

Impact of Domestic Resource Costs on the Competitiveness of Tunisian Fresh Fruit and Vegetable Products Exports

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Abstract - This paper analyses the cost structure of the main Tunisian agricultural export products using the Domestic Resource Cost (DRC) as an indicator. The DRC compares the opportunity cost of the primary factors used in the production of certain goods with its aggregated value at an international price. The DRC can be also interpreted as an indicator of comparative advantage. In this paper we present some results and draw conclusions from using the DRC calculation in Tunisian olive oil, oranges, and tomato sectors. Results show that Tunisia presents a comparative advantage in the olive oil sector ($DRC < 1$). This competitiveness is variable between years and remains highly correlated to the very fluctuating yield of this culture. Tunisian citrus and tomato sectors are not competitive in the international market ($DRC > 1$). However, the tomato sector records, despite its “weak competitive performances”, continuous improvements, in its DRC score, which are especially due to the increase in the output by hectare in addition to some other technical factors. For

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citrus sector, geographical distribution of production plays an important role in determining its export competitiveness. Availability of natural resources in the mentioned region (especially land) constitutes a constraint for the increase of exportable oranges volumes and consequently, affects negatively the international competitiveness of this product.

Key Words: Domestic Resource Cost, Vegetables, Fruits, Competitiveness, Tunisia.

JEL- Classification: Q13, Q10, Q17.

1. Introduction

During the last decades, globalization has a prevailing tendency in almost world's economies. The world economy has become more independent, and commercial links between countries become more and more important and intensified. Consequently, economic growth and commercial models were two linked variables which have to be simultaneously overpowered. In this context, exchange models becomes, since the 70's, more regulated and controlled through a set of international laws and agreements which are mainly administrated by the World Trade Organization (WTO). Actually more than 90% of countries around the world are engaged in the liberalization process and are members of the WTO. Such engagements can be considered as an exogenous factor needing radical changes in the domestic and foreign policies for a given country. The reduction and elimination of imports barrier and the decrease in support for domestic productions and exports are among necessary reforms. Those reforms haven't only caused an opening of economies but also changes in factors endowments because of the technological improvement diffusion (Klasra and Fidan, 2004). According to the same authors, within this changed environment of globalization, if trading patterns of any country experiences such changes, then pattern of specialization (comparative advantage), trade structure and competitiveness of trade is also expected to change.

Agriculture is among sectors which are the most affected by this new globalization framework. In fact, agricultural negotiations about trade' barriers, bilateral and multilateral conventions within WTO are among the most hard and confuse ones. Still there is a considerable debate about the success of Doha development agenda between the developed and developing countries. But in the economic literature it is already proved that competitiveness bring the better allocation of scarce resources. There is a long debate about the precise measurement of the international competitiveness in the economic and business literature. Among others, DRC (Bruno, 1965 and 1972), revealed comparative advantage (Balassa, 1965), market share (Krugman and Hatsopoulos, 1987), relative unit labour costs (Turner and Golub, 1997) are the major indicators of international competitiveness in the micro concepts. The Domestic Resource Cost (DRC) ratio are using in this analysis as its permit the analyst to draw conclusions about competitiveness without using data from other than one country, thus the unilateral view of the concepts.

The objective of this paper is to assess the international trading performance of some strategic Tunisian agricultural products (olive oil, citrus and tomato). In fact, we'll try in a first step to

present some general descriptive indexes of production and exchange for the selected products. In a second step, the competitiveness of those products will be assessed quantitatively by using a domestic resource cost indicator of comparative advantage or disadvantage. In this second step, we bring out also some explicative factors of the observed performances.

The paper is divided into four further sections. The first one is a theoretical section where definitions and the calculation method of the DRC are provided. In the second section, we provide a description of the Tunisian fruit and vegetable sectors. Production performances and some general descriptive indicators are presented. The third section presents the empirical application of the DRC estimation in the case of Tunisia for selected strategic products. Results and discussions are presented in the final section.

