

Math Studies IA

Relationship Between Crime Rate and Unemployment

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A. Statement of Task

Studies of crime across the United States show that crime rates rise and fall with unemployment. The aim of this project is to test this by establishing whether or not there was a relationship between crime and unemployment in the United States between 2007 and 2008. In order to investigate this, I will examine the crime and unemployment rates during that period and perform a statistical analysis. I plan to randomly generate 10 states to test over a period of 5 years to provide enough data points. Once I have generated the states and years I will collect the data and organize it into a table. I will calculate the averages and plot these values in a scatter plot. Then I will use Pearson's product-moment correlation coefficient to find the regression line. If this shows strong correlation then I will use the regression equation. If it does not show a strong correlation then I will do a Chi-square test to further test the relationship of variables.

B. Data Collection

I assigned numbers to each of the 50 states then used random.org in order to randomly generate 10 states to use for my study. By doing this I ensure that I have a random sampling of the United States. To do this I entered:

Generate 10 random integers.

Each integer should have a value between 1 and 50.



The site generated these numbers:

39-Maryland, MD
 1-Washington, WA
 5-Nevada, NV
 45- Massachusetts, MA
 4- Hawaii, HI
 29- Wisconsin, WI
 35- West Virginia, WV
 8-Utah, UT
 20- Iowa, IA
 16- Texas, TX

I then chose 5 years over which to conduct my study. I chose 5 years in order to have enough data points, as well as get a good idea of the change in rates over time. I then collected unemployment rate data on each of these states over the 5 years from <http://ycharts.com/indicators/> and data on crime rates from www.disastercenter.com/crime/

raw data: see appendix

1. Unemployment
2. Crime

C. Calculations

Averages:

In order to create a scatter plot of the data, I first needed to find the averages of my data. In order to do this for unemployment rate, I added all the months percentages together and then divided by 12.

For Example:

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
IA	2007	3.60%	3.60%	3.60%	3.70%	3.70%	3.80%	3.80%	3.80%	3.90%	3.90%	3.80%	3.90%

To find the average unemployment rate in Iowa for 2007, I used my calculator to do:

$$\frac{3.60 + 3.60 + 3.60 + 3.70 + 3.70 + 3.80 + 3.80 + 3.80 + 3.90 + 3.90 + 3.80 + 3.90}{12}$$

$$\text{Average} = 3.758$$

I repeated these steps for all 51 rows to find an annual average for each state.
averages: see appendix 3

The Crime Index also needed to be calculated. Crime Index is found by dividing the sum of the violent crime and property crime values by the population of the state, then multiplying by 1000. The crime index represents the number of crimes committed as a percentage out of 100 so that all states may be compared equally regardless of population. Without this consideration, crime would have to be measured just by the sum of violent and property crimes which would mean a state like Texas would have a value in the millions whereas Iowa's value would be much smaller and this would skew interpretation because population would not also be considered.

Example of crime index calculation:

State	Year	Pop		Violent	Property
IA	2007	2,988,046		8,805	78,154

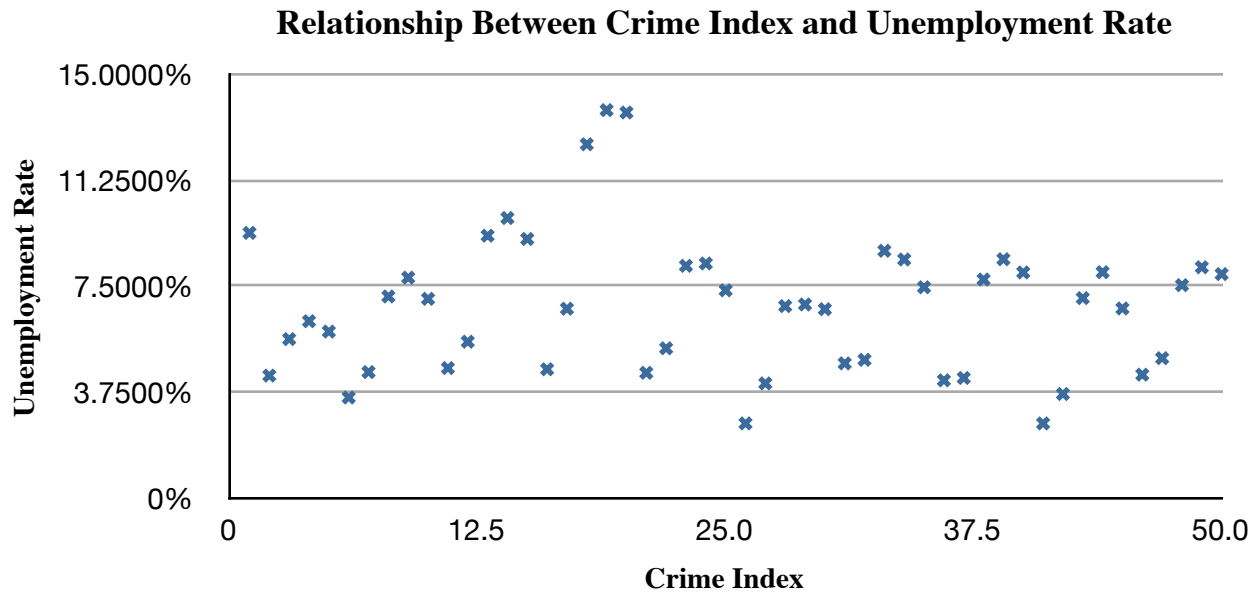
$$\frac{(\text{Violent} + \text{Property})}{\text{Population}} \times 1000 = \text{Crime Index}$$

