THE RELATIONSHIP BETWEEN CRIME RATE, UNEMPLOYMENT RATE AND THE SHARE OF TOTAL SCHOOL POPULATION. A MULTIFACTORIAL MODEL

Author
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Abstract. Unemployment is a criminal factor because the person is marked by the deterioration of living standards, its emotional structure becomes unstable, the family is affected and the person can not control their desires and in this context is influenced to commit crimes.
Profession as a criminal factor can influence the commission of offenses related to individual specialization, a special interest in representing crime “white collar” or the school.
ILO (International Labour Office) unemployment rate in effect reflects the proportion of ILO unemployed in the age group in the active population in age group x and long-term unemployment rate is the proportion of ILO unemployed are unemployed for 12 months and over in the labor force. These two rates can be aggregated by gender, by age, level of education, by residence, region of development and these are indicators of efficiency. Data source is the National Institute of Statistics Statistical Yearbook of Romania through and LFS (Labour Force Survey).
Share of total population is the proportion of school pupils and students in the total population.
Crime rate is the number of offenses recorded and dealt with 100,000 inhabitants (stable population using July 1, the reference year).

Keywords: crime rate, unemployment rate, the share of school, multifactor regression model.

1. Short introduction
Offences committed by people trained or the unemployed

Unemployment is a factor because the criminal individual is marked by the deterioration of living standards, its emotional structure becomes unstable, the family is affected and the person can not control their desires and in this context is influenced to commit crimes.

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Crime is high during the economic crisis because people have no where to work, the salary is low; they are being affected socially unprotected and therefore resort to committing crimes.

Profession as a criminal factor can influence the commission of offenses related to individual specialization, a special interest in representing crime “white collar”.

In “White Collar Crime” published in 1949, Sutherland defines the crime as committed by the individual in society and has a high social status, businessmen, politicians, senior management etc.

Analyzed legally, these offenses do not differ greatly from those committed by other criminals, but the way the crime was committed is more refined, they benefit because the social status of an indulgence overall, their reputation is not compromised, their personality is determining the offense.

Crime “white collar” is achieved through regulatory gaps speculation, misinterpretation of the law. Sutherland pointed out that the usual crime statistics present a picture of the criminal population composed of individuals belonging to lower strata of society and economic privileges not enjoyed. This does not mean that crime in the upper social classes do not include respected businessmen, politicians. Sutherland argued that the most common, white-collar crime occurs through misrepresentation of the financial situation of enterprises through stock manipulation and bribery of public figures in order to secure profitable contracts, financial embezzlement, etc.

Criminals with “white collar” commit acts which are defined by Sutherland as a “violation of criminal law by persons with high socio-economic status as part of their occupational class”.

Education does not act directly on reducing crime. In fact, the substance of other factors may increase crime being directed to certain offenses that require the individual to be trained as follows: fraud, tax evasion, corruption, unfair competition, etc. offenses against state security.

Youth groups formed in the band is organized and structured way of survival and adaptation of the marginalized and frustrated against regulatory environment and the value of the privileged. Banda is a negative social organization of young people, by the failure of social institutions, corruption and indifference to the situation of youth unemployment, poverty and many little opportunities for fun and recreation.

A variant of the theory of “delinquent subculture” explaining juvenile delinquency as a result of learned behavior is that of “street-side groups” or “street corner society”, prepared by W.F. White.

By adopting codes of conduct illegal and undesirable means of success, youth groups are transformed into true potential sources of deviance and delinquency by inducing and learning by members of criminal techniques. Danger of these groups is that the street is made up of young people who have serious social deficits,
young people left school and ran away, young unemployed and young people who have had criminal convictions.

Making knowingly false records and knowingly failing to accounting records, resulting in distortion of revenues, expenditures, financial results and assets and liabilities is reflected in the balance is classified as an offense of forgery in accounting law and is classified offenses related to the economic activities of a company.

Other offenses may be committed by people trained are offenses against state security. Legal object is the common generic social relations whose development is determined by the existence and defense of the state, perform the functions and tasks. In this group of offenses are included: betrayal, betrayal by helping the enemy, betraying the secret transmission, hostile actions against the state, attempt threatening state security, attack against a community, subversion of state power, undermining the national economy, propaganda favor of the totalitarian state, action against the constitutional order, conspiracy, compromise of state interests, disclosure of secrets that endanger state security, not denunciation, offenses against the representative of a foreign state etc.

