FAOUZI GSOUMA ET HASSAN AYOUB

Total factor productivity and competitiveness : the Tunisian case

RESUME

L'objectif de cet article est d'étudier l'impact de la conjoncture internationale et la modification des facteurs exogènes sur les exportations.
Les résultats économétriques montrent l'importance de la P.G.F. comme facteur permettant une réduction des coûts de production, et par la suite améliorant la compétitivité.
JEL classification : D24, F23, O55

MOTS-CLÉS : Productivité globale des facteurs, Compétitivité, Tunisie

ABSTRACT :

The objective of this article is to study the impact of the international economic situation and the modification of the exogenic factors on exports.
The econometric results show the importance of the TFP as factor allowing a reduction of the production costs, and thereafter improving competitiveness.
JEL classification : D24, F23, O55

Key words : Total factor productivity, Competitiveness, Tunisia

INTRODUCTION

The globalization is characterized by an accelerated flexibility to the exchanges, made possible due to multilateral (within WTO) and bilateral (agreements of associations, free trade areas,…) negotiations. The inevitable consequence of this phenomenon in a stressing of the international competition which relates from now on to the control of the price allowing an improvement of competitiveness, quality, differentiation, …

Tunisia for its part, has an increasing commercial integration with the European union (more than 80% of its trade in goods are carried out with Member States of the union, Economie européenne, 2003, pp. 86) and is in front of new constraints to manage international competition by the control over costs and the choice of a good specialization.

Tunisia, which has a comparative advantage based on a cheap labour is confronted with the challenge to adapt to the new standards of the competition based not only on the prices but also on the innovation and the control of the technological development.

Our objective is to show to what extent the level of exports can be influenced by the total factor productivity. With this intention, we will try to highlight the relation between exports and competitiveness-price through an indicator of competitiveness inspired of work of Mathis and al. (1988), who allows the comparison of the foreign prices expressed in national currency with the unit costs of production, in order to deduce a testable relation between exports and TFP.

In section 2, we examine, by the means of a simple modeling inspired of work of Bourgain and al. (2001a and b), the impact of the Tunisian economy's opening to the international market, the variations of the prices of the foreign competitors, the exchange rate and the unit costs of production on the performance of the exporting sectors.

In section 3 we test, using an econometric estimate, the impact of the indicator of competitiveness on Tunisian exports of the goods and services, and in particular the role of the TFP.

2 - THEORETICAL FRAMEWORK

Our objective is to show how the level of exports can be influenced by competitiveness as an economic indicator. With this intention, we will present initially the traditional determinants of an export function, represented by the foreign request (D) addressed to the domestic production (Q).

Being given our interest for the small opened economies, we suppose that the domestic production is completely exported (D=Q). Then, we will try to highlight the relation between exports and competitiveness-price through an indicator of competitiveness. In the end, we deduce a testable relation between exports and TFP.

2.1 - The export function

Let us suppose an exporting company which faces an international request expressed by the following relation :

$$D = D(P, eP^*, Y^*) = D(\tau, Y^*), avec\, D_\tau > 0, D_{Y^*} > 0 \qquad (1)$$

- τ : the real exchange rate $\dfrac{eP^*}{P}$; P : the domestic price of exported good ;
- e : the exchange rate (value in currency domesticates of a foreign monetary unit) ;
- P^* : the price of the foreign competing product expressed in units of foreign currency ;
- Y^* : foreign aggregate income expressed in terms of units of foreign currency.

The request function (1) under the assumption can be derived from an optimal behavior of the economic agents which maximize an objective-function under the constraint of their resources (Goldstein et Khan, 1985). We will use in our model the foreign GDP as indicator of the foreign income.

The decomposition of the growth rate of equation (1) gives :

$$\frac{dD}{D} = \varepsilon\left(\frac{d(eP^*)}{eP^*} - \frac{dP}{P}\right) + \eta\frac{dY^*}{Y^*} \qquad (2)$$

Where $\varepsilon = \dfrac{D_\tau}{D}\tau$ et $\eta = \dfrac{D_{Y^*}}{D}Y^*$, with $\varepsilon > 0$ et $\tau > 0$ respectively elasticities of the foreign request compared to the real exchange rate and the foreign aggregate income.

