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EVOLUTION OF RATES OF RETURN TO SCHOOLING IN TUNISIA: 1980-1999

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Abstract

With reference to the theory of human capital, we estimate the Mincerian earnings functions based on individual data from national surveys of population and employment in 1980 and 1999. We show that the rates of return to education are, in 1980 and 1999, increasing proportionally with educational level. This growth of return rates means that the incentives for human capital accumulation continue to be strong. This result is general, it is observed for men and women, and in urban and rural areas. However, between 1980 and 1999, the average rate of return to education declined from 9.5% to 5.9%. Furthermore, this decline in the rates of return is general for all levels of education. This phenomenon affects the urban and rural areas as well as men and women. But the decline in the rate of return increases when the education level is low: the less the education level is, the bigger the decline in the rate of return is. This can result in a general deficiency in demand for labor by companies which seriously affects low qualified people. Following Heckman (1979), we re-estimate the earnings functions corrected for selection bias due to Mill's reversed ratio. The new findings of education return rates are superior to those obtained from the standard estimates. The results prove that education return rates increase when the education level increases; moreover, it explained the decline that happened between 1980 and 1999, which touched all education levels. However, the relative decrease in returns to education becomes larger in higher education levels; the lack of demand for labor would be felt more for the more educated.

Keywords: Labor Market, Education System, Mincerian Earnings Function, Selection Bias, Mill's Inverted Ratio, Rate of Return of Education

1. Introduction

Since its independence, Tunisia recognized the importance of human capital in economic development and has always sought to promote human resources such as free education and free access into training institutions, from the basic school to university, to all young people according to their merits. But, while the demand for education was maintained by employment opportunities related to the development of the public sector, recent trends in the labor market appear to cease providing sufficient incentives. The shortness of the public employment and insufficient demand for graduates in the private sector are combined with the effects of

population growth continue, for a few years, to weigh heavily on the labor market. This resulted in a sharp and worrying unemployment among young graduates and a desire for international migration leading to lower incentives for investment in human capital and disabling growth opportunities in the long run of the economy.

In this context, it is interesting to first analyze the functioning of the labor market and see how it carries signs of revitalization or, conversely, shortness of breath, signs tell about project work that drives the demand for education and determines the returns to human capital. For this, we refer to education statistics published by the *Ministry of Education* and the *Ministry of Higher Education* and the *Census Data* of 1975, 1984 and 1994 and the *National Surveys of Population- Employment* in 1997 and 1999. Finally, to study the assumptions involved, empirical investigations based on individual data from the population-employment investigations conducted by the *National Institute of Statistics (NIS)* in 1980 and 1999 will be a great help. The analysis of education return rates that we can identify evaluates the optimality of resource allocation within the education system at its various levels and assesses the impact of employment policies on incentives to accumulate human capital.

2. The Labor Market

In 1995, Tunisia signed an association agreement with the European Union which aims at creating, a common area of free trade within twelve years. Various theoretical studies have attempted to analyze the effects of trade liberalization on the labor market (Boughzala, 1997). Others have developed, within the framework of computable general equilibrium models, scenarios to assess the impact on the Tunisian economy in general and on the labor market in particular (Kébabdjan, 1995). Taken together, these studies conclude that this will lead to potentially positive impacts but all agreed that some measures should be taken to ensure a successful transition of the economy (active macroeconomic policy, important accompanying measures and continuous flow of domestic and foreign investment). We propose here to take stock of the developments in the labor market to identify its trends and to identify the factors that may influence the profitability of investment in human resources.

2.1. Analysis of Labor Supply

The Tunisian population has been increasing since 1975 leading to a decelerating rate with a lag, a parallel movement with respect to the working-force population. While this decelerated growth is supposed to mark the evolution of the labor force, there is the contrary, since 1994, an increase in the rate of growth of the labor force has increased from 2.64% between 1984 and 1994 to 3.45% between 1994 and 1999 (Table 1).

Table 1. Demographic and activity, 1975-1999

	Population in (000)				Average annual growth in (%)		
	1975	**1984**	**1994**	**1999**	**1975-84**	**1984-94**	**1994-99**
Total population	5,577	6,975	8,786	9,443	2.52%	2.33%	1.49%
Working-age population	3,233	4,231	5,724	6,528	3.03%	3.07%	2.73%
Labor force	1,622	2,137	2,772	3,144	3.11%	2.64%	3.45%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984 and 1994.

These movements have generally resulted in an increase in the gross participation rate and a continual increase in additional job demands. Indeed, in addition to demographic factors, other factors shaped the evolution of the behavior of active Tunisians especially Tunisian women. Among these determinants, education may have played a vital role; it would have remarkably contributed to the participation of women and men in both urban and rural areas.

Table 2. Evolution of activity rate

	1975	1984	1994	1999
Gross participation rate	29.1%	30.6%	31.6%	33.3%
Overall participation rate	50.2%	50.5%	48.4%	48.2%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984 and 1994.

2.1.1. Activity and Environment

Despite a higher fertility in rural areas, active population has increased much faster in urban areas. Hence, more pressure for additional demand for jobs (or labor supply) has been exerted, mainly in urban areas. Since 1994, three out of four additional assets have been in urban areas (Figure 1 and Figure 2).

This situation has correlated with increasing urbanization of the Tunisian landscapes, fueled by rural-urban migration, the expansion of municipal areas and the promotion of rural communities in small towns. The urban environment is more favorable for the promotion of human resources because it allows easier access of the population to social infrastructure. There has also been a greater professional mobility of people and it fed new expectations especially for women who have a greater tendency for activity.

