THE EFFECTS OF LIBERALIZATION AND INNOVATION ON THE LABOR MARKET OF TUNISIAN INDUSTRY

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ABSTRACT

The object of this paper is to estimate the effects of: the exchange liberalization (imports and exports), the technology transfer through foreigner direct investment (FDI) and the innovation (especially strategic innovation), on the Tunisian labor market. In our econometric model which uses static panel data concerning six sectors of the Tunisian manufacturing industry during different periods, the innovation is estimated by upgrade program investments (UPI). Concerning the period, it depends on the situation of Tunisian economy, we have chosen: Macroeconomic stabilization and the structural adjustment program (SAP: 1983-1989), pre-liberalization (1990-1995) and finally Liberalization and the technological innovation (1996-2015). The results of this study found out that the effects of imports and exports vary with the methods and the equations used. It also indicates a positive significant effect of FDI. In spite of the decomposition of employment between skilled and unskilled, the result doesn't show a technological bias.

KEYWORDS: *Globalization, Technology and Strategic Innovation, Technological Bias, Employment, FDI, Tunisian Manufacturing Industries*

INTRODUCTION

This paper examines, on one hand, the effects of a liberalization of the exchanges on the employment based on data on the period from 1983 until 2015 concerning the sectors of Tunisian industry. On the other hand, and from 1990, we shall analyze the effects of the FDI. Finally, what distinguishes this work, it's that it tries to test the impact of the technological innovations on the Tunisian labor market by dividing the component of labor to the skilled and unskilled labor to test the hypothesis of a technological bias in favor of the one or other type.

Until now, there are few studies which treated the induced effects of the evolution of exchanges and innovation on the composition of the employment request in the industry of developing countries.

We present in a first time, a brief outline of the policies adopted by Tunisia for the liberalization as well as its relation to the development of the Technological innovation. Next, we lead a descriptive analysis of the evolution of the various categories of employment. Then, the accent will be put on the empirical study and finally, the last section concludes this study.

Relation between the Economic Openness and Development of Technological Innovation

After a politics of foreign trade directed to the protection of the internal market and based at first on an industrial politics of replacement in the imports. Since this date, Tunisia has began the experience of the promotion of the exports with the promulgation of the law of encouragement of the exporting industries (which are more intensive on work than the imports industries) giving fiscal advantages to companies. The numerous measures taken in the SAP participated in the liberalization of the foreign trade and in the reduction of the protection of the economy. These measures were followed first in 1989 by the membership of Tunisia in GATT, then in 1990 with the promotion of the FDI by giving various advantages and finally in 1995 by the signature of the agreement of association of the free trade area with the European Union and the membership to the world trade organization as a founder member. All these actions prepared Tunisia for the commitment in the international openness what constitutes an important issue as the openness will have impacts on the competitive structure and conditions on its markets. This openness in the world economy, accompanied with a reduction of the national economy protection is going to lead necessarily an accentuation of the foreign competition through the import of products at competitive prices. These measures require the preparation of the local industry with the support national institutions to be able to face this competition and to adopt this new context.

This country must give a big importance to the industry promotion through the upgrade program of local companies (for which the investments have increased from 1556MD for 852 companies in 2000 to 9323MD for 5347 companies until 2015). This program, began in 1996 had for objective to reach the international standards in quality and costs as well as increasing the competitiveness of industrial companies. It allows the productive system a better adaptation to the requirements of the strongly competitive world market and it encourages the industrial partnership. It strengthens also the socioeconomic environment of the company through the business models. It's defined by the introduction of the innovation through tangible investments, intangible investments, and financial restructuring. The favorable macroeconomic environment allowed Tunisia to attract more and more FDI in diverse sectors what has consolidated the efforts of the researchers on innovation by an acquisition of new technologies through their transfer from developed countries. This transfer required an improvement of the quality of infrastructures and an adaptation of the skills to the concrete needs of employers with the aim of a better orientation.

