Crime Surge and Institutional Weakness: are They Associated? Evidence from a Conflict Country

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Abstract: This paper investigates the degree of association between major four crimes in Sudan, including illegal drug trafficking, murder, theft, and prostitution, with indicators of institutional weakness that include surge in other four crimes: duty & customs, forgery, passport related, and firearms & ammunition crimes. These later four crimes has been considered indicators of institutional weakness because upswing in these crimes is a reflection of corruption or negligence, or incompetence of institutional performance in the country. The canonical correlation test result indicates there is a very high and significant association between the major four crimes and the indicators of institutional weakness. This finding implies institutional weakness can nurture crime surge in the country. Cluster analysis indicates the type of crimes in conflict states of Darfor region are featured in the rest of the country except in the capital state, Khartoum which represent a separate cluster on its own. Cluster analysis also indicate murder crime is connected with prostitution; and theft crime is associated with firearms & ammunition crimes; custom & duty crimes connected with passport -related and illegal drugs crimes. However, illegal drugs crime is connected with murder, theft, and prostitution crimes.

Keywords: Crimes; Multivariate analysis; Sudan.

1. Introduction

Crime rate is considered important indicator of society's well-being and a measure of quality of living or dwelling in specific area in a town or a region. Increase in crime rate in certain area has sever negative impact on welfare of inhabitants in that area and divert scarce resources from support to productive activities to crime combating requirements. Understanding the nature and dynamics of crime requires thorough knowledge of its interdependence across different locations in the country. To do so, we need first to identify the major crimes in all eighteen states in the country, and then cluster or classify crimes based on similarities and commonalities in different states in the country, and finally identify their relationship with major indicators of institutional weakness in the country.

To address these issues we employed multivariate statistical methods including, profile analysis, principal component & factor analysis, and cluster analysis. The remaining parts of this research structured as follows: section two explores international evidences of crimes institutional links, section three includes some basic statistical analysis of crimes in Sudan, section four presents the methodology of the research, section five discusses the empirical findings, the final section concludes the study.

2. Institutional Links

There is increasing concern of association of crime trend with indicators of state weakness and institutional corruption. In this respect World bank indexing of state weakness relate weak states to countries that fail to secure *their populations from violent conflict and crime surge.* On a similar direction Rotberg (2002) indicates weak states fail to provide services that reduce domestic threats to the national order and social structure, as arms and drug trafficking become more rampant. Also indicated that failed states exhibit flawed institutions in which the judiciary lack independence and citizens lose trust and confidence on court system for redress or remedy, especially against the state. The Tenth United Nations Survey of Crime Trends and

Operations of Criminal Justice Systems, revealed that in Mexico high levels of corruption in the police, judiciary have contributed greatly to the crime increase, as drug trafficking, assault and theft make up the vast majority of crimes in that country. Given such evidences in this research our primary goal to investigate institutional links with the major four crimes, theft, murder, illegal drugs, and prostitution in Sudan. Since there is lack of reliable statistics on judiciary and police corruption in this country, we relied on statistical indicators that may reveal institutional weakness. These indicators include passport-related crimes, custom & duty crimes, fire arms &

ammunition crimes, and forging crimes. We stand on strong belief that surge in these four crimes in any country is a reflection of weakness in law enforcement institutions particularly the judiciary and police departments.

3. Data Analysis

Crime data in this research has been collected from the annual report of crime statistics for the year 2016, published by the Interior Ministry of Sudan.

Crime statistics summary in table (1) indicates across all eighteen states of the country Khartoum state is taking the largest share of illegal drugs trafficking, while other states such as Senar, South Kordofan, and Gedarif also rank above the national average level in illegal drug crime rates. Regarding the theft crime, Kharoum and AlGazira records the highest rates in the country. Murder crime is exclusively higher in Khartoum, and conflict states of South Kordofan, West Kordofan and three Darfor states (North, South, West). However, Central Darfor state record the lowest crime rates in all 18 states in the country, and the other remaining eight states in the country are relatively safe as their crime levels recorded below the national average level[1].

