Decomposing violence: terrorist murder and attacks in New York State from 1933 to 2005

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Decomposing Violence: Terrorist Murder and Attacks in New York State from 1933 to 2005

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Abstract: I apply the Beveridge-Nelson business cycle decomposition method to the time series of murder in the state of New York. (1933-2005). Separating out "permanent" from "cyclical" murder, I hypothesize that the cyclical part coincides with documented waves of organized crime, internal tensions, breakdowns in social order, crime legislation, social, and political unrest, and recently with the periodic terrorist attacks in the state. The estimated cyclical terrorist murder component warns that terrorist attacks in the state of New York from 1962 to 2005, historically occur in the estimated turning point dates, of whether a declining, or ascending cycle, and so, it must be used in future research to construct a model for explaining the causal reasons for its movement across time, and for forecasting terrorist murder and attacks for New York.

Keywords: A model of cyclical terrorist murder in Colombia, 1950-2004. Forecasts 2005-2019; the econometrics of violence, terrorism, and scenarios for peace in Colombia from 1950 to 2019; scenarios for sustainable peace in Colombia by year 2019; decomposing violence: terrorist murder in the twentieth in the United States; using the Beveridge and Nelson decomposition of economic time series for pointing out the occurrence of terrorist attacks.

JEL classification codes: C22, D74, H56, N46, K14, K42, N42, O51.

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The opinions expressed do not compromise the company for which I currently work.
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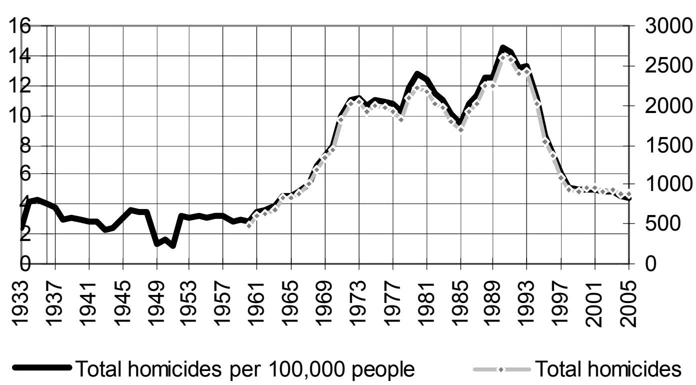
1. Introduction.

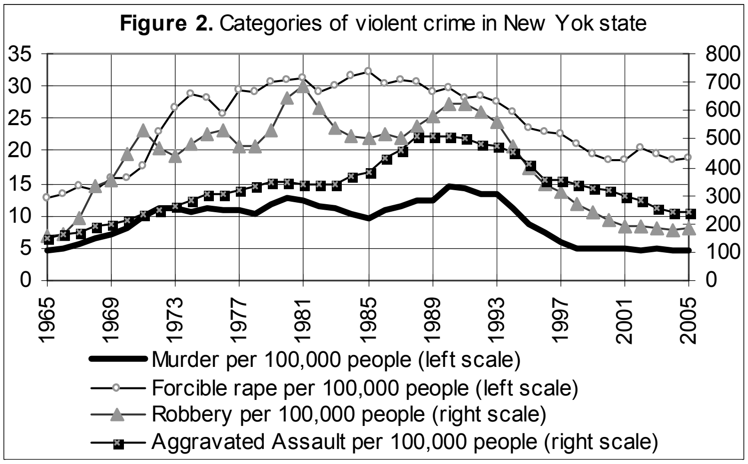
After decomposing violence, and creating the cyclical terrorist murder and attacks index for the United States: *decomposing violence: terrorist murder in the twentieth century in the United States* (Gómez-Sorzano 2006C), this paper continues that methodology research applied at the State level. The current exercise for the state of New York, is the first one at decomposing violence at the state level on the purpose of constructing murder and attacks indexes preventing the closeness of attacks or tragic events. This research shows that the estimated cyclical component of murder carefully pointed out the date of occurrence of the last couple of terrorist attacks occurred in New York, particularly, the World Trade Center bombing, and 9/11 2001; the paper suggests that the state of New York has been able to break up the cycle of violence having a current problem of growing permanent murder (i.e., the estimated permanent component of murder increases, Fig. 4).

