8	19,378	248,239,000	6,591.8
1990	5820.28	5.62	5.4	18,894	248,709,873	6,707.9

1991	5897.80	6.85	4.2	18,526	252,177,000	6,676.4
1992	5660.22	7.49	3	18,358	255,082,000	6,880.0
1993	5484.44	6.91	3	19,033	257,908,000	7,062.6
1994	5373.53	6.10	2.6	19,559	260,341,000	7,347.7
1995	5275.90	5.59	2.8	19,871	262,755,000	7,543.8
1996	5086.60	5.41	2.9	20,372	265,284,000	7,813.2
1997	4922.70	4.94	2.3	21,162	267,637,000	8,159.5
1998	4615.50	4.51	1.6	21,821	270,296,000	8,508.9

Data continued

Year	HIGH SCHOOL	COLLEGE	INCOME DISPARITY	TANF	POVERTY RATE
1967	51.1	10.1	22990.94942	5,014,000	11.8
1968	52.6	10.5	22963.78335	5,705,000	10
1969	54	10.7	24205.27315	6,706,000	9.7
1970	55.2	11	24522.77123	8,466,000	10.1
1971	56.4	11.4	24626.23785	10,241,000	10
1972	58.2	12	26342.95485	10,947,000	9.3
1973	59.8	12.6	26530.35843	10,949,000	8.8
1974	61.2	13.3	25624.80778	10,864,000	8.8
1975	62.5	13.9	25182.34726	11,165,185	9.7
1976	64.1	14.7	25823.3201	11,386,371	9.4
1977	64.9	15.4	26582.52608	11,129,702	9.3
1978	65.9	15.7	28186.57479	10,671,812	9.1
1979	67.7	16.4	28849.40178	10,317,902	9.2
1980	68.6	17	27710.62408	10,597,445	10.3
1981	69.7	17.1	27556.71883	11,159,847	11.2
1982	71	17.7	28468.97022	10,430,960	12.2
1983	72.1	18.8	29021.93974	10,659,365	12.3
1984	73.3	19.1	30181.84845	10,865,604	11.6
1985	73.9	19.4	31487.97709	10,812,625	11.4
1986	74.7	19.4	33096.59303	10,996,505	10.9
1987	75.6	19.9	34237.21729	11,065,027	10.7
1988	76.2	20.3	34736.99362	10,919,696	10.4
1989	76.9	21.1	36415.3351	10,933,980	10.3
1990	77.6	21.3	35229.12341	11,460,382	10.7
1991	78.4	21.4	34493.05603	12,592,269	11.5
1992	79.4	21.4	34947.82332	13,625,342	11.9
1993	80.2	21.9	38760.13564	14,142,710	12.3
1994	80.9	22.2	39414.27206	14,225,591	11.6
1995	81.7	23	39529.44297	13,652,232	10.811
1996	81.7	23.6	40611.30896	12,648,859	10.3
1997	82.1	23.9	42560.65983	10,936,298	10

1998	82.8	24.4	44063.5743	8,770,376	9.3

Data continued

Year	DISCOUNT RATE	PRISON POPULATION	HS/C
1967	4.19	194896	5.059405941
1968	5.16	187914	5.00952381
1969	5.87	196007	5.046728972
1970	5.95	196429	5.018181818
1971	4.88	198061	4.947368421
1972	4.50	196092	4.85
1973	6.44	204211	4.746031746
1974	7.83	218466	4.601503759
1975	6.25	240593	4.496402878
1976	5.50	264970	4.360544218
1977	5.46	300024	4.214285714
1978	7.46	307276	4.197452229
1979	10.28	314006	4.12804878
1980	11.77	329821	4.035294118
1981	13.42	361384	4.076023392
1982	11.02	405962	4.011299435
1983	8.50	437248	3.835106383
1984	8.80	463866	3.837696335
1985	7.69	503315	3.809278351
1986	6.33	528945	3.850515464
1987	5.66	570519	3.798994975
1988	6.20	627600	3.753694581
1989	6.92	712563	3.644549763
1990	6.98	773519	3.643192488
1991	5.45	825529	3.663551402
1992	3.25	883656	3.710280374
1993	3.00	970174	3.662100457
1994	3.60	1053738	3.644144144
1995	5.21	1126293	3.552173913
1996	5.02	1182169	3.461864407
1997	5.00	1244554	3.435146444
1998	4.92	1302019	3.393442623

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ENDNOTES

[1] Resources include things such as money, personal connections, knowledge of assistance, credit, credit opportunities and property.
[2] The derivation of the income disparity variable is shown in Appendix C the data was obtained from the US Census Bureau.
[3] Arson was added as an index offense in 1979 and therefore not included in the data presented.
[1] These variables are expected to be multicollinear because they include similar income data.
[5] Since both the HIGH SCHOOL and COLLEGE variables were not superfluous (see Appendix A) HS/C was created by dividing the original HIGH SCHOOL variable by the COLLEGE variable to help cure the multicollinearity in the model. The variable represents the percent of people that completed four or more years of high school divided by the percent of people that completed four or more years of college.
[6] The Park Test for heteroskedasticity was also performed (Appendix B), though it is less relevant for time-series data.