Table (2) indicates there is significant upswing of theft and drug trafficking in 2015, as theft crime increased by 11% on national level, and about 14% in Khartoum state alone, whereas drug trafficking increased by about 7% on national level, and by 27% in Khartoum state during the same year. Similar conclusion can be deduced from figure (1) too.

Table-1. Crime distribution map

Name of state	Drugs	Theft	Murder	Adultery
National average	418	5520	101	184
Khartoum	✓✦	✓✦	✓	✓✦
Northern			●	
Nile River				
White Nile				✓
Blue Nile				
AlGazira		✓		✓
Senar	✓			
North Kordofan				
West Kordofan			✓	
South Kordofan	✓		✓	✓
North Darfor			✓	
South Darfor			✓✦	
West Darfor			✓	
Central Darfor	●	●		●
East Darfor			✓	
Red Sea				
Gadarif	✓			
Kassala				

(✓)=above national average level; (✦)=highest level; (●)=lowest level

Table-2. Crime statistics

Type of crime	2013	2014	2015	% change (2014-2015)
Murder - national level - Khartoum state	1429 273	2036 247	1817 249	-10.6 0.8
Theft - national level - Khartoum state	71768 32691	89502 44747	99361 50995	11 13.9
Adultery - national level - Khartoum state	3829 1467	3207 1172	3322 1164	3.5 -0.6
Illegal drugs -national level - Khartoum state	7490 3006	6946 2264	7419 2879	6.8 27.1

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[1] Some government officials in Central Darfour state believe that the low crime rate statistics reported in this state is due to reluctance of citizens to report crimes since a majority of them are internally displaced refugees who lacks confidence and trust in the local police and security.

4. Methodology
4.1. Principal Component Analysis

Principal component analysis deals with a single sample of n observation vectors $y_1, y_2, \ldots \ldots y_p$ that form a group of points in a multi-dimensional space. Principal component analysis can be applied to any distribution of y, but it can be easier to visualize geometrically if the group of points is ellipsoidal. If the variables $y_1, y_2, \ldots \ldots y_p$ are correlated the cluster of points is not oriented parallel to any of the axes represented by $y_1, y_2, \ldots \ldots y_p$.

Principal component analysis explores the natural axes of the swarm of points with origin at the mean vector of ys. This is done by translating the origin to the mean vector of ys and then rotating the axes. The axes can be rotated by multiplying each y by an orthogonal matrix A:

$Z_i = Ay_i$ such that A is orthogonal A'A=I and the distance to the origin is unchanged:
$$Z'_i Z_i = (Ay_i)'(Ay_i) = y'_i A' A y_i = y'_i y_i$$

Thus, an orthogonal matrix transforms yi to a point zi that is the same distance from the origin, and the axes are effectively rotated.

Finding the axes of the ellipsoid is equivalent to finding the orthogonal matrix A that rotates the axes to line up to the natural extensions of the swarm of points so that the new variables (principal components) z1, z2,……zp in Z=Ay are uncorrelated.

4.2. Canonical Correlation

Canonical correlation investigates linear association between two sets of variables:

$y' = (y_1, y_2, \ldots \ldots, y_p) and\ x' = (x_1, x_2, \ldots \ldots, x_q)$. For simplification purposes we denote each of these two sets as y and x. It is important to realize that canonical correlation is an extension of multiple correlation, which is the correlation between one y and several x's. The canonical correlation, however, is the correlation between multiple dependent variables (y matrix) and multiple independent variables (x matrix). Canonical correlation analysis is often a useful complement to a multivariate regression analysis.

In the case of several y's and several x's the covariance structure associated with two sub-vectors y and x can be partitioned as:
$$S = \begin{pmatrix} S_{yy} & S_{yx} \\ s_{xy} & s_{xx} \end{pmatrix}$$

Where s_{yy} is the pxp sample covariance matrix of the y's, s_{yx} is the pxq matrix of the sample covariances between the y's and the x's, and s_{xx} is the qxq sample covariance matrix of the x's.