According to the Federal Bureau of Investigation, Uniform Crime Reporting System, total homicides in New York State increased from an average of 845 per year in the 1960s to 1,905 in the 1970s, 2,025 in the 1980s, and 1,783 in the 1990s (Fig. 1). When adjusted for population growth, i.e., homicides per 100,000 people in the population, a identical pattern emerges, reaching a first peak in 1973 with 11.17 murder per capita and, subsequent peaks in 1980, 1990 and, 1993 respectively with 12.73, 14.48 and, 13.30 per capita respectively.

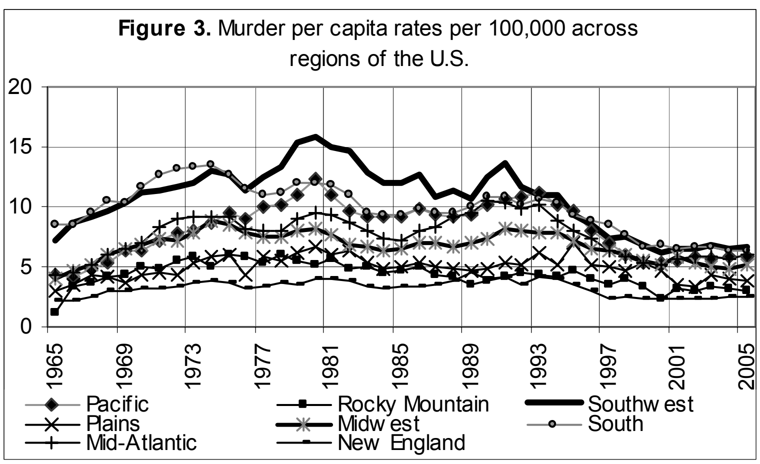
Figure 1. Total homicides, New York State, 1933-2005



Out of the state's four categories of crimes, measuring violent crime (murder, forcible rape, robbery, and aggravated assault) murder is the one that varies the less showing and stabilization tendency (Fig. 2).



Although the U.S., murder rates appear stabilizing during the last years, the highest per capita rates are found in the southwest and, south regions with 6.67 and 6.39 per capita, the Mid-Atlantic region where New York belongs appears as the third highest of the country with a rate of 5.93 for 2005 (Fig. 3).



2. Data and methods

The Bureau of Justice Statistics has a record of crime statistics that reaches back to 1933, (for this analysis I use the murder rates per 100,000 people[1]). As is known, time series can be broken into two constituent components, the permanent and transitory

[1] Taken from FBI, Uniform Crime Reports.

component. I apply the Beveridge-Nelson (BN for short 1981) decomposition technique to the New York state series of murders.

Beveridge and Nelson decomposition

I use the augmented Dickey Fuller (1981), tests to verify the existence of a unit root on the logarithm of murder 1933-2005. These tests present the structural form shown in equation (1).

$$\Delta L\,\mathrm{hom}_t = \alpha + \theta.\,t + \phi\, L\,\mathrm{hom}_{t-i} + \sum_{i=1}^{k} \gamma_i\, \Delta L\,\mathrm{hom}_{t-i} + \varepsilon_t \qquad (1)$$

The existence of a unit root, is given by (phi) ϕ=0. I use the methodology by Campbell and Perron (1991), in which an auto-regression process of order k is previously selected in order to capture possible seasonality of the series, and lags are eliminated sequentially if: a) after estimating a regression the last lag does not turn out to be significant, or b) if the residuals pass a white noise test at the 0.05 significance level. The results are reported on table 1.

Table 1 Dickey & Fuller test for Unit Roots

Series	K	Alpha	Theta	Phi	Stationary
D(Lhnewyo) – murder series	19	0.109	0.004	-0.183	No
State of New York , 1933-2005		(3.27)	(3.57)	(-2.76)	

Notes: 1. K is the chosen lag length. T-tests in parentheses refer

To the null hypothesis that a coefficient is equal to zero.

