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Abstract

For the past two decades, Tunisia has been undertaken important structural reforms, which call in most cases for market and trade liberalization (agricultural structural adjustment program, GATT reforms, free trade area with the European Union). The private-led type of growth strategy with less government intervention has culminated these last years into a more rapid economic growth and openness.

Within this context, this paper examines the agricultural sector role into the economic growth and its interactions with the other sectors using time-series co-integration techniques. We use annual data from 1961 to 2005 to estimate a VAR model that includes GDP indices of five sectors in Tunisian economy.

Empirical results from this study indicate that in the long-run all economic sectors tend to move together (co-integrate). But, in the short-run, the agricultural sector seems to have a limited role as a driving force for the growth of the other sectors of the economy. In addition, growth of the agricultural output may not be conducive directly to non-agricultural economic sector in the short-run.

JEL classifications: C22; O13; Q18

Key words: co-integration, economic growth, agricultural sector, Tunisia.

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1. Introduction

The ongoing globalization process in the world economy is a big challenge for Tunisia, a country which has "suffered" a large process of structural economic reforms and liberalization after decades of a socialist economic model with heavy state direction and participation in the economy.

Historically, Tunisia followed a socialist economic model with close state control of the economy. The government's economic policies had limited success during the early years of independence. During the 1960s, a drive for collectivism caused instability, and agricultural production fell brutally. Higher prices for phosphates and oil and growing revenues from tourism stimulated growth in the 1970s, but an emphasis on import substitution to protect the domestic manufacturing industries led to inefficiencies. A balance of payments crisis in 1986 forced the policy makers to switch to World Bank and International Monetary Fund sponsored economic liberalization and structural adjustment programs (1987-1994).

Over the past decade, evidence suggests that Tunisia's economic performance has been one of the strongest in the region, reflecting gradual but continuous structural reforms, prudent macroeconomic policies and well-targeted social policies. Real growth averaged 5% in the 1990s, and inflation is slowing.

Despite the change and diversification observed in the Tunisian economy (industrialization, growth of service sector and the expansion of tourism), the agricultural sector remains economically and socially important for its contribution to the achievement of national objectives as regards to food security, employment, regional equilibrium and social cohesion.

As a government policy objective, Tunisia needs its agriculture, to maintain employment as much as to earn export earnings. In fact, agricultural sector generates around 15% of total Gross Domestic Product (GDP), employs 20% of total labour force and agro-food exports represent around 15% of total exports.

Although the high importance placed on the agricultural sector, in context of Tunisian economy, the issue of the agricultural contribution to the economic growth has often been evoked by policy makers but rarely examined empirically.

Accordingly, the aim of this empirical paper is to investigate the agricultural sector role into the Tunisian economic development process. We use Johansen's multivariate approach to co-integration to overcome the problem of spurious regression. Special attention is paid to the distinction between long-run structural relationships and short-run dynamics in estimating the relation between agricultural and non-agricultural sectors.

The remainder of the paper is organized as follows. Section 1 provides a brief review of literature on the role of agricultural sector in economic growth. Section 2 describes the Tunisian macro-variables used in our empirical work and presents the econometric framework of our study. This section also discusses empirical results with distinction between long-run relationship and short-run dynamics. Some Concluding remarks and findings are given in section 4.

2. Brief review of literature

The macroeconomic linkage between agricultural sector and economic growth has been one of the most widely investigated in the development literature and was debated virtually from two broad points of view.

The first view argues that agriculture only plays a passive role as most important source of resources (food, fiber, and raw material) for the development of industry and other non-agricultural sectors (Lewis, 1954; Hirschman, 1958; Ranis and Fei, 1961; Fei and Ranis, 1964). This point of view suggests that agriculture provides input materials, capital and labour for the rest of economy in order to raise the total national output since the industrial sector is more productive than agriculture and the modernization of the economy and, therefore, the growth of the global output passes by a certain taxation of agriculture as means to develop the industrial sector and to transfer resources from agriculture toward the other sectors (forward linkage effects). This idea was mainly evoked in the context of dualistic models. In this traditional analysis of agriculture–industry linkages and the behavior of the real sectors in the economy, the agricultural performance is treated as exogenous to the economy, while industrial performance is endogenous, owing in part to rain dependence of agricultural output.

