THE DYNAMIC EFFECTS OF ECONOMIC DISTURBANCES OVER THE PERMANENT AND TRANSITORY VIOLENCE IN COLOMBIA*

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ABSTRACT

The purpose of the paper is to stablish the variables that affect the dynamics of Colombian violence showing the relations encountered between them; and to state based on the econometric evidence found what could be called "The provisional foundations for a theory to explain violence cycles in Colombia".

The first part is methodological; it discusses the three well known econometric approaches for modeling business cycles: the traditional approach (trend stationay), the alternative one (difference stationary), and the Beveridge and Nelson (B&N) decomposition of economic time series wich is the finally selected to obtain two types of violence for Colombia: permanent and transitory one.

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Based on above, the ground is prepared to estimate two unrestricted models of the VAR type with the intention of getting evidence of the multiple channels by means of wich the two identified types of violence are fed. For this purpose, unit root tests are applied to 24 socio-economic variables which were hypotetically considered related with the phenomenon. The socio-economic variables are divided into two general subsets: real variables wich include real military and police defense expenses and many others; and the so called "effective" variables to refer to no monetary ones as the number of police personnel and army troops between others. The unit root tests results show that the whole set of variables are non stationary, condition wich permitted the search for cointegrating vectors. For this purpose two seven variable cointegrating vectors were finally estimated after testing sequencially the significance of the the initial long list of candidates.

The first one related with permanent violence includes as independent variables trade balance, government consumption, total number of active troops, defense expenditures, number of students enrolled and the unemployment rate. The second one related with transitory violence includes total number of police personnel, Gross Domestic Product, private consumption, total number of army troops, money supply and trade balance again.

These cointegrating regressions technically permit now the estimation of two seven variable vector error correction models (VEC) each one including the above mentioned variables.

Econometrically speaking, the technical consistency permits me to take the risk of proposing as conclusion the provisional foundations for a theory to explain Colombian violence cycles, based on the results coming from the decomposition of variance, the F tests, wich explain the lagged variables that are specifically influencing each of the dependent variables or equations; the reconstruction and chaining of the series of effects that each of the variables exert on the types of violence, as can be concluded from the impulse response functions (IRF) and finally obtaining help from the immediate signs found for the dynamic response of the two systems when effective and real shocks are applied.

JEL classification: K42

Keywords: Contemporarily inversely correlated.

THE DYNAMIC EFFECTS OF ECONOMIC DISTURBANCES OVER THE PERMANENT AND TRANSITORY VIOLENCE IN COLOMBIA [1]

INTRODUCTION

There is growing concern regarding the increase in Colombian domestic violence and specially for its escalation during the 90's. Some observers and specialists in this topic have stressed the secular nature of the phenomenon beginning in 1947, when Colombia began a process of violence which has progressively grown worse.

Some authors, among them General Alvaro Valencia Tovar [2], consider Colombian violence as a continuous chain of violences, possibly having remote origin in the acts of the Spanish conquest. In those times the Spanish imposed cruel penalties to the rebellious Comuneros captains. Afterwards Independence War would confirm the violent nature of Colombian man. After the independence in the turn from the XIX to the XX century, we find Colombia affected by the costful and bloody War of the One Thousand Days.

General Rafael Reyes assumes the presidency in 1904, when the country was in physical and moral ruins and depressed by the loss of Panama. After this when everything indicated that the country had reached certain Republican maturity, several sporadic but short violence outbreaks occurred in 1931 and 1932, due to the wave of nationalism having origin in the Peruvian occupation of Colombian Amazonic territories. At this time begins what could be called a new stage in the phenomenon of Colombian violence, basically characterized by the division of the two traditional parties and by the creation of subversive and guerrilla groups.

In regards to the traditional political parties, in 1946 begins a struggle for burocratic positions the winners in elections wish to dominate all the positions, while the losers fight hard not to lose them. The armed forces become tainted by politics, a situation that extended to such a point that in 1953 there was an undeclared civil war (Graph 3). In that year the military government of General Gustavo Rojas Pinilla assumes power, and there was a decrease in the pace of violence. However the brief period of the military regime could not eradicate the phenomenon.

Afterwards with the creation of the National Front, the violence originated in traditional party struggles ceased. However the peasant self-defense movements or communist guerrilla appears, and then grows in an accelerated manner through different ideologies, some with Marxist-leninist ideas, inspired by the Cuban Revolution and others following the line of the revolutionary peasant war headed by the Chinese leader Mao Tse-Tung, that condemned the sovietic "revisionism", which appeared after the death of Stalin.

The debate about the reasons for Colombian domestic violence is open. However it is necessary to point out that some of the factors that contributed to its evolution and escalation in the past have now, that the XXI century is approaching, disappeared. First the socialist model that inspired guerrillas has collapsed and on the other hand traditional political partisanism is in agony due to generalized loss of confidence by the people in the political parties.

The aim of this paper is then framed in the economic context, in view of the urgent need to look for additional evidence conducive to explain us some of the variables exerting influence on the dynamics of Colombian domestic violence.

This work begins by rapidly reviewing the different econometric approaches existing in the international literature for the study of business cycles.

For the Colombian case, the traditional approach or "Trend stationary" (TS), and the alternative approach or "Difference

Stationary" (DS), are examined and then as central part of the study it is proposed an approach based on vector autoregressions analysis (VAR) and of vector error correction (VEC).

In order to study this latter one it is used the The Beveridge & Nelson (B&N) [3] decomposition of economic time series methodology, to obtain two components which are the basis for later estimating two systems, (VECVP) and (VECVC), including respectively the permanent and transitory violence as well as other real and effective variables.

APPROACHES FOR THE STUDY OF FLUCTUATIONS OR CYCLES IN VIOLENCE [4]

1) The Traditional Approach (TS):

From the econometric point of view the traditional approach for the study of violence fluctuations implies to assume that violence continues growing exponentially or linearly and that it adjusts to historical data, being the linear trend the permanent component and the deviations or residuals resulting from the regression the cyclical part of it. One of the main problems of this approach is that this trend would not reflect the continued changes and innovations in the series of violence.

As an example for this approach, we use the annual data from the Colombian GDP 1975-1992 [5]. Then we can perform the regression of the logarithm of the GDP against time (linear tendency) and a constant; an ARMA model (1,11) was fitted to the deviations obtained from the logarithm of the GDP in regards to that tendency. (See equation 1)

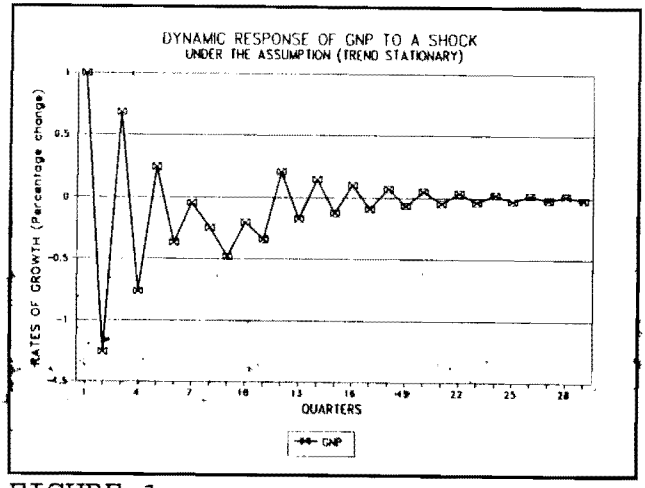


FIGURE 1

$$LY = -0.03805 - 0.8458LY_{t-1} - 0.4100e_{t-1} - 0.3768e_{t-2} - 0.1789e_{t-3} - 0.3987e_{t-4} - 0.1621e_{t-5} - 0.3533e_{t-6} - 0.2811e_{t-7} - 0.6871e_{t-8} - 0.6073e_{t-9} - 0.5068e_{t-10} - 0.07961e_{t-11} + e_t.$$

$Q = 8.55$, *significance level* = 0.9984

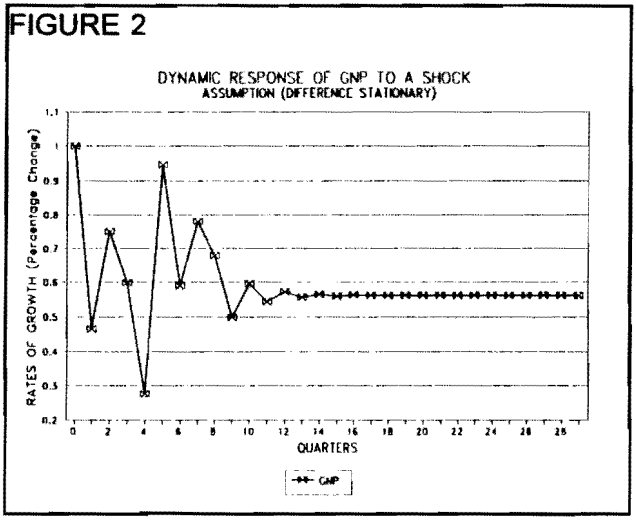
In Figure 1, it is possible to observe the implications of the moving average representation of the model or similarly to trace out the dynamic effects of a shock on GNP over time. The problem with this approach are that by assuming that the GDP, or similarly violence, grows according to a linear tendency, it admits that this tendential component is smooth and therefore the fluctuations in production or violence only have origin in transitory disturbances; additionally it overstimates the cyclical component and by consequence understimates the permanent one.

2) The alternative approach (DS):

This second approach, in opposition to the first one, discards the idea of the existence of a constant and smooth growth tendency of the series of GDP or violence, thus completely rejecting the existence of cyclical fluctuations deviating us from that tendency, and then goes on to propose occasional changes in the rate of growth of the series, and if applicable, changes in each period, that may come either from sporadic or permanent outbreaks of violence.

Again, as an example for the Colombian case, under this approach it was estimated an ARIMA (1,1,9) model for the the logarithm of the real GDP for the same period of time of the previous approach and by using the Cuddington & Winters linear approximation to measure persistence (1987), it was found to be 0.56 (Figure and equation #2).

FIGURE 2



$$\Delta LY = 0.004504 - 0.5337\Delta LY_{t-1} - 0.4040\varepsilon_{t-4} + 0.4993\varepsilon_{t-5} - 0.2333\varepsilon_{t-9} + \varepsilon_t$$

(2)

$$\Delta LY = 0.04504 - 0.5337\Delta LY_{t-1} + (1 - 0.4040_{t-4} + 0.4993_{t-5} - 0.2333_{t-9})e$$

$$Q = 23.12 \; significance \; level = 0.28$$

Under this, the existence of transitory disturbances has no sense, and on the contrary, any disturbance becomes permanent, being therefore more consistent with reality, because it permits to conclude the possibility of the existence of permanent changes in the path of the series studied. In the case of the series of violence, it would permit changes such as those that may come from a successful peace process and from a decrease in domestic violence [6].

Finally knowing the deficiencies of the first two approaches it is finally proposed the Beveridge and Nelson decomposition of economic time series, which technically permits to obtain two new series of the phenomenom being studied; in this case the permanent and the transitory components of the Colombian violence.

3) Descomposition of Colombian Domestic Violence into permanent and transitory components

The Beveridge & Nelson decomposition of economic time series has been applied in Colombia basically for the variable Gross Domestic Product (GDP), by authors such as Cuddington(1986), Clavijo y Fernández(1989), Clavijo(1989), Cárdenas(1991), Gaviria y Posada(1992) and Gómez(1996) among others. It is applied in this article for social variables, related with crimes [7], specifically Colombian domestic violence or number of annual homicides recorded between 1946 y 1996. The principal goal of its application here is to obtain transitory and permanent components of violence, in order to compare them dynamically with real and effective variables, permitting us to obtain more evidence about this phenomenon, which can lead us to propose what could be called the provisional foundations for a theory to explain violence cycles in Colombia.

After verifying that the series of the logarithm of the homicides 1946-1996, does not permit to reject the existence of the unit root (See Chart #2) we proceed to perform the decomposition, which begins by adjusting the violence series to an ARIMA model of the form :

$$\Delta LV_T = \mu + \sum_{i=1}^{k} \gamma_i \Delta LV_{t-i} + \sum_{i=1}^{h} \psi_i \varepsilon_{t-i} + \varepsilon_t \qquad (3)$$

where K y H are respectively the autoregressive and moving average components.

It is important to point out that initially for the selection of the ARIMA model several tests were made with the homicide 46-96 series in logarithms, for models of multiplicative type; however it happens first that the B&N methodology has not yet been developed for models with multiplicative components or for ARMA models and, on the other hand, these models, in spite of supplying very good statistical t's, did not show good indicators of adjustment against white noise.

For this reason we started the "search" for a common ARIMA model[8].

SELECTION OF THE ARIMA MODEL **CHART #1**

ARIMA MODELS (P,D,Q)	REMARKS	AJUSTMENT INDICATORS
(4 1 5)	Included lags 1,2,3 & 4 and the moving average of order 5. It did not supply a cyclical component with zero average	Q=2.83 SQ=0.75 SCH=-4.19 D.W.=1.932
(2 1 2)	Included lags 1,2 & the moving averages of order 1,2. It did not supply a cyclical component with zero average	Q=13.22 SQ=0.066 SCH=-3.88 D.W.=1.65
(4 1 10)	Included lags 2,3 & 4 & the moving averages 1,2,5 & 10. It did not supply a cyclical component with zero average	Q=13.68 SQ=0.003 SCH=-4.63 D.W.=2.26
(0 1 3)	It only included the moving averages of order 1 & 3. It supplies a cyclical component fluctuating with zero average.	Q=8.45 SQ=0.5841 SCH=-3.76 D.W.=2.0809

Where: Q:Ljung-Box's statistics, SQ= Ljung-Box's significance level, SCH=Schwartz's criterion D.W = Durbin Watson's statistic.

After trying different mixed combinations, such as of only autoregressive or moving averages components, it is concluded that the best ARIMA models for estimating the logarithm of annual violence 46-96 (National Police) are those which only contain

moving average components[9]. In Chart 1, a summary of the best estimations is shown. In that chart we should point out the fact that the best fittings obtained in accordance with LJUNG-BOX's, SCHWARTZ's y D.W's statistics, are those including the moving average of order 3. Out of these models we finally selected the fourth (0,1,3), which is the only one of the four, which due to having the optimum combination among the Schwartz's and D.W's statistics, clearly generates a stationary cyclical component with zero average.

Now, based on the ARIMA (0,1,3) model of the equation (4) [10], the permanent component is calculated in accordance with Beveridge & Nelson(1981), as can be seen in Equation (5) [11].

$$\Delta LV = 0.0695 + 0.3115e_{t-1} + 0.3.36e_{t-3}$$
$$(2.22) \qquad (2.36) \qquad (2.29) \qquad\qquad (4)$$
$$Q = 8.45,\ NS = 0.5841,\ SCH = D.\ W. = 2.08$$

$$V_t^p = V_0 + \frac{\mu.t}{1 - \gamma_1 - \ldots \gamma_k} + \frac{1 + \psi_1 + \ldots \psi_h}{1 - \gamma_1 - \ldots \gamma_k} \sum_{i=1}^{t} \varepsilon_i \qquad (5)$$

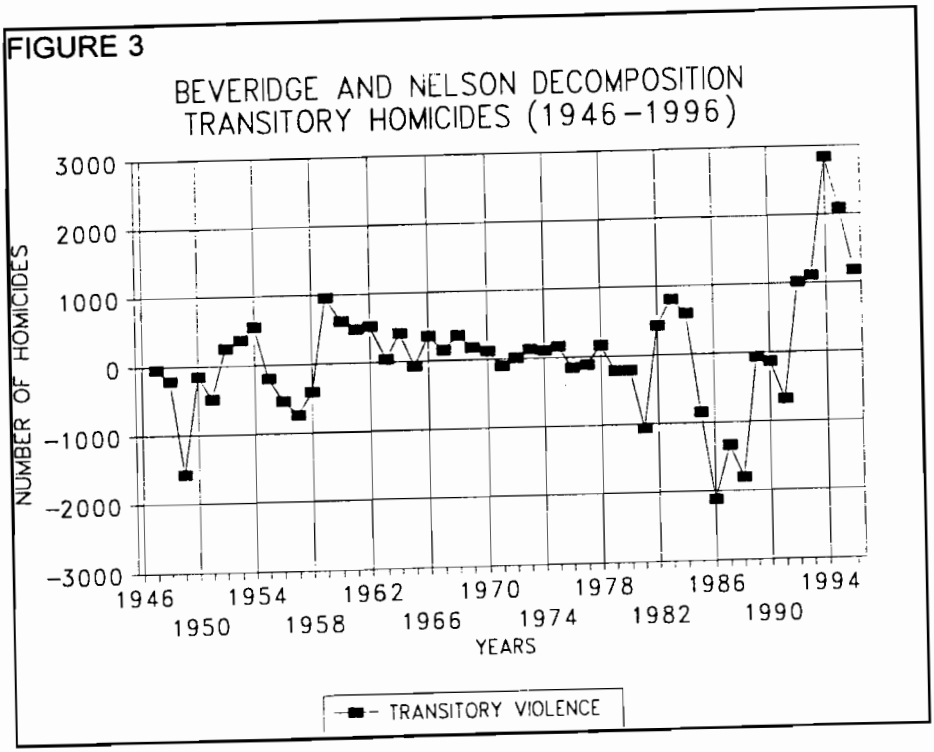
The transitory or cyclical violence is then calculated by means of the difference between the logarithm of the original violence observed and of the permanent violence calculated based on the equation(5). This cyclical component of Figure 3, clearly shows how from 1953 to 1957 when the military regime of General Gustavo Rojas Pinilla was in power, the transitory violence decreased and began a rising cycle again in 1958, immediately after the fall of the military regime. During the military regime of Rojas Pinilla thousands of guerrilla men surrendered their weapons between 1953 and 1954 in regions such as the Eastern Plains, Antioquia and Tolima, and therefore that cycle is associated with the required violence to finish the two party struggle. From then on, transitory violence begins again to decrease during the years of government of the National Front. The oscillations that took place in 1963 coincide with the offensive of Pedro Antonio Marin, also known as

Manuel Marulanda Vélez or Tirofijo, when he started offensive operations in Marquetalia[12].

On the other hand, the oscillation of year 1965 perfectly corresponds to the bloody attack to the town of Simacota occurred on January 7 of that year, when by surprise appears the newly-born guerrilla movement in the northeastern part of the country. There it showed its strength for the first time the self called National Liberation Army, also known as the ELN.

The M-19 movement appears in 1970. In December 1979 some 5000 weapons were robbed from an army canton in the north of Bogotá. Those years were characterized both by the decrease of transitory violence and by the replenishing and strengthening of this group.

FIGURE 3



From 1982 to 1986 there were intensive efforts by the government, conducive to reach cease fire agreements with the different subversive groups, except for the ELN, as it is shown in Figure #3, which depicts again the decrease of this type of violence. However, in these agreements the substantial items on this matter were not clearly resolved, specially regarding demobilization of the rebellious groups and the surrendering of their weapons. The agreements generated positive advantages for the rebels, by paralyzing military operations and leaving large empty gaps, that were occupied by new guerrilla fronts, by means of the spreading out of the already existing fronts.

As a result of above, from 1986 to 1990 transitory violence takes the form of general conflict, made of a confrontation among the government, the drug traffickers and the guerrilla, which caused hundreds of deaths in the Unión Patriótica, the assessination of the Attorney General of the Nation Carlos Mauro Hoyos and of reputable leaders such as Jaime Pardo Leal, Bernardo Jaramillo, Luis Carlos Galán and Carlos Pizarro. The assault to the Palace of Justice on October 6, 1985 by the M-19 revolutionary movement was the final thrust to the frustrated peace seeking processes and caused the vertical take-off of Colombian domestic transitory violence. The figure clearly shows the escalation of this series beginning in that year. Even though during 1995 and 1996, transitory violence begins to decrease [13], being the decrease specially noticeable in Cali and Medellín, according to a report issued by the Colombian Legal Medicine authorities, a fact that will affect the total national average. However, the condition continues to be worrisome, if you take into consideration that from 1995 to present, 26 mayors and 140 councils have been assessinated [14].