2. Definitions and Theoretical Approach

Domestic Resource Cost (DRC) is a measure, in terms of real resources, of the opportunity cost of producing or saving products to foreign exchange. It provides a comparison between the domestic costs to produce a given good with its value added at international price. It is thus an ex ante measure of comparative advantage, used to evaluate exchange projects and policies. The term was introduced to the economics literature by Bruno (1963, 1972). It was used frequently since this date by many economists and international institutions such the World Bank, which use it mainly to evaluate development policies in less developed countries.

The DRC sought to take account of market-factors distortions in contexts where factors opportunity cost could be measured in domestic currency, and the opportunity cost of tradable products and inputs can be measured in a foreign currency. By separating the two types of factors, this ratio allows ranking of activities without knowing the shadow value of foreign exchange. A shadow exchange rate is still necessary to determine the cut-off between efficient and inefficient activities¹ (Pearson and Meyer, 1974).

The DRC provides also comparison of the relative economic efficiency in production across sectors. In fact, the comparison of DRC calculations values across sectors provides estimation on which sector can use more efficiently domestic resources than others. According to this,

¹ Or those that are protected and those unprotected.

policy makers can take efficient decisions on domestic factor allocation between sectors. Moreover, examined in conjunction with the goals and incentives supplied by economic policy, the DRC can also be used as an indicator of the impact of restrictions to external trade (Ruiz, 2003). It provides, according to the same author, an approximation of the effects of trade policy on the efficiency of the allocation of production resources and hence of the influence of trade policy on the productive structure in a given country.

The analytical form of the DRC² ratio can be represented by the value of non tradable inputs (primary production factors) evaluated at their opportunity cost divided by the value added of this product evaluated at border/frontier prices.

$$\text{DRC} = \frac{\text{Opportunity costs of domestic resources}}{\text{Value added in border price}}$$

For a given production process of a commodity i the DRC can be mathematically defined by the following equation (1) : (Gorton and Davidova, 2001).

$$DRC_i = \frac{\sum_{j=k+1}^n a_{ij} V_j}{P_i^r - \sum_{j=1}^k a_{ij} P_j^r}$$

$a_{ij}, j = k + 1$ to n , are the technical coefficients for domestic and non-tradable inputs.

V_j are the shadow prices of domestic resources and on-tradable inputs.

P_i^r are the border/reference prices of traded output.

$a_{ij}, j = 1$ to k are the technical coefficients for traded inputs and are the border/reference prices of traded inputs.

P_j^r : are the border/reference prices of traded inputs.

For a commodity (i), and according to the equation (1), a DRC lower than the unit indicates that the country has a comparative advantage in the production activity of this product. However, a DRC higher than the unit means that the economic value of the national resources used by the mentioned activity is higher than the amount of currencies gotten by this activity. Resources engaged for this production can, in this case, being better valorised in other activities. An activity which the DRC is equal to the unit is known as even deal.

² For a given product and an adopted technology.

3. Tunisian' Fruits and Vegetables Sector's Description

3.1. Fruits and vegetables production

Production analysis of fruits and vegetables production structure in Tunisia shows that olives, citrus, and tomato production are among most strategic agricultural productions (MedAgri, 2004). In addition, they constitute the main commons Mediterranean countries agricultural production. This justifies our choice to analyze the competitiveness of those specific commodities for the Tunisian case.

In fact, fruits occupy a significant place in the Tunisian agricultural production. Traditionally, the most cultivated species are those which are best adapted to the agro-climatic characteristics of the different areas of the country (olive-tree, citrus fruits, date palm, etc).

Olive oil is a particular activity in Tunisia. Initially it is used to be a traditional activity and an important source of income especially for the olive oil that is highly remunerated on the international export markets. Moreover, the strategic extent of this sector is a consequence of its social dimension. Since, the production of olive oil occupies nearly 100 thousand farmers, that is to say 30% of the whole of the farmer population. Moreover, nearly a million people draw part of their income from the Tunisian olive oil sector. Whereas, the citrus farming represents, on average, 2.9% of the value of total agricultural production. The citrus plantations cover 25 thousands hectares in 2001. This area was only 19.4 thousand ha in 1990. Yields generally oscillates between 10 and 15 tons per ha (MedAgri, 2004).

