

Agricultural policy and poverty in Tunisian rural areas: an empirical analysis using agricultural prices and investment

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Jel Classification: Q12, Q18

1. Introduction

The sharp rises in the price of agricultural commodities, combined with a rise in the cost of energy, are contributing to a deep crisis across the Tunisian farming sector. Indeed, the aforementioned crisis has highlighted a decline in the purchasing power of the average farmer and a corresponding increase in poverty within the rural areas and for small farmers, in general. The feelings associated with this situation were revealed by the results of the last household consumption and budget survey presented by the National Statistics Institute (NSI) in April, 2005 and published in January, 2007, which recommended a strong intervention on the part of public authorities to support the farming sector by keeping the price of agricultural products at a level that would support profitable production. According to available statistical data, the degradation seems to be the result of a decline in the exchange terms of agricultural products, whereas improvement in productivity did not catch up, and on the other hand, the decline of public investment in the agricultural sector was not compensated by investment from the private sector.

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Abstract

The aim of the study is to analyse the impact of a reduction in investment in the agricultural sector and the exchange terms degradation on the farmer's situation from the standpoint of income and standard of living. In order to examine the relationship between the degradation of exchange terms, a decline in public investment and the slow increase in farmer's income, a time series data sample design was adopted on the basis of an on-going household consumption and budget survey series initiated in 1975. The variables used in both the descriptive and analytical analyses are: the price of primary inputs and agricultural products, the public investment in the agricultural sector and the evolution of farmer income. Results from descriptive analysis highlight a degradation of the farmer's purchasing power and an unfavourable distribution of growth to employees in this sector. Econometric analysis shows a structural change in the data between the structural adjustment period (mid-1980s until mid-1990s) and the post-adjustment period, with an acceleration of the degradation of exchange terms during the second period. Finally, a global analysis of the evolution of farmer's income, according to the output/input price ratios, showed a decrease in farmer's income, in particular the producers of traditional products.

Keywords: Agricultural farms, agricultural prices, income, agricultural investment, econometric model, Tunisia.

Résumé

L'objectif de cette étude est d'analyser l'impact de la réduction des investissements publics dans le secteur agricole et la dégradation des termes de l'échange des produits agricoles sur le revenu et le niveau de vie des exploitants. Afin de vérifier cette relation entre la dégradation des termes de l'échange et la baisse des investissements publics, d'une part, et la faible évolution du revenu des agriculteurs, d'autre part, on a adopté un dispositif de série chronologique, basé sur les données des enquêtes concernant la consommation et le budget des ménages, entreprises à partir de 1975. Le prix des intrants et des produits agricoles primaires, les investissements publics dans le secteur agricole et enfin, l'évolution du revenu des exploitants sont les variables retenues dans l'analyse descriptive et dans l'analyse économétrique. L'analyse descriptive met en évidence une dégradation du pouvoir d'achat des produits agricoles pour les exploitants et une distribution de la croissance défavorable pour les travailleurs de ce secteur. L'analyse économétrique montre un changement de la structure des données entre la période de l'ajustement structurel (du milieu des années 1980 jusqu'au milieu des années 1990) et la période post-ajustement, avec une accélération de la dégradation des termes de l'échange durant la seconde période. Enfin, une analyse globale de l'évolution du revenu des agriculteurs en fonction du rapport de prix entre les produits et les intrants indique une réduction du revenu des agriculteurs et notamment, de ceux qui pratiquent des cultures traditionnelles.

Mots-clés: Exploitations agricoles, prix agricoles, revenu, investissement agricole, modèle économétrique, Tunisie.

As a result, the objective of this paper is to assess the impact of investment in the agricultural sector on farmer's income, with special attention paid to the change in exchange terms for agricultural products, in terms of degradation of farmer income. To the author's knowledge, this is the first attempt to estimate the impact of investment in the agricultural sector on farmer income in the rural area of Tunisia.

The paper is structured as follows: in section 2, the profile and determinants of poverty in Tunisia are outlined. This is followed by the basic background of rural poverty and agricultural policies in section 3. In section 4, the methodological framework, data and estimation procedure are described. Main empirical results are presented and discussed in section 5, with some concluding remarks, emphasizing the implications of public policy, in section 6.