It can then be concluded that the cyclical or transitory violence obtained from the annual series of homicides (source: National Police) coincides statistically with the political reality of the country from 1946 to 1996 [15]. It can also be seen how during the last three government periods 1986-1990,90-94 and 94-96, the phenomenon grows markedly [16].

FIGURE 4

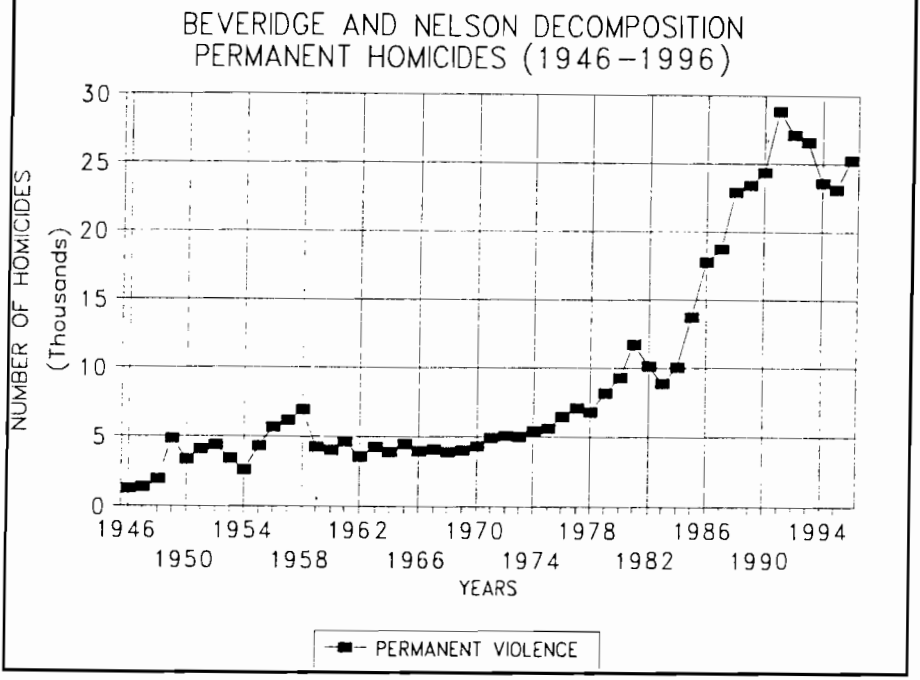
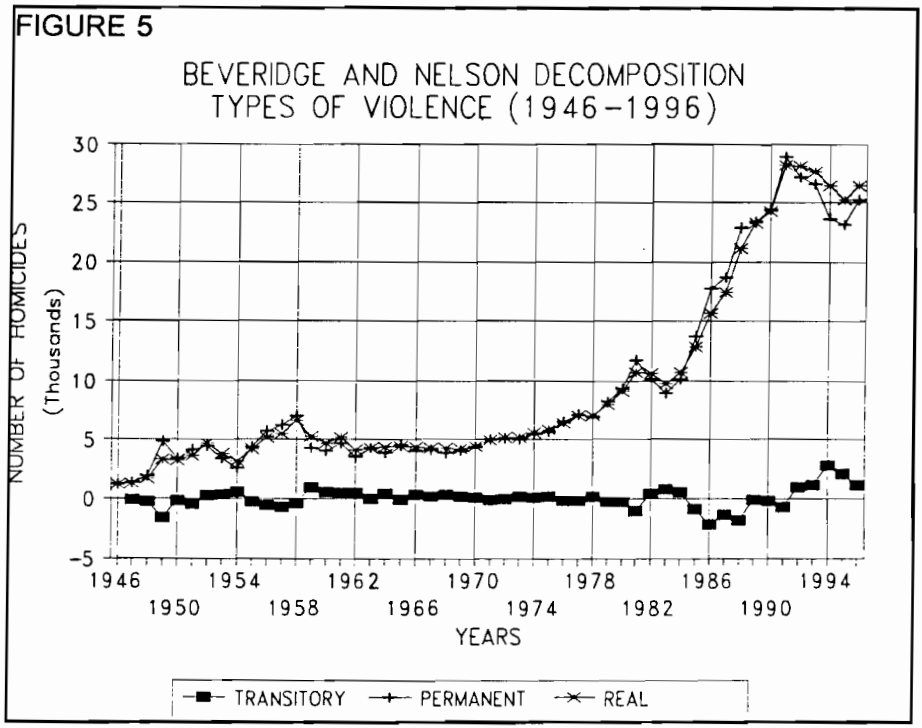


FIGURE 5



VECTOR AUTOREGRESSION APPROACH (VAR):

It is finally adopted and used in this paper the methodology proposed by Syms for modeling fluctuations in production. This one postulates the existence not only of one single and specific type of disturbance, either nominal, real or mixed (a weighted average of the first two) as it is assumed by the alternative and traditional approaches, and admits the existence of several disturbances that jointly affect production or the series studied by means of a system of linear equations.

Therefore, by knowing the deficiencies of the two first approaches, we will attempt to study the fluctuations of domestic violence by using this third method, which permits to know the joint behavior of domestic violence and of other socio-economic variables by means of a methodology of vector autoregressions (VAR) and of vector error correction (VEC) [17]. Traditionally, violence is supposed to be likely controlled by the presence of two types of innovations: first, "real innovations" such as the increase in military and police expenses, which could be considered from the Keynesian perspective as transitory, in the sense that real shocks of this type would cause decreases in the dynamics of violence, that would disappear with time, not causing final eradicating effects in the long run. On the other hand, the "effective innovations" (increase in the number of active troops) are expected to have long run effects on its behavior. The approach of this paper is then, to study how different types of variables; as effective, real or social ones, affect jointly the permanent and transitory components of Colombian domestic violence.

DESCRIPTION OF THE REAL VARIABLES

The real variables comprise an ample group of macroeconomic variables such as military expenses, national police expenses, total defense expenditures (addition of the first two), total taxes,

monthly legal minimum wage, gross domestic fixed capital formation (FBKF); expenses of the Ministries of Public Works, Justice, Health and Education (these last two are commonly classified as social expenditures); money supply M1 (as a proxy to measure the wealth effect), capital balance, gross exploitation surplus, trade balance, Gross Domestic Product (GDP), interest rate, private consumption, and governmental consumption. As deflactor it is used the implicit price index of the GDP base 75=100.

DESCRIPTION OF THE EFFECTIVE VARIABLES

The effective ones comprise a group of basically non monetary variables such as the total number of personnel of the Colombian Police, total number of active members of the armed forces [18], total number of active troops (addition of these last two); and other variables of social character such as the evolution of the number of students enrolled in all fields of knowledge and unemployment rate [19]. The historical series for the two types of variables are those corresponding to the period 1946 -1996.

CHARACTERIZATION OF THE SERIES UNIT ROOT TESTS

The tests most frequently used in order to verify the presence of unit roots are the Dickey & Fuller's tests. The Dickey & Fuller's simple test (DF) uses the following specification:

$$\Delta Y_t = \alpha + \theta \cdot t + \phi y_{t-1} + \varepsilon t \qquad (6)$$

And for Augmented Dickey & Fuller test (ADF), which adds several lags to the independent variable in an attempt to correct possible autocorrelation problems of the residuals, its specification would be the following :

$$\Delta Y_t = \alpha + \theta.t + \phi\, y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (7)$$

In both tests, the null hypothesis, that is, the existence of a unit root, is given by ϕ=0. The application of the unit root tests, was carried out following Misas and Suescún methodology [20], in which in ADF tests, in order to select the autoregression process, k, a general model is specified, in which a maximum limit of lags k*, is previously selected, but large enough to capture possible seasonalities of the series, and lags are eliminated sequentially if: a) when estimating regression the last lag does not turn out to be significant b) if the residuals of the corresponding regression passes a white noise test at the 0,05 significance level [21].

With annual information for the period from 1946 to 1996, coming from stationary tests, it is then concluded that all the variables are non stationary as it can be seen in chart #2, thus implying that due to having unit root it will be necessary to differentiate them before entering to the corresponding VAR or VEC models.

Chart #2 Dickey & Fuller's tests to verify the presence of unit roots. 1946-1996.

(Real Variables)

SERIES	TEST 1					TEST 2				
	DF	ADF	SQ	R	ROOT	DF	ADF	SQ	R	ROOT
Lhomito	2.83	1.38	0.95	10	Yes	-1.49	0.64	0.94	10	Yes
VIPER	1.87	1.67	0.99	8	Yes	0.37	0.37	0.8	61	Yes
VITRA	-2.87	2.98	0.96	5	NO	-2.84	-2.86	0.96	5	Yes
(GDEF)	5.04	4.34	0.21	1	Yes	3.80	3.62	0.14	1	Yes
(TAXT)	2.79	4.02	0.61	18	Yes	1.45	3.08	0.73	12	Yes
SMLM)	0.0417	-0.259	0.99	9	Yes	-1.78	-2.29	0.988	9	Yes
(FBKF)	3.402	3.30	0.97	11	Yes	1.81	2.79	0.98	11	Yes
(GASOC)	2.023	1.021	0.785	17	Yes	0.33	0.76	0.63	17	Yes
(M1)	2.37	-0.708	0.99	13	Yes	-0.045	-1.01	0.99	13	Yes
(BAK)	0.04701	0.22	0.84	6	Yes	-0.69	0.48	0.75	18	Yes
(EXBRU)	2.44	0.00231	0.68	14	Yes	-0.32	-0.69	0.26	18	Yes
(BCIAL)	0.38	-0.29	0.81	9	Yes	-1.21	-0.73	0.85	9	Yes
(GDP)	16.6	0.34	0.98	14	Yes	7.51	3.88	0.82	3	Yes
(TINTE)	0.283	0.91	0.90	2	Yes	-1.15	-0.87	0.91	2	Yes
(CPRIVA)	9.42	1.07	0.82	15	Yes	3.89	3.50	0.49	12	Yes
(CONGOB)	9.92	2.56	0.93	11	Yes	6.61	2.73	0.90	11	Yes
Critical values		With no drift				With drift				
5 percent	-1.95	-1.95				-3.50	-3.50			
10 percent	-1.61	-1.61				-3.18	-3.18			

Notes: Test 1: Without constant and deterministic tendency. (No drift)

Test 2: With constant and deterministic tendency. SQ: Q Lung-Box's Significance level, ADF's. (With drift)

R: Number of lags included in ADF test. ROOT: Unit root, the null hypothesis is the existence of unit root.

LHOMITO: Logarithm of the homicides series (National Police)

VIPER: Permanent component of the homicide series

VITRA: Transitory component series of the homicide series

GDEF: Total defense expenditure (National police + military armed forces)

TAXT: Total taxes

SMLM: Monthly minimum legal salary

FBKF: Gross domestic fixed capital formation

GASOC: Social expenditures (Ministry of Education + Ministry of Health expenditures)

M1: Money supply

BAK: Capital balance

EXBRU: Gross exploitation surplus

BCIAL: Trade balance

GDP: Gross domestic product

TINTE: Effective interest rate

CPRIVA: Private consumption

CONGOB: Governmental consumption

GAJUS, GASOB, GASED y GASUD, which correspond to expenditures in justice, public works, education and health respectively also showed to have unit root

Continuation of Chart #2 (Effective variables)

SERIES	TEST 1					TEST 2				
	DF	ADF	SQ	R	ROOT	DF	ADF	SQ	R	ROOT
(PIEPO)	3.58	4.0	0.98	1	YES	0.038	0.038	0.68	1	YES
(PIFM)	3.84	4.12	0.63	1	YES	1.40	2.20	0.99	9	YES
(PITAL)	4.40	4.0	0.83	1	YES	0.94	1.57	0.99	3	YES
(ESTUDI)	11.6	2.20	0.51	9	YES	4.45	2.58	0.86	12	YES
(D4)	0.34	0.44	0.97	3	YES	-1.85	-1.85	0.38	1	YES
Critical values	With no drift					With drift				
5 Percent	-1.95	-1.95				-3.50	-3.50			
10 Percent	-1.61	-1.61				-3.18	-3.18			

Notes: Test 1: Without constant and deterministic tendency. (No drift)

Test 2: With constant and deterministic tendency SQ: ADF's Q Lung-Box significance level, (With drift)

R: Number of lags included in ADF test. ROOT: Unit root, the null hypothesis is the existence of unit root.

PIEPO: Total number of policemen (includes civilian personnel)

PIFM: Total number of active members of the Colombian army.

PITAL: Total number of active militar and police personnel.

ESTUDI:Number of matriculated students (pre-elementary, elementary, secondary, university).

D4: Unemployment rate in four largest cities.

METHODOLOGY AND CALIBRATION OF VAR MODELS

In order to reply to the question of how the changes in real and effective variables can play an important role in the escalation of permanent or transitory violence and viceversa, or how the increase in both types of violence affects the aforementioned variables, maybe a complete model would be the most appropriate. However that type of model can be a very narrow structure in this context. Usually the models designed for simulation can typically be of this type.

Additionally, there is less freedom in this type of model in regards to the hypothesis suggested. In this regard, particularly Sims (1980) clarifies that the specification of a model requires to impose many arbitrary restrictions. Such type of warning does not sound good in the context of this paper, where by one side, we

know that the factors of influence over the two types of violence may be of many and varied nature and by the other having in mind that there is not enough quantity of econometric work in Colombia in regards to the determination of violence. Due to these reasons the Sim's innovation-accounting technique, discovered by Sims and perfected by Doan Litterman (1981) was selected, because of being potentially more informative than traditional modeling [22].

In view of our lack of knowledge about the variables influencing the specification of the equations of transitory and permanent violence, two vector autoregressions (VAR's) are proposed for estimating empirically the dynamic relationships among the real, effective and social variables.

The procedure followed consisted of estimating two unrestricted seven variable vector autoregressions (VAR's), using annual data for years 1946 to 1996 [23].

The estimated VARs by themselves supply little information, but they can be used to find the moving average representation of the system, which expresses the current value of each variable as an infinite addition of lags from the past innovations of all the variables of the system, plus the current innovations of the dependent variables.

We now derive the joint process followed by these seven variables, implied by our assumptions. Let Y denote the vector of the dependent variables, and "ed" the vector of the 7 types of resulting disturbances. Let X be the vector $(\Delta Y)'$ and e the vector of the disturbance (ed)'.

The assumptions of the following part imply that X follows a stationary process given by:

$$X(t) = A(0)e(t) + A(1)e(t-1) + \ldots\ldots \quad (*)$$

$$X(t) = \sum_{j=0}^{\infty} A(j)e(t-j), \qquad (8)$$

With Var(e) = I ,then based on the equation (*)

we obtain the VAR model:

$$\Delta Y = \sum_{j=i}^{k} \Delta Y_{t-j} E_{t-j} + e_t \qquad (9)$$

Where the sequence of matrices A is such that its left-hand entry , a11(j), j= 1,2,.....,sums to zero.

Equation (*) gives vector Y as distributed lags of the vector of disturbances, ed. Since these two disturbances are supposed to be uncorrelated, its variance covariance matrix is diagonal; the assumption that the covariance matrix is the identity, is then simply a convenient normalization. The contemporaneous effect of e on X is given by A(0); subsequent lag effects are given by A(j), $j \geq 1$. As X has been assumed to be stationary, neither disturbance has a long-run effect on any of the variables forming the vector, ΔY.

The restriction:

$$\sum_{j=0}^{\infty} a_{11}(j) = 0 \qquad (10)$$

implies that ed also has no effect on the level of Y itself. To see why this is so, notice that a11(j) is the effect of ed on ΔY after j periods and therefore:

$$\sum_{j=0}^{k} a_{11}(j) \qquad (11)$$

it is the effect of ed on Y itself after k periods. For ed to have no effect on Y in the long run, we must have then that:

$$\sum_{j=0}^{\infty} a_{11}(j) = 0 \qquad (12)$$

It is now possible to recover this representation from the data. Since $X^{(24)}$ is stationary, it has a Wold-moving average representation :

$X(t) = v(t) + C(1)v(t-1)+...$ (**)

That is:

$$X(t) = \sum_{j=0}^{\infty} C(j)v(t-j), \qquad (13)$$

with $Var(v) = \Omega$

$$\Delta Y = \sum_{j=i}^{k} \Delta Y_{t-j} E_{t-j} + V_t \qquad (14)$$

But here we have already transformed the et of the reduced form into v_t of the structural form.

This moving average representation is unique and can be obtained by first estimating and then inverting the vector autoregressive representation of X in the usual way.

Comparing equations (*) and (**) we see that v, the vector of innovations, and e, the vector of original disturbances, are related by v = A(0)e, and that A(j) = C(j)A(0), for all j. Thus knowledge of A(0) allows us to recover e from v, and similarly to obtain A(j) from C(j).

But is A(0) identified? An informal argument suggests that it is. Equations (*) and (**) imply that A(0) satisfies:

$A(0)A(0)'=\Omega$, and that the upper left-hand entry in the following equation is zero:

$$\sum_{j=0}^{\infty} A(j) = (\sum_{j=0}^{\infty} C(j))A(0) \qquad (15)$$

But given (, the first relation imposes three restrictions on the four elements of A(0); given:

$$\sum_{j=0}^{\infty} C(j) \qquad (16)$$

the other implications impose a fourth restriction. This informal argument is indeed correct. A rigurous and constructive proof,

which can be used to obtain A(0) is the following: Let S denote the unique lower Choleski's factor of Ω.

Any matrix A(0) such that A(0)A(0)' = Ω is an orthonormal transformation of S. The restriction that the upper left-hand entry in

$$(\sum_{j=0}^{\infty} C(j))A(0) \qquad (17)$$

be equal to zero is an orthogonality restriction [25], that then uniquely determines this orthonormal transformation[26].

In short, the procedure is as follows. We first estimate a vector autoregressive representation for X (VAR), and invert it to obtain (**). Following Sims' and Litterman's procedures, matrix A(0) is constructed; which is used to obtain:

A(j) = C(j)A(0), j = 0,1,2,.....,

Methodologically, we can summarize that it is necessary to orthogonalize the innovations by means of Choleski's factoring, by means of testing several types of ordering of the variables of the system. This ordering orcalibration is imposed a priori before obtaining the impulse response function, on which these types of figures are based.

The effects of changes in these orderings are shown further below and permit us to conclude which of the variables has the highest incidence in the dynamics of the two types of violence.

COINTEGRATION OF THE SERIES

The unit root tests confirm that the whole set of variables considered are not stationary, that is they have unit root. Therefore, there exists the possibility to perform linear combinations of these non stationary variables in order to find cointegration stationary vectors, which means that it is possible that the series be cointegrated. The cointegration between variables implies long run equilibrium relations between them with a return tendency.

The cointegration test for the series of permanent violence [27] consists of estimating by means of OLS the equation [28]:

$$VIPER = \alpha_1 BCIAL_t + \alpha_2 CONGOB_t + \alpha_3 PITAL_t + \\ + \alpha_4 GDEF_t + \alpha_5 ESTUDI_t + \alpha_6 D4_t + U_t \qquad (18)$$

For the series of transitory violence the equation selected was the following [29]:

$$VITRA = \alpha_1 PIEPO_t + \alpha_2 PIB_t + \alpha_3 CPRIV_t + \\ + \alpha_4 PIFM_t + \alpha_5 MI_t + \alpha_6 BCIAL_t + U_t \qquad (19)$$

Afterwards we go on to prove for each of the regressions the stationary nature of the corresponding Ut error term. Once the series of Ut error terms are obtained, two unit root tests are performed with regressions such as :

$$\Delta U_t = U_{t-1}$$

This is the **(20)**

DICKEY FULLER TEST FOR COINTEGRATION

If there is a unit root, then the error is not stationary, which means that the variables included in permanent violence are not cointegrated. This means that any shock in permanent violence has no tendency to disappear because homicides do not tend to return to their zero average, which means that a stable and predictable relation would not be confirmed between the real permanent violence and the independent variables. Since all the series included in the cointegrating vector both for permanent and transitory violence are I(1), it is possible to go on to prove the existence of cointegration, for the two series. By applying SARGAN & BHARGAVA's test, the cointegrating equations estimated (23 & 24) for the two types of violence are:

T Student statistics are those shown in parenthesis. According to ENGLE & YOO chart (1987) the critical values of the test [30], for a high order system with 50 data are: 1.49(1%), 1.03(5%), 0.83(10%).

