

# **Contribution of institutional shocks to Tunisian macroeconomic fluctuations: Structural VAR approach**

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## **Abstract**

**Purpose:** The objective of this paper is to identify and assess the contribution of budgetary, monetary and institutional shocks affecting the Tunisian economy over the period 1976-2003. The methodology used is vector autoregressive models and structural recent techniques for the analysis of time series related. The empirical results show a significant relationship between the supply shock and institutions on the one hand, and between institutional shocks and economic activity on the other hand.

**Research Design, Data and Methodology:** As part of this section we will try to identify and assess the contribution of various shocks to macroeconomic variables' fluctuations for the Tunisian economy. The study period is: 1976-2003 and observations are annual.

**Results:** The real business cycle theory argues that fluctuations in aggregate economic activity are the result of the interaction of the only real factors namely agents' preferences, technological opportunities, factor endowments and possibly certain institutional constraints.

**Conclusions:** The lowest contribution to the variability of these rights is the monetary shock. As for "civil liberties", the largest share of their variability is the shock relating to the "political rights" during the first four periods .

**Keywords:** Budgetary Shocks, Monetary Shocks, Institutional Shocks, Structural VAR.

**JEL classifications :** C22, O43, O47, E11.

## **1. Introduction**

Since the contribution of Sims (1980), VAR models are considered the most suitable methodological framework for the analysis of fluctuations in terms of innovations. Recent developments in the field of time series analysis have enabled the development of this methodological approach. Restrictions identifying structural forms, lack of exogeneity tests and inadequate treatment of expectations are the most common criticisms addressed to Keynesian models.

Based on these criticisms, Sims (1980) proposes estimating a reduced form multivariate autoregressive and without constraints. VAR modeling is to consider all causal relationships between variables of a system without seeking the exogeneity of a particular variable and avoids imposing a priori constraints. This model also allows the identification of different types of shocks. Thus, the empirical framework proposed by Sims is more favorable to the identification and estimation of different contributions to changes in economic stimulus modeled from statistical innovations. The objective of this work is to identify and assess the contribution of various shocks: budgetary, monetary and especially institutional, affecting the Tunisian economy.

## 2. Structure and Identification of VAR

As part of this section we will try to identify and assess the contribution of various shocks to macroeconomic variables' fluctuations for the Tunisian economy. The study period is: 1976-2003 and observations are annual.

### 2.1. Choice of variables

Deal with the plurality of shock may influence the macroeconomic variables, and given that VAR models do not work properly with a large number of variables (5 variables maximum), a judicious choice of these variables is required. So we opt for the choice of the following:

- Real GDP per capita is a measure of real wealth created by the country during a year. This variable is used to generate an innovation generally called supply shock.
- Inflation: measured by changes in the GDP deflator. This variable can inform us about the impact printed by economic policy (monetary policy).
- Public spending approximated by the share of government consumption in GDP. This variable can inform us about the budgetary shocks.
- The political rights defined by the degree of government control by individuals.
- Civil liberties: it is the freedom of the press, freedom of assembly, free of political organizations, free trade unions, religious institutions free and independent judiciary.

Both indicators are measured on a scale of 1 to 7. 1 being the highest degree of freedom and 7 the lowest. These last two variables can provide information on the institutional shocks.

Before starting the estimation of a VAR model, it is necessary to study the characteristics of series to choose the suitable variant in addition to determining the proper sequence and identification of shocks.

## 2. 2. Series characteristics and identification of shocks

### 2. 2.1. Stationarity tests

Among the tests most frequently used in recent research, the ADF (Augmented Dickey-Fuller), PP (Phillips-Perron) and KPSS (Kwiatkowsky et al, 1999), will be used in this work. For the ADF and PP tests, we used the strategy of Perron (1988). This strategy proceeds by the principle of elimination and begins with the testing of the model with constant and trend.

Each time a coefficient is not significant, it is eliminated in the next sequential step. This strategy uses the ADF and PP tests to reject or accept the unit root hypothesis. They are supplemented by tests of null hypotheses based on the statistics attached  $\Phi$  to verify the conditions imposed on the parameters. In case of rejection of the null hypothesis of unit root, the procedure of Perron (1988) uses the t-test to study the significance of the constant and trend. Tests ADF, PP and KPSS attest the non stationarity of real GDP, inflation, public expenditure, political rights and civil liberties. Indeed they accept the presence of a unit root in these five series expressed in levels. This result prompted us to test the stationarity of the series after being differentiated. The three tests confirm the stationarity of the five series differentiated. The specification used is the first difference. The VAR model to estimate will therefore be constructed from the average annual growth rate of real GDP ( $\Delta$ PIBR), the inflation rate in first difference ( $\Delta$ INFL), public expenditure in first difference ( $\Delta$ Dép pub), political rights in first difference ( $\Delta$ DP) and civil liberties in first difference ( $\Delta$ LC).