Unfair competition is another offense that can be committed by a person trained. Competition is unfair if the trader's activity is achieved by using illegal methods, contrary to commercial practice. Processes that characterize unfair competition are numerous. They either acts or acts contrary to honest practices law and can be grouped into crimes, misdemeanors and/or civil offenses. Facts that the law deems acts of unfair competition are aimed at creating a confusion which consumers tend to produce the idea that the company, products or services come from competitors or close links exist between the tender or at the expense of obtaining the benefits or advantages in competition economic activity in practices contrary to law or morality. Therefore, comparative advertising involving elements of disloyalty in order to achieve market advantage is unlawful where the comparison is inexact and subjective. Competition where it is considered illegal, the desire to quickly enter or to win a greater market share as a company directly damaging, and often intentionally competitors activity, using illegal practices: denigration (circulation of inaccurate or false information about their activities), competition “parasitic” (obtaining benefits as a result of confusion registered trademarks etc.), unlawful competition, tax fraud (violation of tax law which allows for lower costs and can practice low prices), dumping etc.
2. Definition and Description of Development Indicators Analyzed in Period 1990-2010

**ILO unemployment rate in effect** reflects the proportion of ILO unemployed in the age group in the active population in age group x. It can aggregate by gender, by age, by level of education, by residence, by region of development. It is an indicator of efficiency. Source of information is the National Institute of Statistics in the Statistical Yearbook of Romania and LFS.

**Long-term unemployment rate** is the proportion of ILO unemployed are unemployed for 12 months and over in the labor force. It can aggregate by gender, age group, by level of education, development regions and the average residence. It is an indicator of efficiency. It determines the percentage ratio between the number of ILO unemployed which are unemployed for over 12 months and active population. Data source is the National Institute of Statistics Statistical Yearbook of Romania through and LFS. The data are disseminated quarterly and annually.

**Share of total population** is the proportion of school pupils and students in the total population.

**Crime rate** is the number of offenses recorded and dealt with 100,000 inhabitants (using stable population from July 1, the reference year).

<table>
<thead>
<tr>
<th>Day</th>
<th>Number of people</th>
<th>Population density (inhabitant/square kilometer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 December 1930</td>
<td>135370</td>
<td>85.5</td>
</tr>
<tr>
<td>25 January 1948</td>
<td>167533</td>
<td>105.8</td>
</tr>
<tr>
<td>21 February 1956</td>
<td>196265</td>
<td>124</td>
</tr>
<tr>
<td>15 March 1966</td>
<td>229773</td>
<td>145.2</td>
</tr>
<tr>
<td>5 January 1977</td>
<td>287738</td>
<td>181.8</td>
</tr>
<tr>
<td>7 January 1992</td>
<td>286965</td>
<td>181.3</td>
</tr>
<tr>
<td>18 March 2002</td>
<td>300123</td>
<td>189.6</td>
</tr>
</tbody>
</table>

Data source: Statistics Ilfov County
The average crime for Bucharest in the period 1990-2010 was 1357 persons per 100,000 people. Crime rate has increased by 30 persons per 100,000 annually. The chart presented reveals a particularly strong it. The average unemployment rate for Bucharest in the period 1990-2010 was 3.57% and average gain for the same period was 0.115 percentage points. Share of education in this period shows an increasing trend with 0.046 percentage points annually. The highest rate of crime was in 2002 (1965 persons per 100,000 inhabitants) and lowest in 1990 (706 persons per 100,000 inhabitants). The unemployment rate was registered in 1999 (7.1%) and lowest in 1990 (0%). The largest share of students in the total population was recorded in 2007 (33.47%) and lowest in 1993 (21.88%). These results allow us to conclude that crime rate is directly proportional relationship with the unemployment rate and inversely proportional share of total school population.
Econometric analysis of crime rate model = f(rata_șomaj (unemployment_rate), the share of total school population)

a) Specifying the regression model

The crime rate model = f(unemployment rate, the share of total school population)

To play multiple linear regression model I used data from Bucharest between 1990 and 2010 about the crime rate, unemployment rate and the share of total school population data taken in implementing such EViews.