For the regression of permanent violence the null hypothesis of no cointegration is rejected at 0,01 level, while for transitory violence the null hypothesis of no cointegration cannot be rejected at the same level.

$$VP = 2366.8 + 0.99\,BCIAL + 0.27\,CONGOB + 0.54\,PITAL + 0.24\,GDEF -$$
$$(-4.02) \quad (13.2) \quad (6.96) \quad (3.81) \quad (12.14)$$
$$-0.0016\,ESTUDI - 577.6D4 \qquad \textbf{(21)}$$
$$(-5.88) \quad (-6.71)$$
$$DW = 1.98 \qquad R^2 = 0,988$$

$$VT = -779.7 + 0.83\,PIEPO + 0.16\,PIB - 0.21\,CPRIV - 0.041\,PIFM$$
$$(-1.59) \quad (2.93) \quad (2.02) \quad (-2.14) \quad (-2.93)$$
$$-0.043\,MI - 0.018\,BCIAL \qquad \textbf{(22)}$$
$$(-2.39) \quad (-6.14)$$
$$DW = 1.38 \qquad R^2 = 0,68$$

In order to be more certain about the above mentioned hypothesis contrasts, we proceeded then to apply DICKEY & FULLER's contrast to the residuals coming from the previous regressions and after using the Sargan & Bhargava's tests, the following results were obtained for the case of the permanent violence:

$$\Delta Residuals VP_t = -0,9944 Residuals_{t-1}$$
$$(-6.73) \qquad \textbf{(23)}$$

and in regards to transitory violence :

$$\Delta ResidualsVT_t = -0,7084 Residuals_{t-1}$$
$$(-465) \qquad (24)$$

The charts which show that the critical values of the "t" coefficient, are as follows: –5.41(1%), –4.76(5%), and –4.42(10%) allow us to reject the null hypothesis of no cointegration of the variables that comprise the equations of permanent and transitory violence. Then we conclude that the series are cointegrated[31], and therefore it is possible to modify the VAR models for permanent and transitory violence, introducing the error terms of the Sargan & Bhargava's equations, which incorporate the equilibrium relations of these variables, being therefore possible to arrive through this method to vector error correction models (VEC).

The results found by means of the cointegrating equations, are really surprising and are far from obvious. In the case of permanent violence the data are consistent with the following signs for the elasticities calculated: positive signs for the trade balance, for government consumption, total active military forces, and defense expenditures. And negative ones for the number of enrolled students and for unemployment rate.

In the case of the elasticities estimated for transitory violence, we have positive signs for total active police personnel and for Gross Domestic Product; and negative ones for private consumption, total active army troops, money supply and trade balance.

VECTOR ERROR CORRECTION MODELS VEC [32]

Vec model for permanent violence

Based on the evidence found by means of the equation of permanent violence and the existence of cointegration between its

variables, it is decided to estimate a VEC model, which incorporates the error term of the Sargan & Bhargava's equations, which incorporates the relations of equilibrium between the variables. The model includes the following variables: total active troops (police personnel plus armed forces); total defense expenditures (national police expenditures plus armed forces expenditures), total of enrolled students (pre-elementary, elementary, high school and graduates), governmental consumption, trade balance, unemployment rate in the four largest cities and the estimated series of permanent homicides (permanent violence).

Vec Model for Transitory Violence

This model includes the variables total active police personnel, GDP, private consumption, total active army troops, M1 money supply as proxy for the wealth effect, trade balance and the estimated series of transitory homicides (transitory violence).

TESTS OF LAG LENGTH

There are relatively few interesting hypothesis that can be proven through the use of estimates of an independent equation of a VAR model. Even the Block F tests, which indicate if variable z helps to forecast variable x one period in advance, are not individually important, considering that z may still affect x through the other equations in the system.

There are other tests such as the likelihood ratio for the two models, whose intention is to prove if it is better to work with a model with less lags and more parsimoniously. Therefore in this part it is used the likelihood ratio (which uses the correction of SIMS)[33] degrees of freedom, and additionally it is used the selection criteria of lengths of AKAIKE's and SCHWARTZ's, in order to determine the specification more accurately.

The unsubmitted results confirm, with the use of the likelihood ratio for the two models, a good interrelationship between variables when working with two lags in each of them; however the performance of additional tests such as the AKAIKE's and SCHWARTZ's criteria, permitted to establish more precisely that for the VECVP and VECVT[34] models the optimum length lag is 2, thus obtaining a parsimonious specification.

VARIANCE DECOMPOSITION AND CALIBRATION

The following charts present the variance decompositions for the forecast errors, that are made in each moment in time, and their purpose is to show how the variance of the errors in the projection is explained by each of the variables that participate in the VEC's

Here is where the important point related with the calibration or factoring of the equations is necessary in order to obtain orthogonalized errors so as to carry out the moving average representations given by equation (16)

Permanent violence

Decomposition of Variance for Series HOMP, ordering:(dbc dcong dpit dd4 dest dgd dhomp [35])[36] CHART #3

Step	Std Error	BC	CONG	PIT	D4	EST	GD	HOMP
1	1096.3506	21.24007	10.10889	12.05468	16.34066	0.93699	3.22600	36.09272
3	2776.8496	32.37160	14.03321	17.69043	5.96562	0.46283	1.10115	28.37516
5	4099.5811	33.74424	20.05715	17.47070	3.85691	0.61518	0.94182	23.31400
7	5047.3737	30.55417	29.64996	16.10305	4.07035	0.51798	1.13115	17.97334
9	6113.2014	26.95426	39.82874	12.46940	6.24069	0.38630	1.55353	12.56709
11	7871.6542	22.50742	44.56333	7.69863	10.45362	0.87958	1.97872	11.91869
13	10883.0633	18.18730	41.31907	4.08921	14.99091	2.57444	2.09187	16.74719
15	15541.2607	15.33177	34.32932	2.33654	18.26744	4.98663	1.93182	22.81647
17	22063.2208	13.92223	27.55668	1.71485	20.25799	7.46226	1.68039	27.40560

Decomposition of Variance for Series HOMP, ordering:(dgd dest dd4 dbc dcong dpit dhomp) CHART #4

Step	Std Error	GD	EST	D4	BC	CONG	PIT	HOMP
1	1096.35061	1.13724	1.68569	8.43370	32.66344	7.41669	12.57052	36.09272
3	2776.74582	0.26689	0.42414	1.60163	41.01536	9.60764	18.70706	28.37728
5	4068.29246	0.61915	0.30095	1.38387	43.82418	12.45525	18.18958	23.22701
7	4905.86605	3.03379	0.21619	1.18254	41.89385	18.37509	16.75979	18.53876
9	5828.55860	6.76276	0.19601	0.84815	40.13014	25.46637	13.10754	13.48902
11	7325.67761	9.62492	0.84685	0.58814	36.68330	30.35458	8.36018	13.54204
13	9843.83651	10.30522	3.15431	0.66489	30.06685	30.68759	5.25170	19.86944
15	13704.14078	9.01670	6.60348	1.06090	23.66254	27.69197	4.36897	27.59544
17	19000.92515	7.07759	10.31568	1.53835	19.19486	23.90429	4.65595	33.31328

Decomposition of Variance for Series HOMP, ordering:(dbc dcong dpit dgd dest dd4 dhomp) CHART #5

Step	Std Error	BC	CONG	PIT	GD	EST	D4	HOMP
1	1096.35061	21.24007	10.10889	12.05468	2.39295	0.65886	17.45183	36.09272
3	2776.74582	32.39143	14.44254	17.73666	0.73500	0.45639	5.86069	28.37728
5	4068.29246	34.40611	21.05194	17.21424	0.51569	0.56569	3.01932	23.22701
7	4905.86605	30.44024	31.51570	15.93460	0.57810	0.41132	2.58127	18.53876
9	5828.55860	26.30173	43.42910	12.50011	0.78789	0.42806	3.06409	13.48902
11	7325.67761	21.61193	50.33517	7.97981	0.97029	1.61951	3.94125	13.54204
13	9843.83651	16.11853	48.09264	4.78131	0.97714	5.09358	5.06736	19.86944
15	13704.14078	11.94182	40.32892	3.50872	0.84082	9.76228	6.02200	27.59544
17	19000.92515	9.58421	32.08512	3.31898	0.66777	14.39421	6.63644	33.31328

Charts 3, 4 and 5 show three different orderings for the variables, considering that there is an important correlation between the variables comprising vector Ut of equation (8) relating permanent violence. In Chart 3 it can be seen that when performing the order trade balance, government consumption and total active troops BC,CONG,PIT). At the beginning, the largest possible quantity of innovations of each period is attributed to exogenous shocks in these variables, which means that this ordering assigns the most important role to these variables, in order to explain the forecast error in permanent violence. This conclusion is confirmed by Charts 4 and 5.

In Chart #4 these three variables are now put at the end of the ordering (dgd, dest, dd4 dbc dcong, dpit, dhomp), and the conclusion is that the contribution of the trade balance, government consumption and total of active troops continue prevailing in order to explain the forecast errors of the series of permanent violence. There you can see that the contribution of these variables increases rapidly, while the contribution in defense expenditures, enrolled

students and unemployment decrease, as the forecast horizons extends. After 14 years, it can be seen that trade balance, government consumption and total active troops are a lot more responsible for the forecasting errors than the rest of the variables. Chart 5 shows the order finally selected, which is responsible for the efficient orthogonalization of the errors by means of the seven equations estimated [37].

Transitory violence

The calibration of the VECVT model is carried out by trying different types of factorization. Charts 6, 7 and 8 show the evidence found.

Decomposition of Variance for Series HOMT, ordering (dbc dpipo dpifm dpib dcpr dm1 dhomt) [38] CHART #6

Step	Std Error	BC	CPR	PIFM	M1	PIB	PIPO	HOMT
1	469.206372	31.20928	2.31894	7.78887	0.63796	11.14465	4.29406	42.60623
3	1233.903207	47.83724	0.49668	3.79702	0.28997	2.07825	2.11322	43.38760
5	1765.215285	45.47886	0.53992	4.78845	0.36537	1.02624	1.60009	46.20106
7	2216.575392	42.76574	0.38918	5.55823	0.98968	0.68470	1.82467	47.78779
9	2627.535160	41.20586	0.27926	5.78700	1.99639	0.68883	2.36671	47.67595
11	3004.762440	40.84874	0.21687	6.12848	2.73697	0.81952	2.62436	46.62507
13	3347.610133	40.84568	0.18294	6.38794	3.28850	0.91648	2.76179	45.61666
15	3668.705421	41.32500	0.17997	6.48434	3.43723	0.93824	2.82787	44.80734
17	3964.618496	41.86142	0.17394	6.53713	3.43443	0.91993	2.83815	44.23500

Decomposition of Variance for Series HOMT, ordering (dpib dcpr dm1 dbc dpipo dpifm dhomt) CHART #7

Step	Std Error	PIB	PIPO	M1	PIFM	BC	CPR	HOMT
1	469.206372	9.86055	23.46142	5.45320	1.61330	16.77112	0.23417	42.60623
3	1233.903207	6.13615	6.59699	2.39917	2.33029	38.54778	0.60202	43.38760
5	1765.215285	3.33159	5.34561	2.75912	1.70071	40.24837	0.41354	46.20106
7	2216.575392	2.15266	3.87904	3.49888	1.39803	40.99843	0.28517	47.78779
9	2627.535160	1.55854	2.83748	4.17389	1.50188	42.04850	0.20374	47.67595
11	3004.762440	1.24538	2.23156	4.60781	1.61363	43.49566	0.18089	46.62507
13	3347.610133	1.04755	1.84437	4.95991	1.70810	44.63773	0.18569	45.61666
15	3668.705421	0.87316	1.58926	5.07350	1.82545	45.63000	0.20130	44.80734
17	3964.618496	0.75065	1.43491	5.10293	1.90233	46.36944	0.20474	44.23500

Decomposition of Variance for Series HOMT, ordering (dbc dpipo dpifm dpib dm1 dcpr dhomt) CHART #8

Step	Std Error	BC	M1	PIFM	CPR	PIB	PIPO	HOMT
1	469.206372	31.20928	0.01644	10.22419	0.50514	11.14465	4.29406	42.60623
3	1233.903207	47.83724	0.03617	4.33150	0.21600	2.07825	2.11322	43.38760
5	1765.215285	45.47886	0.62288	4.95812	0.11275	1.02624	1.60009	46.20106
7	2216.575392	42.76574	1.55551	5.11364	0.26794	0.68470	1.82467	47.78779
9	2627.535160	41.20586	2.73643	4.82178	0.50443	0.68883	2.36671	47.67595
11	3004.762440	40.84874	3.58345	4.74611	0.75275	0.81952	2.62436	46.62507
13	3347.610133	40.84568	4.18925	4.68904	0.98111	0.91648	2.76179	45.61666
15	3668.705421	41.32500	4.31917	4.58866	1.19371	0.93824	2.82787	44.80734
17	3964.618496	41.86142	4.29817	4.53100	1.31633	0.91993	2.83815	44.23500

In the ordering indicated by Chart 6, you can see that the variables trade balance, total number of police personnel, and total number of active army troops have the greatest responsibility in the explanation of the forecasting errors for the series of transitory violence, the contribution of these three variables is large and grows rapidly as the forecasting horizon extends. The contribution of private consumption, money supply, and gross domestic product is lower than that one of the other three mentioned variables and grows rapidly.

In Chart #7 the entry order of the variables to the system is reversed. Now the trade balance, total number of police personnel and total number of active army troops precedes transitory violence, and the conclusions of the previous paragraph apply also here. The ordering of Chart 8 is the one finally selected.

In short, we conclude based on the evidence found in Colombia that the exogenous movements in the trade balance, the government consumption, and the total number of active troops have played prominent roles in the determination of the path of permanent violence.

In regards to transitory violence the strongest factors have been trade balance, the total number of police personnel, and the total number of active army troops.

F TESTS OF EXCLUSION RESTRICTIONS

The estimated VEC models actually supply little information, however they are interesting because of the calculation of its moving average representations (MAR).

With information purposes we now present the F tests about the set of variables, whose null hypothesis postulates that $\beta=0$ (the lags of the included variables are zero) compared with the alternative $\beta \neq 0$. In Chart 9 are shown the results for model VECVP, and Chart #10 refers to model VECVT. The critical values of the F tests for both models, at the 0,10 level are $F(7,28) = 1.94$ [39] for the first one and $F(7,22) = 2,01$ for the second. In each line of these charts is located an equation of the VEC system, where the dependent variable is in function of the lags of all the variables of the system. In columns 5 and 6 are located the indicators of statistical adjustment for each equation.

The F test of column 1 and row 1, details how that the null hypothesis consisting of the fact that the coefficients of the lags of the trade balance exert influence in order to explain its own evolution are equal to zero, is accepted.

Also, by reading column 2 and row 4 as the hypothesis test consisting of the fact that the set of lags of the growth of government consumption Dcong are equal to zero, or do not influence to explain the changes in defense expenditures is rejected.

CHART #9

F TEST OVER THE SET OF THE COEFFICIENTS OF THE SYSTEM VECVP WITH TWO LAGS AND 28 DEGREES OF FREEDOM BY EQUATION

DEPENDENT VARIABLES EQUATIONS	LAGGED VARIABLES							STATISTICS	
	(1)D BC	(2)D CONG	(3)D PIT	(4)D GD	(5)D EST	(6)D D4	(7) DHOMP	R^^2	D.W
(1)DBC	0.96	0.051	0.025	0.568	0.50	0.50	0.032	0.43	2.08
(2)DCONG	1.76	5.30	0.47	2.17	0.53	3.17	2.01	0.68	2.09
(3)DPIT	1.25	0.78	0.55	1.21	0.14	2.20	0.43	0.38	1.88
(4)DGD	0.27	2.46	1.44	0.96	0.02	0.17	1.69	0.51	1.91
(5)DEST	1.61	0.05	0.27	1.86	6.11	1.15	0.68	0.66	2.04
(6)DD4	3.28	0.35	0.70	2.196	1.33	0.73	1.67	0.58	2.04
(7)DHOMP	0.10	0.17	0.79	0.16	0.73	0.40	0.81	0.52	2.06

Continuing this way the reading we have that the information supplied by the chart is as follows:

a) Government consumption is influenced or depends on the lags of the same consumption, defense expenditures, unemployment rate and permanent violence.

b) The total number of active troops depends on the unemployment rate.

c) Defense expenditure depends on government consumption

.

d) The behavior of the enrolled students depends on its lags (inertial variable).

e) The unemployment rate depends on the trade balance and on defense expenditures.

g) Permanent violence is not influenced by any of the variables herein studied. It seems to be completely exogenous.

CHART #10

F TEST OVER THE SET OF THE COEFFICIENTS OF THE VECVT SYSTEM WITH TWO LAGS AND 22 DEGREES OF FREEDOM BY EQUATION

DEPENDENT VARIABLES (EQUATIONS)	LAGGED VARIABLES							STATISTICS	
	(1) DBC	(2)D PIPO	(3)D PIFM	(4)D PIB	(5)D M1	(6)D CPR	(7) DHOMT	R^^2	D.W
(1)DBC	3.19	0.90	0.02	1.99	0.63	0.31	0.06	0.53	2.03
(2)DPIPO	1.09	2.66	0.11	4.14	0.37	1.72	0.05	0.48	2.09
(3)DPIFM	0.59	1.64	1.99	4.48	1.84	2.77	1.11	0.57	2.29
(4)DPIB	0.14	0.11	1.48	3.04	3.66	1.57	0.62	0.75	1.73
(5)DM1	0.09	1.51	3.25	0.11	1.42	0.15	0.22	0.43	2.14
(6)DCPR	3.61	7.81	0.18	2.87	0.55	4.28	0.18	0.81	1.48
(7)DHOMT	3.18	5.66	1.62	0.97	1.44	0.28	1.79	0.60	1.93

From reading and contrasting the hypothesis in this chart, we can conclude the following :

a) The trade balance is inertial (It depends on its past).

b) The total of the police personnel is influenced by itself and by the GDP.

c) The total number of active army troops depends on the GDP and on private consumption.

d) The GDP is influenced by itself and by money supply.

e) Money supply is influenced by the number of the total active army troops .

f) Private consumption is mainly inertial (consumption generates consumption), and it is additionally influenced by the trade balance, the total number of police personnel and the GDP.

g) Transitory violence is influenced by the trade balance and by the total number of police personnel.

In short, the two charts are showing findings and evidence regarding the two types of dynamics: Additionally it can be seen that the estimates made in regards to the two VEC models are consistent, since you can see that as a result of the second model arise relations as evident as the inertial nature of the GDP, and the capacity of the money supply to exert influence on its path.

IMPULSE- RESPONSE FUNCTIONS

The purpose of this section is to analyze the response of the two systems to unforeseen changes in their variables. For this analysis it is necessary to assume that in a zero moment (t=0) occurs a shock in the explicative variables, but that there are no new disturbances in further periods.

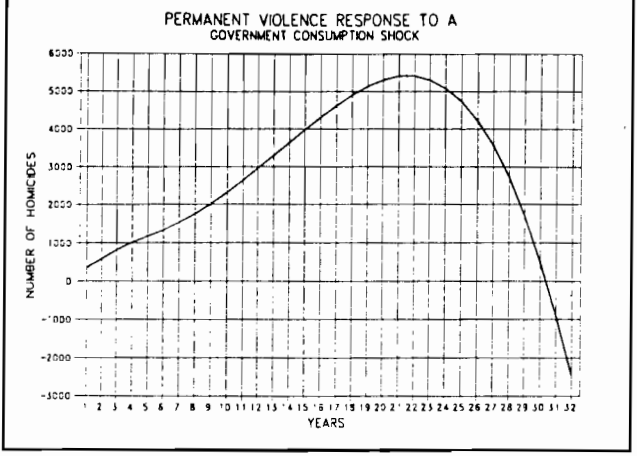
Responses to the vec model wilh permanent violence [40]

The impulse-response functions (IRF), are performed by using the same entry order of the variables to the system, that is BC-CONG-PIT-GD-EST-D4-HOMP, which corresponds to trade balance, government consumption, total nurnber of active troops, defense expenditure, unemployment rate and permanent violence [41].