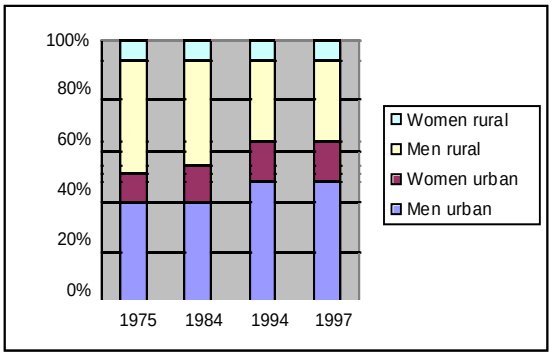

Figure 1. Active population by gender and environment

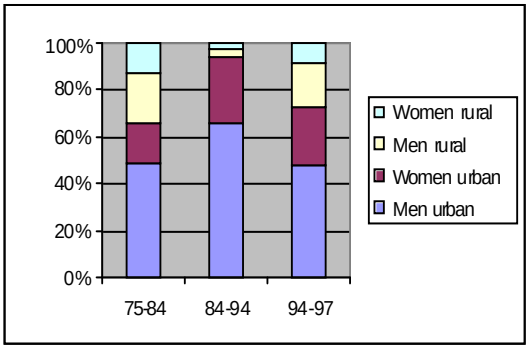

Figure 2. Request additional jobs by the areas and gender

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1997 and the census in 1975, 1984 and 1994.

2.1.2. Activity and Gender

The female labor force grew faster than the male labor force in both urban and rural areas increasing the proportion of women in the total labor force from 18.7% in 1975 to 24.6% in 1999 (Figure 3). Since 1994, an additional active on three has been a woman.

In the assumption of a labor market segmented by gender, a serious imbalance in the female market is remarked because the latter is object of a more intense pressure for additional job demands (female labor supply) than that exerted on the male segment.

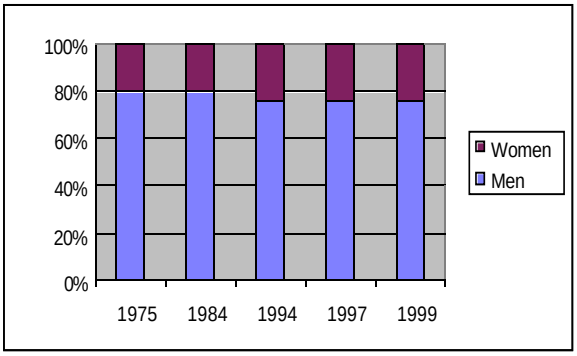

Figure 3. Labor force by gender

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1997 and 1999 and the census in 1975, 1984 and 1994.

The difference in annual growth rates between feminine labor force and masculine labor force induces a downward trend in the overall participation rate of men and a tendency to increase in the overall rate of women (Table 3).

Table 3. Overall rates activity by gender

	1975	1984	1994	1997	1999
Women	18.9%	21.9%	22.9%	23.7%	23.7%
Men	83.5%	79%	73.8%	73.4%	72.6%
Total	50.2%	50.8%	48.4%	48.6%	48.2%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1997 and 1999 and the census in 1975, 1984 and 1994.

Concerning men, the participation rate decreases due to the effect of school drop out on the less than thirty years old and the progress of social programs which involve withdrawal activities earlier and earlier.

For women, the participation rate increases as a result of the emancipation movement enabling them to control their fertility and ensuring an easier access to education and knowledge (Figure, 4).

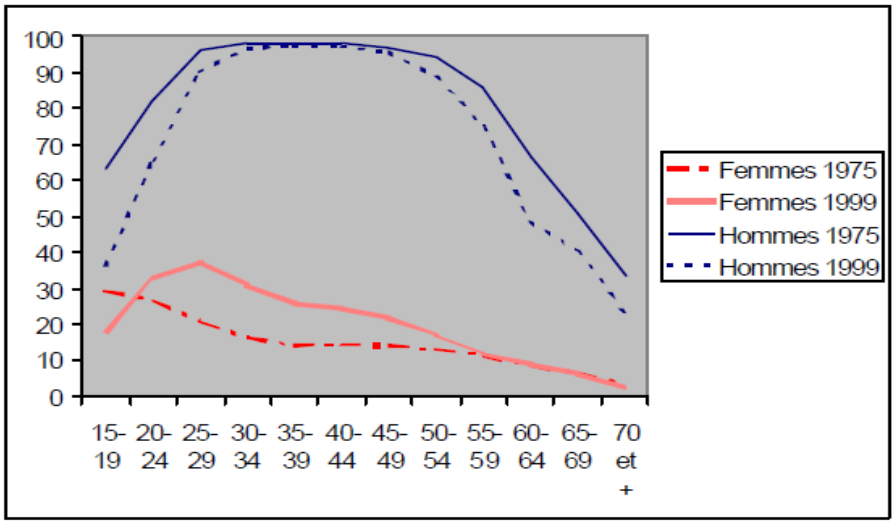

Figure 4. Participation rates of men and women by age

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975. <Femmes: Women / Hommes: Men>

The increase in female participation is evident in all education levels. We notice also, that the weight of women in the active workforce outweighs their education level increase (Table 4).

Table 4. Share of women in the labor force by level of education

	1994	1997
At the primary	22.6%	23.2%
Secondary	24.7%	25.1%
Superior	28.8%	30.4%
Total	23.6%	24.3%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1997 and the census in 1994.

As a result, the average educational level of active women is higher than that of active men as evidenced by the distribution of the workforce in 1994 and 1997.

The dominance of women among the most educated active workforce can cause greater difficulties in entering the labor market for this category especially in a context where the absorptive capacity of the market is generally limited to face rapid human capital growth.

2.1.3. Activity and Education

Education has strongly influenced Active behaviors. In fact, the increasing pressure on the labor market is accompanied by a steady evolution of the educational profile of the additional demand for jobs as the supply of human capital has increased (Figures 5 and 6).

Since 1994, the average active labor force with just a primary education level has increased 1% per year, while the percentage of the assets having secondary and high levels have increased annually, respectively, to 4.4% and 8.3%. This evolution is more likely to meet the needs of the economy for qualification and human resources, it exerts a heavy pressure on the market for graduates and requires urgent adjustments including graduates wants in the field of employment and wages, without which the risk of unemployment is likely to increase.