$$\frac{(8,805 + 78,154)}{2,988,046} \times 1000 = 29.10229628$$

The crime index for Iowa in 2007 is 29.1 (to 3s.f). I repeat this equation for all 51 columns in order to find the crime index for all the states over the 5 years.
see calculated averages below

State	Year	Crime Index	Unemployment Rate
IA	2007	29.1	9.39
	2008	27.4	4.34
	2009	26.1	5.63
	2010	25.2	6.27
	2011	25.9	5.90
MD	2007	40.7	3.57
	2008	41.3	4.47
	2009	37.9	7.14
	2010	35.4	7.81
	2011	33.5	7.06
WA	2007	43.7	4.61
	2008	40.9	5.54
	2009	40.2	9.29
	2010	40.1	9.92
	2011	38.7	9.18
NV	2007	45.3	4.57
	2008	41.6	6.71
	2009	37.7	12.53
	2010	34.4	13.73

State	Year	Crime Index	Unemployment Rate
	2011	31.2	13.65
MA	2007	28.1	4.44
	2008	28.4	5.31
	2009	27.9	8.23
	2010	28.3	8.31
	2011	26.9	7.36
HI	2007	45.0	2.65
	2008	38.4	4.07
	2009	39.4	6.80
	2010	36.1	6.86
	2011	36.3	6.69
WI	2007	30.8	4.78
	2008	30.4	4.90
	2009	28.7	8.76
	2010	27.6	8.45
	2011	26.7	7.47
WV	2007	28.0	4.18
	2008	28.3	4.26
	2009	28.4	7.74
	2010	25.3	8.46
	2011	25.9	7.99
UT	2007	37.3	2.65
	2008	36.1	3.69
	2009	35.1	7.08
	2010	34.0	8.00
	2011	31.7	6.72
TX	2007	46.3	4.38
	2008	45.0	4.96
	2009	45.1	7.54
	2010	42.2	8.18
	2011	38.8	7.93
	Averages	34.456	6.803

Scatter Plot:

After finding the averages, I put the values into a scatter plot with my variables on each axis. No clear patterns can be seen in the scatter plot, so to determine the regression line and correlation, I used Pearson's product-moment correlation coefficient (allowing that x is crime index and y is unemployment rate).

Pearson's Correlation Coefficient:

$$r = \frac{s_{xy}}{s_x s_y}, \text{ where } s_x = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n}}, s_y = \sqrt{\frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n}}$$

and s_{xy} is the covariance

$$s_{xy} = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(x_i - \bar{y})$$

Appendix 3 shows the intermediate calculations in a table necessary for the formulas.

The table shows that $\bar{x} = 34.456$, $\bar{y} = 6.803$

From the table, we can calculate $s_x = 6.456908238$ $s_y = 2.468248164$ $s_{xy} = -2.54965290196$

Therefore,

$$r = \frac{-2.549653}{(6.456908)(2.468248)}$$

simplified, $r = -0.15998073$

When r is between approximately -0.4 and 0, then there is no correlation between the variables. This determines that the unemployment rate and crime index are not linearly related, so I must do a χ^2 to test whether there is any relationship.