The best overall measure of association is the largest squared canonical correlation (maximum eigenvalue) $r_1^2 of\ s_{yy}^{-1} s_{yx} s_{xx}^{-1} s_{xy}$.

The canonical correlations can also be obtained from the partitioned correlation matrix of the y's and x's,
$$R = \begin{pmatrix} R_{yy} & R_{yx} \\ R_{xy} & R_{xx} \end{pmatrix}$$

Where R_{yy} is the pxp sample correlation matrix of the y's, R_{yx} is the pxq matrix of sample correlations between the y's and the x's, and R_{xx} is the qxq sample correlation matrix of the x's.

4.2.1. Tests of Significance

Under H_0 (the null-hypothesis) there is no (linear) relationship between the y's and the x's, and H_0 is equivalent to the statement that all canonical correlations $r_1 r_2 \ldots \ldots r_s$ are non-significant. The significance of $r_1 r_2 \ldots \ldots r_s$ can be tested by Wilk's test:
$$\Lambda_1 = \frac{|S|}{|S_{yy}||S_{xx}|} = \frac{|R|}{|R_{yy}||R_{xx}|}$$

Which is distributed as $\Lambda_{p,q,n-1-q}$. We reject H $_0$ if $\Lambda_1 \leq \Lambda_\alpha$. Critical values Λ_α are available in table A.9 in Rencher (2002).

$v_H = q\ and\ V_E = n - 1 - q$>. Also Λ_1 is expressible in terms of the squared canonical correlations:
$$\Lambda_1 = \prod_{i=1}^{s} (1 - r_i^2)$$

If the parameters exceed the range of critical values for Wilks' critical values, we can use the Chi-square approximation as:
$$X^2 = -\left[n - \frac{1}{2}(p + q + 3)\right] ln\ \Lambda_1$$

Which approximately distributed as Chi-square with pq degrees of freedom. We reject H $_0$ if $X^2 \geq X_\alpha^2$

4.3. Cluster Analysis

Cluster analysis deals with identification of the observation vectors that are similar and group them into clusters. As a result, to capture similarities between groups cluster analysis use the distance between each pair of observations in the data. Since a distance increases as two units become further apart, distance is used as a measure of dissimilarity between groups. A common distance function is the Euclidean distance between two vectors:

$x = (x_1, x_2, \ldots x_p)'$ and $y = (y_1, y_2, \ldots y_p)'$
defined as:

$$d(x,y) = \sqrt{(x-y)'(x-y)} = \sqrt{\sum_{j=1}^{p}(x_j - y_j)^2}$$

To adjust for change in variances and covariances among variables we can use the standardized distance measure:

$$d(x,y) = \sqrt{(x-y)'S^{-1}(x-y)}$$

Where S is the sample covariance matrix.

The most common cluster technique, is hierarchical method that include single linkage (nearest neighbor) and other clustering algorithms (see Rencher (2002), for details). Hierarchical clustering algorithm involve a sequential process, that merge a cluster into another cluster in each step sequentially. As a result, in the hierarchical algorithm the number of clusters decreases until we end up with one single cluster.

4.4. Profile Analysis

Profile analysis is useful when y is $N_p(\mu, \Sigma)$ and the variables in y are measured in the same units with approximately equal variances, and the objective is to compare the means $\mu_1, \mu_2 \ldots \mu_p$. The pattern connecting several means is called a profile, and some times the primary purpose can be to compare between several sample means.