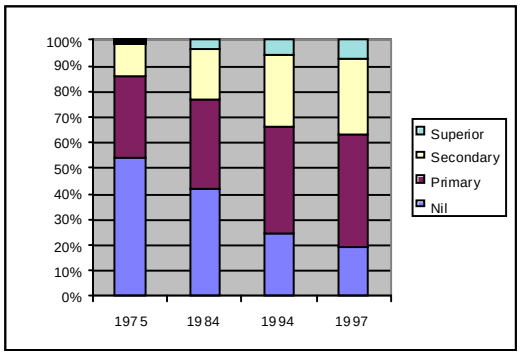

Figure 5. Labor force by educational level

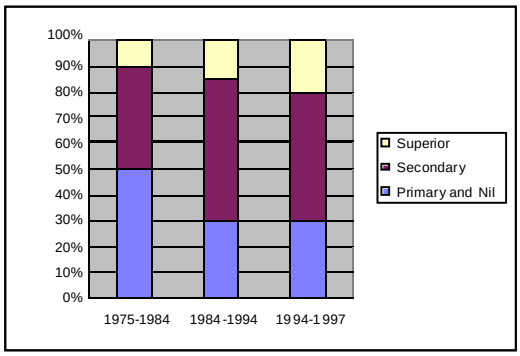

Figure 6. Additional labor force by level of education

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1997 and the census in 1975, 1984 and 1994.

2.2. Analysis of the Demand for Labor

The period covered by the analysis is characterized partly by good overall economic performance and also by significant changes in the economic policy. The period 75-84 corresponds to a period of economic growth in a protected environment where the public sector plays a dominant role, 84-94 is a period of economic stabilization and structural adjustment where the weight of the state decreases and the economy is opened and liberalized, the era

after 1994 was marked by efforts to upgrade businesses and to integrate into the international economy. This came to life in 1996, with the signing of the free trade agreement with the European Union, which stated, the opening and the reduction of the economical protective measures in the Tunisian market within 12 years and hence competition with foreign producers started.

Although these economic policies have led to significant sectoral adjustments and were sometimes marked by a relative austerity, two constants have been preserved: First, government spending in the social sectors remained a priority and the state has continued to recruit staff in public places. Then an active policy of promoting employment has been implemented to encourage companies to hire and promote micro-enterprises and encourage job seekers to settle in their own account. Meanwhile, the search for comparative advantages has led to a greater diversification of the industrial base and increasing net wage employment creation. The fact was that the restructuring has often led to subtle job losses in manufacturing and alleviated unemployment which remained fairly significant over the entire period (Zouari-Bouattour, 1994).

In conclusion, the growth of the Tunisian economy has increased the annual job creation which went from 46,600 jobs per year between 1975 and 1984 to more than 62,900 a year between 1994 and 1999. These creations are accompanied by changes in the distribution of employment according to sectors (Figure 7), levels of education, types and gender.

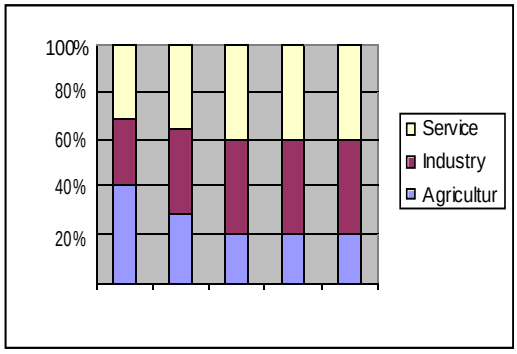

Figure 7. Distribution of employment by sector

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984 and 1994.

The economic growth has led to a re-allocation between sectors for instance; the share of agriculture has declined in favor of industrial employment, and especially employment in services. However, while the annual job creation in industry tends to fall, that in the agricultural sector tends to increase. The services sector is the most creative job sector (Table 5).

Table 5. Distribution of job creation by sector

	Workforce in (000)			Structure in (%)		
	1975-1984	**1984-1994**	**1994-1999**	**1975-1984**	**1984-1994**	**1994-1999**
Agriculture	-3.7	2.6	19.0	--------	4%	28%
Industry	25.6	17.8	17.6	55%	30%	26%
Services	21.1	39.1	31.2	45%	66%	46%
Undeclared	46.6	53.4	62.9	100%	100%	100%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984 and 1994.

The particular dynamics experienced by the agricultural sector since 1994 have led to a strong growth in job creation in rural areas where the annual job creation between 1994 and 1999 were close to those that were created in urban areas.

The growth of manufacturing and export including: the textile and engineering industries have been the source of a strong demand for female labor. The restructuring of manufacturing industries as a result of economic protection reduction and privatization of public enterprises since 1997 has led to job losses[1]; the intensity was probably greater for women (Table 6).

Job losses in manufacturing industries[2] were offset by job creation in agriculture, in construction and in services (Table 5 and 6). As construction is almost exclusively a masculine field, sectoral reallocation of female employment was mostly in favor of services, that's why the demand for labor remained for one third female employment (Table 7).

Table 6. Employment in the industrial sector

	Employment in (000)					Average annual growth rate		
Industry	**1975**	**1984**	**1994**	**1997**	**1999**	**75-84**	**84-94**	**94-97**
Agrifood	19.2	28.2	48.6	51.3	------	4.3%	5.6%	1.8%
Building materials, ceramics and glass	19.2	27.4	33.5	35.0	------	4.0%	2.0%	1.5%
Mechanical and electrical	16.7	29.7	48.6	61.3	-----	6.6%	5.1%	8.1%
Chemical	7.5	11.2	16.9	21.7	-----	4.5%	4.2%	8.6%
Textiles and leather	145.0	203.9	239.9	259.2	-----	3.9%	1.6%	2.6%
Various	27.5	44.9	68.2	77.9	-----	5.6%	4.3%	4.6%
Manufacturing industry						**75-84**	**84-94**	**94-99**
	235.2	345.1	455.7	506.5	481.3	4.4%	2.8%	1.1%
Mining and energy	29.0	38.0	36.8	32.9	32.7	3.1%	-0.3%	-2.3%
Building	128.4	237.5	305.8	304.8	372.0	7.1%	2.6%	4.0%
Non manufacturing industry	157.4	275.5	342.5	337.7	404.7	6.4%	2.2%	3.4%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and 1997 and the census in 1975, 1984 and 1994.

The demand for labor in "private services" sectors slowed since 1984 as evidenced by the decline in annual job creation. At the same time, there is a reallocation in favor of tourism and financial sectors. Education, health and administration have continued to provide a large demand for human resources. Overall, services were the field which needed almost half of the demand for labor. This demand was essentially organized through selective educational levels (Table 8).