The date's production amounted to 111,000 tons in 2003, including 69,000 tons of *deglet nour*, down 3.5% and 4.2% respectively, compared to the previous year, due to irregular weather conditions during the pollination period. But in spite of the excessively high temperatures experienced in August and early September 2003, impeding the development of fruits, especially in areas with new plantations, the harvested dates were of higher quality, thanks to the efforts aimed at clearing plantations and protecting the groves from adverse weather conditions.

Concerning vegetables in Tunisia, they constitute especially an activity of small-scale farming. The production of this sector exhibited a quite increase over the last decade. This growth results mainly from the extension in the irrigated perimeters, development of greenhouse techniques and the use of new varieties. Over the period 1995-2000, the annual average growth (in value) of the production of vegetables in Tunisia was evaluated at 5 %.

At constant prices, tomato contributes with 2.7% on average to the value of the total agricultural production. The cultivated areas of tomato represent around 22.1 thousand hectares in 2002 (Lachaal *et al.*, 2005). The production has clearly increased. It passes from 530 thousand tons in 1990 to 810 thousand tons in 2002. This increase translates the growth of the outputs which have passed from 25.2 to 36.65 tons per hectares during the same period. In 2003 the tomato production amounted to 992,000 tons, up 85,000 tons from 2002, as a consequence of favourable weather, an extension of cultivated lands (26,300 hectares, 18,600 in seasonal crops), and an increased use of drip irrigation technology. Production would have been even higher if temperatures had not risen so high in the summer, impacting negatively on both tomato quality and yields.

3.2. Tunisian fruits and vegetables trade

The olive-growing policy in Tunisia started since 1962 gives an absolute priority in the exportation of olive-oil and encourages the grain-oils productions and the subvention of their consumption prices. Exportation rates expressed by the ratio exported quantities by the total production, exceeded 80% during the period 1990-02. Tunisian exports are mainly destined to the European Union area in addition to the Arab countries (Table 1).

Table 1. Structure of Tunisian olive oil trade (Tons).

		1998	1999	2000	2001	2002
Olive oil						
Import	Quantities	872	1,309	8	26	30
	<i>Leading exporting countries</i>	TUR (818) ESP (18)	ITA (1309)	ESP (8)	ITA (16) NOR (10)	ALL (22) FRA (6)
Export	Quantities	124,104	163,868	113,861	94,525	22,502
	<i>Leading markets</i>	ITA (94,126) ESP (16,261)	ITA (77,534) ESP (67,271)	ITA (89,419) ESP (12,712)	ITA (77,428) ESP (5,851)	ITA (19,604) ESP (932)
Fresh oranges						
Import	Quantities	0	0	0	102	0
	<i>Leading exporting countries</i>	-	-	-	EGY (102)	-
Export	Quantities	22,543	19,797	22,213	24,809	22,666
	<i>Leading markets</i>	FRA (22,179)	FRA (19,437)	FRA (21,119)	FRA (23,247) CZE (519)	FRA (22,153) CZE (195)
Fresh tomato						
Import	Quantities	0	0	0	0	0
	<i>Leading exporting countries</i>	-	-	-	-	-
Export	Quantities	1,307	1,072	1,560	2,382	1,874
	<i>Leading markets</i>	FRA (1,182)	FRA (962) RUS (37)	FRA (1,502) CAN (14)	FRA (2,043) LYB (298)	FRA (1,829) CAN (14)

Source: ITC calculations.

EU is the largest market of Tunisian olive oil (80% of the sales). Among Arab countries, Libya is the principal potential market in the Maghreb region. Various customers are mainly USA, Norway, Russia, Canada, etc. The absence of national label, in addition to the absence of a strategic approach of export (packing, design, marketing) and the competition originated from some EU countries, prevent this product beneficiaries and negatively affects the competitive capacity (Lachaal *et al.*, 2005). More than 90 % of the citrus fruits productions (around 200,000 tons) were yearly exported towards the French market during the period 98-2002. Weak quantities are intended towards Eastern Europe (Bosnia, Romania, etc.) and the Gulf countries (Saudi Arabia, Qatar, Kuwait, etc.) (Table 1).