Chi-Square Hypothesis Testing:

Null Hypothesis: The unemployment rate and crime index are related variables.
 Alternative Hypothesis: The unemployment rate and crime index are not related variables.

First, the numbers must be grouped based on the mean. I counted how many values are above and below the mean for each variable and put it into this contingency table. Then, I calculated row and column totals:

	Below Average UR	Above Average UR	row total
Below average CI	11	15	26
Above Average CI	13	11	24
column total	24	26	50

I also used this table to determine the degrees of freedom, or number of data values that are free to vary. This number will determine my interpretation of the critical values table and whether I must use a Yates' correction for Chi Square.

$$\text{degrees of freedom} = (\text{number of rows} - 1)(\text{number of columns} - 1)$$

$$\text{df} = (2 - 1)(2 - 1)$$

$$\text{df} = 1$$

Chi-square is found using the formula below:

$$\chi^2_{calc} = \sum \frac{(f_o - f_e)^2}{f_e}$$

However, because my table is 2 by 2 and because there is only 1 degree of freedom, I must use the Yates' correction for continuity. The formula for the Yates' correction is:

$$\chi^2_{calc} = \sum_{i=1}^n \frac{(|O_i - E_i| - 0.5)^2}{E_i}$$

It is convenient to list observed and expected values in the table below:

f_o	f_e	$(f_o - f_e)^2$	$\frac{(f_o - f_e)^2}{f_e}$	$\chi^2_{calc} = \sum_{i=1}^n \frac{(O_i - E_i - 0.5)^2}{E_i}$
11	12.48	2.1904	0.1755128205	0.0769551282
15	13.52	2.1904	0.1620118343	0.0909763314
13	11.52	2.1904	0.1901388889	0.0833680556
11	12.48	2.1904	0.1755128205	0.0769551282

I calculate the sum by adding the four values in righthand column:

$$0.0769551282 + 0.0909763314 + 0.0833680556 + 0.0769551282 = 0.3282546434 \text{ (0.328 to 3s.f.)}$$

This sum is the chi-square calculation that I can then use to compare with the critical value.

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of χ^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81
7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21
11	3.053	4.575	5.578	7.584	10.341	13.70	17.28	19.68	24.72
12	3.571	5.226	6.304	8.438	11.340	14.85	18.55	21.03	26.22
13	4.107	5.892	7.042	9.299	12.340	15.98	19.81	22.36	27.69
14	4.660	6.571	7.790	10.165	13.339	17.12	21.06	23.68	29.14
15	5.229	7.261	8.547	11.037	14.339	18.25	22.31	25.00	30.58
16	5.812	7.962	9.312	11.912	15.338	19.37	23.54	26.30	32.00
17	6.408	8.672	10.085	12.792	16.338	20.49	24.77	27.59	33.41
18	7.015	9.390	10.865	13.675	17.338	21.60	25.99	28.87	34.80
19	7.633	10.117	11.651	14.562	18.338	22.72	27.20	30.14	36.19
20	8.260	10.851	12.443	15.452	19.337	23.83	28.41	31.41	37.57
22	9.542	12.338	14.041	17.240	21.337	26.04	30.81	33.92	40.29
24	10.856	13.848	15.659	19.037	23.337	28.24	33.20	36.42	42.98
26	12.198	15.379	17.292	20.843	25.336	30.43	35.56	38.89	45.64
28	13.565	16.928	18.939	22.657	27.336	32.62	37.92	41.34	48.28
30	14.953	18.493	20.599	24.478	29.336	34.80	40.26	43.77	50.89
40	22.164	26.509	29.051	33.660	39.335	45.62	51.80	55.76	63.69
50	27.707	34.764	37.689	42.942	49.335	56.33	63.17	67.50	76.15
60	37.485	43.188	46.459	52.294	59.335	66.98	74.40	79.08	88.38

I pick the alpha level of 5% ($\alpha=0.05$) and I have already calculated 1 degree of freedom.

Using the Critical values of the χ^2 distribution table in my information booklet, I find that the critical value for 0.05 with 1 degree of freedom is 3.84. I compare my value from the chi-square test. It falls to the left of the critical value, $0.328 < 3.84$, which means I must reject the null hypothesis or accept the alternative hypothesis. Therefore, there is not enough evidence to suggest that unemployment rate and crime index are related variables.