Table 7. Structure of job creation by genre

	Workforce in (000)			Structure in (%)		
	1975-1984	**1984-1994**	**1994-1999**	**1975-1984**	**1984-1994**	**1994-1999**
Male	32.5	38.8	41.3	69.6%	72.5%	65.6%
Female	14.2	14.7	21.6	30.4%	27.5%	34.4%
Total	46.7	53.4	62.9	100.0%	100.0%	100.0%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984 and 1994.

[1] The number of workers made redundant by restructuring totaled 3,900 in 1996, 6,002 in 1997 and 5,100 in 1998. The privatizations were originally laid off 2,000 on average during this period (World Bank, 2000).

[2] The analyzes that we conduct are based on census data from 1975, 1984 and 1994 as well as those of national surveys on population and employment in 1997 and 1999, the Ministry of Economic Development publishes annual series of job creation by sector where it appears that manufacturing industries have dismantled since 1996, an increasing potential for job creation. Between 1997 and 2000, they would have created 18,250 jobs annually (please see "Annual Report" issued by Tunisian Central Bank, 2001).

Table 8. Employment in services

	Employment in (000)					Average annual growth rate		
	1975	**1984**	**1994**	**1997**	**1999**	**75-84**	**84-94**	**94-99**
Trade	86.6	118.3	217.9	260.5	252.9	3.5%	6.3%	3.0%
Transport	56.0	86.7	112.0	122.7	128.1	5.0%	2.6%	2.7%
Hotel	30.1	35.5	75.7	83.8	95.2	1.9%	7.9%	4.7%
Bank insurance and other services	75.6	103.6	194.9	205.8	220.1	3.6%	6.5%	2.5%
Private services	248.3	344.1	600,6	672.7	696.3	3.7%	5.7%	3.0%
Health, education and	1546	251.0	385.3	415.4	445.5	5.5%	4.4%	2.9%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984, 1994.

Although there is a strong growth in the share of the workforce having a university education, job creation is still relatively dominated by an educational level that does not exceed the primary level (43% of jobs created between 1994 and 1999, see Table 9).

Table 9. Distribution of annual job creation by level of education

	Workforce in (000)			Structure en (%)		
	1975-1984	**1984-1994**	**1994-1999**	**1975-1984**	**1984-1994**	**1994-1999**
At the primary	20.6	13.8	26.9	44.2%	26%	43%
Secondary	20.7	30.6	23.1	44.4%	57%	37%
Superior	5.3	9.0	12.9	11.4%	17%	21%
Total	46.6	53.4	62.9	65.7	100%	100%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984 and 1994.

The weakness of the labor market occurs from its ability to generate wage employment. Whereas, till 1994, wage employment accounted for over 85% of created jobs, since 1994, they have represented just less than half of the jobs (Table 10). The wage is substituted by self-employment mainly geared towards men and family micro projects which are more captive for women.

Table 10. Distribution of annual job creation by statute

	Workforce in (000)			Structure en (%)		
	1975-1984	**1984-1994**	**1994-1999**	**1975-1984**	**1984-1994**	**1994-1999**
Salaried	38.0	47.6	30.3	85.2%	85.2%	47.8%
Boss and independ	6.0	6.9	17.9	13.4%	12.3%	28.2%
Caregiver	0.6	1.4	15.3	1.4%	2.5%	24.0%
Total	44.6	55.9	63.5	100%	100%	100%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1999 and the census in 1975, 1984 and 1994.

Despite this evolution, part- time and seasonal employment declined. Perhaps, behind this development, there is an important labor supply effect, increasing urbanization of the country and promotion in educational levels and their impact on the lifestyles and needs, are the causes of changing attitudes towards the work as all individuals: men and women have a greater preference for full-time employment (Table 11).

Table 11. Distribution of employment by type

	Employment in (000)			Average annual growth rate	
	1984	**1994**	**1997**	**1984-1994**	**1994-1997**
Full-time	1363,3	1705,3	2137,8	2.3%	7.8%
Seasonal and partial	383,9	598,4	343,6	4.5%	-16.9%
Unreported	39,2	16,9	22,2	-8.1%	9.5%
Total	1786,4	2319,7	2503,6	2.7%	2.6%

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1997 and the census in 1984 and 1994.

3. From the Interaction Between the Education Market and the Labor Market: Insights From the Earnings Functions

In fact, the analysis reveals that, since 1975, the Tunisian economy has generated increasing number of jobs in which the rhythms of evolution have surpassed those of the additional job application. However, although the coverage of additional requests for the creation of jobs has been growing, the additional demand has never been fully covered. Also, the number of jobless people there continued to grow for both men and women. However, by level of education, the increase of graduates since 1994, especially for women, has far exceeded the absorption capacity of the market in a context where wage employment creation slowed down and where industrial restructuring induced job losses. One should confirm also that the studies have been profitable. Likewise, while the field of industry restructures and reduces the number of employees, agriculture has relied heavily on labor; the reallocation of labor to an area of lower productivity should also be accompanied by a decline in the profitability of investment in human resources in rural areas. What is it?

3.1. Theoretical Models

In our attempt to answer these questions we referred to the human capital theory as synthesized by the Mincerian earnings functions. These functions consider the wages earned by people pays the academic and professional investment they have made. The easiest way to understand the educational investment is by approximating the length of schooling or its level. Professional investments, in turns, are approximated by the length of professional experience and its square. The quadratic form is introduced as a consequence of assuming a professional investments decline over time (Mincer 1974, Becker 1964)[3].

Overall, the theoretical developments lead to the following equation:

$$\ln y_i = \alpha_1 + \alpha_2 SCHOOL_i + \alpha_3 EXP_i + \alpha_4 EXP_i^2 + \varepsilon_i \quad (1)$$

with:
ln y: The natural logarithm of the wage of an individual i;
SCHOOL: The education of the individual i measured by the number of years of formal education;
EXP: The experience measured as the difference between the age of the individual, his preschool and schooling duration.

According to this equation, α_1 is autonomous and independent human investment earnings, α_2 is the average of education return rate, α_3 and α_4 year are significant effects of

[3] For a review of alternative interpretations of the earnings function, see Zouari-Bouattour (1987), Hanchane and Moullet (1999), Lemistre and Plassard (1999).

experience on wages parameters. It is expected that such α_4 is negative as a result of the assumption of diminishing returns to professional investments.