2.2 - Exports, price-competitiveness and total factor productivity

In this paragraph, we use the indicator of competitiveness inspired by the work of Mathis and al.. (1988), defined by the ratio : $I = \dfrac{eP^*}{c}$. This indicator makes it possible to compare the foreign prices expressed in national currency (eP) with the unit costs of production.

(c). The competitiveness of the economy improves when I increases.

The indicator of competitiveness can be written in the following way :

$I = M.\tau$, where $M = \dfrac{P}{c}$ a margin marker and $\tau = \dfrac{eP^*}{P}$ the real effective exchange rate.

It rises from this decomposition that the indicator of competitiveness makes it possible to take account of the attitude of the exporters to the prices. Two extreme situations can appear :

• The domestic producers are *price-tackers* ; in this case, the variation of *I* is reflected directly on *M* because the domestic prices correspond exactly to the international prices ($\tau = 1$).

• The domestic producers are *price-setters* ; in this case, the shock on I is reflected directly on τ because these producers are by definition insensitive to the variations of foreign prices.

To analyze the intermediate situations, it would be judicious to study the optimal behavior of a representative exporter facing a foreign request, whith real exchange rate, while being an indicator of competitiveness, constitutes the principal determinant.

In the absence of transactions costs and other rigidities, the choice of the strategy to be adopted to the modifications affecting the foreign competitor prices, the exchange rate and the domestic unit costs, is dictated by the capacity of the market of the exporting firms. In this case, the more elastic demand price which faces the exporting firms is high, the weaker will be their capacity in the market and they will be brought to adopt a secondary behavior. They tend, consequently, towards a situation of *price-tackers*. If the exporters offer differentiated goods, they can aim at a share of market determined well and thus approach a situation of *price-setters*.

The maximization of profit of the exporters makes it possible to determine the following expression :

$$\frac{eP^*}{p} = z\left(\frac{eP^*}{p}\right)^{1-\beta} c(A,w,r) \quad 0 \leq \beta \leq 1 \qquad (3)$$

The coefficient z is a parameter which depends on b who reflects the space for manoeuvre of the exporting firms regarding the fixing of prices. The function C (A, W, R)[1] represents the unit cost deduced starting from a production function Q=A F (K, L) where Q represents the production intended for export, A the total factor productivity, K the physical stock of capital and L the volume of employment. It is obtained by minimizing the total performance index which depends on the standard of wages, W, and of the user cost of the capital, R ; it is an increasing out of W and R and decreasing function in A. Following the strategy adopted by the exporting firm, two situations can be presented (Bourgain and Al, 2001b) :

• If the exporting firm adapts perfectly to the domestic value of the foreign prices (*price-tackers* pur), the coefficient b and z will tend towards 1. In this case, P will tend towards C and the margin towards 0.

• If the firm fixes its prices independently of those of the competitors (*price-setters* pur), b will tend towards 0. From where P=M.c (A, W, R) where z=M is the margin on the variable cost.

The formulation of the equation (3) in terms of growth rate gives :

$$\frac{d\tau}{\tau} = (1-\beta)\frac{dI}{I} \qquad (4)$$

where :

$$\frac{dP}{P} = \beta\frac{d\left(eP^*\right)}{eP^*} + \left(1-\beta\right)\frac{dc}{c} \qquad (5)$$

While introducing (4) and (5) into (2) one will have :

$$\frac{dD}{D} = \varepsilon\left(1-\beta\right)\frac{dI}{I} + \eta\frac{dY^*}{Y^*} \qquad (6)$$

And

$$\frac{dD}{D} = \varepsilon\left(1-\beta\right)\frac{d\left(eP^*\right)}{eP^*} - \varepsilon\left(1-\beta\right)\frac{dc}{c} + \eta\frac{dY^*}{Y^*} \qquad (7)$$

By breaking up the unit cost, one obtains :

$$\frac{dc}{c} = \alpha_L\frac{dw}{w} + \alpha_K\frac{dr}{r} - \lambda \qquad (8)$$

Where :

α_L : the share of the wages in the unit cost ;
α_K : the share of the capital cost in the unit cost ;
λ : the growth rate of the total factor productivity.