The most recent view maintains the forward linkage effects of agriculture but also underlines its backward linkage to other sectors of the economy (Yao, 2000). Agricultural sector not only provides resources to the non-agricultural sectors, but is also an important market for industrial products and benefits in turn as industry helps modernize traditional production techniques by providing modern inputs, technology, and improved managerial skills (Hazell et Röell, 1983; Timmer, 1988; Haggblade *et al.*, 1989; Delgado, 1994). The end result is that both sectors benefit from each other, and the nation benefits from their growth and increased efficiency.

These last years, several studies were interested, always according to various methodological approaches, to the exam of the agriculture contribution to the economic growth of the less developed countries or the developing countries. We can mention, as an example, the works of Humpheries and Knowleses (1998) for a sample of less developed countries, of Block (1999) for the case of Ethiopia and Henneberry *et al.* (2000) for Pakistan. While a number of linkages can be envisaged, the general idea seems to be one where the contribution of agricultural growth to economic development varies markedly from country to country and from one time period to another within the same economy. In addition, many prominent agricultural economists such as Adelman (1995) and Adelman *et al.* (1995) have recognized the value and important role of agriculture in development.

Given the available econometric techniques, Kanwar (2000) and Chaudhuri and Rao (2004) suggest that in estimating the relation between agricultural and non-agriculture sectors, the former should not be assumed to be exogenous, rather, this should first be established.

Kanwar (2000) criticize also the "neglect" of agricultural sector role in the development process of the less developed economies. In his study, the author studies the co-integration of the different sectors of the Indian economy in a multivariate vector autoregression framework to circumvent problems of spurious regressions given the presence of non-stationarity data.

Yao (2000) demonstrates how agriculture has contributed to China's economic development using both empirical data and a co-integration analysis. Two important conclusions are drawn. First, although agriculture's share in GDP declined sharply over time, it is still an important force for the growth of other sectors. Second, the growth of non-agricultural sectors had little effect on agricultural growth. This was largely due to government policies biased against agriculture and restriction on rural-urban migration.

Katircioglu (2006) analyze the relationship between agricultural output and economic growth in North Cyprus, a small island which has a closed economy using co-integration. This author use annual data covering 1975-2002 period, to find the direction of causality in Granger sense between agricultural growth and economic growth. His Empirical results suggest that agricultural output growth and economic growth as measured by real gross domestic product growth are in long-run equilibrium relationship and there is feedback relationship between these variables that indicates bidirectional causation among them in the long-run period. This study concluded that agriculture sector still has an impact on the economy although North Cyprus suffers from political problems and drought.

Tiffin and Irz (2006) using the Granger causality test and co-integration in the panel data for 85 countries, find evidence that supports the conclusion that agricultural value added is the causal variable in developing countries, while the direction of causality in developed countries is unclear.

All these studies and reflections have made useful contribution to understand the link between agricultural sector and economic growth. However and up to our knowledge, for the

Middle East and North Africa region studies and models related with this topic are generally "limited".

This study seeks to bridge an important gap examining the existence and the magnitude of the link between agriculture and other economic sectors for Tunisia and overcoming the shortcoming literature related with North African economies.

3. Methodological approach: a co-integration analysis

3.1. Variables selection

Availability of long series of data is one of the major problems for economic modeling in Tunisia. In this study time-series data of GDP indices in constant price of five sectors have been considered. Table 1 describes the database used. The sample period covers annual data from 1961 to 2005. All variables are in logarithms.

Table 1: Description of database

Variable	Symbol	Source
Gross Domestic Product (GDP) index of agricultural sector in constant price (Basis 100 = 1990)	AGRP	Institut National de la Statistique (INS). Ministère du Développement et Coopération Internationale. Tunisia.
Gross Domestic Product (GDP) index of manufacturing industry in constant price (Basis 100 = 1990)	IM	
Gross Domestic Product (GDP) index of non-manufacturing industry in constant price (Basis 100 = 1990)	INM	
Gross Domestic Product (GDP) index of transportation, tourism and telecommunication sector in constant price (Basis 100 = 1990)	TTT	
Gross Domestic Product (GDP) index of commerce and services sector in constant price (Basis 100 = 1990)	CDS	

Taking into account the methodological approach followed in this paper, the first step in our analysis has been to explore univariate properties and test the order of integration of each series. When the number of observations is low, unit root tests have little power. For this reason we have examined the results from two different tests: the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979, 1981), which tests the null of unit root, and KPSS (Kwiatkowski *et al.*, 1992), which tests the null of stationarity. Both tests indicated that the five variables were I(1)[1].