An alternative version of the model is to analyze the effects of education through qualitative variables indicating the level.

$$\ln y_i = \alpha_1 + \alpha_2 Level2_i + \alpha_3 Level3_i + \alpha_4 Level4_i + \alpha_5 EXP_i + \alpha_6 EXP_i^2 + \varepsilon_i \quad (2)$$

Level1, the reference level corresponds to those who are illiterate, Level2 represents those who have the primary or one of “Kottab level”, Level3 refers to those who have completed secondary education and Level4 is the top level. Each of these "dummies" takes the value 1 when the individual has the target level and zero if it hasn’t.

This approach has the advantage of assessing the magnitude of the returns to education compared to a given level. When considering several observation points, it allows to study such specific movements that returns undergo over time.

However, the estimation of equations (1) and (2) above from a sample of employees is subject to selection bias. In fact, employees may have specific characteristics different to the total population even different to the population of non-active employees probably because the factors that affect the decision to be active also affect the salary. In this case, generalizing the results obtained from a sample of employees for the entire population can be misleading especially when it comes to deciding on education return rates for special populations: women have a low tendency to activity or other categories of workers who may prefer employment in urban rather than in rural areas.

If selection bias is based on observable characteristics, we can solve the problem by including these variables in the earnings function, in addition to traditional explanatory variables of human capital model. When the selection is based on unobservable characteristics, things are more complex. In fact, those working in urban areas are more determined and motivated than those who work in rural areas. Moreover, working women were higher than those who prefer inactivity. Because, motivation, determination and natural abilities affect wages, the estimated education return rates for working women or those who work in urban areas, overestimates education return rates.

The standard treatment for this selection bias is a two-step process initiated by Heckman (1979). The procedure in question is first to estimate a Probit model of participation or general choice on a characteristic activity, this model is based on an assumption of normality. The results will then be used to integrate Mill's inverse ratio in the Mincerian earnings equation to correct the selection bias. We adopt the Heckman procedure to correct the selection bias that occurs in the estimations from samples of workers in urban areas.

3.2. The Sample Characteristics

The statistical data used are derived from *Population and Employment Surveys (PES)* conducted by the *National Statistics Institute (NSI)* in 1980 and 1999. The average characteristics of workers as they appear from these samples fairly reflect those of people employed on the corresponding dates. Indeed, these surveys conducted among households, covering the entire country and all asset classes. Samples of employees we have learnt about various individual characteristics: age, sex, educational level, marital status, environment, the pace of work, the number of days worked per month ... They also provide information on the final salary, the period associated with the salary and compensation arrangements.

The information available here permits to calculate, in each survey, the equivalent salary of individuals per monthly[4].

The characteristics of the samples as shown in Tables 12 and 13 show that:

- Employees in urban areas account for 70% in 1980 and 72.4% in 1999. This increase is comparable with the general trend of urbanization in the country. The fact shows that the wage is overrepresented in urban areas. Differences in average wages between urban and rural areas are important but shrinking in relative terms. It is the same level of education. The average age of employees is slightly higher in rural areas; young people have a greater tendency to rural exodus.
- Women represent 13.6% of the sample in 1980 and 24.1% in the 1999 sample. This increase is associated with the increased access of women to work and especially wages. Employed women are younger than men. Generally, they have a better educational level but they receive lower wages. The differences observed in 1980 continue in 1999, but become less important.

Table 12. Characteristics of the sample of 1980

	Urban	***Rural***	***Male***	***Female***	***Total***	
Age	33.5	34.05	34.72	26.93	33.7	
Salary in D	94.2	64.6	86.5	77.8	85.3	
Education	6.5	3.6	5.4	7.4	5.6	
Illiteracy	926	889	1676	139	1815	29.9%
Primary	1602	619	1945	276	2221	36.7%
Secondary	1456	289	1390	355	1745	28.8%
Superior	252	22	221	53	274	4.6%
Sample allocation	4236	1819	5232	823	6055	100%
	70.0%	30.0%	86.4%	13.6%	100.0%	

[4] For the 1980 survey, the monthly salary (Y) was calculated as follows:

$$Y = \frac{last\ earned\ salary\ excluding\ allowances\ net}{number\ of\ days\ to\ pay} \times 30 + rewards\ - levies$$

For the 1999 survey, the monthly salary is calculated according to the methods of payment:

$$Y = \begin{cases} \text{Net monthly salary, if the individual states the amount} \\ \text{Net weekly salary} \times \frac{30}{7} \\ \text{Daily net salary} \times 30 \\ \text{Total amount received in the month before the investigation declared by individual if another payment method} \end{cases}$$

Table 13. Characteristics of the sample of 1999

	Urban	*Rural*	*Male*	*Female*	*Total*	
Age	35.72	36.03	37.46	30.62	35.8	
Salary in D	281.44	213.09	271.23	235.23	262.55	
Education	9.0	5.8	7.9	8.9	8.1	
Illiteracy	350	435	630	152	782	13.1%
Primary	1585	767	1855	497	2352	39.4%
Secondary	1788	360	1580	568	2148	35.9%
Superior	601	93	470	224	694	11.6%
Sample allocation	4324	1652	4535	1441	5976	100%
	72.4%	27.6%	75.9%	24.1%	100.0%	

3.3. Estimation Results of Mincer's Earnings Model

The estimates of equation (1) after the Mincerian model, using data from 1980 and those of 1999 are shown in Table 15 below respectively for the total sample (R_1) for men samples (R_2) and women (R_3) and for those who work in urban areas (R_4) and rural areas (R_5).

To make these estimates we converted the instruction such levels that they are entered in the investigations jobs by adopting the following policies:

Table 14. Convert the level of education in number of years of education

Education level	Instruction
Illiterate	0
Primary (y compris koutteb)	5
Secondary first cycle	9
Secondary second cycle	12
Superior	16

Estimates the following results emerge:

1) Concerning the effects of educational investment on gains, they are seized by the movement of the coefficient of the education variable that represents the average return, we observe:

- A sharp fall in the average of education return rates from 9.5% in 1980 to 5.9% in 1999.
- An average rate of return to higher education for women in 1980, probably due to selection bias (12.9% for women against 8.8% for men)
- Differences in education return rates between men and women have decreased significantly in 1999; women have been affected much more than men by the lower profitability of their training.
- An average rate of return to higher education in urban areas and a lower rate of return to higher education in rural compared to urban areas.