Table no. 3

<table>
<thead>
<tr>
<th>Year</th>
<th>Crime rate</th>
<th>Unemployment rate</th>
<th>School population</th>
<th>Total population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>706</td>
<td>0</td>
<td>546757</td>
<td>2325037</td>
</tr>
<tr>
<td>1991</td>
<td>780</td>
<td>1,4</td>
<td>530670</td>
<td>2366678</td>
</tr>
<tr>
<td>1992</td>
<td>732</td>
<td>4,8</td>
<td>521514</td>
<td>2354721</td>
</tr>
<tr>
<td>1993</td>
<td>1112</td>
<td>6</td>
<td>512294</td>
<td>2340606</td>
</tr>
<tr>
<td>1994</td>
<td>1126</td>
<td>5,7</td>
<td>510283</td>
<td>2330119</td>
</tr>
<tr>
<td>1995</td>
<td>1377</td>
<td>5,1</td>
<td>561994</td>
<td>2337293</td>
</tr>
<tr>
<td>1996</td>
<td>1343</td>
<td>3,4</td>
<td>509956</td>
<td>2320924</td>
</tr>
<tr>
<td>1997</td>
<td>1696</td>
<td>5,6</td>
<td>502841</td>
<td>2029899</td>
</tr>
<tr>
<td>1998</td>
<td>1941</td>
<td>5</td>
<td>499004</td>
<td>2021065</td>
</tr>
<tr>
<td>1999</td>
<td>1822</td>
<td>7,1</td>
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</tr>
<tr>
<td>2000</td>
<td>1759</td>
<td>5,7</td>
<td>488832</td>
<td>2010050</td>
</tr>
<tr>
<td>2001</td>
<td>1938</td>
<td>4,5</td>
<td>489790</td>
<td>1996612</td>
</tr>
<tr>
<td>2002</td>
<td>1965</td>
<td>3</td>
<td>481992</td>
<td>1936724</td>
</tr>
<tr>
<td>2003</td>
<td>1442</td>
<td>2,5</td>
<td>486210</td>
<td>1932155</td>
</tr>
<tr>
<td>2004</td>
<td>954</td>
<td>2,6</td>
<td>493929</td>
<td>1930335</td>
</tr>
<tr>
<td>2005</td>
<td>922</td>
<td>2,4</td>
<td>523125</td>
<td>1927448</td>
</tr>
<tr>
<td>2006</td>
<td>1398</td>
<td>2,2</td>
<td>567454</td>
<td>1930390</td>
</tr>
<tr>
<td>2007</td>
<td>1413</td>
<td>1,7</td>
<td>649642</td>
<td>1940486</td>
</tr>
<tr>
<td>2008</td>
<td>1450</td>
<td>1,6</td>
<td>642174</td>
<td>1943981</td>
</tr>
<tr>
<td>2009</td>
<td>1329</td>
<td>2,4</td>
<td>537442</td>
<td>1944367</td>
</tr>
<tr>
<td>2010</td>
<td>1307</td>
<td>2,3</td>
<td>475206</td>
<td>1944451</td>
</tr>
</tbody>
</table>

Source: [www.insse.ro](http://www.insse.ro), Statistical Yearbook, INS regional statistics

Specifying an econometric model also requires selection of a mathematical function that can be described by the relationship between variables.
The relationship between crime rate, unemployment rate and the share of total school population. A multifactorial model

Form multiple linear regression model is:

\[
\text{Rata\_inf\ rac\c{t}a\c{t}i\^on\c{t}\v{a}\v{a}ti} = \alpha + \beta_1 \cdot \text{Rata\_somaj} + \beta_2 \cdot \text{Pond\_pop\_scolare} + \varepsilon, \quad t=1,2,\ldots,n, \text{ where } n=21
\]

\[b)\] Estimate the regression model parameters multifactorial

Following parameter estimation in EVViews equation is obtained:

\[
\text{LS}\ 
\text{Rata\_infra\c{t}ionalit\v{a}\v{t}ii}=C(1)+C(2)\cdot\text{Rata\_somaj}+C(3)\cdot\text{Pond\_pop\_scolare}
\]

The results are summarized below:

**Estimation Command:**

=====
\text{LS RATA\_INFRACT}=C(1)+C(2)\cdot\text{RATA\_SOMAJ}+C(3)\cdot\text{POND\_POP\_SCOLARE}

**Estimation Equation:**

=====
\text{RATA\_INFRACT}=C(1)+C(2)\cdot\text{RATA\_SOMAJ}+C(3)\cdot\text{POND\_POP\_SCOLARE}

**Substituted Coefficients:**

=====
\text{RATA\_INFRACT}=599.664378+136.754100\cdot\text{RATA\_SOMAJ}+58.07849829\cdot\text{POND\_POP\_SCOLARE}

From the table output generated by EVViews we can see estimates of the coefficients, their standard errors, the t statistics and corresponding p value.

