

Criminality and police workforce in the US

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What do we want to analyse?

We often hear that the best way to deal with insecurity is to increase the number of policemen.

- Is a high number of policemen decreasing or not the number of crimes?
- Is a more aggressive police (making more arrests) reducing the number of crimes?

Explanatory variables

- Rate of crimes : number of crimes per 100,000 inhabitants
- Density of policemen : number of policemen per 100,000 inhabitants and 1,000 square kilometers
- Rate of arrests : number of arrests per 100,000 inhabitants
- Efficiency of the police for **violent crimes** and **property crimes** : number of arrests on number of crimes

Composition of the database

Observations

- Number of crimes (total, violence and property)
- Number of law enforcement employees
- Number of arrests (total, violence and property)
- Population
- Superficy
- Death penalty

Sources

- We found lots of data from 1995 to 2011 on the FBI website (www.fbi.gov). Our choice : 2007 and 2010
- Some data missing for Hawaii and Puerto Rico
- Special status of the District of Columbia

First model

Equation eq01

Using the cross-sectional dataset for 49 states , we regressed the rate of crime on the other parameters

$$\widehat{CR_POP} = \beta_0 + \beta_1 * POL_PS + \beta_2 * ARR_POP \quad (1)$$

$$+ \beta_3 * EFF_V + \beta_4 * EFF_P + \beta_5 * DP \quad (2)$$

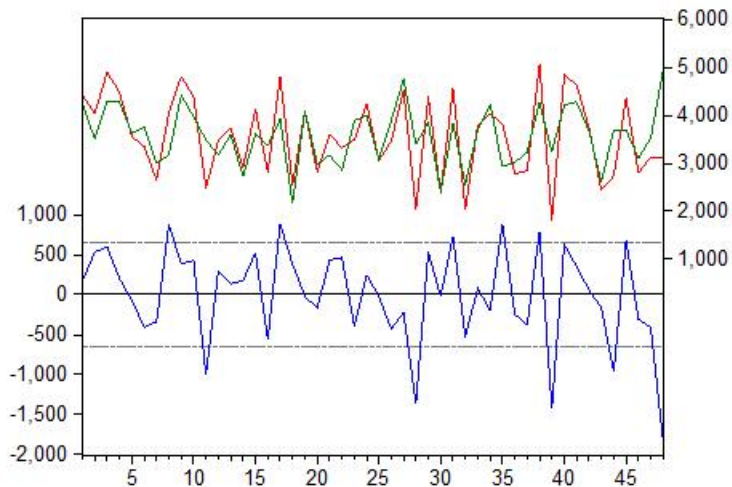
First model

Results

	Coefficient	Std. Error	t-stat	Probability
β_0 : Constant	3 110	357	8.72	0
β_1 : Density of policemen	0.23	5.01	0.05	0.96
β_2 : Arrest rate	0.45	0.1	4.58	0
β_3 : Efficiency (violent crimes)	-0.84	1075	-0.82	0.54
β_4 : Efficiency (property crimes)	-10 638	3615	-2.94	0.01
β_5 : Death penalty factor	578	207	2.79	0.01
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	R-squared	0.51	Mean dependent var	3552
	Adjusted R-squared	0.45	S.D. dependent var	871
	S.E. of regression	643	Akaike info criterion	15.9
	Sum squared resid	17798659	Schwarz criterion	16.1
	Log likelihood	-383	Hannan-Quinn criter.	16
	F-statistic	9	Durbin-Watson stat	2.1
	Prob(F-statistic)	0		

Figure : First regression results

First model



First model

Interpretation

- R^2 has relatively small value : the model is not very accurate
- The model is especially irrelevant for Idaho, New Hampshire, South Dakota, Virginia and Wyoming
- Density of policemen : no significant factor
- Police efficiency regarding violent crimes : no significant factor
- The arrest rate coefficient sign is surprisingly positive (reverse causality)

Conclusion : contradiction with the statement that improving police workforce reduces criminality

Second model

Improvement of the model

Because crimes, police's response, criminals and inhabitants manners are different in rural and metropolitan areas, we decided to use in our new model only states with comparable rates of urbanisation.

We used the density of population, and kept from our dataset all states with a density between 15 hab.km^{-2} and 200 hab.km^{-2} . 32 states remained in our dataset.