3.2. Long-run relationships study

In this work, the co-integration analysis has been conducted using the general technique developed by Johansen (1988, 1991, 1992) and Johansen-Juselius (1990, 1992). They proposed a maximum likelihood estimation procedure which allows researchers to estimate simultaneously the system involving two or more variables to circumvent the

[1] Results are not shown due to space limitations and they are available upon request. Mainly, in this work, we used the Regression Analysis of Time Series (RATS) software package.

problems associated with the traditional regression methods. Further, this procedure is independent of the choice of the endogenous variable, and it allows researchers to estimate and test for the presence of more than one co-integrating vector(s) in the multivariate system.

The procedure starts with the following reformulation of a Vector Autoregression model (VAR) into an error correction mechanism (ECM):

$$\Delta X_t = \Pi X_{t-1} + \delta D_t + \sum_{i-1}^{k-1} \Psi_i \Delta X_{t-1} + \varepsilon_t \quad (1)$$

where X_t is a (p×1) vector of endogenous variables; Ψ_i (i= 1, 2…) are (p×p) matrices of short-run parameters; Π is a (p×p) matrix of long-run parameters; D_t is a vector of deterministic terms (a constant, a linear trend, seasonal dummies, intervention dummies, etc.); and ε_t is a vector of errors that are assumed to be independently and identically Gaussian distributed, such that $E(\varepsilon_t \varepsilon'_t) = \Sigma$ for all t, where $\Sigma = \{\sigma_{ij}\}$ $(i, j = 1, 2, \cdots, p)$ is an (p×p) positive definite matrix.

In the I(1) system X_t is said to be co-integrated if the following rank conditions are satisfied: $H_r : \Pi = \alpha\beta'$ of rank 0<r<p, where α and β are matrices of dimension (p×r). β is a matrix representing the co-integrating vectors which are commonly interpreted as meaningful long-run equilibrium relations between the X_t variables, while α gives the weights of the co-integration relationships in the ECM equations. The co-integration rank is usually tested by using the maximum eigenvalue (λ-max) and the trace test statistics proposed by Johansen (1988).

The estimation of the ECM (1) subject to rank restrictions on the long-run matrix Π does not generally lead to a unique determination of long-run relationships. Johansen and Juselius (1994), Johansen (1995a), and Boswijk (1995), among others, have developed a testing procedure to solve the problem of identifying the long-run relationships in a linear co-integrating model by imposing linear restrictions in order to determine long-run behavioral parameters such as supply and demand elasticities.

However, sometimes it is more interesting to test joint restrictions on both the co-integration vectors and the adjustment coefficients. Johansen and Juselius (1990, 1992) developed a procedure to carry out individual tests on parameters from both matrices[2]. Mosconi (1998), extended the previous procedure to jointly consider general linear restrictions on both the long-run parameters, α and β. A general formulation of the null hypothesis can be expressed as:

[2] The general procedure is to test restrictions on the β parameters and afterwards on the α coefficients with the restrictions on β being imposed (Ben Kaabia and Gil, 2000).

$$H_0: \begin{cases} \beta = [\beta_1;\ldots;\beta_r] = [H_1\varphi_1;\ldots;H_r\varphi_r] \\ \alpha = [\alpha_1;\ldots;\alpha_r] = [A_1 a_1;\ldots;A_r a_r] \end{cases} \quad (2)$$

where: H_j is a ($k \times s_j$) matrix defining linear restrictions that reduce the k-dimensional vector β_j to the s_j-dimensional vector φ_j, with s_j representing the number of unrestricted parameters in β_j; k_j is the number of restricted parameters in β_j, such that ($k_j + s_j = k$); similarly, A_i are ($k \times f_i$) restriction matrices α_i's, where f_i is the number of unrestricted parameters in α_i.

Note that in the case where α is not restricted (A_i= I), (2) can be used to test the identification restrictions on β. In this case, the hypothesis is formulated as $\beta = (H_1\varphi_1, \cdots, H_r\varphi_r)$. As shown in Johansen (1995b), inference on the coefficients of co-integrated VAR systems is asymptotically based on mixed Gaussian distributions, so the Likelihood Ratio (LR) statistic for testing the hypothesis (2) is asymptotically $\chi^2(v)$.