Contrary to the traditional idea which focuses these searches only on the innovation on products or technology, Christensen (2016) expanded this notion to include the strategic innovation (new business models) opposing disruptive innovation against sustainable innovation. He distinguished between those capable of causing turnovers of the market and those which enrolling in continuity with their usual operational modes. The following figure explains the link between the new business model and information system (IS).
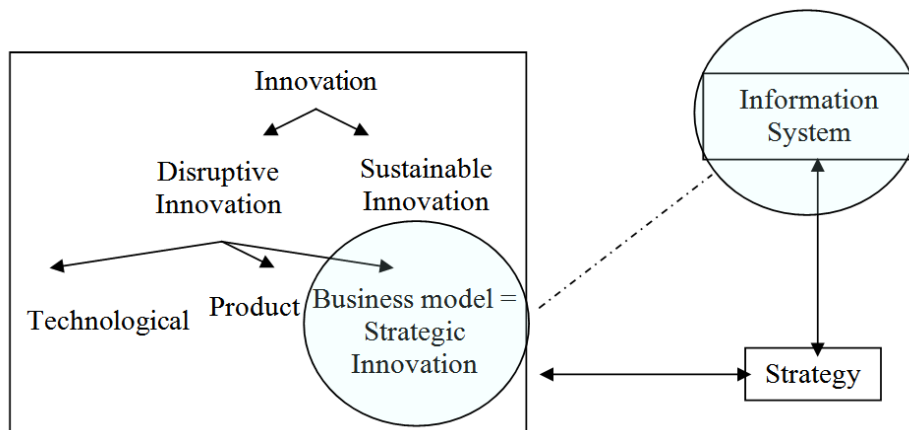
Figure 1: Relationships Studied in Research: Innovation, Information System, and Strategy

The links between IS and strategy created two currents of thought, the first one supports the idea that IS can contribute to the construction of a sustainable competitive advantage while the second considers the ensuring consistency of IS with the company's strategy as a source of performance. In this sense, José and Angel (2015) obtain significant implications for companies, suggesting that investment in new IS must be coupled with a clear sense of strategy.

To reach this performance, in this context of globalization and acceleration of the processes of innovation, it is necessary to master and to manage the information with rigor as a quite other resource, especially that it represents the strategic raw material and it must be obtained there where it's accessible, correlated with the others and exploits at best. To do this, it is the device of economic intelligence (EI) that emphasizes the exploitation of the categories of information sources. The EI is above all a mood shared moret widely possible in the company. The EI, which is defined as the control and the protection of the relevant strategic information for every economic actor, has for objective to generate well useful information to confront the decisions of leaders. The approach of the economic intelligence consists firstly in allowing the made of good decisions at the right time, then in directing the innovation to the acquisition of new ideas and not reinvent what this fact somewhere else and finally to know how to keep and protect its information.

Because our purpose is to test the effect of a set of variables on employment, we dedicate the following section to study the evolutions of workers number of the corresponding costs according to the maintained categories.

Evolution of the Different Categories of Employment
Skilled and Unskilled Workers

Generally, the quality of the workers or qualification depends on the human resources which are a function of the received education and the professional experience. The available data allowed to hold a ventilation of 2 categories of employment: unskilled workers (any education level or primary) and skilled workers in the broad sense (levels: secondary or higher education). In a first time, we begin with a descriptive analysis of the evolution of the categories of these two types of workers in the Tunisian manufacturing industry between 2000 and 2015. Then, we compare the evolution of these categories of employment with the evolution of their respective costs.

Graph 2: Evolution of Number of Employment for the Two Categories (Index Based 100 in 2000)

This graph shows that the skilled employment of the whole industry (the number of workers increases from 204388 in 2000 to 367294 in 2015) evolved with a rhythm more accelerated than that unskilled (the number of workers increases from 314567 in 2000 to 261905 in 2015). The data for every sector shows a divergence between the volumes evolution of the two categories. For unskilled employment, the tendency is for the decline in sectors Textile, apparel, leather industries (TALI) and Miscellaneous industries (MI) but in the increase in the sector Mechanical and electrical industries (MEI) and Agri-food industries (AFI). Concerning the skilled employment, we notice an upward trend in all the sectors with especially TALI and MI. The data for every educated level shows that for all the sectors, the category of employment of upper level believes most strongly and that of any education level falls most strongly.

Volume of Employment and Labor Cost

The data on the remuneration for both categories of employment shows a general tendency to the increase of the annual average salaries of the skilled and unskilled employment. The main increases were detected in the sector AFI for the unskilled and the sector TALI for the skilled.

Certainly, there are other forces except for the evolution of the wages which explain the evolution of the quantities of employment. Among these, we quote firstly the openness of Tunisia to the outside world through the liberalization of the exchanges and secondly the domestic technological innovation through UPI and finally, we do not forget the FDI which participates in the transfer of the technology from developed countries towards Tunisia. The passage in an econometric study will then be necessary with the aim of measuring the respective effects of these various explanatory factors.