A) RESPONSE OF PERMANENT VIOLENCE TO A SHOCK IN GOVERNMENT CONSUMPTION

In general it is seen how permanent violence is sensitive to the increase in government consumption. A shock of a standard deviation of consumption is causing permanent and positive additions to permanent violence, which only begins to decrease many years ahead.

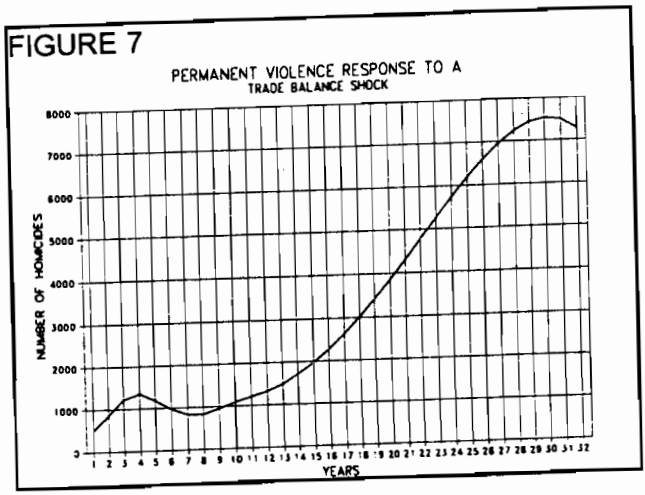
FIGURE 6



B) RESPONSE OF PERMANENT VIOLENCE TO A SHOCK IN THE TRADE BALANCE[42]

The shock in the trade balance causes immediate effects of increase in the homicides, being its action slow. This variable has an effect contrary to the one herein presented, on the series of transitory violence. This situation is partially due to the fact that the two types of violence are contemporarily inversely correlated.

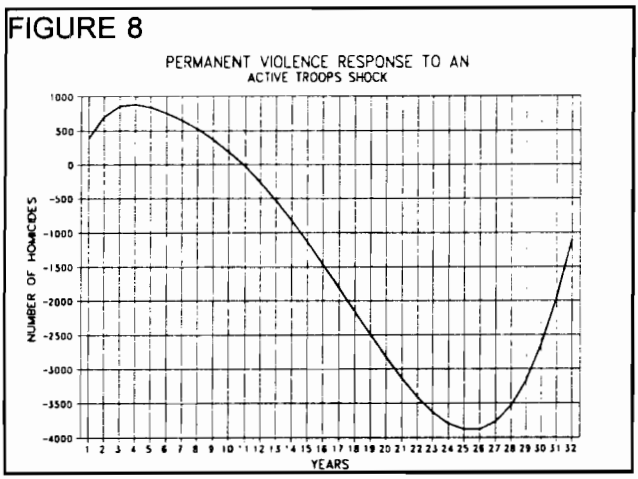
FIGURE 7



C) RESPONSE OF PERMANENT VIOLENCE TO A SHOCK IN TOTAL ACTIVE TROOPS

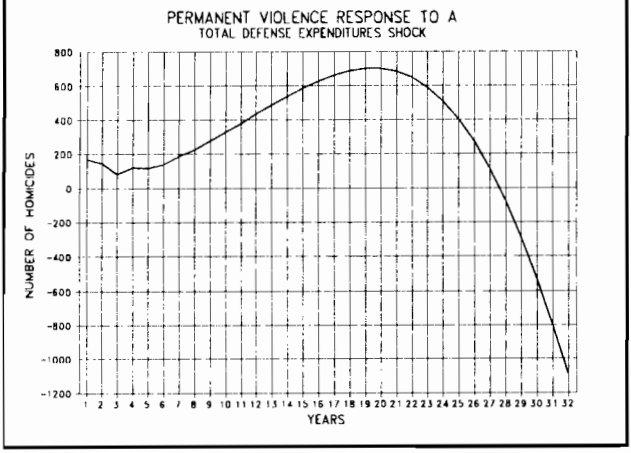
The increase in the total active troops is decisive and even though it increases permanent violence at first, its action is practically immediate, since after the fourth year, the inflection of the series of permanent homicides changes.

FIGURE 8



D) RESPONSE OF PERMANENT VIOLENCE TO A SHOCK IN TOTAL DEFENSE EXPENDITURES.

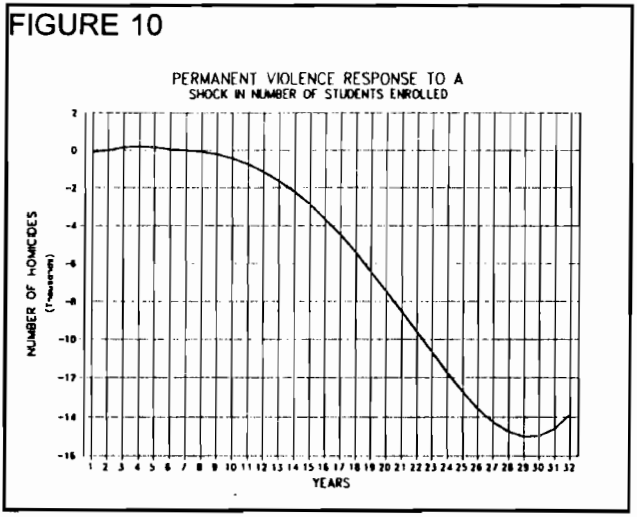
FIGURE 9



The total defense expenditures is inefficient in its effect of decelerating this type of violence . In the figure it can be seen how its action would be operating with a 18 year delay. This figure would also confirm how the defense expenditures generate violence. Behind this result it is possibly hidden the fact that inefficiency in defense is the cause of this situation (Figure #9).

E) RESPONSE OF PERMANENT VIOLENCE TO A SHOCK IN NUMBER OF ENROLLED STUDENTS

FIGURE 10

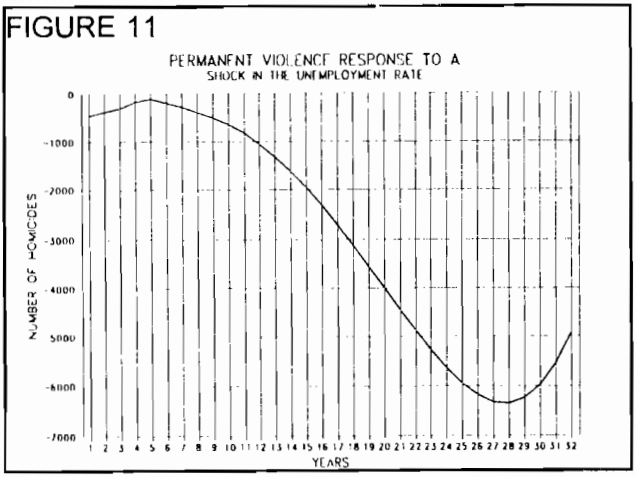


The increase in the educational capacity in terms of number of students enrolled at all levels is an efficient variable in the control of this type of violence. It can be seen how in year 14, after the shock, this variable will have diminished permanent violence by 2000 homicides a year, while the increase in the total number of active troops can only decrease violence by 750 cases during this year.

F) RESPONSE OF PERMANENT VIOLENCE TO A SHOCK IN THE UNEMPLOYMENT RATE [43]

The result obtained in this figure is maybe one of the most surprising. Firstly the escalation of the unemployment rate in the four largest cities generates increases in the series up to the fourth year, but then it begins to decrease. In regards to this matter, I kindly send the anxious reader to the section of conclusions, where the reasons for this result are explained and where the provisional foundations for a theory explaining the cycles of violence is stated.

FIGURE 11



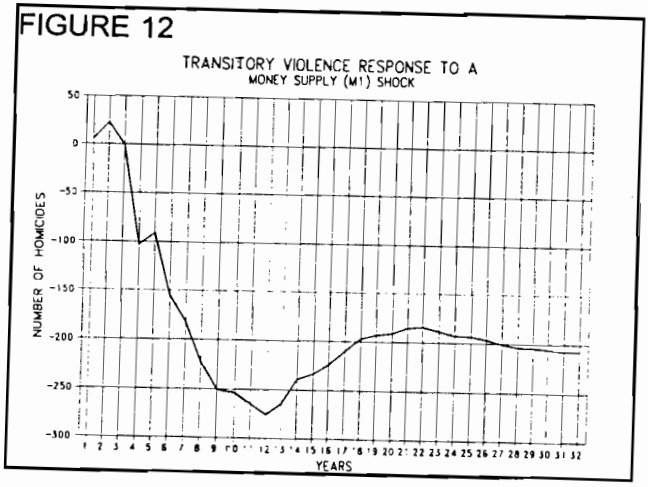
RESPONSES TO THE VEC MODEL WITH TRANSITORY VIOLENCE [44]

The impulse-response functions (IRF), are shown by using the same entry ordering of the variables to the system, that is BC-PIPO-PIFM-PIB-M1-CPR-HOMT, which corresponds to trade balance, total number of police personnel, total active troops in the armed forces, Gross Domestic Product, money supply, private consumption and transitory violence.

A) RESPONSE OF TRANSITORY VIOLENCE TO A SHOCK IN MONEY SUPPLY

The wealth effect measured by a shock in money supply shows from the beginning an immediate effect to control transitory homicides.

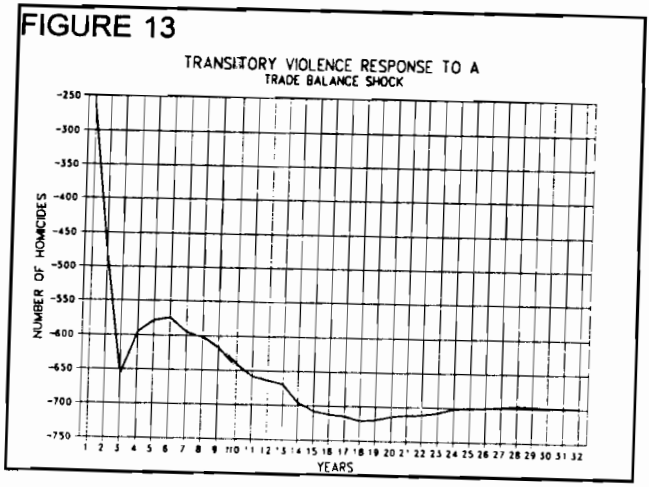
FIGURE 12



B) RESPONSE OF TRANSITORY VIOLENCE TO A SHOCK IN THE TRADE BALANCE

As previously stated, the trade balance has an inverse effect in the case of the transitory violence; this is the most effective variable for controlling transitory violence, since a shock in the trade balance decreases this type of violence by 275 homicides the first year, and stabilizes in 700 beginning in the 14th year.

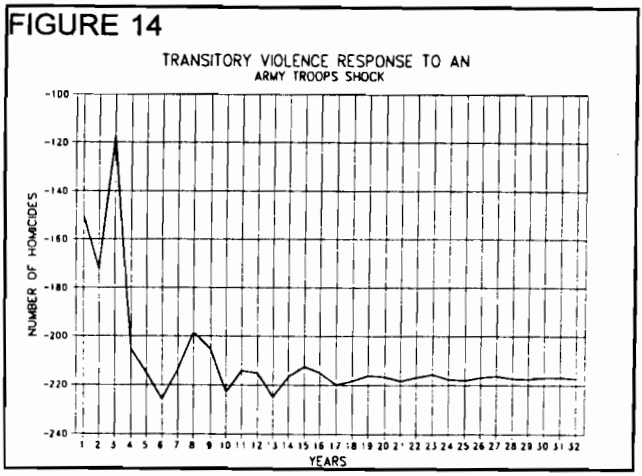
FIGURE 13



C) RESPONSE OF TRANSITORY VIOLENCE TO A SHOCK IN TOTAL NUMBER OF ACTIVE ARMY TROOPS

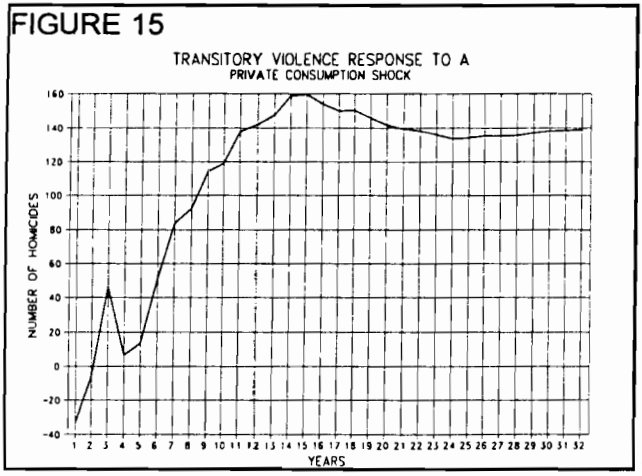
An increase in the total number of active troops is highly efficient for controlling transitory or political violence. It causes an immediate effect. The first year homicides decrease by 150 and stabilize in 200 towards the 14th year.

FIGURE 14



D) RESPONSE OF TRANSITORY VIOLENCE TO A SHOCK IN PRIVATE CONSUMPTION

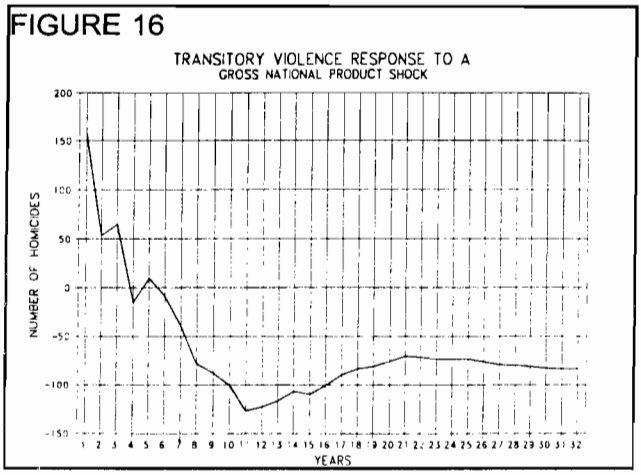
FIGURE 15



It can again be seen how the increase in consumption, private in this case, influences transitory violence in a positive and persistent manner. Firstly a decrease in violence occurs, but as of the second year there are innovations which increase this type of violence.

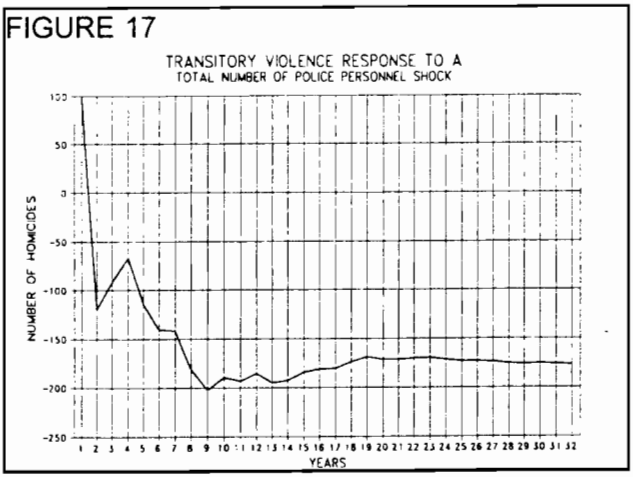
E) RESPONSE OF TRANSITORY VIOLENCE TO A SHOCK IN GROSS DOMESTIC PRODUCT.

FIGURE 16



F) RESPONSE OF TRANSITORY VIOLENCE TO A SHOCK IN THE TOTAL NUMBER OF POLICE PERSONNEL

FIGURE 17



It is shown the persistence of the variables total number of active army troops (Figure #14). And in this figure the total number of police personnel are highly effective variables to control this kind of violence.

CONCLUSIONS

The purpose of this paper has been to establish the variables that affect the dynamics of the Colombian violence, based on a completely atheoretical and unrestricted model, of the VAR type, beginning with an array of 24 variables which were hypothetically considered to be related with the phenomenon.

Firstly, the B&N decomposition of economic time series is applied in order to obtain two types of violence. It was possible to find an ARIMA model with good fitting, which was the one responsible for obtaining the permanent and transitory components contemporarily inversely correlated, called permanent and transitory violence respectively. It was found that the second component particularly coincides with the general historical framework that has characterized Colombian violence from 1946 to 1996. For that

reason, I decided to name Colombian transitory violence with the generic expression "political violence".

Based on above the ground is prepared to estimate two VAR models, permitting to contribute evidence of the multiple channels by means of which the two identified types of violence are fed. For this purpose, unit root tests were applied, and it was found that the 24 variables are either non stationary or have unit root, which permitted to start searching stationary cointegrating vectors in order to obtain the benefit inherent to the cointegrating regressions. By making an optimum search of these regressions through varying combinations of explanatory variables, I established that each of the two types of violence is explained in a solid and coincidential manner by a total of six independent variables, thus arriving at two compact reduced-form models of the Colombian violence. In regards to permanent violence this is explained by the dynamics of the trade balance, the government consumption, the total number of active troops, the defense expenditures, the number of enrolled students and the unemployment rate.

As far as transitory violence is concerned, this is explained by the total number of police personnel, the Gross Domestic Product, private consumption, total number of active army troops, money supply and again by the trade balance.

The cointegrating regressions, besides having the quality of being solid due to their fitting, permit the estimation of elasticities which up to that moment surprise us for showing apparently contradictory signs. However these regressions technically permit the estimation of vector error correction (VEC), which benefit first from the properties of the cointegrating equations, which convert them into efficient models for forecasting purposes and on the other hand from an optimum process of orthogonalization of the residuals between the equations.

Econometrically speaking, there is technical consistency, which permits me to take the risk of proposing the provisional foundations for a theory to explain the Colombian violence cycles, based on the results coming from the decompositions of variance, the F tests, which explain thelagged variables that are specifically influencing

each of the dependent variables or equations; the reconstruction and chaining of the series of effects that each of the variables exert on the types of violence, as can be concluded from the IRF and finally obtaining help from the immediate signs found for the rest of the dynamic effects caused in the rest of the variables, when the shocks of all the variables are considered [45].

PROVISIONAL FOUNDATIONS FOR A THEORY TO EXPLAIN VIOLENCE CYCLES IN COLOMBIA

Evidence for permanent violence

By briefly summarizing the findings, we would have the following scheme of relationships:

Through decomposition of variance we know that the trade balance, the government consumption and the total number of active troops are the variables that have played the dominant role in the determination of the Colombian permanent violence path.

Based on the F tests, we found the following sequence of relationships:

a) GDEF-TD-VP-CONG, which means that the defense expenditure , the unemployment rate and permanent violence exert in that order of importance, influence over the government consumption.

b) TD-PIT, in a similar manner ; unemployment rate influences the total number of active troops.

c) CONGOB-GDEF, government consumption influences defense expenditures.

d) BC-GDEF-TD, the trade balance and defense expenditure influence unemployment rate.

e) Permanent violence is not statistically influenced by any of the these variables, a situation that would imply a very strong inertia of itself.

f) Likewise the number of enrolled students shows inertia.

By ordering this series of relationships in a logical manner, a sequence such as the following is hereby presented :

BC - GDEF - TD - PIT - CONGOB - EST - VP

Up to this point we do not know the signs, and for this reason I obtain assistance from the following chart:

VECVP SYSTEM [46] - CHART #11

INITIAL SHOCK ON	IMMEDIATE OR SHORT RUN REACTION OF THE REST OF THE VARIABLES AS PER TYPE OF SHOCKS [47]						
BC↑	CONG↓	EST↑	GDEF↓	HOMP↑	PIT↓	D4↑	BC↑
CONG↑	CONG↑	EST↑	GDEF↑	HOMP↑	PIT↑	D4↑	BC↓
PIT↑	CONG↓	EST↓	GDEF↓	HOMP↓	PIT↑	D4↓	BC↑
GDEF↑	CONG↑	EST↓	GDEF↑	HOMP↑	PIT↑	D4↑	BC↓
EST↑	CONG↓	EST↑	GDEF↑	HOMP↓	PIT↑	D4↓	BC↓
D4↑	CONG↓	EST↑	GDEF↑	HOMP↓	PIT↓	D4↑	BC↑
HOMP↑	CONG↓	EST↓	GDEF↓	HOMP↑	PIT↑	D4↓	BC↑

We then have that the signs estimated for the sequence of relations in a first moment would be as follows:

↑**BC** - ↓GDEF - - ↓PIT - ↓CONGOB - ↑EST - ↑VP

Which would indicate that an improvement (innovation) in the trade balance, would go hand in hand with a decrease in defense expenditures, government consumption, and total number of active troops as well as with increase in number of enrolled students, and permanent violence.