\[c)\] Testing multifactor regression model parameters

Dependent Variable: RATA\_INFRACT
Method: Least Squares
Date: 02/19/12  Time: 21:18
Sample: 1990 2010
Included observations: 21

\[
\begin{array}{cccc}
\text{RATA\_INFRACT}=C(1)+C(2)\cdot\text{RATA\_SOMAJ}+C(3)\cdot\text{POND\_POP\_SCOLARE} \\
\hline
\text{Coefficient} & \text{Std. Error} & \text{t-Statistic} & \text{Prob.} \\
C(1) & -599.6644 & 739.8550 & -0.810516 & 0.4282 \\
C(2) & 136.7541 & 44.3762 & 3.081694 & 0.0064 \\
C(3) & 58.0785 & 25.7049 & 2.259427 & 0.0365 \\
\hline
\text{R-squared} & 0.366435 & \text{Mean dependent var} & 1357.714 \\
\text{Adjusted R-squared} & 0.296039 & \text{S.D. dependent var} & 398.6205 \\
\text{S.E. of regression} & 334.4520 & \text{Akaike info criterion} & 14.5944 \\
\text{Sum squared resid} & 2013447 & \text{Schwarz criterion} & 14.7436 \\
\text{Log likelihood} & -150.2415 & \text{Durbin-Watson stat} & 0.793691 \\
\end{array}
\]
If the crime rate increased by 1,000 persons per 100,000 population, the unemployment rate will increase by 136.75% and the share of total school population will increase by 58.07%.

3. Student Test

We have the hypotheses:

Null hypothesis, \( H_0 : \alpha = 0 \text{ or } \beta_t = 0, \ t = 1, 2 \)

Alternative hypothesis, \( H_1 : \alpha \neq 0 \text{ or } \beta_t \neq 0, \ t = 1, 2 \)

Thus the unemployment coefficient regression model is \( \hat{\beta}_1 = 136.75 \), standard error \( SE(\hat{\beta}_1) = 44.37 \) and statistics \( \hat{t}_1 = 3.08 \), calculates as \( \hat{t}_1 = \frac{\hat{\beta}_1}{SE(\hat{\beta}_1)} = \frac{Coefficient}{Std.Error} ; \) p-value \((p \text{ value}) = 0.006\), which shows that unemployment is an important factor influencing the crime rate.

Weight ratio of the school population in total population is \( \hat{\beta}_2 = 58.07 \), standard error \( SE(\hat{\beta}_2) = 25.7 \) and statistics \( \hat{t}_2 = 2.25 \). The probability is here 0.036, hence the share of total school population is a significant component of the crime rate regression model estimated.

Coefficient constant term in the regression model is \( \hat{\alpha} = -559.66 \), standard error \( SE(\hat{\alpha}) = 739.85 \), t statistics expressed \( \hat{t}_a = -0.81 \) with probability p value of 0.42. So free time is not significant for regression model chosen.

The report of determination \((R^2)\) shows what percentage is explained by the influence of significant factors. It is calculated as: \( R^2 = \frac{SSR}{SST} = 1 - \frac{\sum \epsilon^2}{SST} \). It is used in assessing model quality. It can take only values in the range \([0,1]\). The values are closer to value 1, the model is better. The value that you take here is 0.3664 and thus we can say that the regression model is not very good. Approximately 36.64% the crime rate is explained by multiple linear regression model chosen.

\[ Rata_{inf} ractionalitatii_t = \hat{\alpha} + \hat{\beta}_1 * rata_{somaj} + \hat{\beta}_2 * pond_{pop_scolare} \]

\[ Rata_{inf} ractionalitatii_t = -599.66 + 136.75 * rata_{somaj} + 58.07 * pond_{pop_scolare}, \]
The relationship between crime rate, unemployment rate and the share of total school population. A multifactorial model

The graphs which explains residue values were also extracted from EViews as follows: first chart shows the values we take residues calculated, taking the interval (-500; 2000) and the second looks and graphics then were calculated residues meaning the rate of crime in the source table chart represented by dashed red line (Actual) and crime rate schedule adjusted amount taken represented by the green line down (Fitted). Continuous blue line and thus chart residue is represented precisely the difference between the other two values above.

4. Hypothesis testing of regression multifactor model

Fisher test is used to test the validity of the model as a whole. It is calculated as the ratio of variation explained by regression and variance unexplained by regression, each of which is in turn divided by their degrees of freedom. Formula
\[ F = \frac{\sum (\hat{y}_i - \bar{y})^2 / k}{\sum (y_i - \hat{y}_i)^2 / (n - k - 1)} \]

looks like this: \( \frac{\sum (\hat{y}_i - \bar{y})^2 / k}{\sum (y_i - \hat{y}_i)^2 / (n - k - 1)} \) with \( k \) = number of variables for the model, here two, and \( T \) = number of observation which is 21.

Analyzing the data in our model shows that we have \( F = 5.20 \) and a probability of 0.016. Therefore we accept that overall multiple linear regression model is better studied.