In the single sample case to compare the means $\mu_1, \mu_2 \ldots \mu_p$, the basic hypothesis is that the profile is level or flat:

$H_0: \mu_1 = \mu_2 = \cdots = \mu_p$ $vs. H_1: \mu_j \neq \mu_k$ $for\ some\ j \neq k$

For a multivariate approach that allow for correlation between variables, we first express the null-hypothesis as p-1 comparisons,

$$H_0 = \begin{pmatrix} \mu_1 - \mu_2 \\ \mu_2 - \mu_3 \\ . \\ . \\ \mu_{p-1} - \mu_p \end{pmatrix} = \begin{pmatrix} 0 \\ . \\ . \\ 0 \end{pmatrix}$$

Which can be expressed as $H_0: C\ \mu = 0$ where

$$C = \begin{pmatrix} 1 & -1 & 0.. & 0 \\ 0 & 1 & -1.. & 0 \\ . & . & . & . \\ 0 & 0 & 0.. & -1 \end{pmatrix}$$

When $H_0: C\mu = 0$ is true, $C\bar{y}$ is $N_{p-1}(0, c\Sigma c'/n)$ and

$$T^2 = (C\bar{y})'\left(\frac{CSC'}{n}\right)^{-1}(C\bar{y}) = (C\bar{y})'(CSC')^{-1}(C\bar{y})$$

Is distributed as $T^2_{p-1,n-1}$. We reject $H_0: C\mu = 0$ if $T^2 \geq T^2_{\alpha,p-1,n-1}$. The dimension p-1 correspond to the number of rows of C.

In the case of two-sample profile analysis instead of the hypothesis that $\mu_1 = \mu_2$, we test the hypothesis $H_{01}: \mu_{1,j} - \mu_{1,j-1} = \mu_{2,j} - \mu_{2,j-1}$ for j=2, 3,…..p, or

$$H_{01} = \begin{pmatrix} \mu_{12} - \mu_{11} \\ \mu_{13} - \mu_{12} \\ . \\ . \\ \mu_{1p} - \mu_{1,p-1} \end{pmatrix} = \begin{pmatrix} \mu_{22} - \mu_{21} \\ \mu_{23} - \mu_{22} \\ . \\ . \\ \mu_{2p} - \mu_{2,p-1} \end{pmatrix}$$

Which can be written as $H_{01}: C\mu_1 = C\mu_2$ using the contrast matrix

$$C = \begin{pmatrix} -1 & 1 & 0.. & 0 \\ 0 & -1 & 1.. & 0 \\ . & . & . & . \\ 0 & 0 & 0.. & 1 \end{pmatrix}$$

From the two sample, $y_{11}, y_{12}, \ldots y_{1n1}$ and $y_{21}, y_{22}, \ldots y_{2n2}$ we obtain $\bar{y}_1, \bar{y}_2$ and S_{pl} as estimates of $\mu_1, \mu_2, and\ \Sigma$. Then the null-hypothesis test:

$H_{01}: C\mu_1 - C\mu_2 = 0,$ the random vector $C\bar{y}_1 - C\bar{y}_2$ is $N_{p-1}(0, \frac{c\Sigma c'}{n_1+n_2})$ and

$T^2 = \frac{n_1 n_2}{n_1+n_2}(\bar{y}_1 - \bar{y}_2)'C'(CS_{pl}C')^{-1}C(\bar{y}_1 - \bar{y}_2)$ is distributed as T^2_{p-1,n_1+n_2-2}. Note that the dimension p-1 is the number of rows of C.

5. Empirical Findings

To select the most important variables from the crime data we employed the principal component analysis to classify the data into major components, and then in the second stage we select the most important variable from each component. Results of the eigen values and corresponding eigen vectors of correlation matrix in table (3) indicate the cumulative percentage of eigen values suggest the largest four eigen values explain about 98.9% of total variability of the crime data. As a result, our selection process of the number of components conclude four major components form the data set. Given variables selection process is based on the largest (absolute value) coefficient values from each component (eigen vector) the variables of illegal drugs, theft, murder, and forger are the variables to be included in the analysis. The canonical correlation analysis attempt to assess the degree of association between the major four crimes, illegal drugs, murder, theft, and adultery, with institutional weakness indicators which include increase in other four crimes: duty & customs, forger, passport, and firearms & ammunition crimes. These four crimes has been taken as indicators of institutional weakness because any surge in these crimes is a reflection of corruption or negligence, or incompetence (or the three together) in institutional performance. The canonical correlation results indicate there is a very high association between the two set of the data, which is about 0.78 and highly significant according to Wilks' test result. This finding imply institutional weakness can nurture crime surge in the country. Profile analysis reveal there is a significant increase in crime rate between the years 2014-2015, as indicated by the T^2 statistic test result. Cluster analysis in table (4), indicate the type of crimes in Darfor region are featured in the rest of the country except in the capital state, Khartoum which represent a separate cluster on its own. Cluster analysis summary in figure (1) indicate murder crime is connected with adultery; and theft crime is associated with fire arms & ammunition crimes. Custom & duty crimes connected with passport and illegal drugs crimes. However, illegal drugs crime is associated with a number of crimes including murder, theft, and adultery.