D. Interpretation of Results

In order to investigate the relationship between crime index and unemployment, I performed the Pearson's Correlation Coefficient test and the Chi-Square Analysis with the Yates' Correction for continuity. The tests showed that the two variables are independent of one another. I was surprised with the results of my project because I had always heard there was a connection between my two variables. I assumed that with the increase of unemployment and less money, there would be more crime in society. This would have shown a clear linear trend on my scatter plot and resulted in an r-value between $(-/+)$ 1 and $(-/+)$ 8 during the Pearson's Correlation Coefficient test, however my actual value was nowhere near this. Not only did the chi-square analysis not show dependence, but my calculation was actually very far from the critical value, even if I had used a different alpha level it would not have differed, which shows just how independent the variables were.

This project holds implications for reality, because the independence of the variables may change the way in which officials deal with crime and unemployment. However, my research can only be applied to the United States because this is the only area that the study focuses on. Internationally, I could not say if the unemployment rate is independent of the amount of crime, further study would be necessary to determine this and would have to be representative of many countries in order to be a good analysis.

E. Validity

The site which I got the data for unemployment rate from had estimates pre-rounded which slightly skews the results. Rounding throughout the paper can alter the results of tests, though not in a way significant enough to change my conclusion to reject the null hypothesis. I often rounded to 3 significant figures, but some values were not rounded so this may affect results. The site I got my crime statistics from attempts to show societal statistics, however given that crime is a relative term and some crime may not be reported, measurements of it may be inaccurate which is another limitation of the data collection. I generated my crime index and unemployment rate averages based on the information from these websites and so those may be inaccurate but are consistent throughout this paper because I used the same source for all data on each variable.

In order to maintain randomness in the experiment and avoid any personal bias, I used a random number generator to determine the states I used for the study. This helps to assure that the sample is wide, in other words not all states are from the midwest, the northeast, etc. By having a good spread, I get a better idea for the nation as a whole rather than just one region, and this makes my conclusion more accurate. I chose the years I used based on the limitations of my websites but also because I wanted a fairly recent view so that I could try to make my study applicable to the current time. By finding the information of ten states over five years, I also made sure that I would have plenty of data points to study, which adds to the validity of the project.

F. Appendix

1.