The procedure outlined above has been applied to the system including the five variables described above (AGRP; IM; INM; TTT and CDS). System (1) has been initially estimated including two lags with a constant term restricted in the co-integration space, implying that some equilibrium means are different from zero.

In the present work, although the underlying variables are trended, they move together, and it seems unlikely that there will be a trend in co-integrating relation between variables[3].

Table 2: Tests of the co-integration rank

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix					Cointegration LR Test Based on Trace of the Stochastic Matrix				
H0 :	Ha :	λ- max	Critical Value (95%)	Critical Value (90%)	H0 :	Ha :	Trace	Critical Value (95%)	Critical Value (90%)
r = 0	r = 1	60.132	34.400	31.730	r = 0	r = 1	122.732	75.980	71.810
r = 1	r = 2	33.932	28.270	25.800	r = 1	r = 2	62.600	53.480	49.950
r = 2	r = 3	12.605	22.040	19.860	r = 2	r = 3	28.668	34.870	31.930
r = 3	r = 4	8.414	15.870	13.810	r = 3	r = 4	16.063	20.180	17.880
r = 4	r = 5	7.649	9.160	7.530	r = 4	r = 5	7.649	9.160	7.530

Note: The critical values are taken from Pesaran *et al.* (2000).

[3] The lag length has been determined by the Akaike's information criterion and Schwarz's information criterion. With respect to the deterministic components, and following Harris (1995), several tests have been conducted to empirically select such components. Results indicated that a model with a restricted constant was statistically preferred. Also, in the case of Tunisia, in 1986 a Structural Adjustment Program was implemented which substantially changed the objectives and instruments of both the economic and agricultural policies. To account for this event on the level of the variables, an earlier model was estimated including a restricted step dummy variable, but there is no statistical evidence to including this dummy variable.

Table 2 shows the results of Johansen's likelihood ratio tests for co-integration rank. As can be observed, at the 5% of significance level, both the maximum eigenvalue and trace statistics do not reject the null hypothesis that there are two co-integrating relation between the variables (r = 2).

In all the following analysis we assume the presence of two stationary or co-integrating relations and three common stochastic trends in the system. The presence of two co-integrating vectors in our system suggests an inherent movement in the system to revert towards long-run equilibrium path of the Tunisian economy subsequent to a short-run shock. Their estimates are presented in Table 3 along with the corresponding adjustment matrix α.

Table 3: Estimated β and α parameters with two co-integration vectors

$$\beta' Y_t = \begin{bmatrix} 0.468 & 1.000 & -5.075 & 6.273 & -6.094 & 17.892 \\ -10.423 & -21.093 & -7.884 & 1.000 & -14.814 & 52.521 \end{bmatrix} \times \begin{pmatrix} AGRP \\ IM \\ INM \\ TTT \\ CDS \\ Cte. \end{pmatrix}$$

$$\alpha = \begin{bmatrix} \alpha_{AGRP1} & \alpha_{AGRP2} \\ \alpha_{IM1} & \alpha_{IM2} \\ \alpha_{INM1} & \alpha_{INM2} \\ \alpha_{TTT1} & \alpha_{TTT2} \\ \alpha_{CDS1} & \alpha_{CDS2} \end{bmatrix} = \begin{bmatrix} \underset{(2{,}407)}{0{,}044} & \underset{(1{,}957)}{0{,}019} \\ \underset{(5{,}141)}{0{,}040} & \underset{(-0{,}702)}{-0{,}003} \\ \underset{(6{,}036)}{0{,}032} & \underset{(-3{,}392)}{-0{,}010} \\ \underset{(7{,}886)}{0{,}060} & \underset{(0{,}908)}{0{,}004} \\ \underset{(7{,}215)}{0{,}045} & \underset{(3{,}779)}{0{,}012} \end{bmatrix}$$

Note: Values in parentheses correspond to t-ratios in the case of the α parameters.

To facilitate the analysis of the co-integration space as summarized by the estimates, we also compute a number of tests to investigate the relative importance of the individual α values. The test of the null hypothesis for α, $H_0 : \alpha_{i1} = \alpha_{i2} = 0$, check for the weak exogeneity. In the co-integration framework the variable is called weakly exogenous if it is not influenced by deviations from the long-run relationships[4]. Individual elements of these joint tests are reported in Table 4.