2. Poverty analysis in Tunisia: profile and determinants

Since the end of the 1980's, the Tunisian economy maintained a pattern of economic growth. This growth was characterised by a decline in the poverty rate and an overall improvement in the welfare of the general population. The poverty rate for the whole population had decreased from 6.7% in 1990 to 3.8% in 2005. However, the distribution of

Years	1980	1985	1990	1995	2000	2005
Total Population (,000)	6369	7154.7	8144	9001.5	9598.3	10029
Poor Population (,000)	823	554	544	559	399	376.5
Poverty rate (%)	12.9	7.7	6.7	6.2	4.2	3.8

Source: Own elaboration from NSI data (Several years).

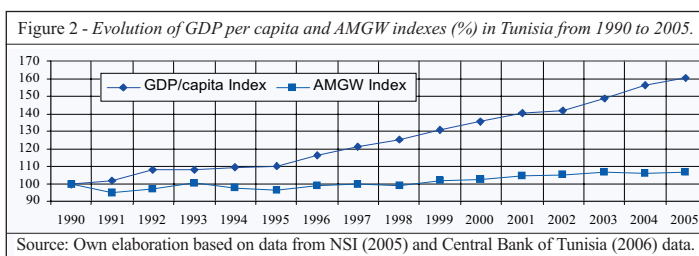
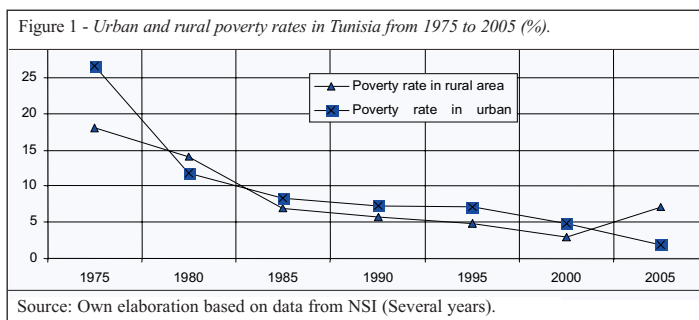
growth has not benefited equitably between the different so-

Social and occupational groups	1990	2000	2005
Executives and employers	2.3	1.4	0.4
Small professions	6.4	3.5	2.3
Non-agricultural workers	9.7	6.3	5.4
Farmers	2.5	3.0	5.5
Agricultural workers	12.7	8.2	10.6
On unemployment	19.2	17.7	17.4
Pensioners and inactives	6.4	2.4	2.5
Resident supports away from households	4.7	5.2	n/a
Total	6.7	4.2	3.8

Source: Own elaboration from NSI data (Several years).

cial and occupational groups. This was especially the case for both dominant populations in the rural categories (farmers and agricultural workers) where their standard of living had degraded. As a result, an increase in the poverty rate was observed for both categories. The Agricultural Minimum Guaranteed Wage (AMGW) for agricultural worker was found to be slightly different from the mean standard of living in Tunisia.

Statistics from the household consumption and budget survey (elaborated by National Statistics Institute - NSI) in 2005 confirmed the continuity of a decline in the poverty rate. However, despite the significant decline of recent years, the overall fact is that the decline still exists and it is greater in some regions of Tunisia. Indeed, wide disparities exist between the coastal areas and both the South and West regions of the country, where poverty is generally higher, compared to the national rate (Béchir, 2011).



Within Tunisia, rural areas experienced a reduction in poverty rates between 1990 and 2000, but an upswing in rural poverty was noted between 2000 and 2005, dropping back to mid-1980 levels, and despite the overall decline of poverty throughout the country during the same period (Table 1). In addition, the pattern was quite different for some of the regions dominated by agricultural activities and for some of the social and occupational groups, in particular farmers and agricultural workers (Table 2).

Regarding farmers, the rate of poverty increased between 1990 and 2005 (2.5% in 1990 to 5.5% in 2005). The same trend was observed for agricultural workers, during the 2000 to 2005 period, but did not reach the levels of 1990. Farmers and agricultural workers made up 23 % of the total population of poor, in 2005, the largest category of employees, and the group that represented the most important contingent of the poor population.

Figure 1 visualizes the evolution of the poverty rate in the rural and urban areas of Tunisia. From the end of the 1980's, the poverty rate in rural areas was higher than in urban areas. According to regional desegregation, it appeared that most of the rural regions, in particular the West Central Governorates represented the highest poverty rate (12.8% versus 3.8 % at the national level) and the highest level of rural population (67.9 % versus 35.1 % for the whole territory), according to the NSI statistics (2005).