### 2. 2. 2. Identification of shocks

The VAR model chosen can be written in matrix form, where the column vector of explanatory variables  $X_t = (\Delta$ PIBR,  $\Delta$ INFL,  $\Delta$ Dép pub,  $\Delta$ DP,  $\Delta$ LC)<sup>T</sup> depends on the p delays of the same vector as follows:

$$X_t = c + \sum_{i=1}^p A_i X_{t-i} + \varepsilon_t \quad (1)$$

Where c is the column vector of constants,  $A_i$  are square matrices of coefficients to be estimated and  $\varepsilon_t$  is the vector of estimation' residuals.  $\varepsilon_t = (\varepsilon_{\Delta$ PIBR,  $\varepsilon_{\Delta$ INFL,  $\varepsilon_{\Delta$ Dép pub,  $\varepsilon_{\Delta$ DP,  $\varepsilon_{\Delta$ LC)<sup>T</sup> represents the value of  $X_t$  not explained by the past behavior of X. From the vector of selected variables [ $\Delta$ PIBR,  $\Delta$ INFL,  $\Delta$ Dép pub,  $\Delta$ DP,  $\Delta$ LC]<sup>T</sup>, the residue of the first equation is a supply shock or activity, the second and third can be considered as demand shocks resulting

from the national economic policy, the fourth and fifth as institutional shocks. However, this simple definition of the shocks may be incorrect because the residues resulting from the canonical VAR are correlated. Therefore, we will, in what follows, proceeding to a structural VAR modeling. Identification of structural shocks requires the imposition of constraints. We chose the Blanchard and Quah (1989)' identification imposing long term restrictions. This identification method is used most recently in that it permits the imposition of profound restrictions and more related to economic theory, so, we propose the estimation of the following structural VAR model:

$$\begin{bmatrix} \Delta PIBR_t \\ \Delta INFL_t \\ \Delta D?_{pub}_t \\ \Delta DP_t \\ \Delta LC_t \end{bmatrix} = A(L) \times \begin{bmatrix} \mu_{\Delta PIBR_t} \\ \mu_{\Delta INFL_t} \\ \mu_{\Delta D?_{pub}_t} \\ \mu_{\Delta DP_t} \\ \mu_{\Delta LC_t} \end{bmatrix}$$

The left side of this equality is obviously the vector of variables entering the VAR system proposed. As for the second part, it consists of matrices of coefficients associated with delays and structural shocks through the column vector  $[\mu]$ . The identification of these structural shocks required as Blanchard and Quah (1989) the imposition of long-term constraints. These long-term constraints are usually presented through the matrix A (l). For the system of selected variables, we identify the various shocks from the matrix A (l) as follows:

$$A(l) = \begin{bmatrix} a_{11}(l) & 0 & 0 & 0 & 0 \\ a_{21}(l) & a_{22}(l) & 0 & 0 & 0 \\ a_{31}(l) & a_{32}(l) & a_{33}(l) & 0 & 0 \\ a_{41}(l) & a_{42}(l) & a_{43}(l) & a_{44}(l) & 0 \\ a_{51}(l) & a_{52}(l) & a_{53}(l) & a_{54}(l) & a_{55}(l) \end{bmatrix}$$

The identification of shocks in a VAR to five variables requires 10 constraints.

The zeros of the first and second lines of this matrix materialize the assumption, justified by economic theory, that only the supply shocks may influence effectively the economic activity over time. The zeros of the third and fourth lines can provide information on the lack of effect of institutional shocks on some economic variables. After the selection of variables and identification of shocks, the estimation of a VAR model requires the selection of an appropriate order. The use of selection criteria (AIC, SC) of this order show that a delay of order 3 as the most suitable.

### 3. Empirical results and interpretations

In what follows, we present the different results of the VAR model specified above. We are interested mainly in the response functions to shocks and variance decompositions of forecast errors. Both instruments can synthesize most of the information contained in the estimated VAR system dynamics. The decomposition of the variance will tell us about the relative importance of each shock in explaining the fluctuations of macroeconomic variables used, including those of economic growth of countries.