State	Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
IA	2007	3.60%	3.60%	3.60%	3.70%	3.70%	3.80%	3.80%	3.80%	3.90%	3.90%	3.80%	3.90%
	2008	3.90%	3.80%	3.90%	3.90%	4.20%	4.30%	4.50%	4.60%	4.60%	4.70%	4.80%	4.90%
	2009	5.10%	5.20%	5.30%	5.30%	5.50%	5.60%	5.80%	5.90%	5.90%	6.00%	6.00%	6.00%
	2010	6.30%	6.30%	6.30%	6.30%	6.20%	6.20%	6.30%	6.30%	6.30%	6.30%	6.20%	6.20%
	2011	6.10%	6.00%	5.90%	5.90%	6.00%	6.00%	6.00%	6.00%	6.00%	5.90%	5.80%	5.60%
MD	2007	3.60%	3.50%	3.50%	3.50%	3.50%	3.60%	3.60%	3.60%	3.60%	3.60%	3.60%	3.60%
	2008	3.60%	3.60%	3.70%	3.80%	4.00%	4.30%	4.50%	4.70%	4.90%	5.20%	5.50%	5.80%
	2009	6.20%	6.50%	6.80%	7.00%	7.10%	7.30%	7.30%	7.40%	7.40%	7.50%	7.60%	7.60%
	2010	8.00%	8.00%	8.00%	7.90%	7.80%	7.80%	7.80%	7.80%	7.80%	7.70%	7.60%	7.50%
	2011	7.30%	7.20%	7.10%	7.10%	7.10%	7.20%	7.20%	7.20%	7.10%	6.90%	6.70%	6.60%
WA	2007	4.60%	4.50%	4.50%	4.50%	4.50%	4.60%	4.60%	4.70%	4.70%	4.70%	4.70%	4.70%
	2008	4.70%	4.70%	4.80%	4.90%	5.10%	5.30%	5.50%	5.70%	5.90%	6.20%	6.60%	7.10%
	2009	7.70%	8.30%	8.80%	9.20%	9.40%	9.50%	9.60%	9.60%	9.70%	9.80%	9.90%	10.00%
	2010	10.20%	10.20%	10.20%	10.10%	9.90%	9.80%	9.80%	9.80%	9.80%	9.80%	9.70%	9.70%
	2011	9.60%	9.50%	9.40%	9.30%	9.30%	9.30%	9.30%	9.20%	9.00%	8.90%	8.70%	8.60%
NV	2007	4.20%	4.30%	4.30%	4.30%	4.40%	4.50%	4.60%	4.70%	4.80%	4.80%	4.90%	5.00%
	2008	5.00%	5.10%	5.30%	5.50%	5.90%	6.20%	6.70%	7.10%	7.60%	8.10%	8.70%	9.30%
	2009	9.90%	10.40%	10.90%	11.40%	12.00%	12.50%	13.00%	13.50%	13.80%	14.10%	14.30%	14.50%
	2010	13.40%	13.50%	13.50%	13.60%	13.70%	13.70%	13.80%	13.90%	13.90%	14.00%	13.90%	13.90%
	2011	13.80%	13.60%	13.60%	13.60%	13.70%	13.80%	13.80%	13.80%	13.60%	13.40%	13.20%	13.90%
MA	2007	4.60%	4.50%	4.50%	4.50%	4.40%	4.40%	4.40%	4.40%	4.40%	4.40%	4.40%	4.40%
	2008	4.40%	4.50%	4.60%	4.70%	4.90%	5.10%	5.30%	5.50%	5.70%	6.00%	6.30%	6.70%
	2009	7.10%	7.40%	7.70%	7.90%	8.10%	8.30%	8.50%	8.60%	8.70%	8.80%	8.80%	8.80%
	2010	8.70%	8.70%	8.60%	8.50%	8.40%	8.30%	8.20%	8.20%	8.10%	8.10%	8.00%	7.90%
	2011	7.80%	7.70%	7.50%	7.50%	7.40%	7.40%	7.40%	7.40%	7.20%	7.10%	7.00%	6.90%
HI	2007	2.40%	2.40%	2.50%	2.50%	2.50%	2.60%	2.60%	2.70%	2.80%	2.90%	2.90%	3.00%
	2008	3.00%	3.10%	3.20%	3.40%	3.60%	3.80%	4.10%	4.30%	4.60%	4.90%	5.20%	5.60%
	2009	6.00%	6.40%	6.60%	6.80%	6.90%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	6.90%
	2010	7.00%	7.00%	6.90%	6.90%	6.80%	6.80%	6.80%	6.90%	6.90%	6.80%	6.80%	6.70%
	2011	6.70%	6.60%	6.60%	6.60%	6.60%	6.70%	6.80%	6.80%	6.80%	6.80%	6.70%	6.60%
WI	2007	4.80%	4.80%	4.80%	4.80%	4.90%	4.90%	4.90%	4.80%	4.80%	4.70%	4.60%	4.50%
	2008	4.40%	4.30%	4.30%	4.30%	4.40%	4.60%	4.70%	4.90%	5.10%	5.40%	5.90%	6.50%
	2009	7.20%	7.80%	8.40%	8.80%	9.00%	9.20%	9.20%	9.10%	9.10%	9.10%	9.10%	9.10%
	2010	9.20%	9.10%	9.00%	8.80%	8.60%	8.40%	8.30%	8.20%	8.10%	8.00%	7.90%	7.80%
	2011	7.70%	7.60%	7.60%	7.50%	7.60%	7.60%	7.60%	7.60%	7.40%	7.30%	7.10%	7.00%