Under the null of non-stationarity, it is necessary to use the Dickey-Fuller critical value that at the 0.05 level, for the t-statistic is -3.50 , -3.45 (sample size of 50 and 100)

After rejecting the null for a unit root (accepting the series is non stationary), I perform the BN decomposition which begins by fitting the logarithm of the per capita murder series to an ARIMA model of the form (2):

$$\Delta Lt\,\mathrm{hom}_t = \mu + \sum\nolimits_{i=1}^{k} \gamma_i \Delta Lt\,\mathrm{hom}_{t-i} + \sum\nolimits_{i=1}^{h} \psi_i \varepsilon_{t-i} + \varepsilon_t \qquad (2)$$

Where k, and h are respectively the autoregressive and moving average components. The selection of the ARIMA model is computationally intense. My search for the right model for the period 1933-2005 stopped with an ARIMA (28,1,25) ran with RATS 4, shown in table 2, and including autoregressive components of order 1,2,6 and 28, and moving average terms of order 2 and, 25; the model is unique at providing a cyclical component oscillating around a zero average:

Table 2. Estimated ARIMA model for murder for New York state

Annual data from 1933 to 2005

Variables	Coeff	T-stats	Std Error	Signif
Constant	0.0200	2.34	0.0080	0.0243
AR(1)	0.5106	6.09	0.0830	0.0000
AR(2)	0.3353	3.71	0.0900	0.0000
AR(6)	-0.1617	-2.37	0.0670	0.0220
AR(28)	-0.1040	-3.94	0.0260	0.0000
MA(2)	-0.9016	-10.69	0.0840	0.0000
MA(25)	-0.8270	-3.2	0.2577	0.0020

Centered R^2 = 0.97

DW= 1.91

Significance level of Q = 0.1754

Usable observations = 44

The seven model parameters are replaced in the equation for the permanent component of murder shown in (3)[2]:

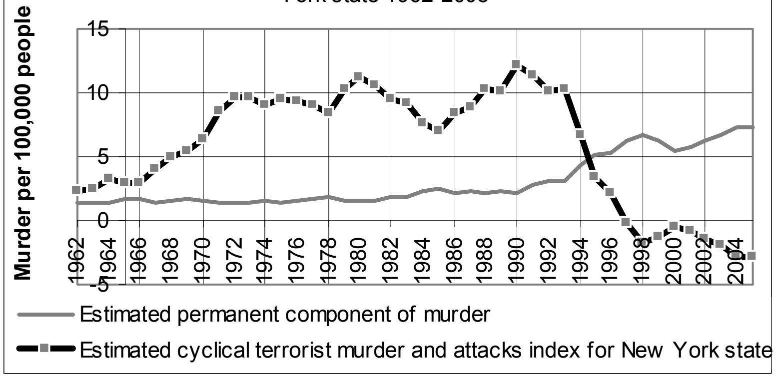
$$L\hom_t^{PC} = L\hom_0 + \frac{\mu . t}{1-\gamma_1 - . . . \gamma_k} + \frac{1+\Psi_1 + \dots \Psi_h}{1-\gamma_1 - . . . \gamma_k} \sum_{i=1}^{t} \varepsilon_i \quad (3)$$

The transitory or cyclical terrorist murder estimate is found by means of the difference between the original series, and the exponential of the permanent per capita component ($L\hom_t^{PC}$)[3], and is shown in Figure 4, that additionally shows the estimated permanent component. It matches the qualitative description of known waves of organized crime, internal tensions, crime legislation, social, and political unrest overseas, and disentangles the timing for terrorist attacks, and terrorist murder in the state of New York. To compare this historical narrative of events with my estimates for cyclical terrorist murder and, attacks I use chronologies, and description of facts taken from Clark (1970), Durham (1996), Blumstein and Wallman (2000), Bernard (2002), Hewitt (2005), and Monkkonen (2001).