As for the response functions to shocks, they allow us to highlight the nature of the effects of various shocks on the economic and institutional variables. We begin with the decomposition of variance, and analysis will focus on the role of institutional shocks to economic growth and the supply shocks to fluctuations in the institutional environment. We will then analyze the functions of reactions to shocks and we will try, at first, to understand the contribution of various impulses to the rate of economic growth. In a second step we examine the relative importance of these shocks in explaining institutional variability.

### 3.1. Sources of fluctuations in the level of economic activity

#### 3.1.1. Results

The table in Appendix 2 show the contribution of each shock to the rate of economic growth through the decomposition of the forecast error of real GDP of each country. It shows a predominance of supply shocks in explaining the dynamics of key macroeconomic variable for the Tunisian economy. This predominance is whatever the period. In fact, these shocks explain between 94% and 97% of the variability in the rate of real GDP growth, regardless of the period. As for institutional shocks combined, they explain between 2% and 5% of the variability in the growth rate. The contribution of monetary and budgetary shocks to the variability in the growth rate is negligible, because it does not exceed 1% regardless of the period. The results of the response functions of real GDP to shocks show that the supply shock and institutional shocks exert significant effects on economic growth in Tunisia. Indeed, the supply shock contributes to the fluctuation in the rate of real GDP growth between the first to the fourth period, while that from the latter the effect exerted by the shock is significantly positive, with maximum impact by 20 percentage points after the eighth period.

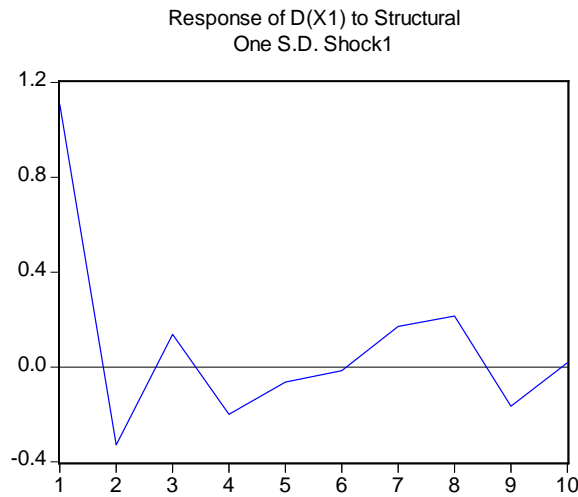


Figure 1: Response of the Tunisian growth rate to supply shock<sup>1</sup>

As for institutional shocks, they have a significant impact on the rate of real GDP growth, with a positive maximum of 4 percentage points for political rights after the seventh period. For the civil Liberties a positive maximum of 2.7 percentage points was recorded at the end of the third period and a negative maximum of 5 points, almost, is recorded at the end of seventh period.

<sup>1</sup> With X1, X4 and X5 are: growth rate of real GDP per capita, “political rights” and “civil liberties”.

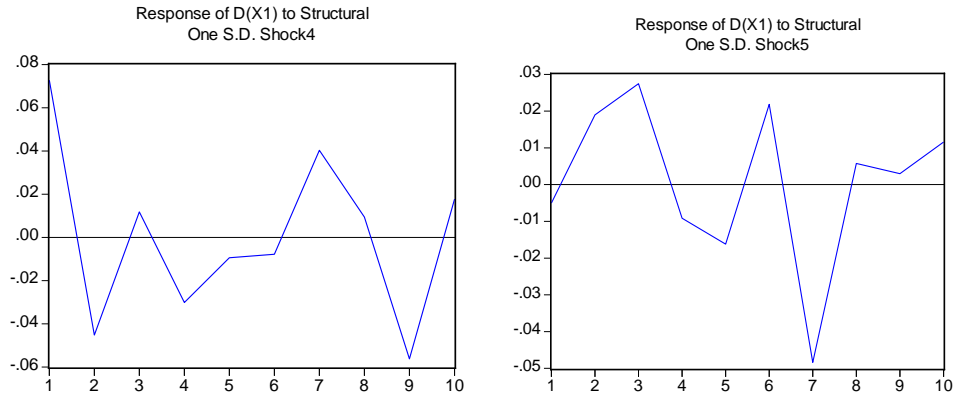


Figure 2: Response of Tunisian growth rate to institutional shock

### 3.1.2. Interpretation of results

The real business cycle theory argues that fluctuations in aggregate economic activity are the result of the interaction of the only real factors namely agents' preferences, technological opportunities, factor endowments and possibly certain institutional constraints. For the Tunisian case, it is mainly the resource endowments and institutional constraints, which may explain the fluctuations in the level of activity. Tunisia, as is the case of the majority of developing countries, suffer from several problems such as the weakness of industrial value added, the importance of the agricultural sector dualism, the disarticulation of industries, the technological, financial and commercial dependence, the importance of the products mining with low value added in the exportations. It is thus evident that the predominance of the supply shock in explaining the level of economic activity shows the vulnerability of these economies to the natural shocks that directly affect agricultural activity.