State	Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
WV	2007	4.20%	4.10%	4.10%	4.10%	4.10%	4.20%	4.20%	4.30%	4.30%	4.20%	4.20%	4.10%
	2008	4.00%	3.90%	3.90%	3.90%	4.00%	4.10%	4.10%	4.20%	4.40%	4.60%	4.80%	5.20%
	2009	5.70%	6.30%	6.80%	7.30%	7.70%	8.10%	8.30%	8.40%	8.50%	8.50%	8.60%	8.70%
	2010	8.50%	8.50%	8.50%	8.40%	8.40%	8.40%	8.40%	8.50%	8.50%	8.50%	8.50%	8.40%
	2011	8.30%	8.10%	8.00%	7.90%	7.90%	8.00%	8.10%	8.10%	8.00%	7.90%	7.80%	7.80%
UT	2007	2.40%	2.40%	2.40%	2.40%	2.50%	2.60%	2.70%	2.80%	2.80%	2.90%	2.90%	3.00%
	2008	3.00%	3.10%	3.20%	3.30%	2.40%	3.50%	3.60%	3.80%	4.00%	4.30%	4.80%	5.30%
	2009	5.80%	6.30%	6.60%	6.90%	7.10%	7.20%	7.30%	7.40%	7.40%	7.50%	7.70%	7.80%
	2010	8.30%	8.20%	8.20%	8.10%	8.10%	8.00%	8.00%	8.00%	7.90%	7.80%	7.80%	7.60%
	2011	7.50%	7.30%	7.10%	7.00%	6.90%	6.90%	6.80%	6.70%	6.50%	6.20%	5.90%	5.80%
TX	2007	4.50%	4.40%	4.30%	4.30%	4.30%	4.30%	4.40%	4.40%	4.40%	4.40%	4.40%	4.40%
	2008	4.40%	4.40%	4.40%	4.50%	4.60%	4.80%	4.90%	5.10%	5.20%	5.40%	5.70%	6.10%
	2009	6.40%	6.70%	7.00%	7.20%	7.50%	7.70%	7.80%	7.90%	8.00%	8.10%	8.10%	8.10%
	2010	8.20%	8.20%	8.20%	8.20%	8.20%	8.10%	8.10%	8.10%	8.20%	8.20%	8.20%	8.20%
	2011	8.10%	8.00%	8.00%	8.00%	8.10%	8.10%	8.10%	8.10%	7.90%	7.80%	7.60%	7.40%

2.

State	Year	Pop	Σ V&P	Violent	Prop	Murder	Rape	Rob	Assault	Burg	L-Theft	Vehicle Theft
IA	2007	3.0E+06	86,959	8,805	78,154	37	904	1,313	6,551	16,941	56,328	4,885
	2008	3.0E+06	81,927	8,651	73,276	77	937	1,249	6,388	16,598	52,302	4,376
	2009	3.0E+06	78,565	8,485	70,080	38	890	1,201	6,356	16,419	49,757	3,904
	2010	3.1E+06	76,931	8,191	68,740	38	883	1,012	6,258	16,746	48,194	3,800
	2011	3.1E+06	79,187	7,826	71,361	46	834	825	6,121	17,400	50,025	3,936
MD	2007	5.6E+06	228,858	36,062	192,796	553	1,179	13,258	21,072	37,095	127,308	28,393
	2008	5.7E+06	233,464	35,385	198,079	493	1,127	13,201	20,564	38,828	133,922	25,329
	2009	5.7E+06	215,920	33,625	182,295	440	1,156	12,007	20,022	36,905	125,771	19,619
	2010	5.8E+06	204,916	31,607	173,309	426	1,228	11,054	18,999	36,704	118,578	18,027
	2011	5.8E+06	195,496	28,797	166,699	398	1,194	10,343	16,862	35,784	114,847	16,068
WA	2007	6.5E+06	282,849	22,120	260,729	173	2,629	6,053	12,691	52,704	170,403	37,622
	2008	6.6E+06	268,624	21,739	247,885	193	2,627	6,397	12,522	52,756	166,384	28,745
	2009	6.7E+06	267,627	22,412	245,215	190	2,583	6,711	12,928	53,047	168,421	23,747
	2010	6.7E+06	270,564	21,138	249,426	154	2,579	5,929	12,476	55,192	168,490	25,744
	2011	6.8E+06	264,267	20,121	244,146	162	2,290	5,638	12,031	56,532	162,779	24,835
NV	2007	2.6E+06	116,173	19,257	96,916	192	1,096	6,932	11,037	24,840	49,745	22,331
	2008	2.6E+06	108,790	18,917	89,873	165	1,104	6,475	11,173	24,208	49,747	15,918
	2009	2.6E+06	99,615	18,639	80,976	156	1,024	6,028	11,431	22,115	46,463	12,398
	2010	2.7E+06	92,933	17,929	75,004	158	965	5,298	11,508	22,286	42,533	10,185
	2011	2.7E+06	85,040	15,309	69,731	141	912	4,299	9,957	20,214	40,032	9,485
MA	2007	6.4E+06	181,058	27,832	154,246	184	1,634	7,006	19,008	35,662	103,592	14,992
	2008	6.5E+06	185,971	29,888	156,083	167	1,744	7,071	20,906	36,260	107,048	12,775