Table-3. Principal components

Eigen values	7.06	1.14	0.63	0.067	0.055
Cumulative % of eigen values	0.78	0.91	0.98	0.98	0.99
Eigen vectors	v1	v2	v3	v4	v5
	-0.35	-0.07	0.15	0.83	-0.11
	-0.37	-0.02	-0.01	-0.11	0.18
	-0.19	0.52	-0.81	0.06	-0.07
	-0.37	-0.04	-0.01	-0.06	-0.05
	-0.05	-0.83	-0.54	0.03	-0.02
	-0.37	-0.01	0.01	-0.06	0.33
	-0.36	-0.08	0.09	-0.50	-0.01
	-0.37	-0.07	0.01	0.04	0.46
	-0.36	-0.06	0.08	-0.14	-0.78

Table-4. Cluster Groups

| Clusters	Groups
C1	East Darfor, West Darfor
C2	Blue Nile, East Darfor, West Darfor
C3	Kassala, North Darfor
C4	River Nile, Kassala, North Darfor
C5	Red Sea, Gadarif
C6	South Kordofan, Blue Nile, Eas Darfor, West Darfor
C7	North Kordofan, Red Sea Gadarif
C8	West Kordofan, North Kordofan, Red Sea, Gadarif
C9	Northern, South Kordofan, Blue Nile, East Darfor, West Darfor
C10	River Nile, Kassala, Red Sea, Northern, South Kordofan, Blue Nile, East Darfor, West Darfor
C11	Senar, River Nile, Kassala, Red Sea, Northern, South Kordofan, Blue Nile, East Darfor, West Darfor
C12	White Nile, West Kordofan, North Kordofan, Red Sea, Gadarif
C13	Gazira, South Darfor
C14	White Nile, West Kordofan, North Kordofan, Red Sea, Gadarif, C11
C15	Central Darfor, C14
C16	Khartoum

5.1. Profile Analysis

T-Square test for the null hypothesis of equal means:

T2

 -61.03939   1059.545   -14.63202   -7.915809

Plot-1. Profile analysis: two sample means
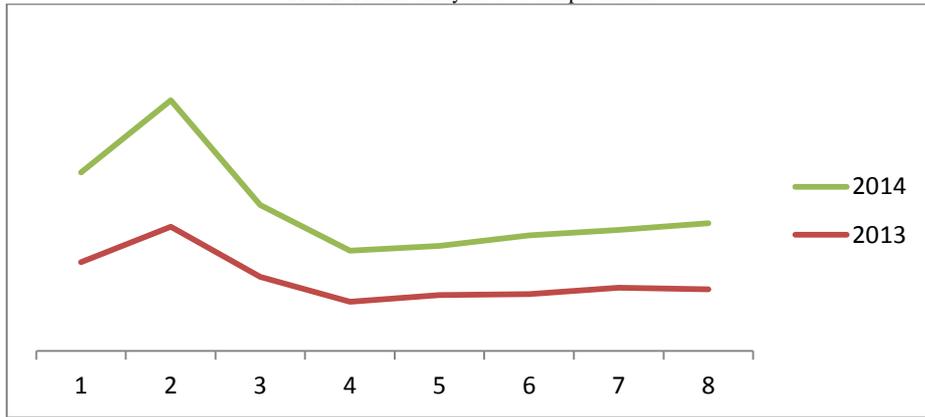
Figure-1. Dendrogram applied to cluster analysis findings
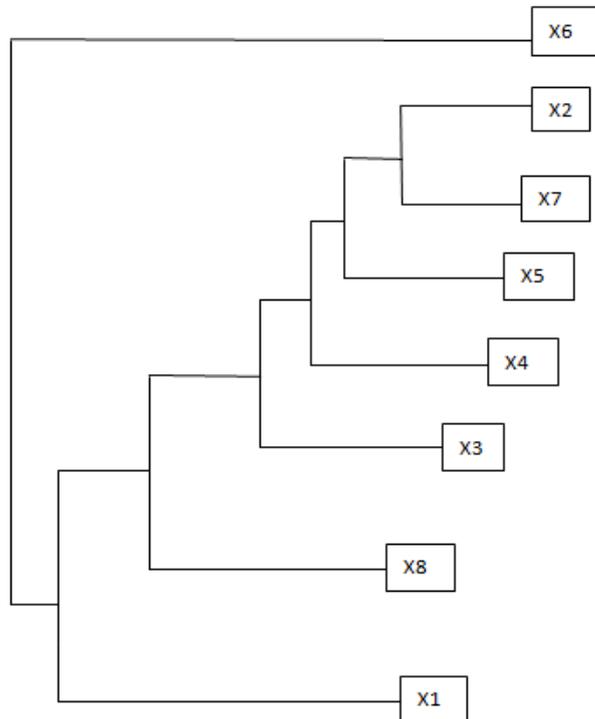
Core crimes:

X1= illegal drugs
X2= theft and robbery
X3=murder
X4= adultery

Institutional weakness indicators:
X5= forger crimes
X6= duty and custom crimes
X7= fire arms and ammunition crimes
X8= passport crimes

6. Concluding Remarks

To capture the pattern and trend of crime in the country the current research uses a number of multivariate statistical methods, including cluster analysis, principal component analysis, profile analysis, and canonical correlation analysis. The data employed in the research include crime data for all 18 states in the country during the years 2014 - 2013. The variables under investigation include four major crimes, and other four crimes intended to reflect institutional weakness. The first group include the crimes of murder, illegal drugs, adultery, and theft, while the second group include passport, tariffs & custom, weapons & ammunition, and medical drugs & pharmaceutical

crimes. Our findings indicate profile analysis reveal the upswing in the major crime rates during 2014 – 2015 is statistically significant, and the canonical correlation analysis show there is strong significant association between the major four crimes and the institutional weakness indicators. Cluster analysis indicate the type of crimes in Darfor region are featured in the rest of the country except in the capital state, Khartoum which represent a separate cluster. Cluster analysis also indicate murder crime is connected with adultery; and theft crime is associated with firearms & ammunition crimes. Custom & duty crimes connected with passport and illegal drugs crimes. However, illegal drugs crime is associated with a number of crimes including murder, theft, and adultery.

References

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Appendix A

Principal components:
EIGENVALUES
  7.0606   1.1402   0.63243   0.67473E-01 0.55147E-01 0.34194E-01
  0.50164E-02 0.34215E-02 0.15001E-02

 SUM OF EIGENVALUES = 9.0000

 CUMULATIVE PERCENTAGE OF EIGENVALUES
 0.78452   0.91120   0.98147   0.98897   0.99510   0.99890
 0.99945   0.99983   1.0000