Analysis of the agricultural minimum guaranteed wage evolution and the long-run purchase parity loss showed a constant appreciation, as characterised by this indicator. However, the increase in wage was hardly sufficient to cover the increase in the cost of living, which, when expressed in terms of GDP, resulted in a loss in purchasing power by agricultural employees (Zafrane and UNDP, 2004).

Nevertheless, an important share of the farm community is composed of small-sized family farms which have additional off-farm activities in order to generate additional incomes. This situation helps to confirm the loss of purchasing power among this category of farmers, in particular and among rural households, in general.

3. Rural poverty and agricultural policies

The liberal policy adopted by the structural adjustment program in the mid-1980s was intended to insert Tunisia into the globalization process following various free trade agreements (WTO, EU, etc.). This policy led to the removal of agricultural support (subsidy reduction and public investment, reduction of transfers to the rural, etc.), stagnation in output prices, and increases in input prices. Consequently, this situation reduced the use of certain inputs, caused stagnation and/or decline in the yields of certain crops and in animal production. Ultimately, natural resources declined under relentless pressure, and led to their rapid degradation. The degradation of rural households, particularly farmers and farm workers, seem to be the result of the degradation of exchange terms for agricultural products, and on the other hand a decrease in investment in the agricultural sector. These patterns partially explained the decline of the productivity.

Analysis of the Tunisian agricultural policy has suggested that since the middle of the 1980s, the Tunisian economy has re-oriented to a structural adjustment program policy, with a special emphasis program for the agricultural sector called the Agricultural Sector Adjustment Program (PASA). The main policy of PASA is to provide recommendations based on the International Monetary Fund and World Bank, and act as an advocate for the disengagement of the State from support of the agricultural sector, in particular investments, and encouraging more involvement of private sector in investment and trade regulation.

The structural adjustment policy towards liberalization and the integration policy entry into the global economy were accompanied by input and output price liberalisation. This implementation policy generally affected a decline in the price trend of input and traditional agricultural products, implying a loss in purchasing power and degradation in the exchange terms of agricultural products. This degradation was further accelerated following the energy crisis and an increase in the price of oil products.

Statistics from NSI (2005) show that agriculture in Tunisia plays an important social and economic part in the national economy. It contributes 10 to 12% of the GDP. In addition, it is an important source of foreign exchange earnings, accounting for 10 to 13% of total exports and is considered an important source of employment (16% of the working population).

Nevertheless, investment in this sector has declined since the end of the 1980's, in spite of an improvement during the end of late 1990's. In terms of volume, investments have declined, in constant dinars, since the beginning of the early 2000's (MARH, 2007). This decline in investments partially explains the low improvement in yield and in the productivity of major inputs.

The total factor productivity (TFP) of the agricultural sector declined over the period of 1991 to 2000, compared to the period of 1981 to 1990. According to Dhehibi and Lachaal (2006), TFP decreased from over 4% in the 1960's and 1980's to less than 3% in the 1970's and the 1990's. Overall, TFP was characterized by stagnation and a regression in productivity for some of the Tunisian agricultural sectors.

In the ovine breeding sector, for example, it appears that while the livestock sector continues to increase, the average production of meat per female has declined since the beginning of the 2000's (Elloumi *et al.*, 2008). The pattern for cereal production also indicated that yields were at levels lower than their genetic potential under Tunisian environmental conditions and falls

even further in drought years (Latiri, 2005). The same case was presented for the olive sector, particularly in the north of the country, where growing conditions were found to be the most favourable (Saï and Msallem, 2005).

Given these patterns in production and poverty, the next step of the work was to analyse the relationship between the reduction of investments in the agricultural sector and the exchange terms degradation on the one hand and the relationship with the farm situation, in terms of income and standard of living welfare, on the other. The analysis was based on an econometric approach with a series of data taken from the database of the Tunisian Ministry of Agriculture and Hydraulic Resources.

4. Empirical framework

Data sources and preliminary analysis

The data used in this study comes from a number of sources. Farmer's incomes have been obtained from the statistics series of the *Enquête Nationale sur le Budget et la Consommation des Ménages* (Households Budget Survey) published by the Tunisian National Statistics Institute (or NSI) and available since 1975. The Annual Agricultural Minimum Guaranteed Wage (AMGW) series was also obtained from the Tunisian National Statistics Institute.

The annual price series for different farm inputs (i.e. irrigation water, Superphosphate 45, ammonium nitrate 33, hard red winter wheat seed, and mechanization) as well as those of the final outputs (agricultural food products such as hard red winter wheat, soft wheat, barley, milk, ovine meat, and olives) were found in the *Annuaire Statistique Agricole* (Yearly Statistical Bulletin) published by the Ministry of Agriculture and Hydraulic Resources (MAHR). The sample period covered yearly data from 1983 to 2007.