Weak exogeneity is rejected for all the variables in the system. For the five variables, the corresponding statistics are larger than the critical value. The rejection of weak exogeneity in agriculture means that agricultural growth can cause the growth of the non-agricultural sector in Tunisia. Also the rejection of weak exogeneity in the non-agriculture

[4] The general concept of weak exogeneity is introduced in Engle et al. (1983) and the weak exogeneity in the co-integration framework is discussed in Ericsson et al. (1998).

sectors means that the growth of these four sectors (IM; INM; TTT and CDS) can cause agricultural to grow.

Table 4: Tests for weak exogeneity

	AGRP	IM	INM	TTT	CDS
$\chi^2(2)$	7.100	18.570	27.875	34.790	32.102
Critical Value (95%)			5.991		

The next problem is that of identity. As the two co-integration vectors include a whole range of the variables, each equation is not uniquely defined. Following the Johansen's approach, we impose a number of restrictions on the β coefficients to see whether some of these coefficients may be equal to zero so that unique relationship can be found.

Without knowing which restrictions may be statistically acceptable and have empirical support, many alternative restrictions on β are conducted. The most acceptable restriction is that the coefficient of TTT in the first vector and the coefficients of AGRP and CDS in the second vector are set to zero. The final co-integrating vectors are presented in Table 5.

Table 5: Estimated β and α matrices under long-run identification

$$\beta' Y_t = \begin{bmatrix} \underset{(0.108)}{-0.285} & 1.000 & \underset{(0.075)}{-0.332} & 0.000 & \underset{(0.072)}{-0.783} & \underset{(0.256)}{1.878} \\ 0.000 & \underset{(0.092)}{-0.823} & \underset{(0.183)}{-0.494} & 1.000 & 0,000 & \underset{(0.477)}{1.824} \end{bmatrix} \times \begin{pmatrix} AGRP \\ IM \\ INM \\ TTT \\ CDS \\ Cte. \end{pmatrix}$$

$$\alpha = \begin{bmatrix} \alpha_{AGRP1} & \alpha_{AGRP2} \\ \alpha_{IM1} & \alpha_{IM2} \\ \alpha_{INM1} & \alpha_{INM2} \\ \alpha_{TTT1} & \alpha_{TTT2} \\ \alpha_{CDS1} & \alpha_{CDS2} \end{bmatrix} = \begin{bmatrix} \underset{(2.338)}{0.591} & \underset{(3.194)}{0.309} \\ \underset{(0.873)}{0.095} & \underset{(4.667)}{0.194} \\ \underset{(-1,239)}{-0.096} & \underset{(4.383)}{0.130} \\ \underset{(3,263)}{0.344} & \underset{(7.890)}{0.318} \\ \underset{(5.769)}{0.497} & \underset{(8.046)}{0.265} \end{bmatrix}$$

$\chi 2(1)=3.25$ p-value = 0.07

Note: Values in parentheses correspond to standard deviations, in the case of the β parameters, and to t-ratios, in the case of the α parameters.

The first vector taken to pertain to the sector of the manufacturing industry, interpreted as a long-run relation, indicates that an increase in the AGRP, INM and CDS induce an increase in the INM. For example, the first co-integration vector, indicates, that a 10% rise in agricultural GDP would raise industry GDP by 2.85%.

The second vector may be taken to relate to the TTT sector. This long-run relation indicates that an increase in the manufacturing industry GDP and non-manufacturing industry GDP originate an increase in the transportation, tourism and telecommunication GDP.

3.3. Short-run relationships study

Once the ECM has been estimated, short-run dynamics can be examined by considering the impulse response functions (IRF). These functions show the response of each variable in the system to a shock in any of the other variables. The IRF should be calculated from the Moving Average Representation of the ECM (see Lütkepohl, 1993 and Pesaran and Shin, 1998):

$$X_t = \sum_{i=0}^{\infty} B_i \varepsilon_t \qquad (3)$$

where matrices B_i (i=2,…,n) are recursively calculated using the following expressions: $B_n = \Phi_1 B_{n-1} + \Phi_2 B_{n-2} + \cdots \Phi_k B_{n-k}$; $B_0=I_p$; $B_n=0$ for n<0; $\Phi_1 = I + \Pi + \Psi_1$; and $\Phi_i = \Psi_i - \Psi_{i-1}$ (i=2,…,k).