EIGENVECTORS

 VECTOR 1
  -0.36221   -0.37514   -0.19291   -0.37496   0.05284   -0.37403
  -0.36670   -0.37203   -0.36701

 VECTOR 2
  -0.07363   -0.02513   0.52903   -0.04776   -0.83283   -0.01983
  -0.08752   -0.07547   -0.06665

 VECTOR 3
   0.15639   -0.00623   -0.81222   0.00523   -0.54712   0.01433
   0.09795   0.00088   0.08148

 VECTOR 4
   0.83537   -0.11266   0.06161   -0.06787   0.03478   -0.06008
  -0.50377   0.04089   -0.14419

 VECTOR 5
  -0.11033   0.18243   -0.07739   -0.05440   -0.02795   0.33372
  -0.00466   0.46092   -0.78802

 VECTOR 6
  -0.35253   -0.01334   -0.09895   0.22463   -0.02531   0.30156
  -0.73470   0.27134   0.33214

 VECTOR 7
  -0.04059   0.62864   -0.01081   -0.57098   -0.00958   -0.37476
  -0.12257   0.28493   0.20071

 VECTOR 8
  -0.04154   -0.39617   0.02674   0.25915   -0.03816   -0.59416
   0.10347   0.63874   0.01631

 VECTOR 9
  -0.03560   0.51020   -0.05293   0.63710   -0.00967   -0.40014
  -0.17015   -0.28103   -0.24817

FACTOR MATRIX (9 FACTORS)

VARIABLE X1
-0.96246   -0.78625E-01 0.12437   0.21699   -0.25910E-01 -0.65188E-01
-0.28749E-02 -0.24299E-02 -0.13788E-02

VARIABLE X2
-0.99682   -0.26839E-01 -0.49534E-02 -0.29263E-01 0.42841E-01 -0.24666E-02
0.44525E-01 -0.23174E-01 0.19761E-01

VARIABLE X3
-0.51259   0.56490   -0.64592   0.16005E-01 -0.18174E-01 -0.18297E-01
-0.76550E-03 0.15639E-02 -0.20499E-02

VARIABLE X4
-0.99635   -0.51000E-01 0.41585E-02 -0.17629E-01 -0.12776E-01 0.41537E-01
-0.40440E-01 0.15159E-01 0.24676E-01

VARIABLE X5
0.14040   -0.88929   -0.43510   0.90338E-02 -0.65643E-02 -0.46797E-02
-0.67868E-03 -0.22322E-02 -0.37459E-03

VARIABLE X6
-0.99387   -0.21176E-01 0.11395E-01 -0.15607E-01 0.78369E-01 0.55763E-01
-0.26543E-01 -0.34755E-01 -0.15498E-01

VARIABLE X7
-0.97440   -0.93454E-01 0.77893E-01 -0.13086   -0.10946E-02 -0.13586
-0.86815E-02 0.60522E-02 -0.65902E-02

VARIABLE X8
-0.98855   -0.80587E-01 0.69866E-03 0.10621E-01 0.10824   0.50175E-01
0.20181E-01 0.37363E-01 -0.10885E-01

VARIABLE X9
-0.97520   -0.71166E-01 0.64794E-01 -0.37454E-01 -0.18505   0.61418E-01
0.14216E-01 0.95382E-03 -0.96120E-02

Appendix B:

Correlation matrix & Canonical Correlation

		x1	x2	x3	x4	x5	x6	x7	x8
Drugs	x1	1	0.95	0.37	0.94	0.95	-0.11	0.95	-0.95
theft	x2	0.95	1	0.49	0.96	0.99	-0.11	0.99	0.99
Murder	x3	0.37	0.49	1	0.42	0.47	-0.29	0.48	0.45
adultery	x4	0.94	0.96	0.42	1	0.98	-0.1	0.96	0.95
forger	x5	0.95	0.99	0.47	0.98	1	-0.09	0.99	0.98
duty, customs	x6	-0.11	-0.11	-0.29	-0.1	-0.09	1	-0.12	-0.68
fire arms	x7	0.95	0.99	0.48	0.96	0.99	-0.12	1	0.99
passport	x8	-0.95	0.99	0.45	0.95	0.98	-0.68	0.99	1

Canonical correlation (C) , Wilk stat (W), eigen values (R1) of the correlation matrix:
C
0.7798594
W
0.2983558E-01
CHI
43.90067
R1
287.0838   0.3658778E-02 -0.1059698E-01 -75.48104