5. Multicolinearity Testing: Test of Klein

For multiple linear regression model chosen: \( R_{\text{ratia}} = \alpha + \beta_1 * R_{\text{ratialitii}} + \beta_2 * P_{\text{pond pop scolare}} + \varepsilon \), it calculated Pearson correlation coefficients between any two independent variables \( r^2_{x_i,x_j} \) and we have the hypotheses:

\[ H_0 : \exists \quad r^2_{x_i,x_j} > R^2 \] we have phenomenon of multicolinearity;

\[ H_1 : r^2_{x_i,x_j} < R^2 \] the multicolinearity phenomenon does not manifest.

From EViews we have the following results:

<table>
<thead>
<tr>
<th>RATA_INFR ACT</th>
<th>RATA_SOMAJ</th>
<th>POND_POP_SCOLARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RATA_INFR ACT</td>
<td>1.000000</td>
<td>0.432145</td>
</tr>
<tr>
<td>RATA_SOMAJ</td>
<td>0.432145</td>
<td>1.000000</td>
</tr>
<tr>
<td>POND_POP_SCOLARE</td>
<td>0.179347</td>
<td>-0.457311</td>
</tr>
</tbody>
</table>

The value for \( R^2 \) is 0.3664 and we find that is greater than all Pearson coefficients, so the multicolinearity phenomenon is not present in the multiple regression model.

6. Farrar-Glauber Test

It is calculated the correlation matrix of exogenous variables in the multiple regression model.

<table>
<thead>
<tr>
<th></th>
<th>C(1)</th>
<th>C(2)</th>
<th>C(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>547385.5</td>
<td>-20227.08</td>
<td>-18575.18</td>
</tr>
<tr>
<td>C(2)</td>
<td>-20227.08</td>
<td>1969.254</td>
<td>521.6506</td>
</tr>
<tr>
<td>C(3)</td>
<td>-18575.18</td>
<td>521.6506</td>
<td>660.7454</td>
</tr>
</tbody>
</table>
The relationship between crime rate, unemployment rate and the share of total school population. A multifactorial model

\[ H_0 : |\Delta| = 1, \text{ there is not the multicolinearity phenomenon} \]
\[ H_1 : |\Delta| < 1, \text{ there is multicolinearity phenomenon}. \]

Test statistic will be equal with -414.92. It will compare with \[ \chi^2_{\alpha:k} \frac{(k-1)}{2} = 3.84. \]
Because the calculated value is less than the table shows that multicolinearity phenomenon can be neglected.

Checking normality:
To test whether or not errors model follows a normal distribution will Jarque-Bera test used with the following assumptions:

\[ H_0 : \text{errors follow a normal distribution: skewness = 0 and kurtosis = 3} \]
\[ H_1 : \text{errors do not follow a normal distribution.} \]

It is known that if the errors are normal law of zero mean and mean square deviation, then we have the relationship:

\[ P(\xi| \leq t_{\alpha|S}) = 1 - \alpha \]

Checking the assumption of normality of errors will be using Jarque-Berra test\(^1\) which is also an asymptotic test (valid for a large sample), which follows a chi-square distribution with a number of degrees of freedom equal to 2, the following form:

\[ JB = n \left[ \frac{S^2}{6} + \frac{(K-3)^2}{24} \right] \sim \chi^2_{\alpha;3} \]

where \( n = \text{number of observations; } \)
\( S = \text{coefficient of asymmetry (skewness), which measures the symmetry of their distribution around the average error, which is equal to zero as the calculation the following relation:} \)
\[ S = \frac{1}{n} \sum_{i=1}^{n} (y_i - \bar{y})^3 \]

\( K = \text{coefficient of flattening calculated Pearson (kurtosis), which measures arching distribution (how “sharp” or flattened distribution is compared with the normal distribution), with the following equation for calculating:} \)
\[ K = \frac{1}{n} \sum_{i=1}^{n} (y_i - \bar{y})^4 \]

Jarque-Berra test assumes that the normal distribution has a zero asymmetry coefficient, $S = 0$, and a flattening coefficient equal to three, $K = 3$. If the probability $p\text{ (JB)}$ corresponding calculated value of the test is sufficiently low, then the assumption of normality of error is rejected, while otherwise, for a sufficiently high probability of error normality hypothesis is accepted or if $JB > \chi^2_{\alpha/2}$, then the hypothesis of normality of error is rejected.

The JB test is 0.31.

Note that Skewness = 1.00 and kurtosis = 3.18, probability of detection is = 0.85. Therefore we accept the null hypothesis, namely that it follows a normal distribution regression. This is observed with the schedule generated by EViews.