[2] The extraction of permanent and cyclical components from the original series is theoretically shown in BN (1981), Cuddington and Winters (1987), Miller (1998), Newbold (1990), and Cárdenas (1991). I show the mathematical details for the U.S.' case in appendix A. Eq.3 above, turns out to be Eq.17 in appendix A.

[3] Turning the estimated permanent per capita component into the level of the permanent component.

Figure 4. Cyclical terrorist murder and attacks index for New York state 1962-2005



3. Interpretation of results.

The terrorist murder and attacks indicator for the state of New York presents the following characteristics. In 1963, and coinciding with the assassination of President John F. Kennedy, it jumps from 2.27 in 1962 to 2.47 in 1963 (8.87% change).

In 1965 reduces from 3.27 in 1964 to 2.90 in 1965 (-11.10 %). This year on 9 November the city of York experienced a first power black-out and massive looting as its consequence.

From 1966 to 1968, the indicator ascends from 2.90 to 3.04 (4.62%) to 4.10 (34.8%), and 4.93 (20.2%) per capita. During these years the American society is torn apart by student protests, the counter-culture movement, and racial unrest, all related in different ways to the escalating U.S, involvement in the Vietnam War. An important fact to note, is the big jump on 1968 coinciding with the assassination of Dr. Martin Luther King, Jr., (the index jumped 20.2%). History repeats no matter the geographical context; same as in Colombia where the assassination of Gaitán (a civic, and presidential candidate) generated widespread violence from 1948 to 1953; the New York state violence registered a period of permanent increase in violence after Dr. King's assassination, this period lasted from 1969 to 1972, where the index moved from 5.48 to 6.37, 8.51, and 9.68 respectively with percent changes of 11.12%, 16.24%, 33.63%, and 13.72% respectively.

In 1976 the index decreases from 9.60 to 9.36 in 1976 (a -2.53 %) apparently as a consequence of the Vietnam War's end.

From 1982 to 1985 the index reduces steadily passing from 10.68 in 1981 to 9.59 to 9.16, 7.68, and 6.96, registering percent changes of -10.1%, -4.5%, -16.1%, and -9.30% respectively for those years. According to Blumstein and Wallman (2000), this fact coincides with the national behavior of adult homicide reduction during those years.

From 1991 to 1992, the index reduces from 11.38 to 10.16 per capita (-10.76 %), coinciding this negative variation with the FBI's successful prosecution of New York's Gambino family crime boss John Gotti on 13 charges of murder, gambling, racketeering, and tax fraud. Gotti had escaped three previous indictments since 1986, and had earned the nickname "Teflon Don".

In 1993, the index jumps from 10.16 in 1992 to 10.24 in 1993 (0.76%), New York experienced this year the World Trade Center bombing, and the Long Island train massacre. The index foretold with amazing precision the turning point date; then decreases moving to 6.75 in 1994 (-34.01% change).

Finally 9/11 2001 attacks in New York were amazingly foretold by the attacks index in a cautionary way, initially the index increased from 1999 to 2000 (from -1.23 to -0.50) getting a peak, or turning point date on 2000, the index clearly warned authorities of the proximity of an attack exactly one year before the actual attack occurred; then the index decreased to -0.77 in 2001 the year of the infamous 9/11 attack, and decreased continuously from 2002 to 2005 moving from -1.47, -1.86, -2.74, and -2.82 respectively. Based on this accurate description of historical facts versus the movement of the attacks index, I claimed in this paper that I have constructed the terrorist murder, and attacks index for New York State (Appendix B).

4. Conclusions.

Provided with a data series of per capita murder from 1933 to 2005, I have constructed the cyclical terrorist murder and attacks index for New York State. The index works amazingly well at pointing out terrorist attack dates; it particularly foretold with amazing precision major recent tragic events in New York as the World Trade Center bombing in 1993, and 9/11 2001 attacks. Immediate research should be done headed towards the construction of a model for terrorist attacks for the State of New York, and a model for permanent murder.

Data Source: FBI, Uniform Crime reports.