Following Pesaran and Shin (1998) the scaled Generalized Impulse Response Functions (GIRF) of variable X_i with respect to a standard error shock in the jth equation can be defined as:

$$GIRF\left(X_{i_t}, X_{j_t}, h\right) = \frac{e'_i B_h \Sigma e_j}{\sqrt{\sigma_{jj}}}; \quad h = 0, \cdots, n \qquad (4)$$

where e_m (m=i, j) is the m^{th} column of the identity matrix (I_p).

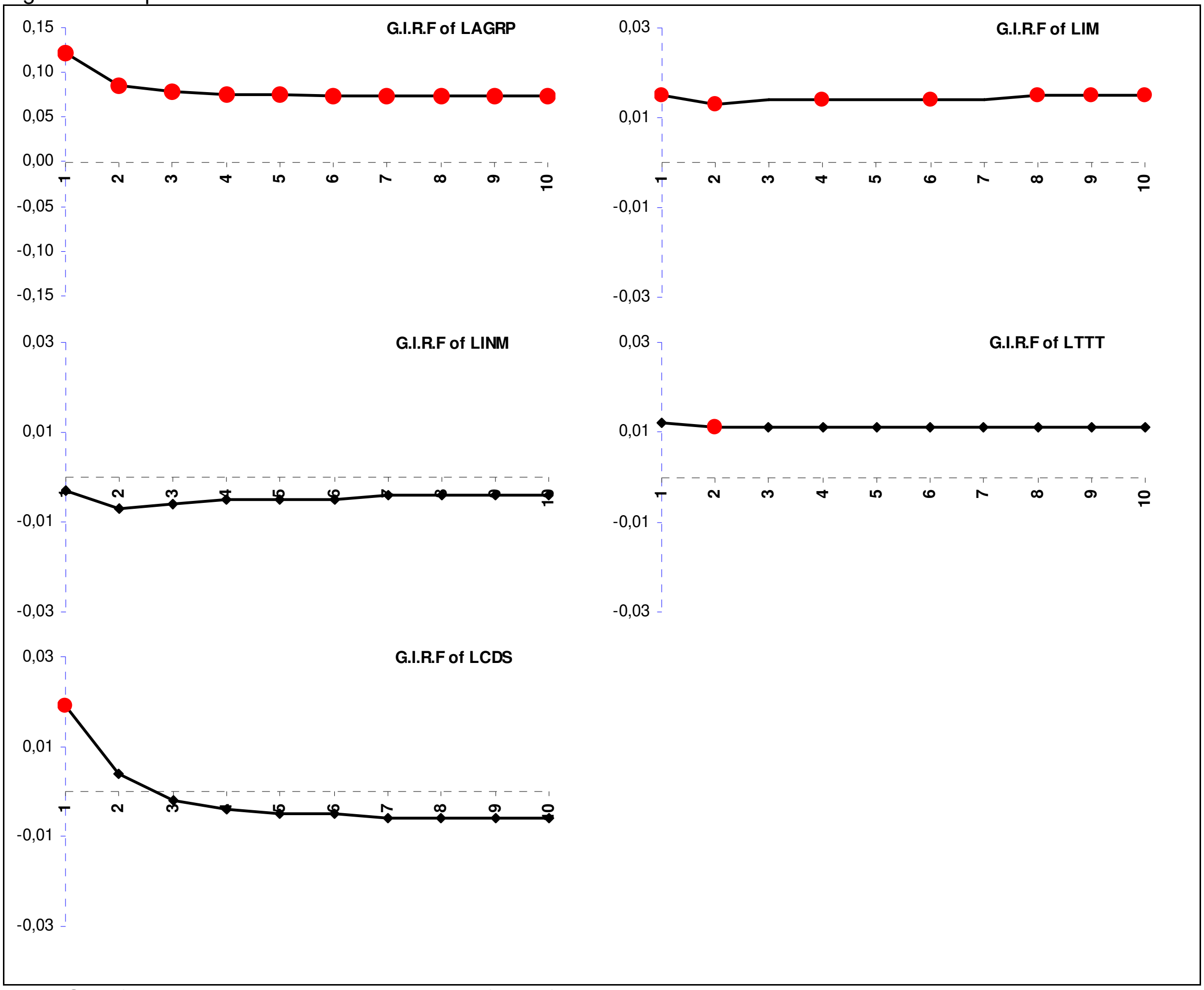
The GIRF are unique and do not require the prior orthogonalization of the shocks (reordering of the variables in the system). On the other hand, the GIRF and the orthogonalized IRF (Cholesky) coincide if the covariance matrix, Σ, is diagonal and j=1.