Tunisia is also considered as a fresh tomato exporting country. However and in spite of the improvements in production, the exported quantities remain very limited and are related to the existence of a surplus compared to the national needs. Indeed, the share of fresh tomatoes consumed or transformed on the domestic market were always higher than those exported. The purchasing prices on the domestic as well as on the external markets are variables according to years. This variability can be caused by the instability of the export' dies. In 2002 Tunisia has exported 1,874 tons of fresh tomato, 1,829 tons of them were designated to the French market and 14 tons to the Canadian one (Table 1). In 2003 tomato is characterized by a high domestic consumption at some 80,000 tons. The surplus available for export in the same year was around 26,000 tons, 5,500 of them were exported for 8.4 MTD, compared to 25,800 tons worth 37.6 MTD in 2002.

The exported quantity of processed tomato varies according to years and remains generally modest. Moreover, these exports are almost intended to the bordering countries, in particular the Libyan market. In 2002, national export of tomato pasture is over 25,801 tones, where 25,500 are designated to the Libyan market and only 242 tones were intended to the French one. During the shortage periods on the national market, exports can be blocked by administrative decision; in the extreme cases of shortage, the imports are used to satisfy the local needs. In fact, Fruits and vegetable represent nearly 1.26 % of total national export (1.19 % and 0.07 % respectively) and 40% of Tunisian food export (fresh and processed). Trend in vegetables exports in the period 1994 - 2003 (2.74%) was better than fruits (1.01%) (table2), but the share of the former in national export still very low and it is over 0.07%.

Vegetables per capita export was around 0.54 \$ in the period 1994 - 2003. This index is over

10 \$ for fruits exports. Regarding to the share in the world market (index P3, table 2), fruits have also higher performance than vegetable with values of 0.38 % and 0.04 % respectively. The share of Tunisian olive oil in the world market is around 2.86 %. The market diversification index (number of equivalent markets, index P5a, table 2) still low for both fruits and vegetables with values of 2.68 and 4.85 respectively.

Table 2. General trade performance of olive oil, tomato and citrus: some indexes.

	Vegetable HS07	Fruits HS08	Tomatoes HS 0702	Oranges HS 080510	Olive Oil HS 1509
Index	Value	Value	Value	Value	Value
G1	5,282,698	87,537,384	2,238,750	9,142,689	88,745,776
G2	2.74%	1.01%	7.65%	-0.71%	-10.81%
G3	0.07%	1.19%	0.03%	0.12%	1.21%
G6	na	na	1.70	1.23	0.80
G7	na	na	11.40%	0.14	1.53%
P1	-19,827,866	75,775,690	2,221,683	9,129,761	88,209,855
P2	0.54	8.90	0.23	0.93	9.03
P3	0.04%	0.38%	0.05%	0.38%	2.86%
P4a	3.17	1.31	na	na	na
P4b	0.141	0.053	na	na	na
P5a	2.68	4.85	1.05	1.05	1.88
P5b	0.137	0.061	0.343	0.308	0.133

Source: ITC calculations based on COMTRADE of UNSD, (2005).

G1: value of exports 2003(\$); G2: trend in exports (1994-2003); G3: Share in national export; G6: Relative unit value (world average=1); G7: The average annual change in relative unit value (94-98); P1 (\$ 000): Value of net exports per capita (2002); P2 (\$/inhabitant): exports (2002), P3: share in world market (2002); P4a (No of equivalent products): product diversification (2002); P5a (No of equivalent markets): and market diversification (2002).

4. Empirical Application of the DRC Calculation

The calculation and analysis of DRC was realized in summer 2005 using the excel office software. The chosen period was 1998-2002. This choice was drawn by many factors. The disposable of information was the most restrictive among them. It is assumed that during this period, no technological adaptation was observed following the validation of the observed prices. This assumption can be valid only for the court and medium term (Bachta *et al.*, 1996). Border prices of non tradable factor are considered as constant in the last tow years. The financial costs of tradable factors are assumed growing with a percentage of 3.5% every year (MARH, 2002-2006). Those two assumptions are valid for all commodities analyzed in this paper.