Checking the homoskedasticity

The homoskedasticity refers to the hypothesis that the regression model that states that errors must have the same variance model: $Var(\varepsilon_i) = \sigma^2$ for any $t=1,...,n$. Presence or not homoskedasticity can identify both graphically and using statistical tests. The chart residues certainly can not say no homoskedasticity existence, but also not the heteroskedasticity. Random variable (residual) is the medium void $M(\hat{\varepsilon}) = 0$ and its dispersion $s^2_\hat{\varepsilon}$ is constant and independent by $X$ - homoskedasticity hypothesis on which one can accept that the relationship between $Y$ and $X$ is relatively stable.

Error checking homoskedasticity hypothesis for this model will be using White test.

White-test involves the following steps:
The relationship between crime rate, unemployment rate and the share of total school population. A multifactorial model

- initial model parameter estimation and calculation of estimated residual variable, u;
- construct an auxiliary regression based on suppose of a relationship of dependency between the square error values, exogenous variables included in the initial model and the square of its values:
  \[ \hat{\varepsilon}_i^2 = \alpha_0 + \alpha_1 x_i + \alpha_2 x_i^2 + \omega_i \]
  and calculating the coefficient of determination, R^2, corresponding to the auxiliary regression;
- verification of model parameters newly constructed meaning and one of them is insignificant, then the error heteroskedasticity hypothesis is accepted.

There are two versions of the test strip White:
- Fisher-Snedecor test using classic, based on the assumption invalid parameters, namely:
  \[ H_0: \alpha_0 = \alpha_1 = \alpha_2 = 0 \]
  If the null hypothesis that the estimation results are insignificant \((F_e < F_{\alpha;\nu_1;\nu_2})\) is accepted, then the homoskedasticity hypothesis is verified, the other case signified the presence of errors heteroskedasticity.

- use test LM (Lagrange multiplier), calculated as the number of observations corresponding to the n model and coefficient of determination, R^2, corresponding to the auxiliary regressions. In general, the LM test is asymptotically distributed as \(\chi^2_{\alpha;\nu}\), for the number of degrees of freedom is equal to: \(\nu = k\), where \(k\) = number of exogenous variables respectively:
  \[ LM = n \cdot R^2 \sim \chi^2_{\alpha;\nu} \]
  If \(LM > \chi^2_{\alpha;\nu}\), errors are heteroscedastic, otherwise are homoscedastic, that hypothesis of invalid parameters \(\alpha_0 = \alpha_1 = \alpha_2 = 0\) is accepted.

The most famous test is White’s test to test the following hypotheses:
Null hypothesis: \(H_0: \sigma_i^2 = \sigma^2\) for all \(i = 1, ..., n\)
Alternative hypothesis \(H_1: \sigma_i^2 \neq \sigma^2\) for at least an \(i\) index.

More specifically, the initial regression model was built auxiliary regression:
\[ \varepsilon_i^2 = \alpha_0 + \alpha_1 \text{rata}_\text{soma} + \alpha_2 \text{pond_pop_scolar} + \alpha_3 \text{rata}_\text{soma} + \alpha_4 \text{pond_pop_scolar} + \omega_i \]

The new errors \(\nu_i\) are normally distributed and independent by \(\varepsilon_i\).

In these circumstances you have the null hypothesis \(H_0: \alpha_0 = \alpha_1 = ... = \alpha_5 = 0\) with the alternative \(H_1:\) not all parameters \(\alpha\) are zero. If we accept the null hypothesis, then we accept hypothesis homoskedasticity and if heteroskedasticity accept different parameters to 0.
For this table the output produced by the new regression model t it is applied the test of significance for each factor separately.

**White Heteroskedasticity Test:**

<table>
<thead>
<tr>
<th></th>
<th>F-statistic 1.243625</th>
<th>Probability 0.332222</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>4.980546</td>
<td>Probability 0.289299</td>
</tr>
</tbody>
</table>

**Test Equation:**

Dependent Variable: RESID^2  
Method: Least Squares  
Date: 02/19/12  Time: 18:45  
Sample: 1990 2010  
Included observations: 21

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>641179.2</td>
<td>1864619.</td>
<td>0.343866</td>
<td>0.7354</td>
</tr>
<tr>
<td>RATA_SOMAJ</td>
<td>124245.6</td>
<td>65600.35</td>
<td>1.893978</td>
<td>0.0765</td>
</tr>
<tr>
<td>RATA_SOMAJ^2</td>
<td>-16429.24</td>
<td>8722.528</td>
<td>-1.883542</td>
<td>0.0779</td>
</tr>
<tr>
<td>POND_POP_SCOLA_RE</td>
<td>-44201.14</td>
<td>138055.6</td>
<td>-0.320169</td>
<td>0.7530</td>
</tr>
<tr>
<td>POND_POP_SCOLA_RE^2</td>
<td>607.2805</td>
<td>2503.446</td>
<td>0.242578</td>
<td>0.8114</td>
</tr>
</tbody>
</table>