Acknowledgements

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Appendix A. The Beveridge & Nelson decomposition of economic time series applied to decomposing the New York State per capita homicides from 1933 to 2005.

I denote the observations of a stationary series of the logarithm of per capita homicides for New York State. by *Lthom* and its first differences by W_t. Following Beveridge & Nelson, BN for short, (1981, p.154), many economic times series require transformation to natural logs before the first differences exhibit stationarity, so the W_t's, then are continuous rates of change.

$$W_t = Lt\hom_t - Lt\hom_{t-1} \qquad (1)$$

If the w's are stationary in the sense of fluctuating around a zero mean with stable autocovariance structure, then the decomposition theorem due to Wold (1938) implies that W_t maybe expressed as

$$W_t = \mu + \lambda_0 \varepsilon_t + \lambda_1 \varepsilon_{t-1} + \ldots, \ \ where\ \lambda_0 \equiv 1 \qquad (2)$$

Where, μ the $\lambda's$ are constants, and the $\varepsilon's$ are uncorrelated disturbances. According to BN, the expectation of $Lt\hom_{t+k}$ conditional on data for $Lt\hom$ through time t is denoted by $Lt\hat{\hom}(k)$, and is given by

$$\begin{aligned} Lt\hat{\hom}(k) &= E(Lt\hom_{t+k} \mid \ldots\ldots, Lt\hom_{t-1}, Lt\hom_t) \qquad (3) \\ &= Lt\hom_t + E(W_{t+1} + \ldots W_{t+k} \mid \ldots, W_{t+1}, W_t) \\ &= Lt\hom + \hat{W}_t(1) + \ldots + \hat{W}_t(k) \end{aligned}$$

Since the $Z_t's$ can be expressed as accumulations of the $W_t's$. Now from (2) it is easy to see that the forecasts of W_{t+i} at time t are

$$\begin{aligned} \hat{W}_t(i) &= \mu + \lambda_i \varepsilon_t + \lambda_{i+1} \varepsilon_{t-1} + \ \ldots \qquad (4) \\ & \mu + \sum_{j=1}^{\infty} \lambda_j \ \varepsilon_{t+1-j}\ , \end{aligned}$$

Now substituting (4) in (3), and gathering terms in each ε_t, I get

$$\begin{aligned} L\hat{\text{hom}}_t(k) &= L\text{hom}_t + \hat{W}_t(i) \qquad (5) \\ &= L\text{hom}_t + \left[\mu + \sum_{j=1}^{\infty}\lambda_j\varepsilon_{t+1-j}\right] \\ &= k\mu + L\text{hom}_t + \left(\sum_{1}^{k}\lambda_i\right)\varepsilon_t + \left(\sum_{2}^{k+1}\lambda_i\right)\varepsilon_{t-1} + \dots \end{aligned}$$

And considering long forecasts, I approximately have

$$L\hat{\text{hom}}_t(k) \cong k\mu + L\text{hom}_t + \left(\sum_{1}^{\infty}\lambda_i\right)\varepsilon_t + \left(\sum_{2}^{\infty}\lambda_i\right)\varepsilon_{t-1} + \dots \qquad (6)$$

According to (6), it is clearly seen that the forecasts of homicide in period (k) is asymptotic to a linear function with slope equal to μ (constant), and a level $L\text{hom}_t$ (intercept or first value of the series).

Denoting this level by $\overline{L\text{hom}_t}$ I have

$$\overline{L\text{hom}_t} = L\text{hom}_t + \left(\sum_{1}^{\infty}\lambda_i\right)\varepsilon_t + \left(\sum_{2}^{\infty}\lambda_i\right)\varepsilon_{t-1} + \dots \qquad .(7)$$

The unknown μ and $\lambda's$ in Eq. (6) must be estimated. Beveridge and Nelson suggest and ARIMA procedure of order (p,1,q) with drift μ.