The relative importance of institutional shocks in explaining the level of Tunisian economic activity reflects the effect of institutional changes on economic activity. Indeed, the promotion of political rights and civil liberties are able to stimulate economic activity through the incentive to invest, to practice the exchange with the rest of the world and to innovate, especially in countries, initially suffering from the absence of these rights and freedoms, as is the case of Tunisia.

Respect for rights, security of freedoms that guarantee and the protection of private property encourage economic investment and innovation in safety, which translates to significant overall economic performance. We can explain the limited effect of economic policies by the nature of the public spending structure. Indeed, this structure is characterized by the predominance of operating expenses and debt service on the one hand. On the other hand, public spending crowd out private investment and more, they are used to finance investments generally unprofitable or marginally profitable. Hence the weakness of the effect of this spending on the Tunisian economy.

## 3. 2. Sources of institutional variables' changes

In addition to the analysis of the economic activity fluctuations, our model allows us to understand the institutional variability.

### 3. 2.1. Results

According to the decomposition of the variance of the forecast error of the variable "political rights" is the supply shock that explains most of the variability of these rights especially after the third period (78.73 % after the last period). The contribution of institutional shocks combined is important, especially during the first periods (92.4% after the first period). The lowest contribution to the variability of these rights is the monetary shock. As for "civil liberties", the largest share of their variability is the shock relating to the "political rights" during the first four periods (86.11% after the first period). While from the fifth period is the supply shock that explains the largest share of this variability (80.25% during the last period).

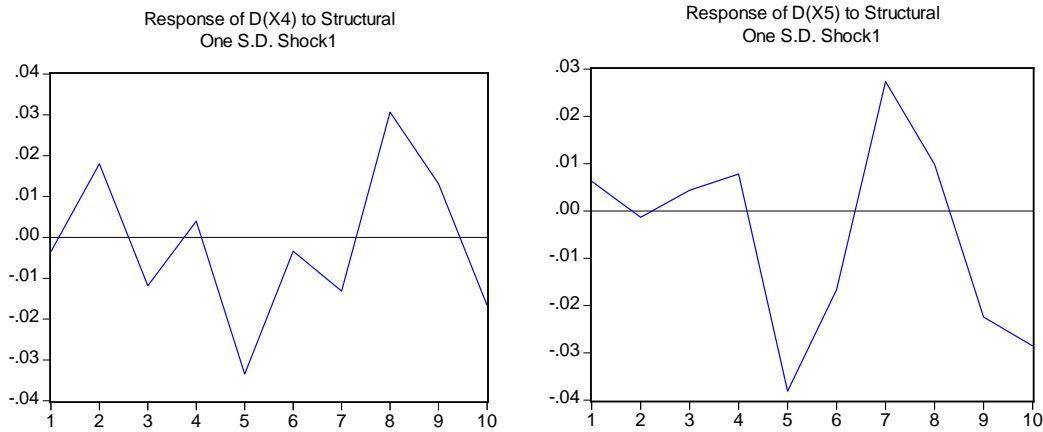


Figure 3: Response of Tunisian institutions to supply shock

These findings are consolidated by the functions of responses to shocks as the supply shock has a significant effect on the dynamic of "political rights" with a maximum level of nearly 3% after the eighth period and a negative one (3%) at the end of the fifth period. As for "civil liberties" the same result is obtained, with some differences.

### 3.2.2. Interpretation of results

The predominance of the supply shock in explaining the Tunisian institutional dynamics can be explained by the fact that in some cases the good economic performance lead to strong institutions. Indeed, political rights and civil liberties are claimed by the people when the level of well-being of these populations is high enough so that basic needs are met. Hence the importance is allocated to secondary needs, such as these rights and freedoms. This idea is reinforced by several researchers such as Barro (1996), Helliwell and Burkhart and Lewis-Beck (1994) who concluded that the positive relationship between income and democracy is widely attributed to the effect of income on democracy and not vice versa.

## 4. Conclusion

In this research project, I have tried to make a contribution to solve the fundamental question: Is there any link between a country's political institutions and the economic performances that it achieves?