R-squared 0.237169  Mean dependent var 95878.42  
Adjusted R-squared 0.046461  S.D. dependent var 134267.1  
S.E. of regression 131110.9  Akaike info criterion 26.60973  
Sum squared resid 2.75E+11  Schwarz criterion 26.85843  
Log likelihood -274.4022  F-statistic 1.243625  
Durbin-Watson stat 1.785419  Prob(F-statistic) 0.332222

Thus, the probability for the constant term is 0.73 which exceeds the threshold of 0.05 and is less than 0.8, this is in the area of uncertainty. During this period all coefficients are variables. Also, F test probability is quite high and again located in the area of uncertainty, p = 0.33. Considering the value of p, we can say that we reject the null hypothesis (presence of heteroskedasticity) with an error of 67%, therefore we can accept the null hypothesis (presence of homoskedasticity) with an error of 33%.

7. Analysis of first order autocorrelation

**Durbin – Watson Test (DW):**  \( \text{cov}(\varepsilon_t, \varepsilon_{t-1}) = 0 \)

For regression analysis equation:
The relationship between crime rate, unemployment rate and the share of total school population. A multifactorial model

\[ Rata_{\text{inf}} \propto Rata_{\text{somaj}} + \beta_2 \times Pond_{\text{pop_scolare}} + \varepsilon, \]

I order autocorrelation of the error is expressed by the equation: \( \varepsilon_t = \rho \varepsilon_{t-1} + \nu_t \) for \( t=2,...,n \) where \( \nu_t \sim N(0, \sigma^2) \). DW statistical test used pair of assumptions:

- \( H_0: \rho = 0 \) (null hypothesis); \( H_1: \rho \neq 0 \) (alternative hypothesis).

DW statistic is tabulated, values depending on the specified significance level, the number of observations in the sample and the number of variables influence the regression model. This, for a specified significance level, has two critical values obtained from tables DW, \( d_1 \) and \( d_2 \).

Reject the null hypothesis regions are defined as:
- If \( DW \in (d_2, 4-d_2) \), it is not autocorrelation;
- If \( DW \in (0, d_1) \), we have positive autocorrelation of errors;
- If \( DW \in (4-d_1, 4) \), we have negative autocorrelation of errors;

But if the DW test value is the remaining intervals \((d_1,d_2)\) or \((4-d_2,4-d_1)\), the test is not conclusive.

In the model analyzed, statistics DW= 0.79. For a significance level of 5% of 21 observations and three variables influence the statistics tabulated values are: \( d_1 = 1.13 \) and \( d_2 = 1.54 \). The value obtained in the model belongs to the interval \((0,d_1)\), so errors are auto correlated positive.

8. Auto correlated analysis of higher order: Breuch-Godfrey test

This test will analyze the existence of autocorrelation order \( k \), \( k \neq 1 \). The regression model assumes that errors are given by the equation:

\[ \varepsilon_t = \rho_1 \varepsilon_{t-1} + \rho_2 \varepsilon_{t-2} + \ldots + \rho_k \varepsilon_{t-k} + \nu_t \], for \( t = k,...,n \) and \( \nu_t \sim N(0, \sigma^2) \).

To evaluate the presence of a statistically autocorrelation order \( k \), will use the following statistical hypotheses:

- \( H_0: \rho_1 = \rho_2 = \ldots = \rho_k = 0 \);
- \( H_1: \rho_1 \neq 0 \) or \( \rho_2 \neq 0 \) or \ldots \( \rho_s \neq 0 \)
Breusch-Godfrey Serial Correlation LM Test:

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>5.217452</th>
<th>Probability</th>
<th>0.018011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>8.289532</td>
<td>Probability</td>
<td>0.015847</td>
</tr>
</tbody>
</table>

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/20/12   Time: 18:51
Presample missing value lagged residuals set to zero.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>10.53621</td>
<td>613.3542</td>
<td>0.017178</td>
<td>0.9865</td>
</tr>
<tr>
<td>C(2)</td>
<td>1.058553</td>
<td>36.86366</td>
<td>0.028715</td>
<td>0.9774</td>
</tr>
<tr>
<td>C(3)</td>
<td>-0.397865</td>
<td>21.28591</td>
<td>-0.018691</td>
<td>0.9853</td>
</tr>
<tr>
<td>RESID(-1)</td>
<td>0.747565</td>
<td>0.246118</td>
<td>3.037427</td>
<td>0.0078</td>
</tr>
<tr>
<td>RESID(-2)</td>
<td>-0.238943</td>
<td>0.247522</td>
<td>-0.957260</td>
<td>0.3527</td>
</tr>
</tbody>
</table>