State	Year	Pop	Σ V&P	Violent	Prop	Murder	Rape	Rob	Assault	Burg	L-Theft	Vehicle Theft
	2009	6.6E+06	183,681	30,503	153,178	173	1,734	7,467	21,129	34,515	106,799	11,864
	2010	6.6E+06	185,233	30,737	154,496	214	1,784	6,897	21,842	37,903	105,124	11,469
	2011	6.6E+06	177,009	28,219	148,790	185	1,628	6,768	19,638	36,533	101,471	10,786
HI	2007	1.3E+06	57,729	3,501	54,228	22	326	1,105	2,048	9,097	38,416	6,715
	2008	1.3E+06	49,454	3,510	45,944	26	363	1,085	2,036	9,404	31,424	5,116
	2009	1.3E+06	51,066	3,550	47,516	23	385	1,030	2,112	9,244	33,415	4,857
	2010	1.4E+06	49,270	3,603	45,667	25	377	1,065	2,136	8,706	31,681	5,280
	2011	1.4E+06	49,838	3,949	45,889	17	434	1,042	2,456	10,008	31,697	4,184
WI	2007	5.6E+06	172,354	16,296	158,959	183	1,223	5,474	9,416	27,839	117,687	13,433
	2008	5.6E+06	170,868	15,499	155,369	146	1,128	5,163	9,062	27,455	116,420	11,539
	2009	5.7E+06	162,342	14,650	147,692	146	1,118	4,904	8,482	26,813	111,947	8,932
	2010	5.7E+06	156,948	14,167	142,781	155	1,191	4,516	8,305	26,636	107,993	8,152
	2011	5.7E+06	152,481	13,532	138,949	136	1,163	4,469	7,764	26,654	104,063	8,232
WV	2007	1.8E+06	50,740	4,987	45,753	64	369	852	3,702	10,814	31,447	3,492
	2008	1.8E+06	51,376	5,027	46,349	67	392	899	3,669	10,914	32,241	3,194
	2009	1.8E+06	51,769	5,554	46,215	84	470	914	4,086	12,005	31,453	2,757
	2010	1.9E+06	46,887	5,586	41,301	58	362	776	4,390	10,778	28,104	2,419
	2011	1.9E+06	48,050	5,861	42,189	80	388	910	4,483	11,192	28,743	2,254
UT	2007	2.6E+06	98,704	6,210	92,594	58	908	1,420	3,824	15,541	68,241	8,812
	2008	2.7E+06	98,457	6,130	92,327	40	916	1,422	3,752	14,754	70,308	7,265
	2009	2.8E+06	97,749	5,998	91,751	39	941	1,304	3,714	15,258	69,556	6,937
	2010	2.8E+06	94,241	5,925	88,316	53	983	1,269	3,620	15,095	67,242	5,979
	2011	2.8E+06	89,252	5,494	83,758	54	854	1,081	3,505	13,122	64,453	6,183
TX	2007	2.4E+07	1.1E+06	122,054	985,142	1,420	8,439	38,769	73,426	228,313	662,930	93,899
	2008	2.4E+07	1.1E+06	123,586	969,920	1,370	8,055	37,739	76,422	230,054	654,482	85,384
	2009	2.5E+07	1.1E+06	121,684	995,082	1,330	8,311	38,022	74,021	240,058	678,455	76,569
	2010	2.5E+07	1.1E+06	113,231	951,246	1,249	7,622	32,843	71,517	228,597	654,626	68,023
	2011	2.6E+07	996,372	104,873	891,499	1,126	7,439	28,395	67,913	215,223	612,938	63,338

KEY: Σ V&P- sum of violent and property crime

Prop- property

Rob- robbery

Burg- burglary

L-theft- larceny thef

3.