However, to close these series of relationships it is necessary to include the unemployment rate, knowing that a shock in TD causes PIT to decrease:

↑TD - ↓PIT, or ↑PIT - ↓TD

Which forces me to obtain assistance from other macroeconomic variables such as saving, investment and GDP, to enable me to include this last relation jointly with the rest of relations. This way I can present a complete hypothesis concerning the channels that give origin to permanent violence; thus the shock in trade balance will cause;

↑BC - ↑PIB - ↓GDEF - ↓CONGOB - ↓PIT - ↑TD - ↑S - ↑I - ↑EST - ↑VP

And stating the same shock inversely, we have finally arrived to the process of permanent violence generation:

↓BC - ↓PIB - ↑GDEF - ↑CONGOB - ↑PIT - ↓TD - ↓S - ↓I - ↓EST - ↓VP

It is important to remind here that the two types of violence are contemporarily inversely correlated. That is whenever the violence be shocked with GDP, the final result will cause permanent violence to increase but transitoy one to decrease. Additionally it is important to note in the above relation the very important channels that affect the permanent violence path that is variables such as trade balance, total number of active troops, government consumption, and defense expenditures. The model and the data are consistent in showing how improvents in the trade balance position during these last fifty years have caused decrease in government consumption, total active troops and defense expenditures therefore escalating permanent violence and viceversa. So we have here a positive relation between trade balance, GDP and permanent violence. Whenever there had been a reduction in these last three ones it has been caused due to the previous government counterattack increasing government consumption, defense expenditures and consequently total number of active troops; indirectly this will be implying that excessive consumism and fiscal deficit are inversely correlated with permanent violence.

Evidence for transitory violence

The findings are as follows:

Through variance decompositions we know that the trade balance, the total number of police personnel and the total number of active army troops are the variables that have played the dominant role in the determination of the path of transitory violence.

The relations of the F tests suggest the following chain of facts:

a) The trade balance (BC) is inertial.

b) PIB - PIPO, the total number of police personnel is affected by the GDP.

c) CPR - PIFM, the total number of army active troops is affected by private consumption.

d) M1 - PIB, this means that GDP is affected by money supply

e) PIFM - M1, Money supply is affected by the total number of army active troops .

f) BC-PIPO-PIB-CPR, private consumption is influenced by the trade balance, the total number of police personnel and by the GDP.

g) BC-PIPO-HOMT, transitory violence is affected by the trade balance and by the total number of police personnel.

We ordered the series of relationships, considering the series of conclusions obtained up to present, thus obtaining the following

BC - M1 - PIB - PIPO - CPR- PIFM - HOMT.

I now proceed to obtain assistance from the signs of the following chart:

VECVT SYSTEM- CHART #12

INITIAL SHOCK IN	IMMEDIATE OR SHORT RUN REACTION OF THE REST OF THE VARIABLES, AS PER TYPE OF SHOCK						
BC↑	PIPO↓	PIFM↓	PIB↓	M1↓	CPR↓	HOMT↓	BC↑
PIPO↑	PIPO↑	PIFM↓	PIB↑	M1↑	CPR↑	HOMT↑	BC↓
PIFM↑	PIPO↓	PIFM↑	PIB↑	M1↑	CPR↑	HOMT↓	BC↑
PIB↑	PIPO↑	PIFM↓	PIB↑	M1↓	CPR↑	HOMT↑	BC↑
M1↑	PIPO↑	PIFM↑	PIB↑	M1↑	CPR↑	HOMT↑	BC↓
CPR↑	PIPO↓	PIFM↓	PIB↑	M1↓	CPR↑	HOMT↓	BC↑
HOMT↑	PIPO↑	PIFM↓	PIB↑	M1↓	CPR↓	HOMT↑	BC↓

Obtaining the following general relation, after a shock in 1)BC, 2)M1 3)PIPO and 4)PIFM respectively.

1) ↑**BC**- ↓M1- ↓PIB- ↓PIPO - ↓CPR -↓ PIFM - ↓ HOMT
2) ↓BC- ↑**M1**- ↑PIB- ↑PIPO - ↑CPR -↑ PIFM - ↑ HOMT
3) ↓BC- ↑M1- ↑PIB- ↑**PIPO** - ↑CPR- ↓ PIFM - ↑ HOMT
4) ↑BC- ↑M1- ↑PIB- ↓PIPO - ↑CPR- ↑ **PIFM** - ↓ HOMT

Which means that improvement relations or shocks in, trade balance(1) and total number of active armed forces troops (4) through the series of relations of the system, are indistictly effective in reducing transitory violence, and on the contrary the wealth effect and police personnel shocks escalates it

But again we have that for closing the series of relations, it is found that increases in private consumption decrease transitory violence; a relation that had been previously noticed in the case of permanent violence where increases in government consumption decreased permanent violence:

↑**CPR** - ↓VT,

Which when added to the general relationship shows the following configuration, based on the fact that the changes shown come from an initial shock in private consumption:

↑BC - ↓M1 - ↑PIB - ↓PIPO - ↑**CPR** - ↓PIFM - ↓HOMT

Now we proceeded again to obtain assistance from the macroeconomic variables saving and investment, thus obtaining the following relationship :

↑BC - ↓M1 - ↑PIB - ↓PIPO - ↑**CPR** - ↓S - ↓I - ↑TD - ↓PIFM - ↓HOMT

Therefore assuming a high marginal propensity to consume, the result of the shock in private consumption would be causing through the same dynamic system, the destination of resources to repressed consumption, thus deteriorating the processes of domestic saving and investment [48], increasing the unemployment rate but diminishing the transitory violence in this case [49].

It is then concluded for this small economy ranked as the second most violent in the Americas, the fact that macroeconomic variables such as saving and investment are possibly channels which by influencing the rest of the variables would permit to close the model that explains the cycles of domestic violence. Only further research on this matter would permit to prove this hypothesis.

POLICY IMPLICATIONS

Regarding permanent violence

In general real variables are totally inefficient in the medium and long run to control a variable as inertial as Colombian permanent violence. Through the impulse-response functions it can be seen that increasing variables such as total defense and government consumption only get to change the inflection point of this curve 22 years ahead after the initial investment.

In regards to government consumption, it is observed that this has been countercyclical to fight the permanent violence, but it should be better to propose its deceleration, taking into consideration its lack of effectiveness.

From the data it is concluded the fact that the continued obtention of positive trade balance in the past has been hand in hand with the growth in permanent violence and with the decrease in transitory violence, a situation which implies that any futuristic policy whose aim be to obtain a strong position in the trade balance, will require any other type of policy to fight the negative effects of trade balance on permanent violence.

An adequate recipe could be the increase in the total number of active troops. This is the variable that has shown to be a short run solution against the inertial permanent violence. Figure #3 shows how this shock changes the inflection of the series as of the fourth year. Obviously this shock will have a high cost while its purpose is achieved.

In regards to transitory violence

Some of the policy recommendations to fight permanent violence are valid for the transitory or "political" violence. Of course if a strong medicine cures a serious disease, the same medicine can eradicate a sickness, which even though slight, grows with speed and if not controlled, could get to kill the patient.

In opposition to the above mentioned case, it is noticed that real variables are effective in controlling and eradicating an uninertial series such as transitory or political violence. Particularly isolated shocks not only in trade balance, but also in money supply or GDP, achieve this goal in the middle run, which will be helped by the private consumption increase which will be boosting the effect of reducing transitory violence.

Therefore, to give a death blow to the sickness, it will be necessary to push the above mentioned effects with an effective increase in the total number of active armed forces troops and policemen.

PROSPECTIVE OF THE ACTIONS PRESENTLY TAKEN IN REGARDS TO SECURITY AND ECONOMIC POLICY

In regards to economic policy we have the following facts: deceleration of the GDP during 1996, accompanied by a negative trade balance; increase in the unemployment rate and excessive consumism by the government. For 1997 it is also expected the continuance of these trends; an unfavorable growth in the GDP, negative trade balance, increases in unemployment and moderation in the excessive public expenditures. On the other hand, in regards to recent measures of economic policy we have an increase in money supply and a decrease in the rate of interest.

The combination of these facts in the light of the conclusions of the previous sections will be forecasting a decrease in the inertia of permanent violence and a jump in transitory one, through two facts: the decreasing trends in real variables such as trade balance, GDP, and money supply; and the increasing ones in public and private consumption.

On the other hand in regards to effective variables, the situation is quite particular, since in our country there is an ample discussion and polemics about the subject of defense expenditures, which as it has been shown it is not and has not been countercyclical for stopping violence[50], rarelly you hear discussions about increasing the number of active troops. Based on this, in the coming years it is not expected to obtain substantial additions in this effective variable, and from this point of view, the government will not be making countercyclical policy based on effective variables

However it can be mention that actions are being taken in regards to effective variables during these last two years in departments that have been greatly affected by the scourge of the two types of violence, as is the case of Antioquia. An increase in the so called security cooperatives, CONVIVIR, could be considered from the evidence shown as a private effort to increase the number of total active troops, which the estimated models forecast as the most efficient variable to fight against the sickness of violence.

The sequence of facts estimated and stated up to present, come from a previous knowledge of the historical series, by means of which I intend to express the lack of knowledge that the author, at least partially, has about the actions taken in the past and those that will be taken in the future by the actor generating transitory violence in Colombia, the guerrilla. A quick look about the situation of the guerrilla movement would permit to state that its active members, its capacity for intimidation and action grow proportionally faster than that of the Government armed forces. However, I do not dare to especulate more on this matter, without having a more substantial knowledge of the realities of the guerrilla.

We can then conclude that the prospects are showing in case of continuation of these trends related with effective and real variables, a deceleration in permanent violence, bearing in mind that the arrival to the point of inflection on the curve will be preceeded by a lot more violence, chaos, domestic economic deterioration and general confusion, which would be in a parallel manner accompanied by acceleration of transitory, political violence or by guerrilla actions. In the light of these conclusions we can say that it is urgent to look for a solution to the armed conflict currently in effect, in view of the growing destruction capacity of the process and the intimidation caused by the guerrilla.

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STATISTICAL SOURCES:

NOTE: The monetary figures are expressed in real values (Colombian pesos of 1975)

HOMITO: Annual recopilation of the series corresponding to homicides and aggravated homicides, taken from the "Criminalidad" magazine, consecutive issues, National Police.

HOMP: Permanent component of national violence, obtained by Beveridge & Nelson methodology (1981)

HOMT: Transitory component of national violence, obtained by Beveridge & Nelson methodology (1981)

IPIM: Implicit price index of the GDP (1975=1), 1946-49 CEPAL, 50-80 Banco de la Republica and 1981-1996 DANE.

POBLA: Total population (millions), Census 1953-68-73-78-83-85-93 and DANE projections.

TAX: Total taxes (millions), (direct and indirect) 1946-1952, taken from the study of Colombian Economic Development (CEPAL), 1953-1960, Banco de la República(BR) magazine; 1960-1970 reports from the manager of the board of directors of the BR; 1971-1996 consecutive BR magazine issues.

GPOL: National Police expenses (millions), 1946-70 taken from the study "Estado y Hacienda Publica en Colombia, 1934-1990, Cesar Giraldo; 1971-1992 Financial reports of the General Comptrollership Office of Colombia.

GMIL: Military expenditure (millions) 1946-70 taken from the study "Estado y Hacienda Publica en Colombia 1934-1990" by César Giraldo, 1971-96, financial reports from the General Comptrollership Office of Colombia.

GDEF: Total defense expenditures (millions) obtained as a summation of the two previous items.

GASAL: Health expenses (millions) 1946-70, taken from the study "Estado y Hacienda Publica en Colombia, 1934-1990, César Giraldo, 1971-96 financial reports from the General Comptrollership Office of Colombia.

GASED: Education expenses (millions) 1946-70, taken from the study "Estado y Hacienda Publica en Colombia, 1934-1990, César Giraldo, 1971-96, financial reports from the General Comptrollership Office of Colombia.

GASOC: Total social expenditure (millions), obtained as an addition of the former two.

GASOB: Public works expenditures (millions) 1946-70, taken from the study called: "Estado y Hacienda Publica en Colombia 1934-1990, César Giraldo, 1971-96, financial reports from the General Comptrollership Office of Colombia.

GAJUS: Justice expenditure (millions) 1946-70 taken from the study "Estado y Hacienda Publica en Colombia 1934-1990, César Giraldo; 1971-96 Financial reports from the General Comptrollership Office of Colombia.

PIPO: Total number of personnel of the Colombian police, National Planning Department (DNP), Justice and Security Unit.

PIFM: Total number of active members of the armed forces, National Planning Department (DNP), Justice and Security Unit.

PIT: Total number of active troops of the armed forces; addition of the former two items.

BAK: Capital Balance (millions) 52-70 International Financial Statistics (IFS) and 70-96 Balance of payments of the Colombian Central Bank. 87-96 data were converted from dollars to pesos using the average of the exchange rate for buying at the Colombian Central Bank which were afterwards deflacted.

EXBR: Exploitation gross surplus (millions) 1952-80, National Accounts of the Colombian Central Bank, 1981-96, DANE.

EXPORT: Non financial exports (millions) 1946-1951 are taken from J.L Londoño (1990) 1952-80, National Accounts of the Colombian Central Bank and 1981-96, DANE.

IMPORT: Non financial imports (millions) 1946-1951 are taken from J. L Londoño (1990), 1952-80, National Accounts of the Colombian Central Bank and 1981-96, DANE.

BC: Trade balance (millions) Obtained as the difference from the two former series.

CPR: Private consumption (millions) 1946-1951 are taken from J L Londoño (1990) 1952-80, National Accounts of the Colombian Central Bank and 1981-96 DANE.

CONG: Governmental consumption (millions) 1946-1951 are taken from J L Londoño (1990), 1952-80 National Accounts of the Colombian Centrak Bank and 1981-96, DANE.

FBKF: Gross domestic fixed capital formation (millions) (does not include changes in stock). 1946-1951 are taken from J.L. Londoño (1990), 1952-80 National Accounts of the Colombian Central Bank, and 1981-96, DANE.

GDP: Gross Domestic Product (millions) 1975=1, 1946-49 CEPAL 50-80 Colombian Central Bank and 1981-1996, DANE

D4: Unemployment rate. For the period 1950-54 comes from the monthly bulletins of statistics (DANE) for the period 1955-76 it was taken from Londoño (1990). Since 1977, it corresponds to the unemployment rate in the four largest cities.

TINT: Efecctive Interest rate in the market. For the period 1950-79, it is taken from Camzosa (1986); from 1980 on, it corresponds to the effective interest rates of the Fixed Term Deposits (CDT's) for 90 day periods, based on the monthly average.

SMLM: Minimum legal monthly salary. For the period 1946-1955 it is taken from Londoño (1990), being the total salary average in pesos per day. The data are multiplied by 30, and deflacted afterwards. As of 1956, these data are taken from the main economic indicators, 1923-1992, Banco de la República (Colombian Central Bank).

M1: Money supply (millions). Taken from the main economic indicators 1923-1992, Banco de la República. For the period 1946-92, corresponds to the figures of the corresponding Decembers. 1993-96 come from the magazines of the Banco de la Republica.

EST: Enrolled students (pre-elementary, elementary, high school, university). For the period 1946-86, they are taken from Londoño (1990); 1987-96 from the Ministry of National Education and the ICFES (Colombian Institute for the Promotion of Higher Education).

NOTES

1. Comments and suggestions by Manuel Ramírez Gómez, Alberto Carrasquilla Barrera, Orlando Rubio Mendoza and Gérman Sánchez P. are thanked. This final version of the paper includes also details and suggestions made by The Inter-American Development Bank and World Bank referees.

2. El conflicto armado en Colombia - Marco histórico general. Revista de las Fuerzas Armadas, marzo de 1997.

3. See work done by them, consisting of obtaining the permanent and cyclical components of a time series (1981).

4. This part corresponds to an adaptation from an article called "The dynamic effects of nominal disturbances over the permanent and transitory Colombian GDP". "Los efectos dinámicos de perturbaciones nominales sobre el PIB permanente y transitorio colombiano". Revista Ensayos de economía, Universidad Nacional de Colombia (Medellín campus) #11, vol 7, December 1996.

5. The ones obtained based on the trimestrialization of the Colombian GDP carried out by the Colombian National Planning Department (DNP), comprised from the following trimesters; first of 1975 and third of 1992, in constant pesos of 1975 and the deseasonalized by the exponential-additive method.

6. Similarly, for the case of the GDP, the permanent change of its path would be admitted as a result of a continued process of technical innovation.

7. The national police distinguishes 15 large types of crimes. Type #13, called crimes against life and personal integrity includes: common body lesions, homicide, culpable lesions, (lesions in work accidents), culpable homicide (working accidents), aggravated homicide (assessination) and others.

The series on which the decomposition was made, includes the categories of homicide and aggravated homicides, in order to concentrate on the so called premeditated and strictly aggresive character of an act of assessination.

8. Beveridge & Nelson propose the deseasonalization of the variables in order to apply the methodology, however my criterion is that this procedure filtrates and cleans the series depriving it from their inherent properties. For this reason, the recommendation was not followed.

9. The models containing autoregressive components supplied explossive revenue functions and therefore transitory components that did not fluctuate with zero average.

10. I want to warn the reader about a methodological subtlety that has cast a doubt on the application of the B&N method, which is the following: using the estimated residuals of equation (4)) to calculate the revenue function, the rates of change of the violence series, called Vp(t), can be computed in the following manner

$$LVp\ (t) - LVp\ (t\text{-}1) = 0.069 + 1.61\ e\ (t)$$

which supplies a differential equation with initial condition, which is easily solved by substituting in same, the initial condition V_0 of equation (5). This initial condition is the first value of the violence series, that is the value for the year 1946. However in order to go on to obtain the levels of the series instead of the rates of change, once the differential equation is solved, the permanent component of the violence series can be found by performing the change Vp(t)=exp{Vp(t)}, and the cyclical component Vc(t) is calculated as the difference between the violence observed and Vp(t). The above considerations clarify that the B&N method is not spurious, since it does not imply the partition of logarithms; we want to note that this is not carried out because the variables are transformed to levels before the substraction required for obtaining the cyclical violence. In this paper, I use equation (5), which gradually accumulates the residuals and goes finding year after year the permanent component.

11. As a curious information I want to mention the fact that the ARIMA model was initially estimated with 46 data 1946-1992, which did not supply according to (B&N) a cyclical component fluctuating with zero average. The inclusion of 4 additional data, that is 46-96 permitted to obtain the required cyclical component. Please note the sensitivity of the methodology in regards to this situation .

12. Specifically the ambush to a supply column between Planadas and Gaitania, where an Avianca small plane was shot down and its pilots kidnapped; in the mean time a high ransom was collected and the military pilots who went on a light helicopter to recover the passengers who died in the Aerotaxi plane (Aerotaxi is an affiliated company of Avianca) were assessinated. Simultaneously in Pato, Guayabero and Riochiquito there was criminal activity of the groups established there.

13. According to a study carried out by the Panamerican Health Organization (OPS) from 87,6/100.000 cases occurred in 1995, the figure passed to

75 in 1996, which makes us become the second most violent country in the Americas, after El Salvador which recorded 156 homicides /100.000 in 1996.

14. Political violence figures. El Tiempo newspaper, Sunday August 10, 1997 issue.

15. It is important to point out that the B&N decomposition methodology supplies permanent and transitory components contemporarily inversely correlated, which is reflected in the fact that decreases in transitory or political violence will imply contemporary increases in permanent violence and vice-versa.

16. A worrisome situation if you consider the proximity of presidential elections. Some people coincide in saying that 98 elections as it happened in 1990 will be preceded by the assessination of presidential candidates.

17. All the econometric work has been made using the RATS 4.02 package under its DOS operational system.

18. The armed forces combine the total number of active troops and the civilian personnel of the Colombian army, air force and navy.

19. It was attempted to include other types of social variables such as the series of the number of medical doctors and hospitals. However this was not possible in view that it was necessary to reconstruct several years of the series.