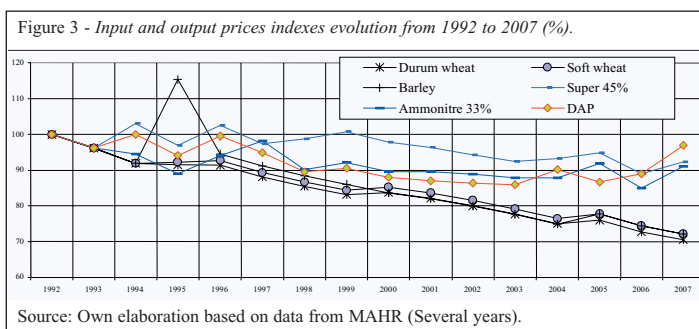
Model specification

Once the relationship between the terms of exchange degradation, the decline in public investment, and the substantial evolution of farmer's income was specified, an empirical analysis was conducted based on a Double-Logarithmic model. This model was based on the hypothesis that the dependant variable (farmer's income) has a causality relationship with the public investments in the agricultural sector and with exchange terms.

This model presents an advantage in that the estimated coefficients can be interpreted directly as elasticities. In addition, it contains a weak residual variance with respect to other functional forms for the same data set (Jud and Joseph, 1974) and adjusts the data better than the linear specification for both forecasted parameters signs and statistical significance. This analytical model has the following expression:

$$LFI_t = \alpha_0 + \alpha_1 LDW_t + \alpha_2 LSW_t + \alpha_3 LMI_t + \alpha_4 LOM_t + \alpha_5 LOO_t + \alpha_6 LAMGW_t + \alpha_7 LAINV_t + U_t \quad (1)$$

where: LFI_t : logarithm of average farmers income during the period t ($T=1983-2007$); LDW_t : logarithm of durum wheat production price divided by average input price; LSW_t : logarithm of soft wheat production price divided by



average input price; LMI_t : logarithm of milk production price divided by water price; LOM_t : logarithm of ovine meat production price divided by barely production price; LOO_t : logarithm of olives production price divided by agricultural minimum guaranteed wage; $LAMGW_t$: logarithm of agricultural minimum guaranteed wage; $LAINV_t$: logarithm of investment in agriculture sector and U_t : error term.

Estimation procedure

The equation (1) is estimated using the Ordinary Linear Squared (OLS) procedure for the three periods of analysis (before the adjustment: 1983-1993, the period post adjustment: 1996-2007, and the whole period: 1983-2007). Several modifications and combinations of variables were used in order to get the appropriate specification. The specified equation (1) can be extended to account for potential structural breaks that occur as a consequence of the Agricultural Structural Adjustment Program (from 1986 until the mid 1990's). Thus, a new variable has been defined in the equation to detect the possibility that this structural change would affect the explanatory variables. Finally, this variable was introduced in the equation (1) in the following way:

$$LFI_t = \alpha_0 + \beta_0 h_t + \alpha_1 LDW_t + \alpha_2 LSW_t + \alpha_3 LMI_t + \alpha_4 LOM_t + \alpha_5 LOO_t + \alpha_6 LAMGW_t + \alpha_7 LAINV_t + U_t \quad (2)$$

Where β_0 , is the parameter which measures the potential impact of the structural change on different variables within the equation; and U_t is the error term.

The selection of the functional form of h_t was important for a correct specification of the model (Moschini and Moro, 1996). Among the different alternatives, for this paper the approach proposed by Ohtani and Katayama (1986) and applied by Moschini and Meilke (1989) was used. Thus, it was assumed that h_t adopts the following form:

$$h_t = \begin{cases} 0 & \text{for } t=1, \dots, \Gamma_1; \\ (t - \Gamma_1) / (\Gamma_2 - \Gamma_1) & \text{for } t = \Gamma_1 + 1, \dots, \Gamma_2 - 1; \\ 1 & \text{for } t = \Gamma_2, \dots, T \end{cases}$$

where, Γ_1 and Γ_2 represent the end point of the first period and the starting point of the second period, respectively. It should be mentioned that the traditional dichotomous dummy variable is a special case in the formula when $\Gamma_2 = \Gamma_1 + 1$. The values of Γ_1 and Γ_2 in Equation (2) have been determined using the method proposed in 1960 by Quandt (1960). Since then it has been widely reported in the literature (Xu and Veeman, 1995; Rickertson, 1995).