state	year	crime index	unemployment rate	$(x - \bar{x})$	$(y - \bar{y})$	$(x - \bar{x})^2$	$(y - \bar{y})^2$	$(x - \bar{x})(y - \bar{y})$
IA	2007	29.1	9.39	-5.356	2.587	28.686736	6.692569	-13.855972
	2008	27.4	4.34	-7.056	-2.463	49.787136	6.066369	17.378928
	2009	26.1	5.63	-8.356	-1.173	69.822736	1.375929	9.801588
	2010	25.2	6.27	-9.256	-0.533	85.673536	0.284089	4.933448
	2011	25.9	5.90	-8.556	-0.903	73.205136	0.815409	7.726068
MD	2007	40.7	3.57	6.244	-3.233	38.987536	10.452289	-20.186852
	2008	41.3	4.47	6.844	-2.333	46.840336	5.442889	-15.967052
	2009	37.9	7.14	3.444	0.337	11.861136	0.113569	1.160628
	2010	35.4	7.81	0.944	1.007	0.891136	1.014049	0.950608
	2011	33.5	7.06	-0.956	0.257	0.913936	0.066049	-0.245692
WA	2007	43.7	4.61	9.244	-2.193	85.451536	4.809249	-20.272092
	2008	40.9	5.54	6.444	-1.263	41.525136	1.595169	-8.138772
	2009	40.2	9.29	5.744	2.487	32.993536	6.185169	14.285328
	2010	40.1	9.92	5.644	3.117	31.854736	9.715689	17.592348
	2011	38.7	9.18	4.244	2.377	18.011536	5.650129	10.087988
NV	2007	45.3	4.57	10.844	-2.233	117.59234	4.986289	-24.214652
	2008	41.6	6.71	7.144	-0.093	51.036736	0.008649	-0.664392
	2009	37.7	12.53	3.244	5.727	10.523536	32.798529	18.578388
	2010	34.4	13.73	-0.056	6.927	0.003136	47.983329	-0.387912
	2011	31.2	13.65	-3.256	6.847	10.601536	46.881409	-22.293832
MA	2007	28.1	4.44	-6.356	-2.363	40.398736	5.583769	15.019228
	2008	28.4	5.31	-6.056	-1.493	36.675136	2.229049	9.041608
	2009	27.9	8.23	-6.556	1.427	42.981136	2.036329	-9.355412
	2010	28.3	8.31	-6.156	1.507	37.896336	2.271049	-9.277092
	2011	26.9	7.36	-7.556	0.557	57.093136	0.310249	-4.208692
HI	2007	45.0	2.65	10.544	-4.153	111.175936	17.247409	-43.789232
	2008	38.4	4.07	3.944	-2.733	15.555136	7.469289	-10.778952
	2009	39.4	6.80	4.944	-0.003	24.443136	0.000009	-0.014832
	2010	36.1	6.86	1.644	0.057	2.702736	0.003249	0.093708
	2011	36.3	6.69	1.844	-0.113	3.400336	0.012769	-0.208372
WI	2007	30.8	4.78	-3.656	-2.023	13.366336	4.092529	7.396088
	2008	30.4	4.90	-4.056	-1.903	16.451136	3.621409	7.718568
	2009	28.7	8.76	-5.756	1.957	33.131536	3.829849	-11.264492
	2010	27.6	8.45	-6.856	1.647	47.004736	2.712609	-11.291832
	2011	26.7	7.47	-7.756	0.667	60.155536	0.444889	-5.173252

state	year	crime index	unemployment rate	$(x - \bar{x})$	$(y - \bar{y})$	$(x - \bar{x})^2$	$(y - \bar{y})^2$	$(x - \bar{x})(y - \bar{y})$
WV	2007	28.0	4.18	-6.456	-2.623	41.679936	6.880129	16.934088
	2008	28.3	4.26	-6.156	-2.543	37.896336	6.466849	15.654708
	2009	28.4	7.74	-6.056	0.937	36.675136	0.877969	-5.674472
	2010	25.3	8.46	-9.156	1.657	83.832336	2.745649	-15.171492
	2011	25.9	7.99	-8.556	1.187	73.205136	1.408969	-10.155972
UT	2007	37.3	2.65	2.844	-4.153	8.088336	17.247409	-11.811132
	2008	36.1	3.69	1.644	-3.113	2.702736	9.690769	-5.117772
	2009	35.1	7.08	0.644	0.277	0.414736	0.076729	0.178388
	2010	34.0	8.00	-0.456	1.197	0.207936	1.432809	-0.545832
	2011	31.7	6.72	-2.756	-0.083	7.595536	0.006889	0.228748
TX	2007	46.3	4.38	11.844	-2.423	140.28034	5.870929	-28.698012
	2008	45.0	4.96	10.544	-1.843	111.175936	3.396649	-19.432592
	2009	45.1	7.54	10.644	0.737	113.29474	0.543169	7.844628
	2010	42.2	8.18	7.744	1.377	59.969536	1.896129	10.663488
	2011	38.8	7.93	4.344	1.127	18.870336	1.270129	4.895688
	Averages	34.456	6.803			41.691664	6.092249	-130.0324
						6.4569082	2.4682482	-2.5496549

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