For Tomato and Orange crops, we consider the economic and financial prices of tradable and non tradable factors and services published by the CIHEAM (Allaya and Petit, 2004). This data set is classified by Mediterranean country. Conversion' coefficients mentioned in this report were also used to convert financial costs of tradable and non tradable factors to border prices. Other technical and economic data for olive, citrus and tomato cultures were collected from various sources such the National Agronomic Institute, the Ministry of Agriculture and hydraulic resources, and other national and regional institutions and organizations.

5. Results and Discussion

By applying equation (1) to the collected data, results shows that only a competitiveness of the Tunisian olive oil can be noted. This competitiveness is variable between years depending with the very fluctuating yield of this culture (Tables 3). For tomato and oranges, DRC values are superior to the unit indicating a low level of competitiveness and a wrong use (allocation) of some non tradable inputs in those cultures.

Table 3. Domestic Resource Cost for tomato citrus and olive oil .

	1998	1999	2000	2001	2002
Tomato	7.07	2.21	1.23	1.56	1.38
Citrus	1.60	3.02	2.58	2.47	3.20
Olive oil	0.235	0.199	0.144	0.25	0.94

Source: Own Elaboration.

Olive oil can be then considered as the major efficient product in the studied group of commodities. The DRC indicates also that this selected product enjoys a comparative advantage in production and export which means that it allocate the domestic resources efficiently. However, even if DRC values were less than the unit, they present a large variability among years.

The following table 4 shows the annual yields and cost composition of the Tunisian olive oil production during the studied period. It can be clear that the variability of the olive oil DRC is mainly due to a fluctuation in the yields. It is clear that the non-irrigated nature of this culture and the low opportunity cost of their planted areas are factors contributing to the minimization of the economic values of non tradable factors in olive culture (Economic costs of land and water are zeros: table 4)). This can make a difference between them and the other studied commodities (compare tables 4, 5, and 6).

Table 4. Competitiveness and cost composition of Tunisian olive oil.

	1998	1999	2000	2001	2002
Yield (Tons/ha)	0.7	0.8	0.8	0.4	0.1
Financial Cost (tradable inputs: TDN/Ha)	76.80	77.31	83.85	84.41	84.41
Economic Cost (tradable inputs: TDN/Ha)	63.40	63.65	69.32	69.60	69.60
Financial Cost (non tradable factors: TDN/ha)	172.85	181.05	181.05	111.15	72.75
Economic Cost (non tradable factors: TDN/ha)	198.28	204.84	204.84	148.92	118.2
- Land (TDN/ha)	0	0	0	0	0
- Water (TDN/ha)	0	0	0	0	0
- Labour (TDN/ha)	126.28	132.84	132.84	76.92	46.20
Economic Cost on farm level (TDN/Ton)	1292.95	1455.11	1859.93	1641.39	1944.49

Source: Own Elaboration.

Concerning the tomato culture designated to the transformation, it is not competitive, but records a continuous improvement which is due mainly to : (i) the increase of the yields, (ii) the stability in prices of tradable factors, and (iii) the increase of the exports prices (and consequently economic price on the farm level) (Tables 3, and 5).

Table 5. Competitiveness and cost composition of Tunisian tomato.

	1998	1999	2000	2001	2002
Yield (Tons/ha)	22.6	35	38.2	34.4	36.7
Financial Cost (tradable inputs: TDN/Ha)	1141.91	1166.10	1191.20	1217.10	1244.00
Economic Cost (tradable inputs: TDN/Ha)	1045.5	1066.4	1088.0	1110.4	1133.5
Financial Cost (non tradable factors: TDN/ha)	1365	1395	1485	1650	1695
Economic Cost (non tradable factors: TDN/ha)	1920	1944	2058	2274	2360
- Land (TDN/ha)	450	450	450	450	500
- Water (TDN/ha)	810	810	900	1080	1080
- Labour (TDN/ha)	660	684	708	744	780
Economic Cost on farm level (TDN/Ton)	58.30	55.49	72.12	7465	77.26
Financial Cost on farm level (TDN/Ton)	95	95	95	93	102

Source: Own Elaboration.