Empirical results suggest that a structural change took place between 1994 and 1995. Thus, these dates were chosen as the values for the two parameters, Γ_1 and Γ_2 . Once the equation was specified, an attempt was made to determine which parameters in the equation (2) were affected by the structural change. The null hypothesis which stated that structural change was not affected by the parameters of equation (2)

could not be rejected at the 5% level of significance as the LR – Likelihood Ratio statistic was 3.12, which was under the critical value of $\chi^2_1 = 3.84$. Therefore, the final estimated model was expressed as follows:

$$LFI_t = \alpha_0 + \beta_0 h_t + \alpha_1 LDW_t + \alpha_2 LSW_t + \alpha_3 LMI_t + \alpha_4 LOM_t + \alpha_5 LOO_t + \alpha_6 LAMGW_t + \alpha_7 LAINV_t + U_t \quad (3)$$

5. Results and discussion

The empirical findings of the farmer's income determinants in Tunisian agriculture are reported in table 3. Given the data limitations in the series, empirical analysis covered the entire reporting period and not the period before (1983-1993) and after the structural change (1996-2007). Statistical results were carried out on the basis of technical and economic rationality. In general terms, results are in agreement with what is known of the period. The adjusted coefficient of determination (R^2) was high (0.98). The F-statistic was significant for the whole period (1983 - 2007) which indicated the global significance of the model. Both indicators confirm the choice of explanatory variables used in the empirical analysis.

Results presented in Table 3 confirmed the impact of degradation of exchange terms and the decline of investment in the agricultural sector on the degradation of farmer's income and welfare deterioration. Moreover, it appeared that traditional speculations (i.e. hard wheat and olive oil sectors) have the most important impact (positive and significant coefficients) on this decline. Furthermore, the variation in the agricultural minimum guaranteed wage (AMGW) was positively correlated with farmer's income. This variable had a direct impact on the income of farm household's which was dominant in the Tunisian agriculture sector by the multiple jobs of the family head and/or the employment of family members.

The analysis of the coefficient relative to soft wheat, which was negative and significant, shows that this activity, which is generally practised by government structures and large farmers, had the effect of depressing farmer's income, instead of improving the price output/input ratio. Thus, the empirical results confirm the positive impact of the investment variation on the farmer's income and welfare in rural areas through, most likely, the improvement of land and productivity factors.

Finally, on the basis of the empirical results, and taking into account the important contribution of the agricultural sector in the Tunisian economy, and the high proportion of the population living in rural areas, it is recommended that agricultural policy makers should keep prices (output/input ratios) at a reasonable level, especially for food crops and traditionally practiced by farmers. Moreover, these results should stimulate agricultural policy decision makers and stakeholders into giving more attention to the investment volume in the agricultural sector, knowing that the improvement of capital available to the agricultural sector is an important determinant factor in the improvement of productivity, and consequently, the profitability of agricultural activity.

Table 3 - Farmers income determinants in the Tunisian agricultural sector, 1983-2007.

Variables	Estimated coefficients (t-ratios)
<i>Dependent variable : LFI_t</i>	
Intercept	0.18 (0.19)
h_t	-0.036 (-0.079)
LDW_t	1.12 (1.49)
LSW_t	-1.14 (-1.99)**
LMI_t	0.069 (0.43)
LOM_t	0.12 (0.85)
LOO_t	0.087 (1.44)*
$LAMGW_t$	0.67 (3.14)***
$LAINV_t$	0.34 (2.74)**
Adjusted R ²	0.98
Log of Likelihood Function	38.62
Durbin - Watson Statistics	2.14
F- statistics	163.916
T (no. observations)	30
k (no. parameters)	8

Source: Own elaboration from NSI and MAHR data (Several years).
Note: The level of statistical significance is denoted as: *10%, ** 5% and ***1%.

6. Concluding remarks and policy implications

The empirical analysis confirmed the preliminary findings on the degradation of income in rural households, in general, and of farmers, in particular. Results confirmed the correlation between degradation of exchange terms and a decline in investment, especially public investments and their impact on the income and welfare of farmers and agricultural workers. These results should be considered in the decision making process of agricultural policies in order to limit the degradation of income in rural households, especially for small farmers, and prevent the risk of mass exodus to urban regions, given that these urban areas could not support the employment demand of these migrants.