Appendix C:

Crime clusters

Correlation Matrix		x1	x2	x3	x4	x5	x6	x7	x8
drugs	x1	1	0.95	0.37	0.94	0.95	-0.11	0.95	-0.95
theft	x2	0.95	1	0.49	0.96	0.99	-0.11	0.99	0.99
murder	x3	0.37	0.49	1	0.42	0.47	-0.29	0.48	0.45
adultery	x4	0.94	0.96	0.42	1	0.98	-0.1	0.96	0.95
forger	x5	0.95	0.99	0.47	0.98	1	-0.09	0.99	0.98
duty, customs	x6	-0.11	-0.11	-0.29	-0.1	-0.09	1	-0.12	-0.68
firearms	x7	0.95	0.99	0.48	0.96	0.99	-0.12	1	0.99
passport	x8	-0.95	0.99	0.45	0.95	0.98	-0.68	0.99	1
		x1	x2	x3	x4	x5	x6	x7	x8
	x1	0.00	1.95	1.93	1.90	1.94	2.72	1.95	2.82
	x2	1.95	0.00	1.42	0.10	0.04	3.24	0.02	1.98
	x3	1.93	1.42	0.00	1.41	1.43	2.48	2.48	1.88
	x4	1.90	0.10	1.41	0.00	0.08	3.18	0.10	1.98
	x5	1.94	0.04	1.43	0.08	0.00	3.23	0.04	1.99
	x6	2.72	3.24	2.48	3.18	3.23	0.00	3.24	3.40
	x7	1.95	0.02	2.48	0.10	0.04	3.24	0.00	1.98
	x8	2.82	1.98	1.88	1.98	1.99	3.40	1.98	0.00
C1=x2,x7									
		x1	C1	x3	x4	x5	x6	x8	
	x1	0.00	1.95	1.93	1.90	1.94	2.72	2.82	
	C1	1.95	0.00	1.42	0.10	0.04	3.24	1.98	
	x3	1.93	1.42	0.00	1.41	1.43	2.48	1.88	
	x4	1.90	0.10	1.41	0.00	0.08	3.18	1.98	
	x5	1.94	0.04	1.43	0.08	0.00	3.23	1.99	
	x6	2.72	3.24	2.48	3.18	3.23	0.00	3.40	
	x8	2.82	1.98	1.88	1.98	1.99	3.40	0.00	
C2=C1,x5									
		x1	x3	x4	C2	x6	x8		
	x1	0.00	1.93	1.90	1.94	2.72	2.82		
	x3	1.93	0.00	1.41	1.42	2.48	1.88		
	x4	1.90	1.41	0.00	0.08	3.18	1.98		
	C2	1.94	1.42	0.08	0.00	3.23	1.98		
	x6	2.72	2.48	3.18	3.23	0.00	3.40		
	x8	2.82	1.88	1.98	1.98	3.40	0.00		
C3=C2,x4									
		x1	x3	C3	x6	x8			
	x1	0.00	1.93	1.90	2.72	2.82			
	x3	1.93	0.00	1.41	2.48	1.88			
	C3	1.90	1.41	0.00	3.18	1.98			
	x6	2.72	2.48	3.18	0.00	3.40			
	x8	2.82	1.88	1.98	3.40	0.00			
C4= x3, C3									
		x1	C4	x6	x8				
	x1	0.00	1.90	2.72	2.82				
	C4	1.90	0.00	2.48	1.88				
	x6	2.72	2.48	0.00	3.40				
	x8	2.82	1.88	3.40	0.00				
C5=x8,C4									
		x1	C5	x6					
	x1	0.00	1.90	2.72					
	C5	1.90	0.00	2.48					
	x6	2.72	2.48	0.00					
C6=x1,C5									
		x1		x6					
	C6	0.00		2.48					
	x6	2.48		0.00					
C7=x6,C6									
c7=x1,x6									