In order to investigate the role of agricultural sector and his interactions with other non-agricultural sectors in the short-run, the GIRF are calculated using the ECM estimated in the previous section (with restrictions imposed on the β and α matrices)[5].

Figure 1 shows the magnitude and time path of the impulse response functions of the five GDP sectors to a one standard deviation shock on the agricultural sector. Significant responses are marked with a circle.

[5] For all GIRF, the standard deviations are computed following the method developed by Pesaran and Shin (1998).

Figure 1: Responses to a shock in the LAGRP



Note: Significant responses at the 10% level of significance are marked with a circle.

The main results from short-run dynamics can be summarized in the following points:

Most of the GIRF were non-significant although showed the expected signs. We have to take into account that we are using annual data and then we do not expects responses longer that one or two years in general.

In the short-run, shock in AGRP does not generate any significant effects on INM sector. The construction, electricity, gas and water supply sub-sectors tended to depend on budgetary allocations rather than directly on impulses emanating from the growth of agricultural sector. A closer examination of the negative sign of the responses may indicate that there exists a reallocation of resources that is not favorable to the non-manufacturing industry sector (for example, the transfer of labour force toward agriculture and the other economic sectors). This relation (between growth agricultural sector and the downfall of the non-manufacturing industry) may indicate that the development of the non-manufacturing sector in Tunisia has been achieved at the expense of the agricultural sector.

The effect of one positive shock in the output of agricultural sector on TTT sector is transitory and the reaction is one period later (the response is only significant for the second year). It is difficult to understand this result without further reflection. In the short-run, this result may reflect the development of the sub-sector of transportation driven by the extension of agricultural activities.

The CDS sector is affected positively only during the first year by one shock in agricultural output. This is probably reflective of widespread administrative controls over activities comprising the service sub-sectors (such as financial and insurance services) for the bulk of the sample period.

A positive shock in the agricultural sector generates a significant and large effect on agricultural output and a persistent reaction in IM sector. It seems that the development of Tunisian manufacturing industry is driven especially by the growth in agro-food industry.

4. Concluding remarks

The aim of this study is to understand the agricultural contribution to the economic growth and the linkages between/among agriculture and other economic sectors in Tunisia.

Empirical finding from the analysis of the long-run relations confirm that the different sectors of the Tunisian economy moved together over the sample period and, for this reason, their growth was interdependent. This implies the presence of a stable equilibrium relationship to which these sectors have a tendency to return in the long-run and any deviation from the long-run path is corrected. As Kanwar (2000) says, this means that is not to imply that some of the sectors did not outpace the others, but only that the economic forces at work functioned in such a way as to tie together these sectors in long-run structural equilibrium and while short-run shocks may have led deviations from this long-run path, forces existed whereby the system reverted back to it. The presence of two co-integrating relations provides evidence that there are two processes that separate the long-run from the short-run responses of the Tunisian economy. Accordingly, this is important since every scenario of macroeconomic policy should be done inside a package of measures taking into account the possible long-run interdependences and linkages between / among agriculture and the other non-agricultural sectors. In this regard, Tunisian economic policy makers should pay more attention to the problem of transfer of resources from agriculture. In order to make agriculture beneficiating from the growth in the other sectors of economy, they should also achieve additional investments in agriculture, especially in infrastructure, transport, market access and research.

The short-run dynamics indicate that agricultural sector seems to have a limited role as a driving force for the growth of the other non-agricultural sectors of the Tunisian economy and growth of the agricultural output may be conducive only to agro-food industry sub-sector in the short-run. This may be the results of the relative decrease of the role that the agriculture sector plays as provider of inputs for the Tunisian industry and the traditional Tunisian export strategy with low-value-added products in agro food export. Accordingly, the role of policy-makers should be to stimulate and promote the private sector control of international marketing of Tunisian agricultural products.

To conclude, it has to be said that results presented in this empirical work depend on the definition on variables and the sample period chosen. Further analysis, including other sub-sectors and an extended sample period, could be conducted in the future.

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