However, on the basis of results in the relationships with soft wheat production, it seems important to disaggregate the analysis by farm size and economic logic (i.e. large farms with the firm logic conception, family farms, cooperative farms, etc.) in order to focus on the impact of agricultural policies on income levels, paying special attention to the dominant farming system and to stimulate the response capacities of farmers to economic incentives and market conditions.

Indeed, the conditions which generated a general degradation in the welfare and production of rural areas was not felt with the same intensity by all farmers, but according to farm size and productive orientation, and thus should be expressed by a new agrarian dualism in rural areas (Elloumi, 2007).

The impoverishment of the farming and rural population was the main driving force for the revolution of January 2011, an event which highlighted the limitations of the agriculture and rural development model, which has emerged since the mid-1990s. This fact has raised awareness of the need for a new design and implementation of a development model that balances the relationship between agriculture and other sectors of the economy, but at the same time helps to diversify the economy in the interior regions, where agriculture continues to be, to a considerable extent, the predominant sector of activity.

Finally, empirical analysis confirms the results published

by different Institutions, such as the International Food Policy Institute and the World Bank, on the important contribution of investments to the agricultural sector as a means for eradicating and reducing poverty. Nevertheless, the Middle Eastern and North African (MENA) countries should strengthen their investments in the agricultural sector, and in rural development, in order to reduce poverty and to reach the millennium development goals.

References

Bécher, R., 2011, *Pauvreté et politiques d'amélioration du niveau de vie, une étude sur le cas tunisien*. New Médit, Vol 10, n. 3, 4-10.

Dhehibi B., Lachaal L., 2006, *Empirical evidence of productivity growth in Tunisian agriculture: 1961-2000*. Revue Africaine de Développement, 18 (10), 248-257.

Elloumi M., Selmi S., Zaïbet L., 2008, *Importance économique et mutation des systèmes de production ovine en Tunisie*. Communication au Colloque international OEP-CIHEAM-IRESA: "Mutations des systèmes de production des ovins et perspectives de leur durabilité" Hammamet, 22-23 octobre 2008.

Elloumi M., 2007, *Agriculture et monde rural dans le contexte de la mondialisation*. In Revue tunisienne de sciences sociales du CERES, 44^{ème} année, n° 134, Tunis.

Institut National de la Statistique - NSI. 2007, *Enquête nationale sur le budget, la consommation et le niveau de vie des ménages* (Several years).

Jud D., Hyman J., 1974, *International demand for Latin American tourism*. Growth and Change, 5 (1), 25-31.

Latiri K., 2005, *Les céréales en Tunisie*, in Felisa Ceña, Mohamed Elloumi, Rosa Gallardo et Mohamed El Bécher Sai (s/d), *Les défis de la terre: l'agriculture en Espagne et en Tunisie face aux défis de la libéralisation*, ouvrage collectif, Tunis, Cérès Editions et IRESA, pp. 259-280.

Ministère de l'Agriculture et des Ressources Hydrauliques., 2009. *Budget économique*.

Ministère de l'Agriculture et des Ressources Hydrauliques., 2006. *Enquête sur les structures des exploitations agricoles, 2004/2005*.

Moschini G., Meilke K.D., 1989, *Modelling the pattern of structural change in U.S. meat demand*. American Journal of Agricultural Economics, 2, 253-261.

Moschini G., Moro D., 1996, *Structural change and demand analysis: a cursory review*. European Review of Agricultural Economics, 23, 239-261.

Ohtani K., Katayama S., 1986, *A gradual switching regression model with auto-correlated errors*. Economics Letters, 21, 169-172.

Quandt R.E., 1960, *Test of hypothesis that a linear regression system obeys two separate regimes*. Journal of American statistic Association, 55, 305-335.

Rickertsen K., 1995, *Structural change and the demand for meat and fish in Norway*. European Review of Agricultural Economics, 23, 316-330.

Saï B., Msallem M., 2005, *Le secteur oléicole en Tunisie : de la protection à la libéralisation*, in Felisa Ceña, Mohamed Elloumi, Rosa Gallardo et Mohamed El Bécher Sai (s/d), *Les défis de la terre: l'agriculture en Espagne et en Tunisie face aux défis de la libéralisation*, ouvrage collectif, Tunis, Cérès Editions et IRESA, pp. 203-222.

Zaafrane H., 2004, *Stratégie de réduction de la pauvreté : Etude du phénomène de la pauvreté en Tunisie*. PNUD, Bureau du Co-ordonnateur Résident en Tunisie.