$$W_t = \mu + \frac{\left(1-\theta_1 L^1 - \dots - \theta_q L^q\right)}{\left(1-\varphi_1 L^1 - \dots - \phi_p L^p\right)}\varepsilon_t = \mu + \frac{\theta(L)}{\varphi(L)}\varepsilon_t \qquad (8)$$

Cuddington and Winters (1987, p.22, Eq. 7) realized that in the steady state, i.e., L=1, Eq. (9) converts to

$$\overline{L\text{hom}_t} - \overline{L\text{hom}_{t-1}} = \mu + \frac{(1-\theta_1 - \dots \theta_q)}{(1-\phi_1 - \dots \varphi_p)}\varepsilon_t = \mu + \frac{\theta(1)}{\varphi(1)}\varepsilon_t \quad (9)$$

The next step requires replacing the parameters of the ARIMA model (Table 2) and iterating Eq.(9) recursively, i.e., replace t by (t-1), and (t-1) by (t-2), etc, I get

$$W_t = \overline{L\hom_t} - \overline{L\hom_{t-1}} = \mu + \frac{\theta(1)}{\phi(1)}\varepsilon_t \qquad (10)$$

$$W_{t-1} = \overline{L\hom_{t-1}} - \overline{L\hom_{t-2}} = \mu + \frac{\theta(1)}{\phi(1)}\varepsilon_{t-1}$$

:

$$W_1 = \overline{L\hom_1} = \overline{L\hom_0} + \mu + \frac{\theta(1)}{\phi(1)}\varepsilon_1 \quad (\textit{this is the value for year } 1962)$$

:

$$W_{44} = \overline{L\hom_{82}} = \overline{L\hom_0} + \mu + \frac{\theta(1)}{\phi(1)}\varepsilon_2 \quad (\textit{this is the value for year } 2005)$$

Adding these equations I obtain W_1 (the value for year 1962), and W44 (the value for year 2005), on the right hand side μ is added "t" times, and the fraction following μ is a constant multiplied by the sum of error terms. I obtain

$$\overline{L\hom_t} = \overline{L\hom_0} + \mu.t + \frac{\theta(1)}{\phi(1)}\sum_{i=1}^{t}\varepsilon_i \qquad (11)$$

This is, Newbold's (1990, 457, Eq.(6), which is a differential equations that solves after replacing the initial value for $\overline{L\hom_0}$, which is the logarithm of per capita murder in year 1923.

Cárdenas (1991), suggests that Eq.(11), should be changed when the ARIMA model includes autoregressive components. Since the ARIMA developed for the U.S' case (Table 2), includes autoregressive, and moving average components, I formally show this now.

$$L\hom_t - L\hom_{t-1} = \mu + \sum_{i=1}^{p}\phi_i W_{t-i} + \sum_{j=1}^{q}\theta_j\varepsilon_{t-j} + \varepsilon_t \qquad (12)$$

$$\Delta L\hom_t = W_t = Lt\hom_t - Lt\hom_{t-1}$$

$$L\hom_t - L\hom_{t-1} = \mu + \sum_{i=1}^{p}\phi_i \Delta L\hom_{t-i} + \sum_{j=1}^{q}\theta_j\varepsilon_{t-j} + \varepsilon_t$$

Bringing the moving average components to the LHS, I get

$$L\hom_t - L\hom_{t-1} - \left(\sum_{i=1}^{p}\phi_i \Delta L\hom_{t-1}\right) = \mu + \sum_{i=1}^{q}\theta_j\varepsilon_{t-j} + \varepsilon_t \qquad (13)$$

Expanding summation terms

$$(1-\phi_1 L^1 - \phi_2 L^2 - . . - \phi_p L^p)(L\,\text{hom}_t - L\,\text{hom}_{t-1}) = \mu + (1+\theta_1 L^1 + . . + \theta_q L^q)\varepsilon_t \quad (14)$$

Rearranging Eq. (14) and including the ARIMA parameters from Table 2, I get.

$$L\,\text{hom}_t - L\,\text{hom}_{t-1} = \frac{0.020}{1-0.51-0.33+0.16+0.10} + \left(\frac{1-0.90-0.82}{1-0.51-0.33+0.16+0.10}\right)\varepsilon_t \quad (15)$$