Table 5 shows that financial costs of tradable output are quite stable during the analyzed period (1998-2002). They pass from 1142 TDN/ha in 1998 to 1244 TDN/ha in 2002, growing by only 9%. The water economic cost is also growing from 810 TDN/ha to near of 1080

TDN/ha which is not the case for the other studied cultures. Citrus production is also inefficient in terms of comparative advantage. This product is cultivated only in the Cap-Bon region. This region is known by its fertile lands and by the availability of many irrigated districts. In those conditions, availability of natural resources (especially the land) becomes quickly a constraint for the increase of exportable oranges volumes and consequently, affects negatively the international (and across sectors) competitiveness of this product (Table 3, and 6). By comparing only the opportunity costs (economic cost) of land between the three studied commodities, we can conclude that the big differences in the economic prices of this factor constitute a real constraint against an improvement in oranges cultivation performance and its contribution in the national agricultural exports. In fact, the opportunity cost of this product is quite stable around 1200 TDN/ha during the analyzed period (Table 6).

Table 6. Competitiveness and cost composition of Tunisian oranges.

	1998	1999	2000	2001	2002
Yield (Tons/ha)	15.9	14.8	15.7	16.3	16.3
Financial Cost (tradable inputs: TDN/Ha)	1356.02	2517.661	2541.527	2567.626	2574.767
Economic Cost (tradable inputs: TDN/Ha)	1224.82	2161.84	2183.42	2208.18	2214.93
Financial Cost (non tradable factors: TDN/ha)	1207.89	1267.89	1333.36	1405.94	1483.98
Economic Cost (non tradable factors: TDN/ha)	2461.72	2559.72	2612.10	2670.55	2732.98
- Land (TDN/ha)	1150	1200	1200	1200	1200
- Water (TDN/ha)	726	726	726	726	726
- Labour (TDN/ha)	564	612	664.38	721.56	783.99
Economic Cost on farm level (TDN/Ton)	173.39	203.27	203.34	201.71	188.21
Financial Cost on farm level (TDN/Ton)	420	439	415	378	430

Source: Own Elaboration.

6. Concluding Remarks and Policy Implications

In this paper we have tried to analyse the competitiveness of some strategic Tunisian agricultural commodities (olive oil, tomatoes and oranges). For this reason, the methodology used is based on the calculation of the Domestic Resources Costs (DRC) index. This DRC is a measure, in terms of real resources, of the opportunity cost of producing or saving products to foreign exchange. It provides a comparison between the domestic costs to produce a given good with its value added at international price. It is thus an ex-ante measure of comparative advantage, used to evaluate projects and policies (Bruno, 1963, 1972). We apply the DRC methodology to a period of five years (1998-2002) using data from various national and

international institutions.

Empirical results showed that only the olive oil commodity has a DRC less than the unit. Thus, this commodity presents a competitive advantage during the studied period. Despite this good level of the DRC indicator, the competitiveness of this former product remain so variable among years, which is mainly due to a variability in the olive yields. The tomato culture isn't competitive ($DRC > 1$) during the studied period, but records a continuous improvement which is due mainly to : (i) the increase of the yields, (ii) the stability in prices of tradable factors, and (iii) the increase of the exports prices. According to those results, this culture can constitute, if improvements be stable, a good exporting opportunity for Tunisia. However, this DRC indicator should be compared with the values of other Mediterranean countries which are known by their high competitiveness level in tomato production (Spain, Morocco, etc.).

Moreover, citrus production is also inefficient in terms of comparative advantage ($DRC \text{ ratio} > 1$). In fact, the geographical distribution of this product (Cap-Bon region) in Tunisia plays an important role in determining its export competitiveness. Availability of natural resources in the mentioned region (especially land) constitutes a constraint for the increase of exportable oranges volumes and consequently, affects negatively the international competitiveness of this product. According to this, it can be useful if the government develops oranges culture in other adequate irrigated areas of the country, where opportunity costs of lands are less than they are in the Cap Bon region.

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