The combination of (4) and (5) makes it possible to write :

$$\frac{dD}{D} = \varepsilon(1-\beta)\frac{d\left(eP^*\right)}{eP^*} - \varepsilon(1-\beta)\left[\alpha_L\frac{dw}{w} + \alpha_K\frac{dr}{r}\right] + \varepsilon(1-\beta)\lambda + \eta\frac{dY^*}{Y^*} \qquad (9)$$

According to this last equation, the determinants of the request for export are :

- foreign prices expressed in national currency ;
- The production factors costs ;
- the total factor productivity ;
- foreign GDP.

The study of the equation (9) shows that the elasticity of exports compared to the PGF is equal to e (1-b) : the effect of an increase in the

TFP on exports is all the more significant as is the degree of independence of the exporters compared to the foreign prices. When b = 0, the impact of the total productivity profits on the performances with export remain significant, i.e. the exporting firms have a capacity raised in the fixing of the prices

3 - ECONOETRIC ISSUES

The estimate of the coefficients e (1-b) and h fact of seeming determinants of exports, beside an entirely exogenic component, an endogenous aspect : sensitivity compared to an indicator of competitiveness, itself influenced by the total factor productivity. As the relative variation is roughly equal to the difference logarithmic curve, and by integrating the function of export (7) with the assumption of constancy of the coefficients, we will be able to consider the expression following :

$$D = a_0 + a_1 * Ln(I) + a_2 Ln(Y*) \qquad (10)$$

Where :

a_0 : the constant of integration ;
$a_1 = e\ (1-b)$;
$a_2 = h$.

3.1 - Data Sources

This empirical analysis is applied to the commercial sectors of the Tunisian economy. This is explained inter alia by the strong exposure of these sectors to international competition.

The data used in this empirical validation is the result of several data bases.

The explained variable represents Tunisian exports of goods and services expressed at constant price (source WDI 2003).

The explanatory variables are :

-an international economic indicator which comprises two variables :

• Y*, approached by the value added at constant prices of the principal partners of Tunisia. The weight of each country being its share in Tunisian exports of goods and services (source WDI 2003).
• $M*$ who represents the total imports of goods and services (at constant prices) of the principal partners of Tunisia, with the same structure of weighting as for Y*. (Source WDI 2003).

- a synthetic indicator of competitiveness ($I = \dfrac{eP^*}{c}$), with :

• eP^*: price of the added value of the principal partners of Tunisia (P*) expressed in domestic currency using the effective exchange rate (E). (Source IFS February 2004).
• c: the unit cost, it is the report/ratio of the costs of the factors capital

and labour with the added value, at constant prices (National accounting Source) :

$$\frac{w.L + r.K}{Y}$$

Where :

Y : value added at constant prices ;
w : compensation of employees, including the fiscal burdens ;
L : the volume of employment ;
K : the physical stock of capital ;
r : the user cost of the capital in which intervene :

• the price of the capital (PK), obtained by bringing back the stock of capital at current prices to the stock of capital at constant prices.
• the rate of depreciation of the stock of capital.
• the interest rate, average enters a long rate on the loans and a short rate (three months) on the money market.

3.2 - Estimation Results

In the analysis of the stationnarity, we used the Dickey-Fuller test. All the variables are stationary in first difference.

Therefore, we will estimate the relation in the dynamic form by the method of ordinary least squares.

The synthetic equation (9) is tested in dynamic form with correction of error, which makes it possible to distinguish a component from short term and a component of long term.