Empirical Study

We propose an econometric model which allows the measurement of the impact of exchange liberalization, FDI entry and technological innovation on both of categories of employment of the Tunisian manufacturing industries. As in most of the developing countries, the Tunisian manufacturing industries are the most concerned with the openness policies, the most exposed to the foreign competition and consequently the most concerned by the structural adjustments. In the Tunisian case, these industries present an important part of the exports, the imports, the FDI entrants as well as employed staff, hence the interest that we carry in our model. We try to show in which measure the Tunisian foreign trade and the flows of the FDI ,as well as the UPI, affect the structure of the employment.

Most of the econometric studies (Nayyar 2015 - Farid et Ariell 2017 - Crozet et Orifice 2017) which tried to estimate models with the aim of explaining the constituent relative to the labor were based on data of the developed countries. The studies (Mekki 2006 - Mnif 2016) which analyzed directly the determination of employment in developing countries are rather rare.

The Model

The econometric analysis adopted in this work (Milner and Wright, 1998) uses a simple static model of maximization of profit by firms by supposing a function of production of Cobb-Douglas of the shape:

$$Q_i = A^\alpha K_i^\beta L_i^\lambda \tag{1}$$

Where:

Q Is the real production, K is the stock of capital, L is the used labor unit and β, λ represent the elasticities of the production with regard to factors. α allows the factor to change the efficiency of the process of production and i represent the industrial sectors. Firms, which maximize their profit, use the capital and the labor at levels such as the labor marginal productivity is equal to the wage w and the capital marginal product is equal to the cost c. By taking into account these conditions and by trying to eliminate the capital from firm production, expression, Milner and Wright (1998) obtain the following expression:

$$Q_i = A^\alpha (\frac{\beta L_i}{\lambda} \frac{w}{c})^\beta L_i^\lambda \tag{2}$$

By using the logarithm and by repeating the equation (2), we obtain the following request function representing a static panel model concerning six Tunisian manufacturing industries during different periods:

$$\ln L_{it} = \theta_0 + \theta_1 \ln W_{it} + \theta_2 \ln Q_{it} + \theta_3 \ln H_{it} + u_{it} \tag{3}$$

Where:

L_{it} Is the employment in the industry i in time t

W_{it} Is the average real wage in the industry i in time t,

Q_{it} Is the real output in term of production in the industry i in time t,

θ_0 Is the constant,

u_{it} Is a term of errors which decompose into three elements, the specific effect of the industry, the specific effect of time and a term of random error,

H_{it} Is a vector of variables which affect the efficiency of the production function. For H_{it}, we introduce the following variables: the exports X_{it} and the imports M_{it} relative to the exchanges, the FDI_{it} relative to the transfer of the

technologies and the UPI_{it} relative to the strategic technological innovation. The evolution of the Tunisian economy defined variables retained for the matrix H according to the following models:

Model 1: It is the period of macroeconomic stabilization and the APS where the production is affected only by the imports and the exports.

$$\ln L_{it} = \theta_0 + \theta_1 \ln W_{it} + \theta_2 \ln Q_{it} + \theta_3 \ln M_{it} + \theta_4 \ln X_{it} + u_{it} \tag{4}$$

With $i = 1...6$, $t = 1983.......1989$ and u_{it} is the error term in the industry i in time t.

- Model 2: It is the period of pre-liberalization where the production is affected by the imports, the exports, and the FDI.

$$\ln L_{it} = \theta_0 + \theta_1 \ln W_{it} + \theta_2 \ln Q_{it} + \theta_3 \ln M_{it} + \theta_4 \ln X_{it} + \theta_5 \ln FDI_{it} + u_{it} \tag{5}$$

With $i = 1...6$, $t = 1990.......1995$ and u_{it} is the error term in the industry i in time t.