20. Misas, Martha, Suescún Rodrigo., FUNCIONES DE DEMANDA DE DINERO Y EL AJUSTE DINAMICO DE CORTO PLAZO DEL MERCADO MONETARIO, (Mimeo.),(MONEY DEMAND FUNCTIONS AND DYNAMIC SHORT RUN ADJUSTMENT OF THE MONETARY MARKET), May 1992, Banco de la República.(Colombian Central Bank).

21. For this purpose the estimated significance level Q is compared and contrasted with the critical level of 0.05%. The null hypothesis is the existence of white noise. If the estimate is located within the acceptance region, the null hypothesis is accepted. If otherwise, then it is rejected.

22. Technique on which it is based all the methodology of vector autoregressions (VAR).

23. Possibly the sample could seem to be short in view of the large number of parameters to be estimated per equation. However, authors like Peter J. Montiel have used short samples such as this for the study and modeling of inflation in countries like Argentina, Brazil and Israel. The methodology has behaved consistently

24. In order to comply with this stationarity assumption it is necessary for the variables having unit root to enter differentiated to the VAR.

25. The purpose of the orthogonalization is to permit the solution of the model in a resourceful manner, considering that, in general, the covariance matrix is not diagonal.

26. Note that the identification is achieved by means of a long run restriction. This presents a difficult technical matter. Without previous knowledge of the length lag, the inference and the restrictions about the type of long run behavior in which we are interested here, is a delicate topic. See for example Christopher Sims (1972); I am here following Sims's results which suppose strictly exogenous regressors.

27. It is important to point out that the performance of cointegration tests for the series of permanent and transitory violence were carried out based on the total of 24 available variables (see Attachment).For this purpose multiple regressions were performed sequentially , in order to rule out the non significant variables in every step, until obtaining those shown in this section.

28. The variables trade balance, government consumption, total number of active troops, total defense expenditures, number of enrolled students and unemployment rate were included, because of being the ones that obtained significant t statistics.

29. Total number of police personnel, Gross Domestic Product, Private consumption, army troops members, money supply (M1) and trade balance.

30. The hypothesis constrast is performed by determining as critical value the one established by the table and as calculated one the D.W estimated by the regressions.

31. It is important to remark that the existence of cointegration between permanent and transitory violence and the corresponding variables comprising each of the two equations, makes them very rich instruments for forecasting and controling the two types of violence, in view that they have foreseable effects on themselves. When there exists cointegration, according to West(1988), the calculation of the estimators is consistent and the hypothesis tests constructed based on these estimates by ordinary least squares of the cointegrating regressions are asymptotically valid.

32. The existence of cointegration for the two equations is what technically permits the estimation of the VEC models, which preserve all the properties of the VAR model, but having the advantage of including the long run restriction. The estimation is performed by taking the first difference of each series, which

is run against the constant and the residuals (obtained by the cointegration regression, included here lagged by one period) and two lags of the first difference of each series in order to capture the short run dynamics.

33. Likelihood ratio (RATIO): (T-c)[log det Σ_r - log det Σ_u]. where Σ_r and Σ_u are the restricted and unrestricted VAR-COVAR matrices respectively and T is the number of observations c is one correction to improve the properties of small samples: Sims suggests to use a correction equal to the number of variables in each unrestricted equation in the system.

34. VECVP and VECVT to refer generically to the VEC models of permanent and transitory violence respectively. The estimation of the two models was performed both in levels and in differences. According to Orden and Robertson (1990), whenever there exists cointegration a VEC model in levels supplies more efficient estimated parameters than a VAR in levels. The suggestion was put into practice in the case of the two VEC models without much success. In regards to the VECVT system, there were obtained buffered impulse-response functions without convergence. In general it was observed that in the two models the existence of cointegration did not improve the adjustment of the equations with the variables in levels and it did cause problems of positive autocorrelation. For these reasons the two models were estimated in differences, being afterwards reparameterized to its equivalent formulations in levels with the intention of tracing the dynamic effects of the different shocks.

35. In VAR analysis the variable which we are interested to study is always placed at the end of the system, before performing the estimation, being in this way treated as an exogenous one.

36. GD: Defense expenditure, EST:number of enrolled students, D4: unemployment rate in the four largest cities, BC: Trade balance, CONG: Government consumption, PIT: Total number of active troops, HOMP: permanent violence.

37. In the section related with the F tests you can see the excellent fit against autocorrelation for the estimated equations. The equations show Durbin Watson's indexes close to 2.

38. The variables are: BC trade balance, PIPO total number of police personnel, PIFM total number of active army troops, GDP Gross Domestic Product, CPR private consumption, M1 money supply and HOMT tansitory violence.

39. F test contrast is: F(M, T-K), where M=linear restrictions or equations, T=Observations, K=Estimated parameters.

40. Impulse response functions shown here correspond to the dynamics of permanent violence after receiving real and effective shocks. People interested in the whole dynamic response of this system may consult annex #1.

41. This ordering is used as a result of Choleski's factorization.

42. Let's keep in mind that the variable trade balance is the one that obtained the highest t student statistic for the two equations.

43. The figure herein shown is similar to the one obtained with the estimation of the model in differences.

44. To see the whole dynamics of this system, consult annex #2.

45. Let's keep in mind that in the section related with the dynamic response of the IRF, only were shown the figures of the results related with the manner on how permanent and transitory violence were affected when they were submitted to shocks of the economic and effective variables. For this section I obtained assistance from the dynamic response of the effective and economic variables when they received each of the shocks that at their times were received by transitory and permanent violence.

46. This is a brief note to warn that this chart should be interpreted cautiously, since there are indirect mechanisms through which for example Homp can affect BC. For example through the relationship of Homp and Cong.

47. I specially want to call your attention to the fact that the arrows herein depicted correspond to the immediate reaction of the variables. In the long run, the adjustment of the variables would change the signs presented. This situation permits to know multiple policy options through the VEC modeling, which may variate whether long run or short run results are required.

48. This is the similar inverse relation between consumption and saving already observed for permanent violence.

49. The unemployment rate is directly correlated with permanent violence but inversely correlated with the transitory one.

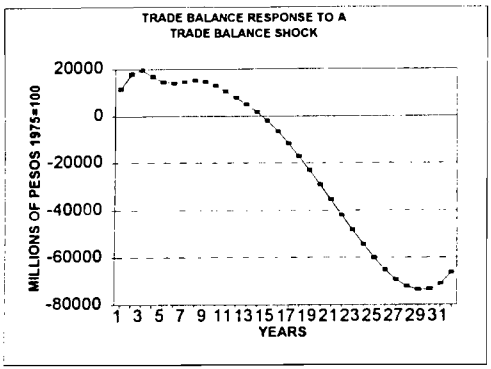
50. You can conclude this knowing that its action is effective just 22 years after the initial investment. See the FIR for permanent violence to an initial shock in defense expenditures.

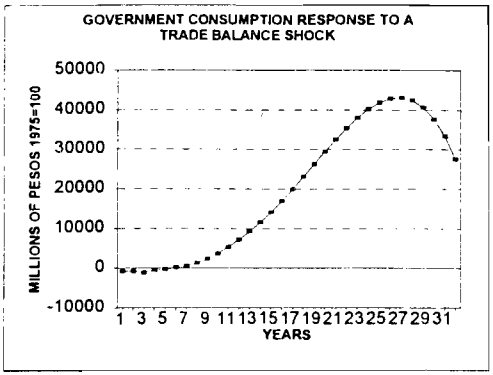
ANNEX #1

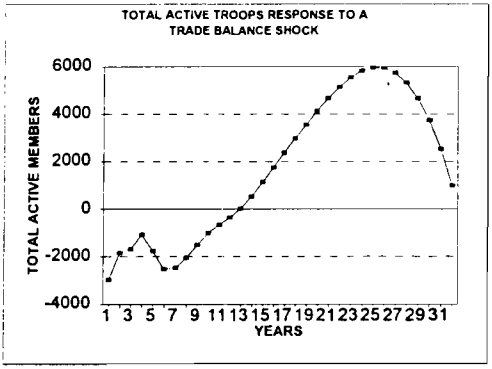
IMPULSE RESPONSE FUNCTIONS FOR THE WHOLE DYNAMIC SYSTEM

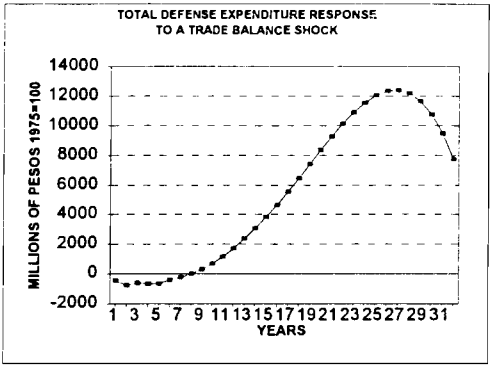
VEC MODEL WITH PERMANENT VIOLENCE

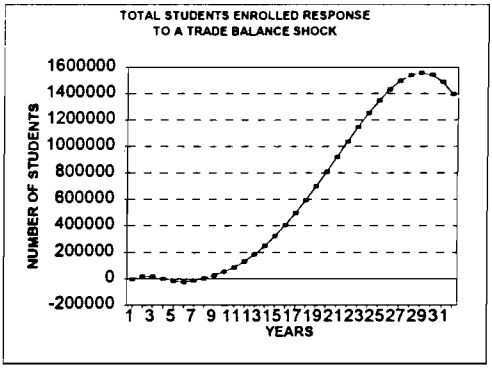
1)One standard deviation shock in trade balance

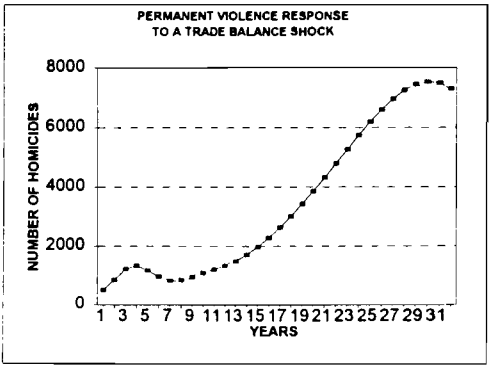








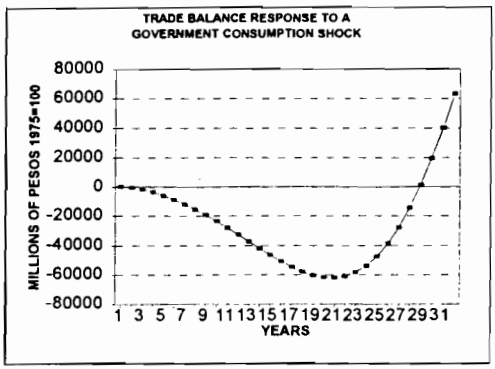


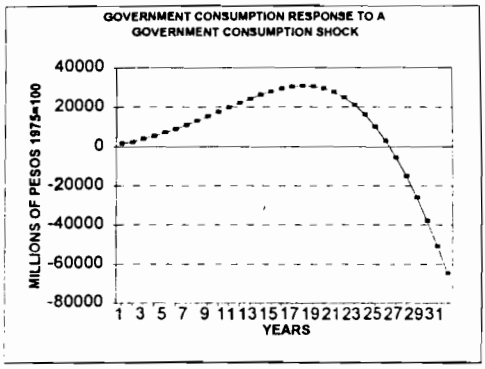


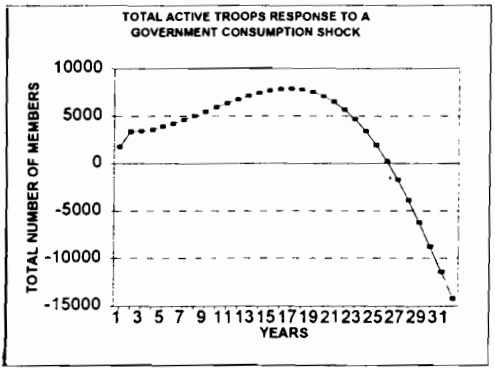
Signs for the immediate dynamic relations:

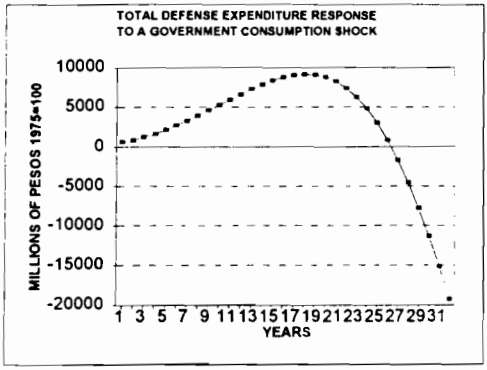
+BC - CONG - PIT - GDEF + EST + TD +VP

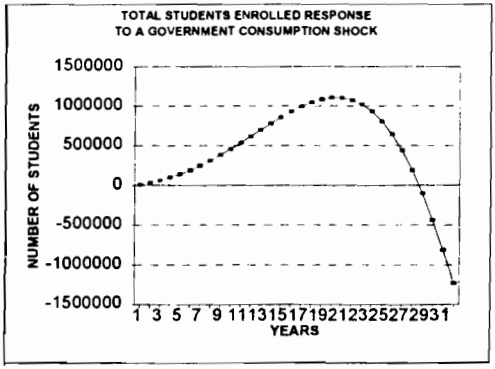
2)One standard deviation shock in government consumption.

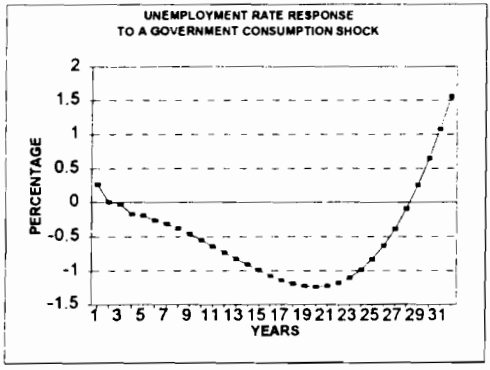


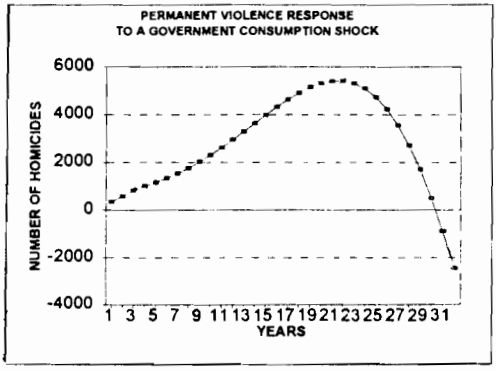








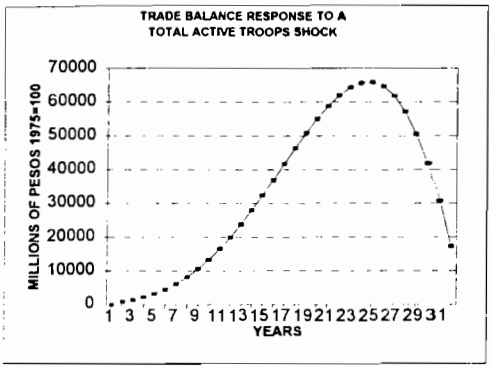


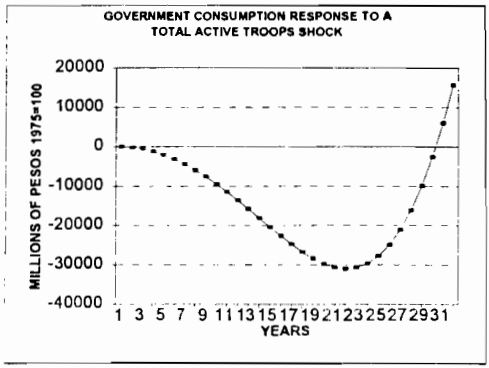


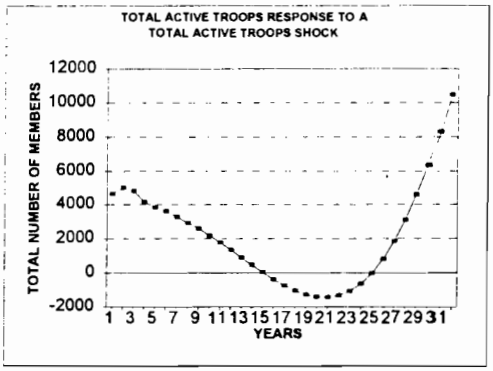
Signs for the immediate dynamic relations:

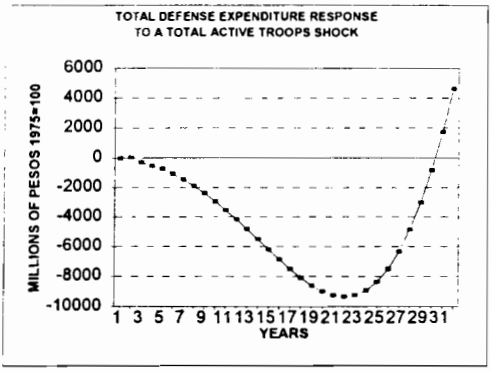
+CONG -BC +PIT +GDEF +EST +TD + VP

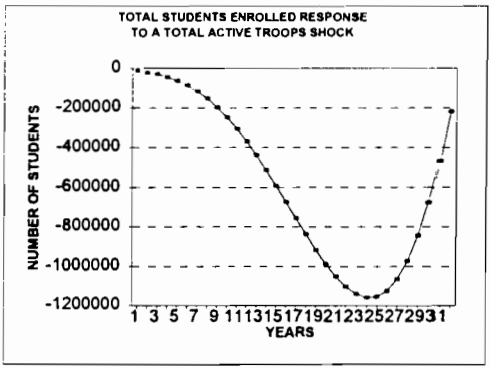
3)One standard deviation shock in total number of active troops.

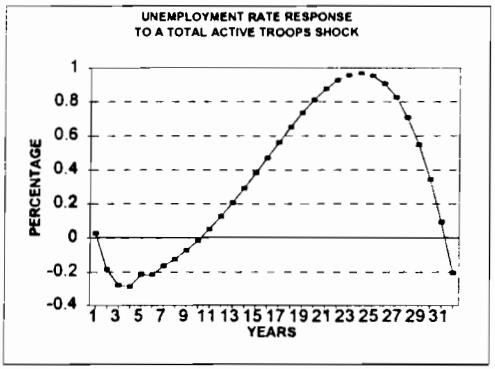


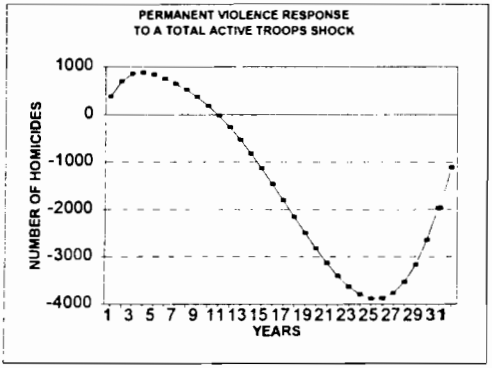








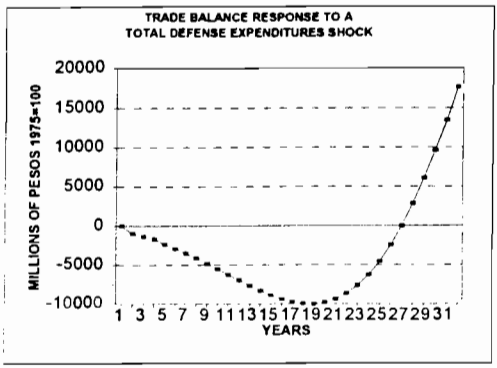


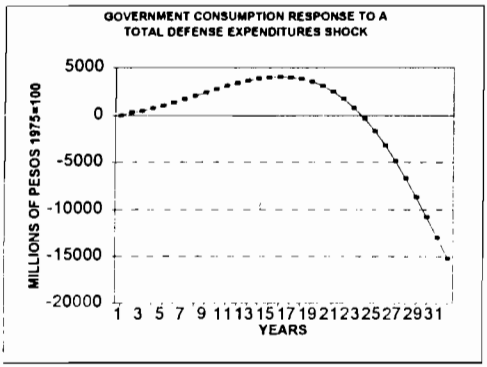


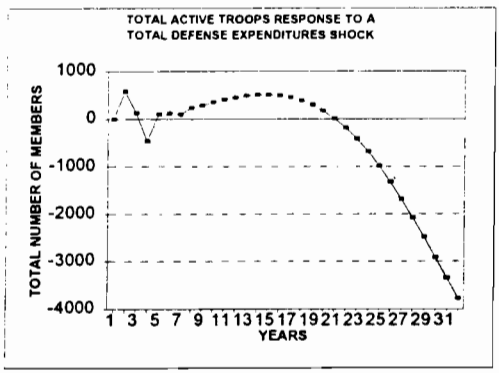
Signs for the immediate dynamic relations:

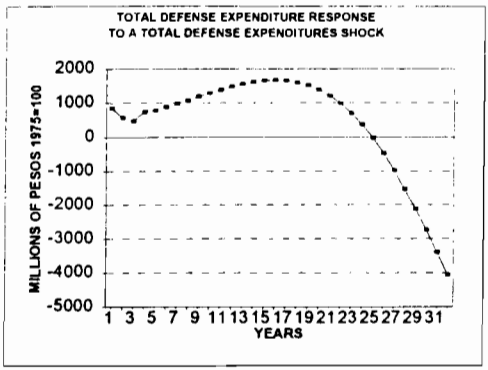
+ PIT + BC - CONG - GDEF - EST - TD - VP

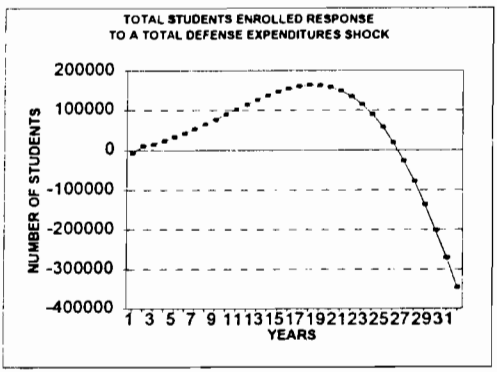
4)One standard deviation shock in total defense expenditures.