$\Delta Ln(D)_t = C1 + C2\Delta Ln(I)_t + C3\Delta Ln(Y^*)_t + C4\Delta Ln(D)_{t-1} + C5\Delta Ln(I)_{t-1} + C6\Delta Ln(Y^*)_{t-1}$ In this dynamic specification, the term on the left except accodances corresponds to the short-term component and the term on the right between the accodances is the component of long term. C4 corresponds to the degree of correction.

$$\Delta Ln(D)_t = C1 + C2\Delta Ln(I)_t + C3\Delta Ln(Y^*)_t + C4\{\Delta Ln(D)_{t-1} + \frac{C5}{C4}\Delta Ln(I)_{t-1} + \frac{C6}{C4}\Delta Ln(Y^*)_{t-1}\}$$

In table 1, an estimate of the dynamic regression which relates to the whole of the goods and services exported by Tunisia.

In the estimate, a variable M* (total imports of the principal partners) will be used like the variable Y*. One initially will estimate the equation (10) with Y* (regression 1) and with M* in the second place (regression 2).

Tableau n° 1 : Estimate of the dynamic equations
Explained variable : Δ **Ln D**
A number of observations : 32   (1970-2001)

Variables	Regression 1	Regression 2
$\Delta Ln(I)$	0.510	0.35
	(2.409)**	(1.57)
$\Delta Ln(Y^*)$	0.168	-0.43
	(0.174)	(-1.10)
$\Delta Ln(M^*)$	-	0.54
		(1.68)*
C	-0.294	3.34
	(-0.251)	(1.37)
$Ln(D)_{(-1)}$	-0.148	-0.29
	(-1.685)*	(-2.34)**
$Ln(I)_{(-1)}$	0.126	0.15
	(0.789)	(0.66)
$Ln(M^*)_{(-1)}$	-	0.49
		(1.67)*
$Ln(Y^*)_{(-1)}$	0.119	0.47
	(1.785)*	(1.29)
D90	-0.0030	0.0046
	(-0.102)	(0.158)
R^2	0.39	0.48
DW	2.156	2.26
F	2.65	2.55
Proba	0.041	0.039

Numbers between brackets : T statistical.
*** significant to 5 % ; * significant to 10%.*

A dummy variable for the year 1990, to improve the precision of the results is not significant.

The DW makes it possible to conclude the absence from autocorrelation of the residues.

The results of the regression (2) lead to the relation of long term following :

$$D = \exp^{11,52} . I^{0,52} . M^{*1,69}$$

It is noticed that the coefficient $\varepsilon(1-\beta)$ is 0,52. This elasticity means that increase of 10% of the indicator of competitiveness implies a stepping up of exports of 5,2%.

The estimated value 0,52 is no other than the elasticity of exports compared to the total productivity factor. Moreover, it appears that the impact of the international economic situation on exports is high enough for a small open economy like Tunisia's (elasticity 1,69).

The regression (1) (with Y*) gave us a relation of long term close to its results of the regression (2) : $D = \exp^{-1,99} . I^{0,85} . Y^{*0,80}$

4 - CONCLUSIONS AND POLICY IMPLICATIONS

Through a simple model of a small opened economy like Tunisia's, one can study the impact of the international economic situation and the modification of the endogenous factors (presented in a synthetic indicator of competitiveness), on exports.

Among the endogenous factors of competitiveness, it is remarkable that the TFP is an essential parameter because it allows a reduction of the production costs.

This empirical validation makes it possible to conclude that an acceleration of the TFP of (10%) results in an improvement of competitiveness, through an increase in exports in (5,2%).

Therefore, the new requirements of competitiveness for the Tunisian economy, open on outside, consist on the control of an industrial policy centered on the productivity and better specialization to allow the improvement of competitiveness.

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Notes

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[**] He is PhD student at the Laboratoire d'Intégration Economique Internationale, Faculté des Sciences Economiques et de Gestion de Tunis, Tunisia. Currently he is a researcher at the Institut d'Economie Quantitative (IEQ), Tunis, Tunisia.

[***] He earned his PhD at the Université de Nice-Sophia-Antipolis - CEMAFI in 2002. Currently he is a researcher in the Cadre - Université de Lille 2, France, Consulting of Arab Countries - D-Consult (Belgique), attached Researcher at CEMAFI - Université de Nice Sophia Antipolis, France.

[1] The output Q does not appear in the unit performance index since we suppose that the function of production is with constant outputs of scale.