Now, after recursively replacing, t with (t-1), and (t-1) with (t-2), etc, and after adding together "t" times, I have

$$L\,\text{hom}_t - L\,\text{hom}_0 = \frac{0.020.\,t}{1-0.51-0.33+0.16+0.10} + \left(\frac{1-0.90-0.82}{1-0.51-0.33+0.16+0.10}\right)\sum_{i=1}^{t}\varepsilon_i \quad (16)$$

And rearranging,

$$L\,\text{hom}_t = L\,\text{hom}_0 + \frac{0.020.\,t}{1-0.51-0.33+0.16+0.10} + \left(\frac{1-0.90-0.82}{1-0.51-0.33+0.16+0.10}\right)\sum_{i=1}^{t}\varepsilon_i \quad (17)$$

In the steady state, when L=1, Eq. (17) yields the permanent component of the per capita murder for New York, the last step requires taking the exponential to the LHS of Eq. 17, getting the level for the permanent component. The cyclical component is finally obtained by the difference of the level of the observed per capita murder minus the level of the permanent component. Both permanent and cyclical estimated components are shown in Fig.4.

Appendix B : data table

	Original Data		BEVERIDGE - NELSON Terrorist murder and attacks index	
year	Murder	Muerder per capita	Cyclical - component	Permanent component
1933		2.40		
1934		4.20		
1935		4.30		
1936		4.00		
1937		3.70		
1938		3.00		
1939		3.10		
1940		2.90		
1941		2.88		
1942		2.84		
1943		2.30		
1944		2.46		
1945		3.05		
1946		3.63		
1947		3.50		
1948		3.49		
1949		1.41		
1950		1.56		
1951		1.27		
1952		3.20		
1953		3.10		
1954		3.20		
1955		3.10		
1956		3.20		
1957		3.20		
1958		2.80		
1959		3.00		
1960	480	2.86		
1961	603	3.54		
1962	626	3.60	2.27	1.33
1963	689	3.89	2.47	1.42
1964	824	4.60	3.27	1.33
1965	836	4.63	2.91	1.72
1966	882	4.83	3.04	1.79
1967	996	5.43	4.10	1.33
1968	1185	6.54	4.93	1.61
1969	1324	7.23	5.48	1.74
1970	1444	7.94	6.37	1.56
1971	1823	9.91	8.52	1.39
1972	2026	11.03	9.69	1.34
1973	2040	11.17	9.76	1.41
1974	1919	10.60	9.09	1.51
1975	1996	11.02	9.60	1.41
1976	1969	10.89	9.36	1.53
1977	1919	10.71	9.01	1.69

1978	1820	10.25	8.39	1.86
1979	2092	11.85	10.25	1.60
1980	2228	12.73	11.23	1.50
1981	2166	12.31	10.69	1.62
1982	2013	11.40	9.60	1.80
1983	1958	11.08	9.16	1.92
1984	1786	10.07	7.68	2.39
1985	1683	9.46	6.97	2.49
1986	1907	10.73	8.50	2.23
1987	2016	11.31	8.91	2.40
1988	2244	12.54	10.36	2.18
1989	2246	12.51	10.14	2.37
1990	2605	14.48	12.26	2.22
1991	2571	14.24	11.38	2.86
1992	2397	13.23	10.16	3.07
1993	2420	13.30	10.24	3.06
1994	2016	11.10	6.76	4.34
1995	1550	8.55	3.45	5.10
1996	1353	7.44	2.19	5.25
1997	1093	6.03	-0.21	6.24
1998	924	5.08	-1.64	6.73
1999	903	4.96	-1.24	6.20
2000	952	5.02	-0.51	5.52
2001	960	5.00	-0.77	5.77
2002	909	4.80	-1.47	6.27
2003	934	4.90	-1.87	6.77
2004	889	4.60	-2.74	7.34
2005	874	4.50	-2.82	7.32

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