R-squared 0.394740     Mean dependent var -6.90E-14
Adjusted R-squared 0.243425     S.D. dependent var 317.2891
S.E. of regression 275.9823     Akaike info criterion 14.28281
Sum squared resid 1218660.     Schwarz criterion 14.53150
Log likelihood -144.9695     Durbin-Watson stat 2.033096

It is noted that statistical probability F is 0.018 (rather large), so it is present autocorrelation of order 2.

After analyzing the data entered in the multiple regression model to obtain better results on homoskedasticity, error autocorrelation or normality model, several observations can be introduced to capture the links between them.

**Anticipation**
I supposed the unemployment rate for 2011 = 10% and 20% share of school and in 2012, unemployment 20% and 25% share of the school population and the forecast of the crime rate will be:

<table>
<thead>
<tr>
<th>Year</th>
<th>Crime Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>766.3419</td>
</tr>
<tr>
<td>1991</td>
<td>893.9113</td>
</tr>
<tr>
<td>1992</td>
<td>1343.194</td>
</tr>
<tr>
<td>1993</td>
<td>1492.199</td>
</tr>
<tr>
<td>1994</td>
<td>1451.753</td>
</tr>
<tr>
<td>1995</td>
<td>1493.989</td>
</tr>
<tr>
<td>1996</td>
<td>1141.284</td>
</tr>
<tr>
<td>1997</td>
<td>1604.763</td>
</tr>
<tr>
<td>1998</td>
<td>1518.064</td>
</tr>
<tr>
<td>1999</td>
<td>1775.628</td>
</tr>
<tr>
<td>2000</td>
<td>1592.303</td>
</tr>
<tr>
<td>2001</td>
<td>1440.395</td>
</tr>
<tr>
<td>2002</td>
<td>1256.172</td>
</tr>
<tr>
<td>2003</td>
<td>1203.476</td>
</tr>
<tr>
<td>2004</td>
<td>1242.125</td>
</tr>
<tr>
<td>2005</td>
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<td>2006</td>
<td>1408.702</td>
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<td>2007</td>
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<tr>
<td>2008</td>
<td>1537.475</td>
</tr>
<tr>
<td>2009</td>
<td>1333.835</td>
</tr>
<tr>
<td>2010</td>
<td>1134.309</td>
</tr>
<tr>
<td>2011</td>
<td>2099.969</td>
</tr>
<tr>
<td>2012</td>
<td>2527.116</td>
</tr>
</tbody>
</table>

9. Conclusions

The multifactor model reflects the relationship between crime rate, unemployment rate and the share of total school population for the period 1990-2010 Bucharest is properly identified, have positive autocorrelation, so the model should be corrected. The data recorded by the INS on the economy of this county show that the crime rate is directly proportional to the unemployment rate and inversely proportional share of total school population. Analysis should be undertaken over several years, but must take into account the fact that in 2009 global economic crisis began.

Based on statements founder of sociology, E. Durkheim to say that is simply normal to have crime and that “any company that has the power to judge will inevitably use the power to punish”\(^2\), we can say that the prison institution, created in over two centuries ago is an indispensable component of the criminal justice system. However, it is clear that prison work around the world is still subject to extensive training process and to the consecration of other punitive state

remains the main component that manages the execution of criminal punishment, deprivation of liberty.

Relative to prison work and approaches are extreme and contradictory. Thus, some criminologists and sociologists say that depth psychology have developed criminal and Penology, because it believes that virtually every human being can take potentially criminal behavior if circumstances lead him to such deeds, while others consider that the vast majority of adults, if not almost all people, commit over the course of life at least once criminal acts punishable by law.

However, other experts, including Gary Becker, Nobel laureate for economics in 1992, proposed the abolition of all prisons and custodial sentences replace all fine and its amount to cover the real cost of crime, which includes in addition amount of damage to victims and suppression costs resulting from criminal behavior, that financing costs for police, justice, etc. detention centers.

Perhaps to counter the current divergent it is noted internationally in recent years trying to redefine the role of justice in the community, fostering the application of alternative measures to detention and reduced role of the main prison and repressive element transformation to the community custodial institution.

**Bibliography**

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The relationship between crime rate, unemployment rate and the share of total school population. A multifactorial model