Model 3: It is the period of liberalization and the technological innovation where the production is affected by the imports, the exports, the FDI and the UPI.

$$\ln L_{it} = \theta_0 + \theta_1 \ln W_{it} + \theta_2 \ln Q_{it} + \theta_3 \ln M_{it} + \theta_4 \ln X_{it} + \theta_5 \ln FDI_{it} + \theta_6 UPI_{it} + u_{it} \tag{6}$$

In this model and with regard to the others, we distinguish in the analysis of the effects on the skilled L_{qi} and unskilled L_{nqi} labor what allows appearing the following request functions:

$$\ln L_{qit} = \theta_0 + \theta_1 \ln W_{qit} + \theta_2 \ln Q_{it} + \theta_3 \ln M_{it} + \theta_4 \ln X_{it} + \theta_5 \ln FDI_{it} + \theta_6 UPI_{it} + u_{it} \tag{7}$$

$$\ln L_{nqit} = \theta_0 + \theta_1 \ln W_{nqit} + \theta_2 \ln Q_{it} + \theta_3 \ln M_{it} + \theta_4 X_{it} + \theta_5 \ln FDI_{it} + \theta_6 UPI_{it} + u_{it} \tag{8}$$

With $i = 1...6$, $t = 1996.......2015$ and u_{it} is the error term in the industry i in time t.

Data and the Estimations Procedures

The data used in this model are static panel data concerning six Tunisian manufacturing industries (AFI, Construction materials and glass industries (CMGI), MEI, Chemical industries (CHI), TALI and MI) during the period of study. The Sources of data for descriptive analysis (section 3. Evolution of the different categories of employment) and econometric modeling (section 4. Empirical study) are presented below:

-Databases of National Statistics Institute (NSI) relative to the occupied population total, the occupied population, wage, occupied population nonwage, the classification of the population occupied total (wage and nonwage) by educational level: nought, primary, secondary and higher, the labor remuneration (for population wage only). The NSI gives also data for exports, imports and productions from the input-output tables out of the national accounts;

Databases of Tunisian Institute for Competitiveness and Quantitative Studies (TICQS) which supplied methods and the results on the calculation of average wages. To be able to calculate the average wages of skilled and unskilled

work, it was necessary to ventilate the quantities of employment of occupied population nonwage (which is not important with regard to that of the occupied population wage) between both categories of employment. What allows us to deduct the quantities of skilled and unskilled employment, wage only which will be associated with the remuneration wage. When occupied population nonwage increases a lot with regard to that nonwage, it can cause a decrease of the wage quantity of employment in question while the real quantity (wage and nonwage) of this employment increased. The data on the quantities and salaries corresponding to skilled and unskilled labor are data, calculate using a database of the TICQS and NSI with author's ventilation.

Databases of upgrade office (UO) and foreign investment promotion agency (FIPA) which gives respectively UPI and FDI.

We estimate these models by using the methods: Ordinary Least Squares (OLS), fixed effects (FE) and the PARKS autoregressive model using the SAS regression procedure for panel data which is the procedure Time Series Cross Section Regression (TSCSREG).

Empirical Results

The estimation results of our models are presented in the following tables:

Table 1: Estimation of the Employment Models Relative to the Equations (4), (5), (6), (7) and (8) For a Panel of Six Manufacturing Industries Using the OLS Method

Variables	(4) L	(5) L	(6) L	(7) Lq	(8) Lnq
Constant	21,18***	16,48***	16,66***	15,33***	25,61***
Ln W	-1,99***	-1,66***	-1,62***		
ln Wq				-1,18***	
ln Wnq					-2,44***
ln M	0,13	0,08	-0,47***	-0,39***	-0,61***
ln X	0,07	-0,26	0,55***	0,59***	0,63***
ln FDI		0,16**	0,14***	0,14***	0,08***
ln UPI			-0,16***	-0,13**	-0,11***
ln Q	0,63**	1,09***	0,53***	0,38***	0,56***
Adjusted R²	**0,4722**	**0,8215**	**0,9**	**0,8956**	**0,9541**

Table 2: Estimation of the Employment Models Relative to the Equations (4), (5), (6), (7) and (8) For a Panel of Six Manufacturing Industries Using the FE Method

Variables	(4) L	(5) L	(6) L	(7) Lq	(8) Lnq
Constant	10,20***	12,09***	13,58***	25,7***	12,99***
Ln W	-0,07	-0,37***	-0,30***		
ln Wq				-1,23***	
ln Wnq					-0,37***
ln M	-0,02	-0,07	0,07	-0,17	0,03
ln X	-0,0003	-0,03	-0,02	-0,02	0,01
ln IDE		-0,008	-0,0001	0,0008	0,002
ln IPMN			-0,001	-0,009*	-0,0003
ln Q	-0,007	0,20**	-0,19	-0,53**	-0,16
Adjusted R²	**0,9988**	**0,9992**	**0,9968**	**0,9906**	**0,9982**