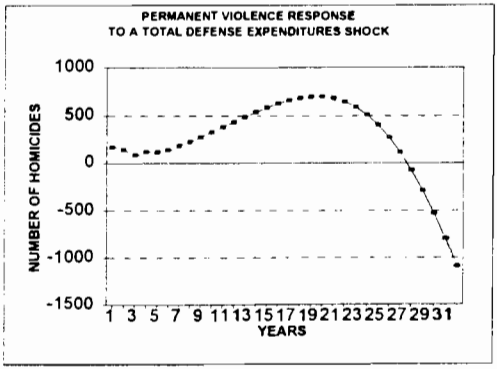








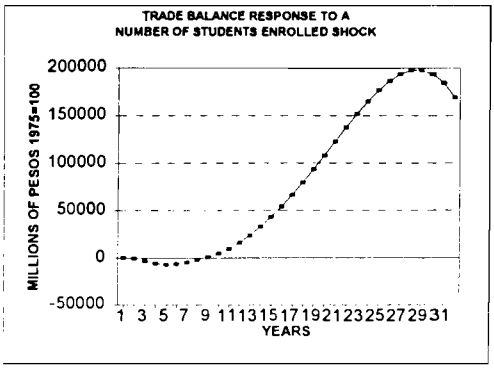


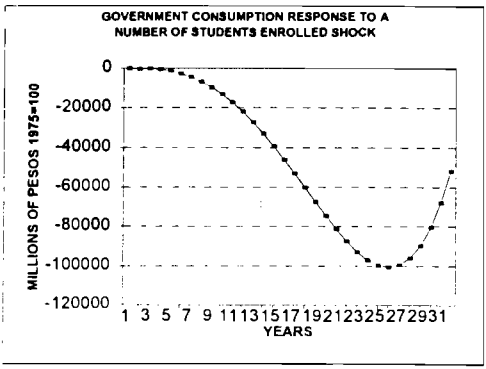


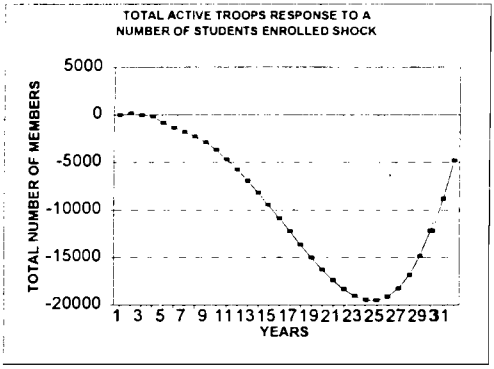
Signs for the immediate dynamic relations:

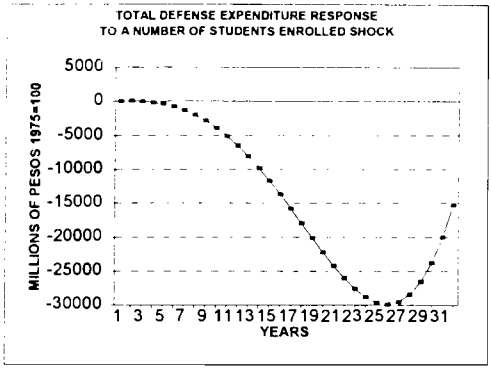
+GDEF - BC + CONG + PIT - EST + TD +VP

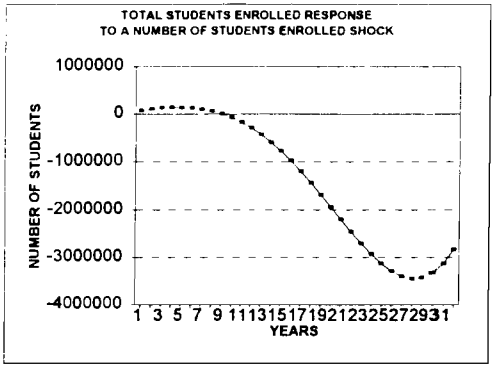
5)One standard deviation shock in number of students enrolled.

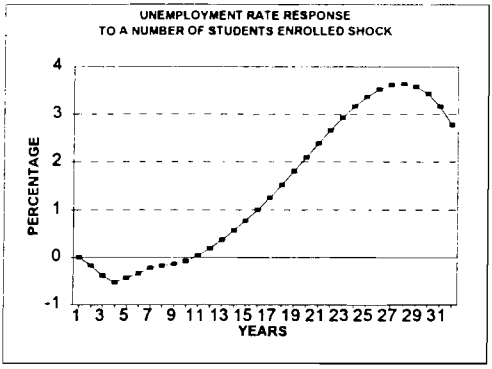


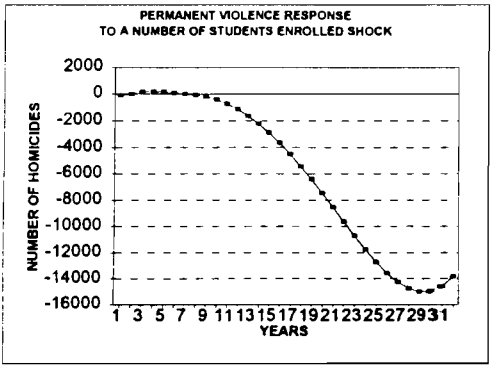








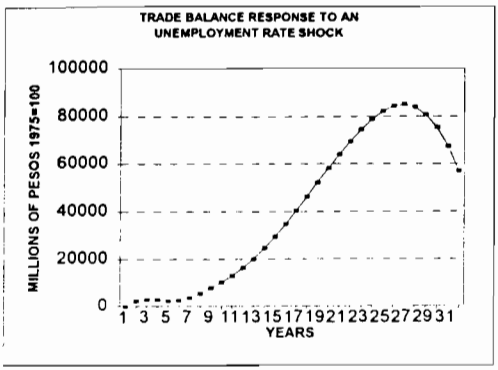


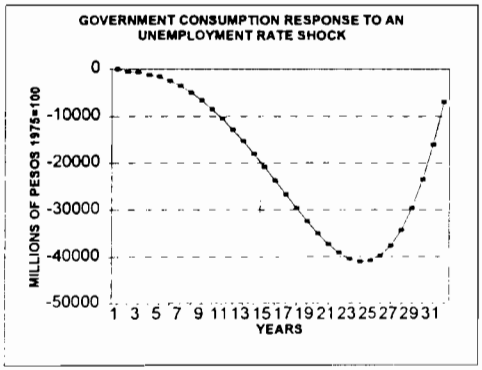


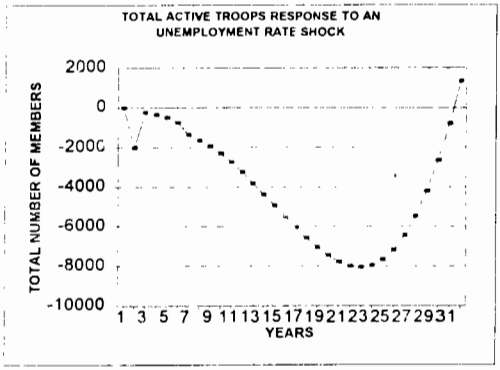
Signs for the immediate dynamic relations:

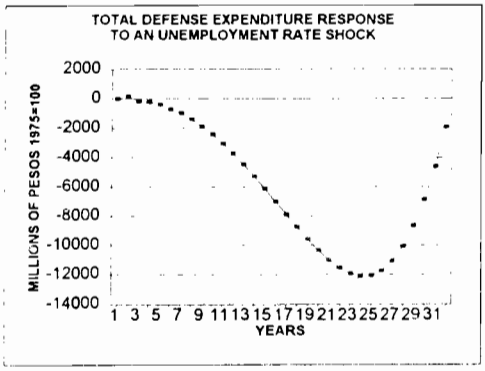
+ EST - BC -CONG +PIT +GDEF -TD -VP

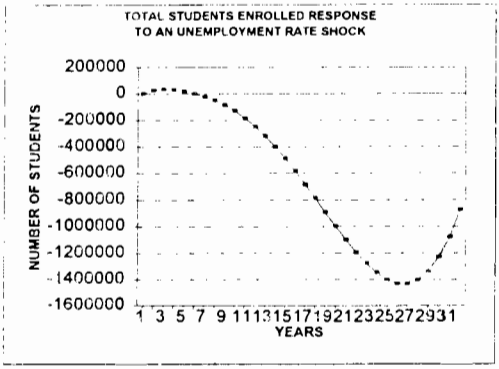
6)One standard deviation shock in unemployment rate.

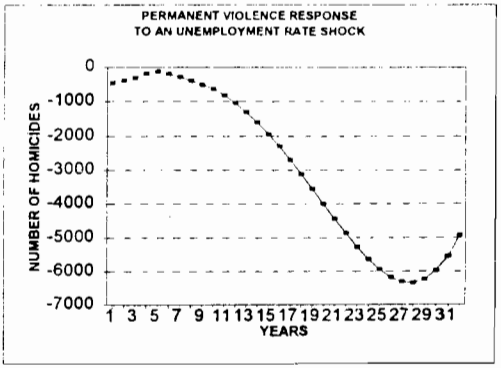








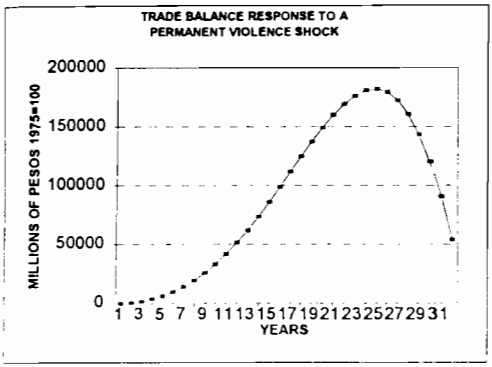


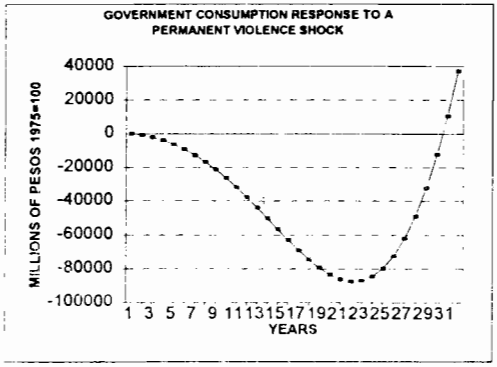


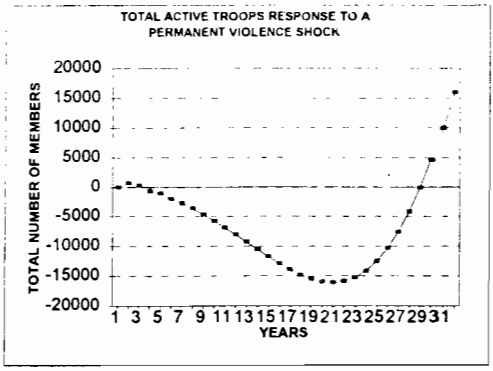
Signs for the immediate dynamic relations:

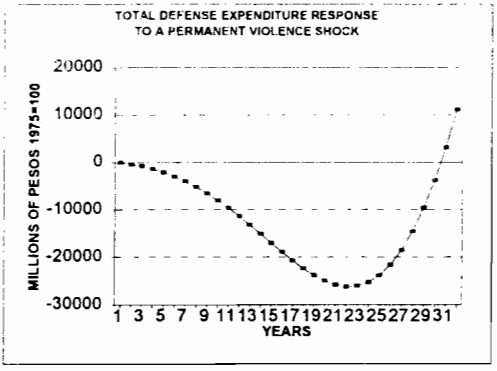
+ TD + BC - CONG - PIT + GDEF + EST - VP

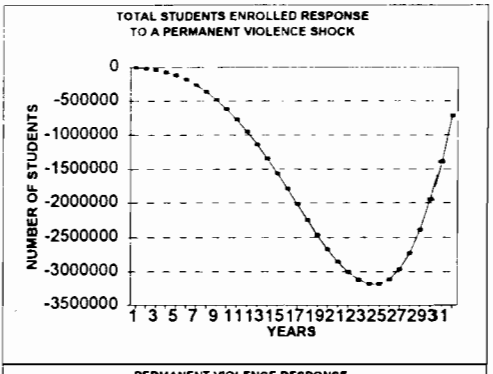
7)One standard deviation shock in permanent violence.

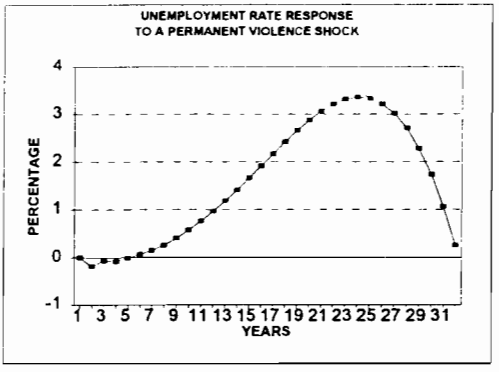


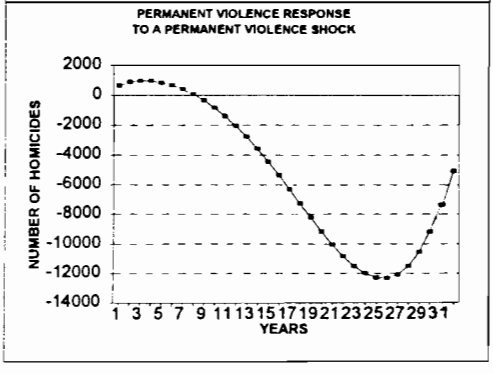












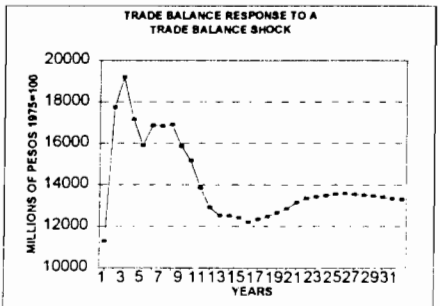
Signs for the immediate dynamic relations:

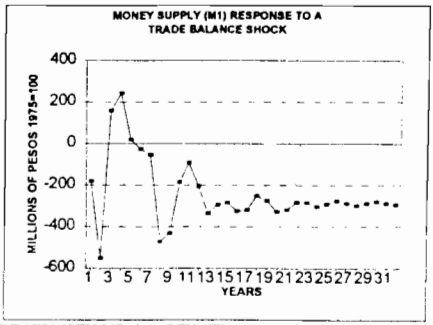
+ VP + BC - CONG +PIT - GDEF - EST - TD

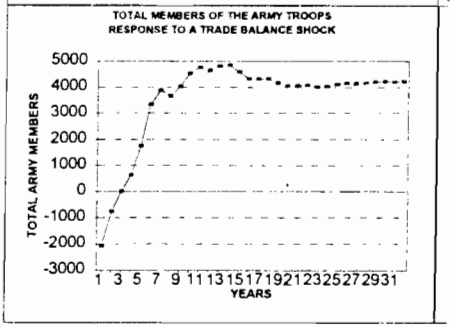
ANNEX #2

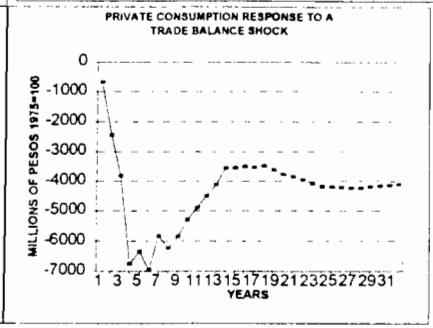
IMPULSE RESPONSE FUNCTIONS FOR THE WHOLE DYNAMIC SYSTEM
VEC MODEL WITH TRANSITORY VIOLENCE

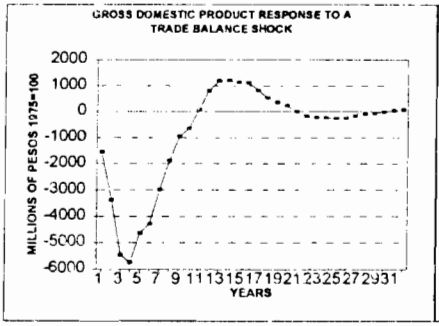
1)One standard deviation shock in trade balance

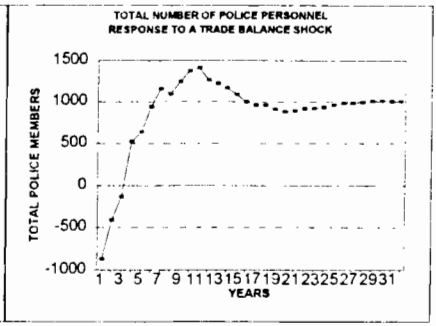


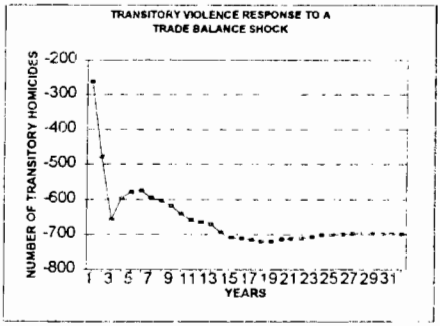








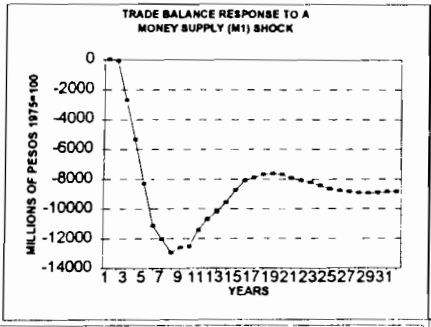


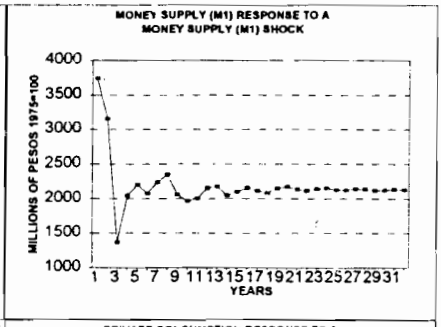


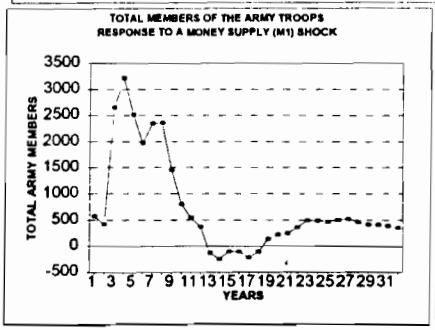
Signs for the immediate dinamic relations:

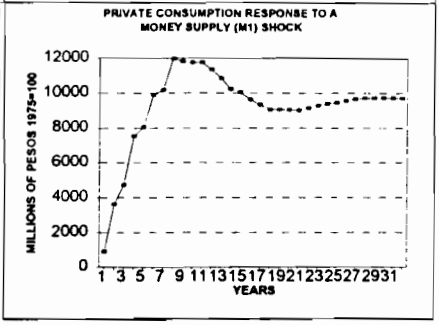
+BC -M1-PIFM -CPR -PIB -PIPO -HOMT

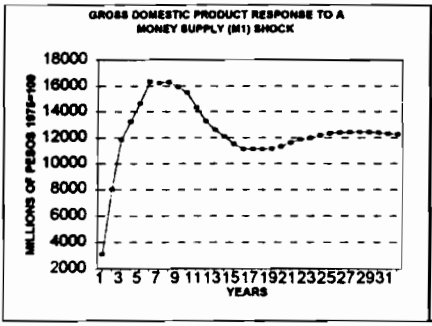
2)One standard deviation shock in money supply (M1)

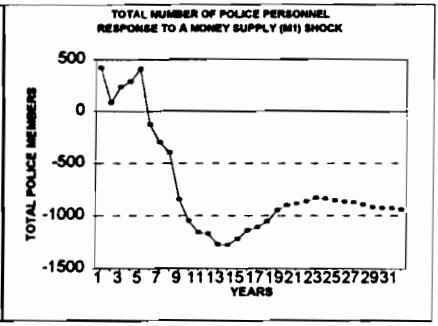


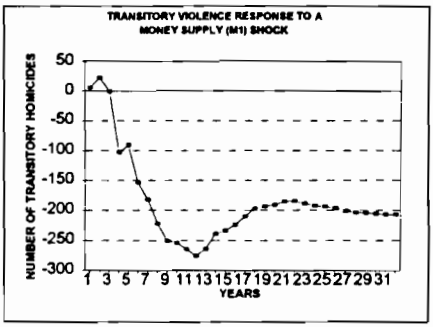








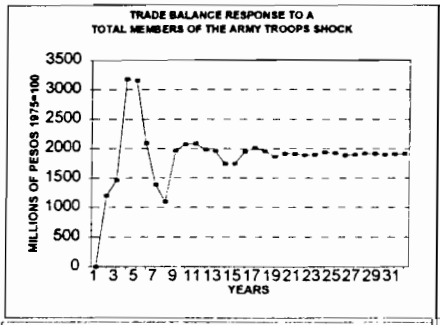


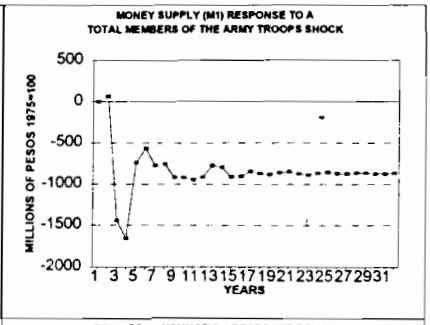


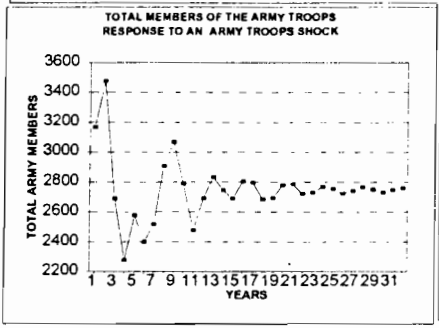
Signs for the immediate dynamic relations:

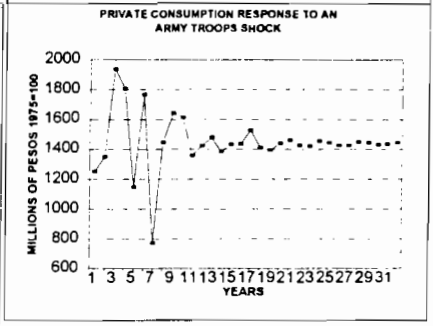
+M1-BC +PIFM +CPR +PIB +PIPO +HOM

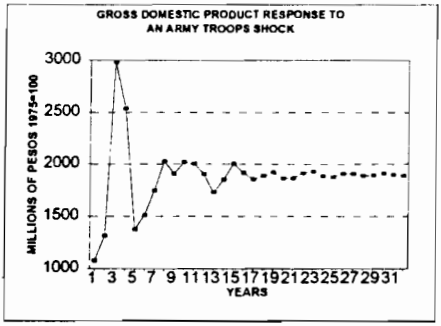
3)One standard deviation shock in army troops.

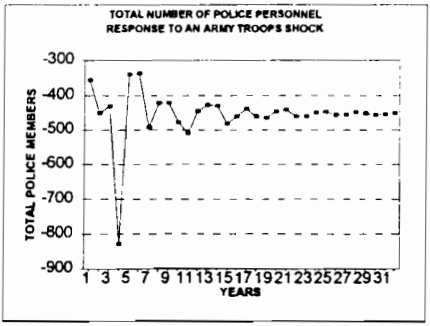


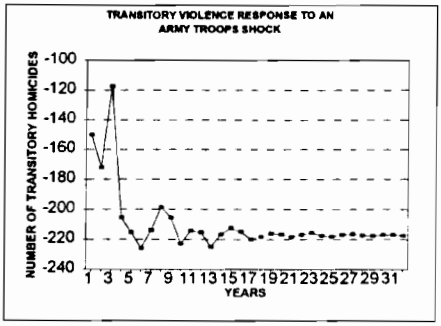








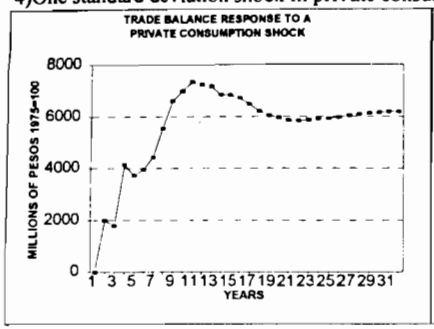


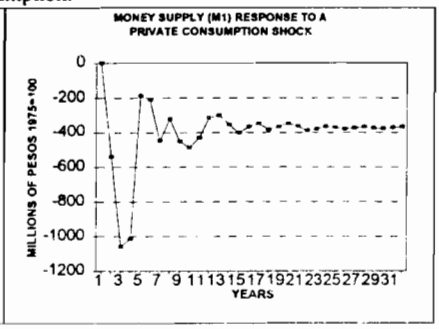


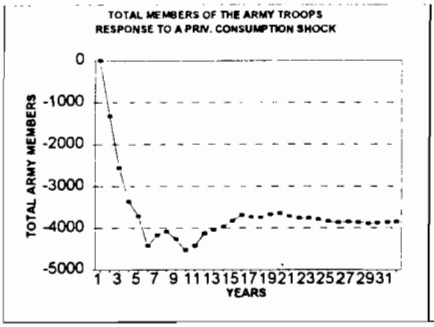
Signs for the immediate dynamic relations:

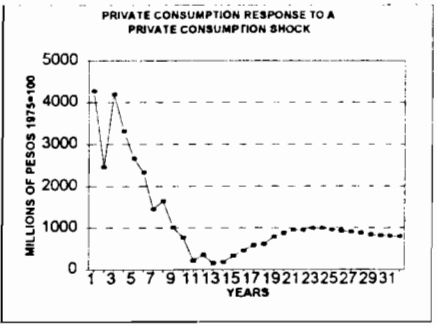
+PIFM +BC +M1+CPR +PIB -PIPO -HOM

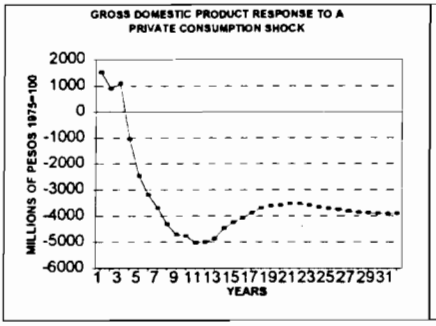
4)One standard deviation shock in private consumption.

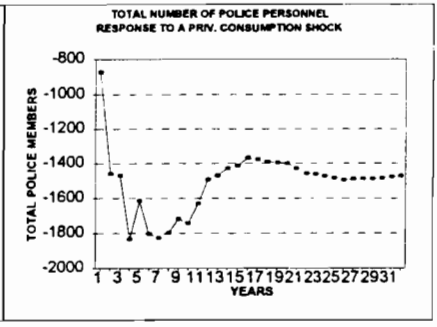


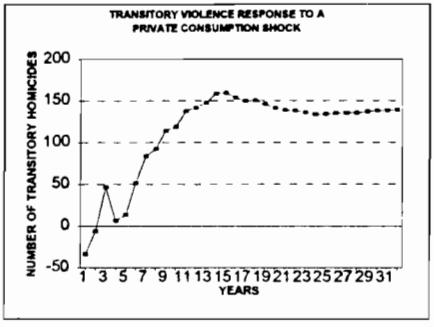








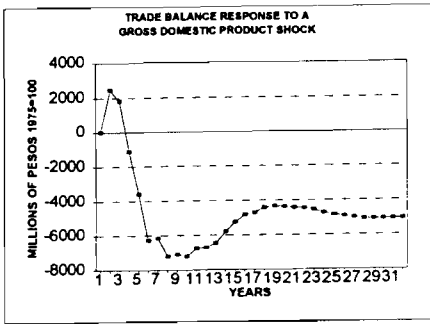


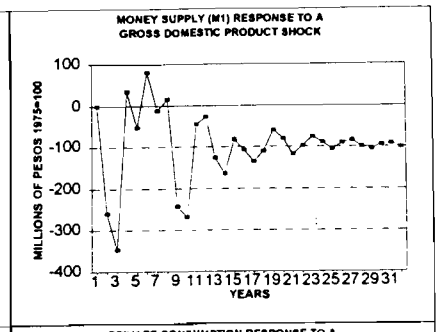


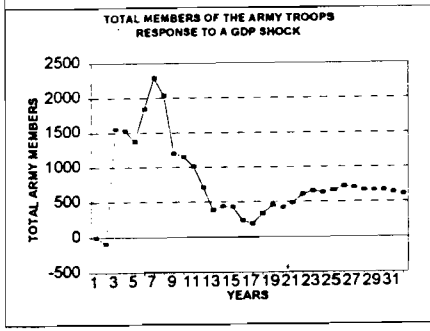
Signs for the immediate dynamic relations:

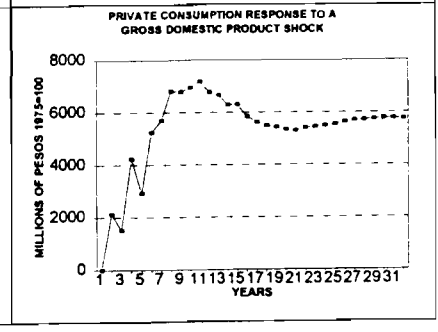
+CPR +BC -M1-PIFM +PIB -PIPO -HOMT

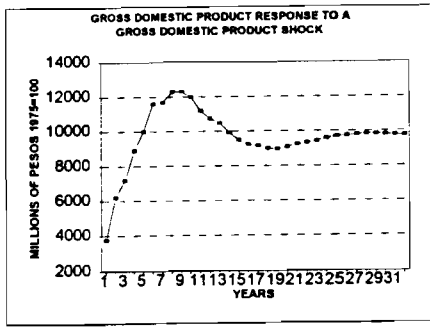
5)One standard deviation shock in Gross Domestic Product (GDP).

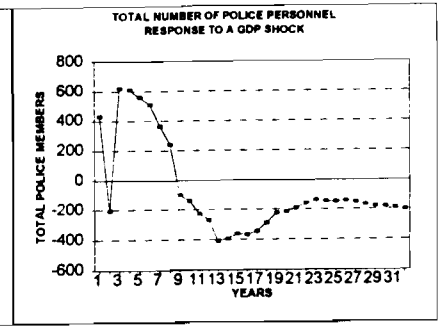


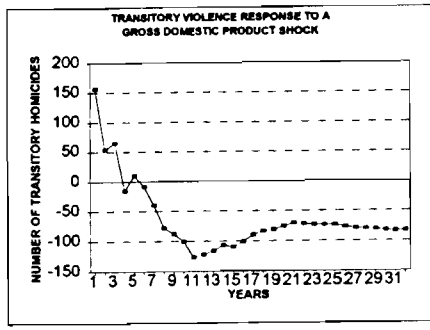








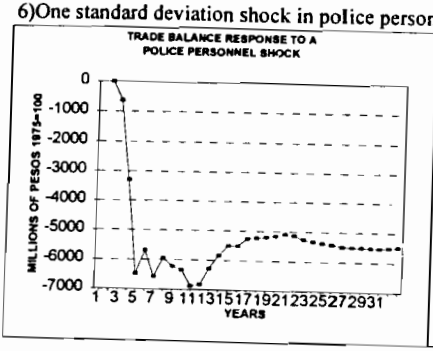


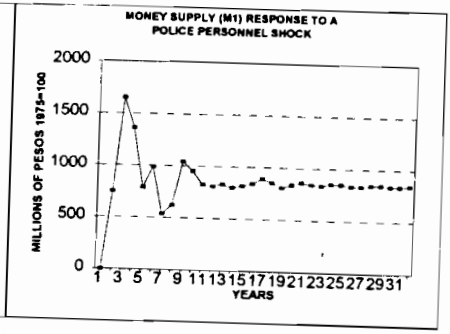


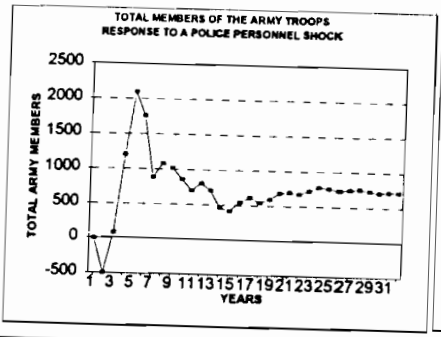
Signs for the immediate dynamic relations:

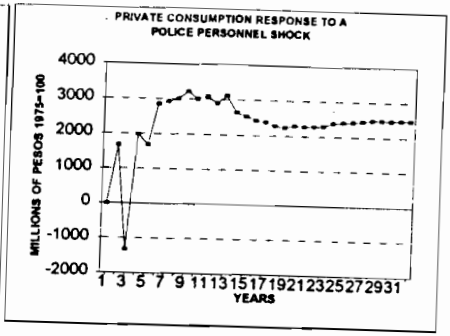
+ PIB + BC - M1 - PIFM + CPR + PIPO + HOMT

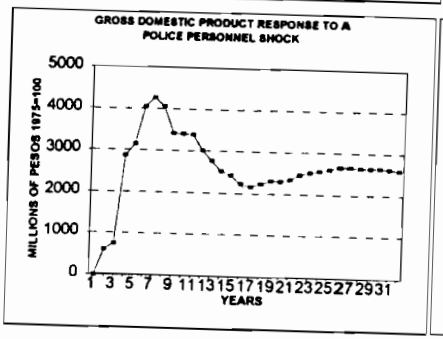
6)One standard deviation shock in police personnel.

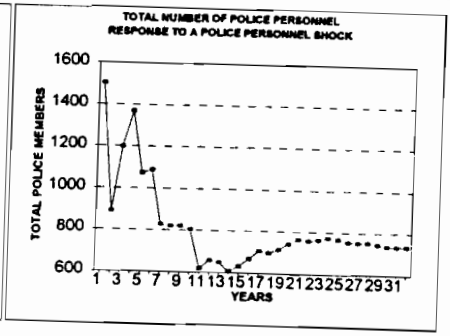


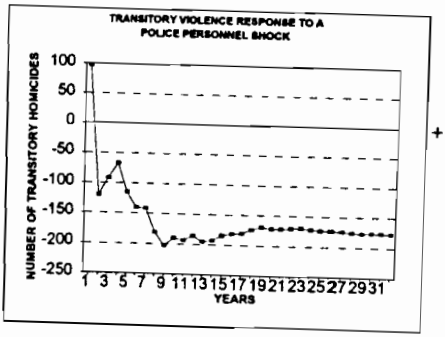








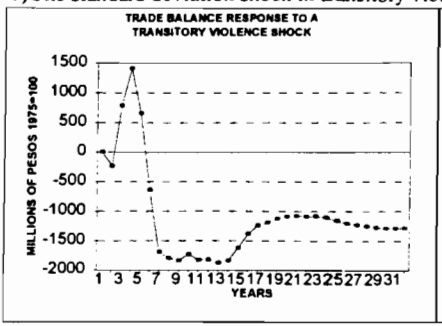


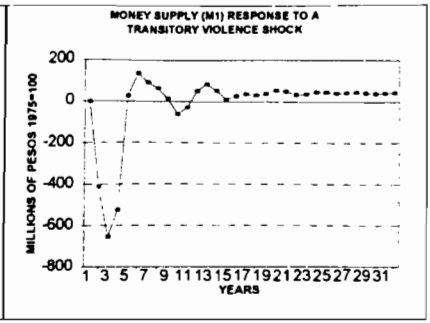


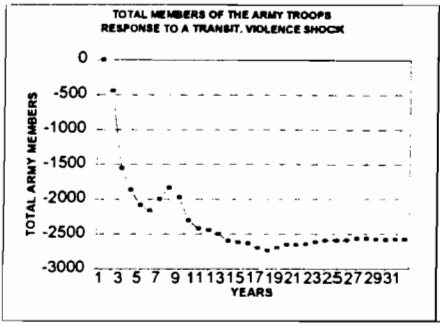
Signs for the immediate dynamic relations:

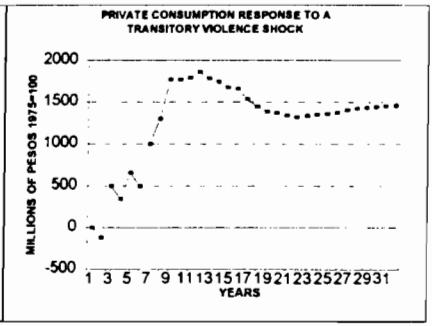
+ PIPO -BC +M1 -PIFM +CPR +PIB +PIPO +HOM

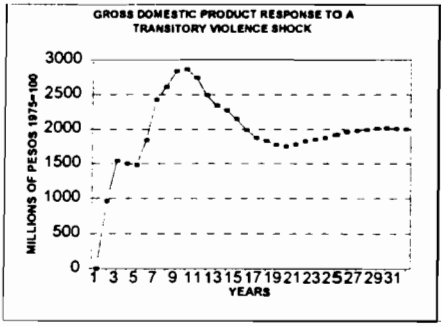
7)One standard deviation shock in transitory violence.

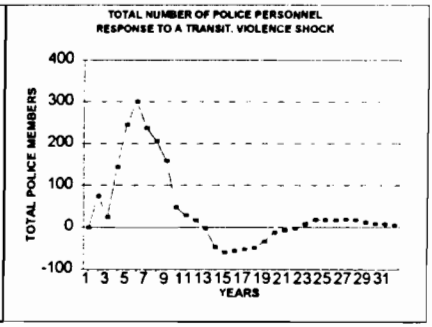


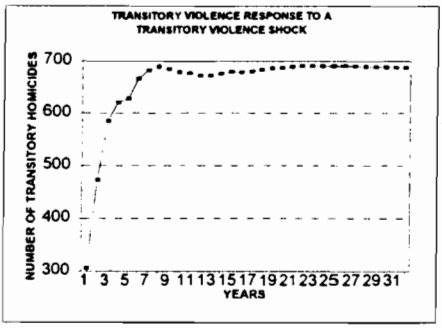












Signs for the immediate dynamic relations:

+HOMT - BC - M1 - PIFM - CPR + PIB + PIPO