To this end, I have employed a structural vector autoregressive model concerning the Tunisian economy during the period 1976-2003. Our empirical results show a significant relationship between the supply shock and institutions on the one hand, and between institutional shocks and economic activity on the other hand. To conclude, these analyses have permitted, though in part, to show that there exists a relationship between the institutional factors and the economic performances of the developed and the developing countries. However, it is important to note that, despite the importance of the empirical results which this work has led to, some insufficiencies may be raised:

- For lack of data, I haven't used other institutional variables.
- The influence of the threshold level of economic and institutional development hasn't been tested.

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## Appendices

### Appendix 1: Stationary tests: ADF and PP tests

Stationarity tests: ADF and PP tests (level Series)

Series	ADF Test		PP Test	
	Trend	Constant	Trend	Constant
Real GDP per capita	-0.99	0.73	-1.20	1.12
Inflation	-2.67	-1.48	-3.94*	-2.18
Public spending	-2.4	-2.45	-2.58	-2.65**
Political Rights	-2.96	-2.71**	-2.56	-2.48
civil liberties	-3.67*	-3.75*	-2.34	-2.39

\*: Reject of null hypothesis at 5%

\*\* : Reject of null hypothesis at 10%

Stationarity tests: ADF and PP tests (differentiated Series)

Series	ADF Test		PP Test	
	Trend	Constant	Trend	Constant
Real GDP per capita	-3.74*	3.54*	-5.69	-5.54
inflation	-3.32**	-3.34*	-6.18	-6.38
Public spending	-4.31*	-4.44	-5.13	-5.29
Political rights	-3.28*	-3.31*	-4.85	-4.92
Civil liberties	-5.64	-5.74	-3.52**	-3.62*

Stationary tests: KPSS test

Series	Level	differentiated
Real GDP per capita	0.66*	0.22
Inflation	0.45**	0.13
Public spending	0.13	0.13
Political rights	0.20	0.06
Civil liberties	0.12	0.14

### Appendix 2: Decomposition of the variance.

#### Decomposition of the GDP variance ( %)

Period	Shock1 <sup>2</sup>	Shock2	Shock3	Shock4	Shock5
1	97.83284	0.000399	0.342520	1.815507	0.008735
2	97.23197	0.012927	0.329848	2.304402	0.120854
3	97.13333	0.013719	0.320204	2.198036	0.334710
4	96.86458	0.016425	0.317993	2.444630	0.356373
5	96.75995	0.017865	0.323402	2.466513	0.432266
6	96.62259	0.018209	0.337006	2.456960	0.565239
7	95.52143	0.021014	0.341968	2.890136	1.225451
8	95.61718	0.021507	0.350478	2.817407	1.193426
9	94.78999	0.021544	0.351076	3.652630	1.184761
10	94.67677	0.027772	0.360172	3.719791	1.215495

<sup>2</sup> With the shocks from 1 to 5 are : supply shock, monetary shock, budgetary shock, institutional shock relating to "political rights" and institutional shock relating to "civil liberties"



**Decomposition of « political rights » variance ( %)**

Period	Shock1	Shock2	Shock3	Shock4	Shock5
1	4.680597	0.773341	2.073444	27.76862	64.70400
2	47.94272	0.295140	1.048453	12.58563	38.12805
3	53.72691	0.235207	1.404063	10.19580	34.43801
4	50.67202	0.478056	1.308837	10.23178	37.30931
5	71.94085	0.208858	0.881914	9.984226	16.98416
6	67.08215	0.193806	1.088031	15.89777	15.73824
7	68.84902	0.231301	1.035404	14.79351	15.09076
8	76.76018	0.183881	0.971060	10.94065	11.14423
9	77.19612	0.179321	1.107182	10.93271	10.58467
10	78.73849	0.167576	1.042417	10.18718	9.864336

**Decomposition of the « civil liberties »( %)**

Period	Shock1	Shock2	Shock3	Shock4	Shock5
1	10.73389	0.028038	1.299332	86.11114	1.827601
2	9.787666	0.059245	1.439320	85.90423	2.809540
3	7.834494	0.049035	0.931019	85.78331	5.402141
4	14.03824	0.045320	0.856845	78.98858	6.071006
5	65.94419	0.069974	0.783846	30.79631	2.405679
6	69.03913	0.081462	0.716473	27.86857	2.294362
7	74.54794	0.063365	1.197310	21.42943	2.761963
8	74.72998	0.062549	1.371252	21.06285	2.773370
9	76.87807	0.056973	1.285231	18.69420	3.085526
10	80.25391	0.068274	1.146029	15.95503	2.576761