Table 15. Estimation of the model (1), the average return to education

		Sample size	INTERCEPT	Explanatory variables			R^2	F
				SCHOOL	EXP	EXP^2		
R_1 Total sample	1980	6055	3.008176 (109.89)	0.095341 (57.118)	0.050525 (26.408)	-0.000640 (-18.546)	36.53%	1160.84
	1999	5976	3.993297 (130.851)	0.059471 (51.859)	0.061044 (27.865)	-0.000817 (-22.248)	40.5%	1354.88
R_2 Male	1980	5232	3.165585 (103.98)	0.088247 (48.703)	0.044323 (21.439)	-0.000573 (-15.708)	33.13%	863.39
	1999	4535	4.1695 (114.212)	0.058546 (45.514)	0.053181 (21.520)	-0.000727 (-18.205)	38%	925.6
R_3 Female	1980	823	2.471338 (39.94)	0.129224 (33.370)	0.063311 (11.263)	-0.000772 (-6.350)	58.20%	380.06
	1999	1441	3.79447 (60.157)	0.064016 (26.079)	0.064516 (11.441)	-0.000839 (-7.651)	46.73%	420.16
R_4 Urban	1980	4236	3.03669 (97.91)	0.094074 (49)	0.049192 (22.299)	-0.000568 (-13.752)	37.85%	859.13
	1999	4324	3.921292 (108.563)	0.062215 (46.942)	0.062917 (24.048)	-0.000798 (-17.909)	44.48%	1153.66
R_5 Rural	1980	1819	3.148037 (53.67)	0.080786 (20.892)	0.043065 (11.059)	-0.000629 (-9.773)	22.33%	173.97
	1999	1652	4.28398 (74.197)	0.0435533 (17.330)	0.049919 (12.485)	-0.000757 (-11.684)	23.38%	167.64

2) Concerning the effects of professional investment on gains, they are seized by the marginal effect of one year of experience on gains (Goux and Maurin, 1994), we observe:

- An increase in the marginal effect of experience on earnings, wage profiles have become more concave, reflecting the fact that young people must undergo further the costs of their training experience. This movement may result from an excess supply in the labor market; it is noticeable in urban and rural areas (Table 16 and Figure 9).
- The earnings profiles of women are more concave than men. Women should begin their careers with lower wages and demonstrate their skills to benefit from increased earnings. The concavity of the wage profile of women in the light of experience remained virtually stable between 1980 and 1999, while that of men has increased (Table 16 and Figure 8).

Table 16. Marginal Effect of experience

Sample	**1980**	**1999**
Total	0.050525 – 0.001280 EXP	0.061044 – 0.00163 EXP
Woman	0.063311 – 0.001544 EXP	0.064516 – 0.00168 EXP
Man	0.044323 – 0.001146 EXP	0.053181 – 0.00145 EXP
Urban	0.049192 – 0.001136 EXP	0.062917 – 0.00160 EXP
Rural	0.043065 – 0.001239 EXP	0.049919 – 0.00151 EXP

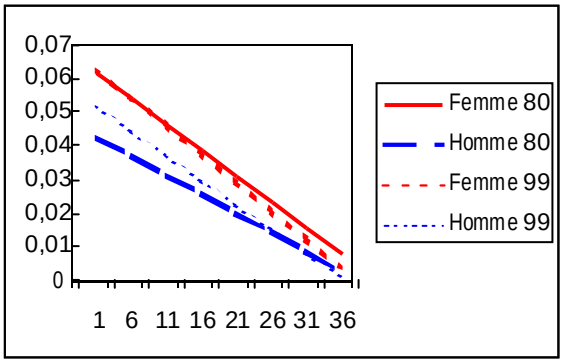

Figure 8. Marginal effect of experience on earnings by gender

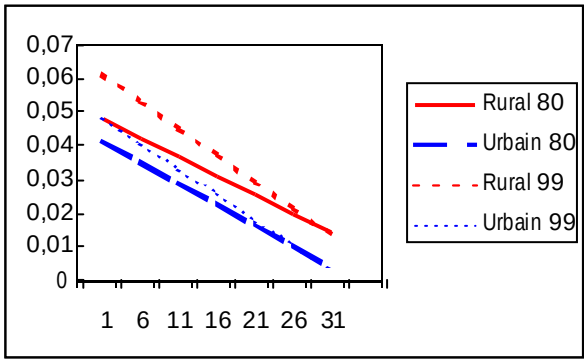

Figure 9. Marginal effect of experience on earnings by areas

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1980 and 1999.

The model (1) has allowed revealing a decrease in the average cost of studies, how is this movement perceived by the various levels of training? Is it due to an effect of lower return rates of some levels of education, precisely, higher-level, dropout which would mean that there is an excess supply of human capital. In this case, we must implement incentives to limit the growth of higher education (Zouari- Bouattour S. 1998). Is it due, contrary, to a general decline in education returns regardless to the level? This decline in return, that would mean transitory difficulties in the labor market, is due to a lack of labor demand and low absorption of additional labor whatever educational level capabilities are. In this case, we should review the incentives for job creation (Anteluis, 2000).

To respond to these questions, we estimate model (2) that integrates qualitative variables of education, (Table 17).

The new estimations confirm the previous results. They also show that:

- The education return rates are increasing according to the educational level; this is true in 1980 and 1999. The growth rates of return means that schooling continues to be a strategy that allows individuals to increase revenue as we advance in education. Incentives for human capital accumulation continue to be strong software. This result is general, it is observed for men and women, in urban and rural environments[5].
- Between 1980 and 1999, there was a decrease in return rates to all levels of education. This movement was observed both in urban and rural areas and for both men and women. But the decline in return rates is more important when the level of education is low. The return rates to primary education has declined 85.3%, that of secondary education 74.5% and finally to higher education 47.2%. These findings give reason to suspect an effect of general lack of demand for labor on the part of companies, that is to say, a lack of investment.

[5] However, there was in 1999, a lower rate of return for secondary education in rural areas.