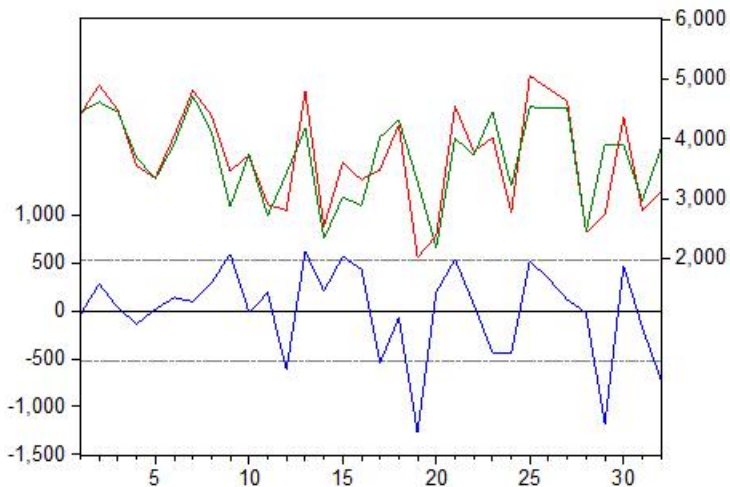
Second model

Results

	Coefficient	Std. Error	t-stat	Probability
β_0 : Constant	2 748	357	7.7	0
β_1 : Density of policemen	4.71	8.2	0.58	0.57
β_2 : Arrest rate	0.54	0.12	4.38	0
β_3 : Efficiency (violent crimes)	-1008	1103	-0.91	0.37
β_4 : Efficiency (property crimes)	-9810	4338	-2.21	0.04
β_5 : Death penalty factor	749	231	3.23	0.03
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R-squared	0.69	Mean dependent var	3703	
Adjusted R-squared	0.64	S.D. dependent var	867	
S.E. of regression	522	Akaike info criterion	15.5	
Sum squared resid	7106533	Schwarz criterion	15.79	
Log likelihood	-242	Hannan-Quinn criter.	15.81	
F-statistic	11.88	Durbin-Watson stat	2.03	
Prob(F-statistic)	0			

Figure : Second regression results

Second model



Second model

Interpretation

- R^2 is not very high but the model seems to generally well fit crime rate to the other parameters
- Virginia and New Hampshire are still far outliers
- Police presence is still not significant
- Positive death penalty factor confirms our belief that violent crimes perpetrators are not afraid of police arrests and the eventual capital punishment following it

Second model

Homoskedasticity

F-statistic	1.17	Prob. F(19,12)	0.4
Obs*R-squared	20.8	Prob. Chi-Square(19)	0.35
Scaled explained SS	18.2	Prob. Chi-Square(19)	0.51

Table : First regression Heteroskedasticity Test (White)

The null hypothesis of homoskedasticity is not rejected at the usual levels of confidence.

Second model

Normality of errors

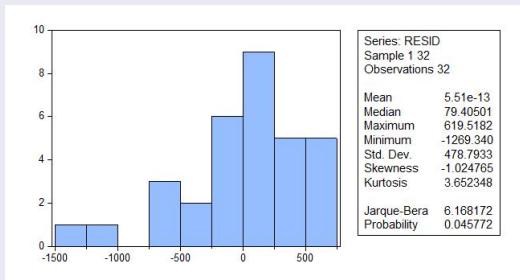


Figure : Residuals histogram

Removing these two states (NH and VA) from the dataset brings normality to the errors.

Coefficient verification

To try to understand why these two states do not fit into the model, we used the same regression equation with the data from one other year (2010).

Coefficient	2007	2010
β_0 : Constant	2747	3039
β_1 : Density of policemen	4.71	13.7
β_2 : Arrest rate	0.54	0.47
β_3 : Efficiency (violent crimes)	-1008	-827
β_4 : Efficiency (property crimes)	-9610	-9784
β_5 : Death penalty factor	749	578
R-squared	0.696	0.71
Adjusted R-squared	0.64	0.65

Table : Coefficient and R-squared values

Coefficient verification

Coefficient	2007	2010
β_0 : Constant	0	0
β_1 : Density of policemen	0.57	0.05
β_2 : Arrest rate	0	0
β_3 : Efficiency (violent crimes)	0.37	0.3
β_4 : Efficiency (property crimes)	0.04	0.01
β_5 : Death penalty factor	0	0.01

Table : Probabilities

- Same biggest errors of the model for the year 2007 and 2010
- Density of policemen surprisingly significant
- The other coefficient values, standard errors and probabilities are in line with the 2007 regression

Conclusion

Final Results

We found out that no "efficient" effect (negative) of police workforce on criminality was emerging from the data we collected. That effect was either not significant (in 2007) or positive, probably because of reverse causality.

If that does not prove that increasing police workforce has no effect or an increasing effect on criminality, it does show that other parameters linked to the police methods have a more direct effect on criminality.

Questions ?

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Some references

<http://www.fbi.gov/about-us/cjis/ucr/ucr>

<http://www.people.hbs.edu/rditella/papers/AERPoliceCrime.pdf>

<http://pricetheory.uchicago.edu/levitt/Academics.html>

<http://bjs.ojp.usdoj.gov/>

http://fr.wikipedia.org/wiki/Fichier:Death_penalty_statutes_in_the_United_States.svg