Table 3: Estimation of the Employment Models Relative to the Equations (4), (5), (6), (7) and (8) For a Panel of Six Manufacturing Industries Using the PARKS Method

Variables	(4) L	(5) L	(6) L	(7) Lq	(8) Lnq
Constant	13,06***	16,57***	17,74***	22,79***	
Ln W	-0,6***	-1,28***	-1,42***		
ln Wq				-1,10***	
ln Wnq					-2,07***
ln M	0,08**	0,06*	-0,34***	-0,22***	0,46***
ln X	0,03**	0,013	-0,34***	-0,22***	0,46***
ln IDE		0,016***	0,032**	0,05***	0,006
ln IPMN			-0,004	-0,04***	-0,02
ln Q	0,27***	0,58***	0,68***	0,70***	0,55***
Adjusted R²	**0,557**	**0,9918**	**0,9184**	**0,9822**	**0,9781**

For these three tables: * present the significance threshold of 10 %. ** present the significance threshold of 5 %. *** present the significance threshold of 1 %.

We proposed five series of estimations for the employment equation: the differences between a series and the other concerned the period and the exogenous variables. For the last two series, we estimated separately skilled and unskilled employment.

In most of the cases, and especially for the Parks and OLS methods, the estimated coefficients are significant and in agreement with theoretical predictions: the production is positively correlated with the employment request while salaries are negatively correlated with the employment (whether it is for the global employment (4-5-6) or for skilled and unskilled employment (7-8)).

Concerning the openness effect on employment structure, we found the following results: during short-term period and pre-liberalization (1983-1989 and 1990-1996), the imports affect positively and not always significantly the employment in the Tunisian manufacturing industries. While in the long-term and in a phase of liberalization, the coefficients become negative and significant at 1 %. This result brings to say that the imports are not creative of employment what can be explained by the strong competition due to the liberalization of the exchanges. For the exports, we noticed that this variable affects positively and significantly the two categories of employment whether in short or long-term. This result allows deducting that the Tunisian exports are creative of new employment in manufacturing industries explained by the adoption of exports promotion politics. These creations of employment are especially due to the TALI intensive on unskilled employment.

The technology transfer through the FDI affects positively, significantly but weakly the employment in the Tunisian manufacturing industries. This can explain by the FDI structure in Tunisia. Generally, this investment is relative to implantation of the Small and Medium-size Enterprises and the subsidiaries of the multinationals which aim at manufacturing industries at weak added value and technological contents and which their labor request does not renew. The main part of these FDI was until 1996 in the TALI and since this date, the MEI, the CMGI as well as CHI haveattracted the FDI and participate in the employment creation.

The UPI affects negatively, weakly and not always significantly the global employment as skilled and unskilled employment.

CONCLUSIONS

In this work, we proposed a model testing the empirical relation between the openness, the innovation and the labor market. By using the panel data technique estimation, we tried to deduct the answers of the Tunisian labor market to the openness politics started for many years in this country. Using the basic model (Milner and Wright, 1998), we estimated an econometric equation relative to the short-term and long-term impact of the exchanges, the FDI and the UPI on the employment in the Tunisian manufacturing industries. Our estimation results relative to the reserved methods showed a divergence concerning the effects on employment of the imports and the exports. Globally and as a consequence of the preparation of this country for the liberalization, we notice that the exchange liberalization was very favorable to the development of the Tunisian labor market.

The efforts spread by the politicians ended in the improvement of the quality of the infrastructure, in the development of institutions and services and especially in the adaptation of the skills to the needs of the employers. Thanks to these politics, the national and foreign investments knew a favorable increase in the creation of the employment. During the current phase of liberalization (at the end of the tariff dismantling relative to the free trade area with the European Union), the long-term effect of the exchange liberalization and the technological transfer on the employment will persist as long as the Tunisian economy will be capable to attract the investors and to increase the exports. Besides the study of the exchanges openness and entry FDI impact, this paper also aims to test the bias technological hypothesis. Through the UPI, which according to their natures represents strategic innovations, the estimations results of the relative equations to both categories of employment do not appear this technological bias contrary to the results of Duguet E and Greenan N, 2000 on French data. This result can be explained by the necessity of making a decomposition of these investments enter material and immaterial what does not possible because of data availability. Another possible explanation for this phenomenon and which finds its origin in the intervention policy in the labor market adopted by this country.

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