Table 17. Estimation of the model (2) return rates by educational attainment

Regression		Sample size	INTERCEP	Explanatory Variables					R^2	F
				Level2 Primary	Level3 Secondar	Level4 Superior	EXP	EXP^2		
R_6 Total sample	1980	6055	3.137324 (106.43)	0.343998 (18.501)	0.909371 (42.540)	1.578066 (44.927)	0.04848 (25.135)	-0.000647 (-18.354)	35.05%	653
	1999	5976	4.094273 (128.423)	0.185635 (10.444)	0.521227 (28.589)	1.07226 (47.628)	0.06176 (28.921)	-0.000843 (-23.509)	43.51%	919.75
R_7 Male	1980	5232	3.292414 (102.18)	0.298864 (15.517)	0.832091 (36.597)	1.482259 (38.836)	0.04290 (20.671)	-0.000591 (-15.951)	32.27%	498.02
	1999	4535	4.283401 (113.770)	0.163284 (8.475)	0.511883 (25.630)	1.05924 (41.594)	0.05365 (22.296)	-0.000750 (-19.255)	41.29%	637.11
R_8 Female	1980	823	2.517194 (32.59)	0.677719 (11.041)	1.383976 (22.928)	2.093007 (24.236)	0.056930 (9.672)	-0.000641 (-4.928)	53.94%	191.34
	1999	1441	3.865017 (58.175)	0.245465 (5.874)	0.556414 (13.411)	1.143251 (24.028)	0.06701 (12.230)	-0.000903 (-8.433)	49.86%	285.4
R_9 Urban	1980	4236	3.189455 (93.22)	0.313530 (13.245)	0.860010 (32.633)	1.52022 (39.477)	0.04818 (21.520)	-0.000602 (-14.021)	36.28%	481.71
	1999	4324	4.025857 (102.760)	0.221004 (9.296)	0.551485 (23.170)	1.093666 (40.083)	0.06321 (24.863)	-0.000814 (-18.780)	47.6%	784.58
R_{10} Rural	1980	1819	3.301009 (53.85)	0.220123 (6.656)	0.795085 (18.120)	1.462747 (12.933)	0.03930 (10.063)	-0.000615 (-9.550)	22.29%	104.02
	1999	1652	4.367312 (74.680)	0.079546 (2.757)	0.364064 (10.572)	0.924159 (17.212)	0.05119 (13.069)	-0.000794 (-12.486)	26.63%	119.49

However, it can be argued that these movements are at least partly due to selection bias in return rates. We will try to see how the Heckman model can answer this objection.

3.4. Heckman Model: Labor Arbitrage between Urban and Rural Areas

Some women, as a different category of workers, for example, enjoy higher return rates of education. While, for other classes such as workers in rural areas, we observe lower rates. We are tempted to recommend new measures to encourage the education of girls and make more efforts to educate the children of the rural environment. Such measures are clearly inappropriate because return rates observed for women or those who are found in rural areas are marked by selection bias: Women have much higher tendency to activity when their level of education is high. The more educated people are more likely to migrate to urban areas.

In addition, observed high rates for women and reduced rates recorded in rural areas naturally have an impact on the average return rates in the whole population, they can lead to biased estimations which in turn can lead to misleading choices concerning educational policy or employment policy. To avoid these problems, many studies have referred to homogeneous populations: urban men by example[6].

[6] Thus the early work of Becker (1964) looked at samples of black men who do not work in agriculture.

To correct this selection bias which an estimation may suffer from, Heckman (1979) proposed a two-step method that involves firstly estimating a selection function and secondly reflecting it in the earnings function. This method was most often used to correct biases affecting the estimated education return rates for women. This implies that we have a sample consisting of active and inactive people that allows estimating a model of participation prior to the estimation of the gain functions. In the absence of such data, and as we have a sample consisting of exclusively employees, we adopted the method to account for potential selection bias in the estimation of education return rates in urban areas.

3.4.1. The Model

The first step is to estimate a Probit model of choice (Doquier, Laurent and Perelman 1998). This model incorporates the factors that determine the fact of working in urban areas. The dependent variable is dichotomous. Let's Z_i = 1, if individual i chooses the urban and 0 otherwise. Thus, we can write:

$$P_i = \text{Prob}\,[Z_i = 1 | X_i] = \phi(X_i)$$

with:

P_i: is the conditional probability of X_i to be employed in urban areas,
X_i: is the vector of individual characteristics;
ϕ(.) : is the distribution function of the normal law;
γ : is the vector of parameters to be estimated.
The specification chosen from X_i to the model is indicated as follows:

$$X_i\gamma = \gamma_0 + \sum_{j=2}^{4}\gamma_{1j} Level_{ij} + \gamma_2 NC_i + \gamma_3 MS_i + \gamma_4 Gend_i + \gamma_5 Ag_i + \gamma_6 Ag_i^2 + \mu_i \quad (3)$$

where:
Level: The different levels of education, Levl1 being the reference category;
NC: Number of children in the household, 0 being reference[7];
MS: Marital status of individual i, single being the reference category;
Ag: The age of the individual i that appears in the form of a polynomial of degree two, being 25 years of age reference;
Gend: The gender of individual i , woman being the reference category.

Importantly, at this level, the explanatory variables in the selection equation are of two types: continuous variables (number of children, age and age squared) and qualitative variables (level of education, state marital and sex). Taking into account the variables naturally implies the choice of a reference category that serves as a starting point to measure the differential effects of various methods or quantitative variables.

This allows calculating the various terms and variables average probabilities of participation ϕ (.), (Jennings, 1996).

Thus, the selection bias correction estimators results in the integration of the Mill's inverse ratio in the earnings equation. This is the term:

$$\lambda_i = \frac{\varphi(X_i\hat{\gamma})}{\phi(X_i\widehat{\gamma})}$$

where $\varphi(.)$ and ϕ(.) indicate respectively the density and distribution function of the normal distribution and g is the vector of estimated by Probit function parameters[8].

[7] The variable number of children is taken into account in estimating the 1980 data because information is not available in 1999.
[8] For further development on the issue, see Gouriéroux (1989).

After estimating, in a first step, the Probit model, it is necessary to estimate the earnings function in the following logarithmic form:

$$\ln y_i = \alpha_0 + \sum_{j=2}^{4} \alpha_{1j} Level_{ij} + \alpha_2 EXP_i + \alpha_3 EXP_i^2 + \alpha_4 \hat{\lambda} + \varepsilon_i \quad (4)$$

where:
ln y_i: The natural logarithm of the wage of individual i;
EXP: The professional experience;
$\hat{\lambda}$: Mill's reversed ratio.

3.4.2. Results

We proceeded to estimate n models (3) and (4) simultaneously using the Stata 6.0 software. Statistical tests are used to validate the estimations and show their strength. The selection model (Table 18) shows that the probability of working in urban areas increases with the level of education and number of children (Figure 10), it is higher for singles and is stronger for women. It is further observed that it is increasing and concave with age (Figure 11). These results are consistent with that observed from the statistics on the activity.

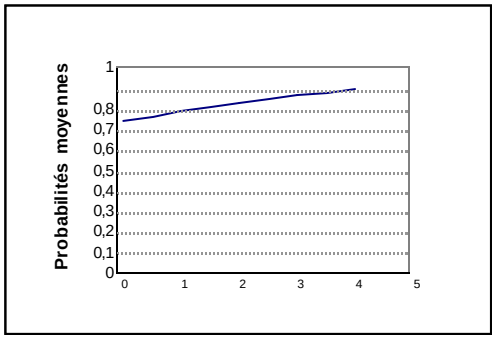

Figure 10. Probability of working in urban areas urban based on the number of children

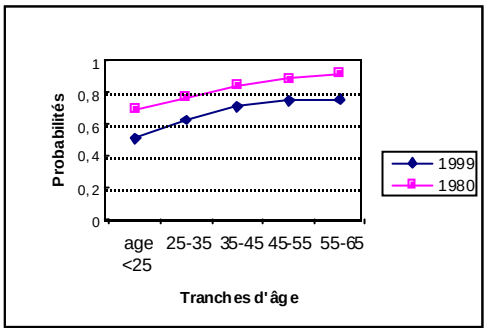

Figure 11. Probability of working in areas according to age

Notes: Based on the population-employment survey conducted by the National Institute of Statistics (NIS) in 1980 and 1999.

The reference individual (an employed woman, illiterate, single, no children, aged 25)[9] has, in 1999, 56.9% probability of being in urban areas against 73.5% in 1980. The probability of working in urban areas increases with the level of education and decreases with the modality: "married, divorced or widow". This probability increases with the number of children and age. It is lower for men.

The Mill's inverse ratio aiming at correcting the selection bias in the presence of the gain function has a coefficient of positive and statistically significant sign. This result confirms the existence of a correlation between working in urban areas and the expected level of wages.

[9] There is a degree of arbitrariness in the choice of the reference individual, various approaches have been adopted in the literature, Gatigual, Roy and Van Audendore (1999) refer for example using average profile.

Table 18. Estimation of models (3) and (4)

	1980				1999			
	Coefficient Estimé	Student's *t*-test	Estimated Probability		Coefficien	T of Student	Estimate Probability	
			Average	Variation			Average	Variation
Model (3) - Endogenous variable: working in urban areas								
							0.5690	
INTERCEPT	-0.167	-0.778			-1.0525	-5.695	0.8218	0.2528
Education Level:							0.9175	0.3485
Level2(primary)	0.7565	15.633	0.7347	0.1821	0.7483	12.814	0.9255	0.3565
Level3(secondary)	1.0957	20.367		0.2230	1.2149	19.702		
Level4(superior)	1.5093	12.486	0.9167	0.2492	1.2694	15.844	-	-
Number of children:			0.9577					
NC	0.1534	10.315	0.9838		-	-		
Marital Status**:**			(fig. 10)				0.5343	-0.0347
MS							(fig. 11)	
Age	-0.3656	-6.002	0.6031	-0.1316	-0.0877	-1.544 *	0.2841	
Ag	0.0353	2.795	(fig. 11)		0.0633	6.254		
Ag^2	-0.0001	-0.897*	0.3804		-0.0006	-4.882		-0.2849
Gender :								
Gend	-0.9313	-13.948		0.3542	-0.7445	-14.771		
Model (4) – Endogenous variable : Logarithme of wages								
INTERCEPT	2.963242	41.405			3.3795	34.238		
Education Level **:**								
Level2(primary)	0.4470	11.233			0.4248	8.085		
Level3(secondary	1.0577	21.650			0.8939	15.147		
Level4(superior)	1.7664	27.704			1.4573	22.917		
Experience **:**								
Exp	0.0499	17.013			0.0711	15.587		
Exp^2	-0.0006	-10.143			-0.0009	-11.570		
Chi 2	1690.18				1779.29			
IMR (Lambda)	0.3310	4.968			0.6161	8.067		
Observation	6055				5976			
(censored)	(1819)				(1652)			

The earning model corrected for selection bias (Table 18) results in higher education return rates than those obtained from the standard estimations. The rate of return to education is increasing with the level of education; incentives to carry on these studies as far as possible continue to be strong. As noted in the standard model, the return rates have decreased since 1980 for all educational levels, but this decrease is much less sensitive. In addition, unlike the results initially found, the relative decline in returns to education is much stronger when the education level is high. The rate of return to primary education has decreased by only 5.2% (against 85.3% in the standard model), the secondary education 18.3% (against 74.5% in the standard) and finally the higher education of 21.2 % (against 47.2% in the standard model) model.

4. Conclusion

Tunisia has begun resolutely to open its economy and try to integrate into the global economy. Evidenced by its commitments towards the *World Trade Organization (WTO)* and the *European Union (EU)*, this opening has an immediate impact on the economy: Tunisian companies must increasingly face, on their own market, competition with foreign producers; they must also cope with a reduction in state support. The activities unable to compete began to disappear, which

has weighed on employment and may seriously threaten the future. If we don't improve the choice of resource allocation to human capital, the downward trend may become more worrisome if it continues especially with advanced educational levels.

Faced with this situation two measures can be beneficial: a significant increase in foreign capital could rebuild the industrial GDP and boost employment and/or a resumption of international migration especially to the European partner especially depending on the qualitative change in resources human.

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