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CONTRIBUTION OF STRUCTURAL CHANGE TO PRODUCTIVITY GROWTH: EVIDENCE FROM TUNISIA

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Abstract

The objective of this paper is to analyze the evolution of productivity and the contribution of structural change to productivity growth in Tunisia since the mid eighties. Using sectoral and firm data we show that productivity increased at a relatively interesting pace, but that the contribution of structural change remained very limited. Trade and labor market reforms did not seem to increase it. The main reasons are barriers to entry in some sectors, the inefficiency of factor markets, and the focus of the firms' upgrading program only on some selected sectors.

JEL Classification: O14, 047, 055

Keywords: Productivity, Structural Change, Employment, Tunisia

ملخص

الهدف من هذه الورقة هو تحليل تطور إنتاجية ومساهمة التغيير الهيكلي إلى نمو الإنتاجية في تونس منذ منتصف الثمانينات. باستخدام البيانات القطاعية وبيانات الشركات يتبين لنا زيادة الإنتاجية بوتيرة مثيرة للاهتمام نسبيا، إلا أن مساهمة التغيير الهيكلي ظلت محدودة جدا. اما إصلاحات السوق والتجارة والعمل لا يبدو لهم زياده. الأسباب الرئيسية هي العوائق أمام الدخول في بعض القطاعات، وعدم كفاءة أسواق وعوامل الإنتاج، والتركيز على برنامج تطوير الشركات فقط فى بعض القطاعات المحددة.

1. Introduction

Tunisia presents an interesting setting in which to study the dynamics of structural change because it went through a progressive program of domestic and foreign liberalization process during the past twenty-five years. Until the late 1980s, a price regulation system had been used in Tunisia. Since 1986, numerous measures and reforms have been taken to gradually liberalize foreign trade and the economy: the structural adjustment plan (1986), the accession to the GATT (1989), to the WTO (1994) and the free-trade agreement with the European Union (1995).

The reforms concern several domains: trade liberalization, prices liberalization, deregulation, restructuring and privatization of government-owned firms, investment liberalization, modernization of the banking sector, reforms of the financial market, setting of an investment code, tax reforms, and development of incentives for foreign investment. Trade liberalization remained relatively limited over the first period (1995-1999) as the government was preoccupied with maintaining social stability and preparing companies for competition. After 2000, the government adopted a more active liberalization policy. Tunisia also undertook labor reforms with the goal of increasing labor market flexibility while maintaining some form of protection to workers at the same time. The main reforms of the labor code took place in 1994 and 1996. Tunisia also developed a competition law in 1991 which was amended several times (on 1993, 1995, 1999 and 2003) which reflects the will to reinforce competitiveness, to forbid anticompetitive practices and predominant abuses and to establish control of concentration.

What were the effects of these reforms on productivity within sectors and on the intersectoral mobility of resources? Were there reallocations from low productivity to high productivity sectors? Did these reallocations foster productivity growth? Did the competition law promote entry and exit of firms leading to higher productivity?

The methodology of this paper is based on productivity calculations at the sectoral and firm levels and regressions to explain the observed patterns of structural change in Tunisia. First we use sectoral data to investigate the evolution of labor productivity growth in Tunisia, its components (within sector productivity and structural change, following McMillan and Rodrik (2011)) and determinants in the 1983–2008 period. Sectoral data captures the reallocations that occurred and the potential misallocations of resources at the economy-wide level. Then we use the National Annual Survey Report to analyze structural change in the Tunisian manufacturing sectors, through the computation of total factor productivity using the approach of Olley and Pakes (1996).

The rest of the paper is organized as follows. Section 2 analyzes the evolution of productivity growth and employment share using sectoral data. Section 3 presents the decomposition of productivity growth between intra-sectoral and structural change components and the results of the regressions on some variables such as trade liberalization. Section 4 presents the firms' survey-based productivity analysis. In section 5 we present some policy discussions and section 6 concludes.

2. Structural Change in Tunisia: Sectoral Data Analysis

2.1 The dataset

We use industry-level data over the period 1983-2008 from the *Institut Tunisien de la Compétitivité et de l'Economie Quantitative* (ITCEQ). The study period covers a first phase from 1983 to 1995 when the Tunisian market had partially opened up (after signing a FTA with the EU) through the relaxation of restrictions on imports of inputs and equipment. After 1995, a more active trade liberalization policy was adopted as well as changes in domestic policies to try to adapt the economy to its new context.

The dataset covers the whole economy which we classify into nine sectors as defined in the ITCEQ classification and in the international standard industrial classification. The nine sectors are: agriculture and fishing, mining, manufacturing, public utilities, construction, hotels and restaurants and commerce, transport and communication, finance insurance and other private services, government services.

The database includes annual data on gross value added at both current and constant (1990 prices) prices from 1983 to 2008. It also includes data on employment, which allows for the computation of labor productivity (value added per worker) trends. Employment in our dataset is defined as ''all persons employed'', thus including wage-earners, as well as self-employed and family workers. For the derivation of meaningful productivity measures, the labor input and output measures should cover the same activities.

We first look at the evolution of employment and value added shares in the different sectors to get an idea of the timing and the intensity of structural change in Tunisia during the last three decades.

2.2 Employment and productivity evolution

Figures 1 and 2 present the sectoral composition of employment and of value added for the years 1983, 1995 and 2008. Tunisia experienced a significant decline in agricultural employment and value added shares especially between 1983 and 1995. The employment share of agriculture decreased from 29% in 1983 to 21% in 1995 and to 18% in 2008. Manufacturing experienced a modest increase in employment share from 17.5% in 1983 to 19% in 2008. Finance services experienced expansion from 1983 to 1995 in terms of employment share and value added share but stagnated after 1995. Hotels and retail sectors experienced significant increase in employment shares while their value added shares decreased during the same period. This means that these sectors became less productive over time.

Despite the stagnation in the employment share of the transport and telecommunication sector over the period of study, its value added share increased significantly between 1995 and 2008. This indicates that this sector became more productive over time. Technological innovations and the boom in demand for telecommunications services were some contributing factors for this evolution.

In sum, Tunisia experienced a modest structural change (a decline in agriculture employment and modest expansions in some services employment) particularly in the late 1980s and early 1990s but this structural change process slowed down after 1995. The employment shares did not change significantly after 1995 in the majority of sectors. These descriptive analyses and results will be further investigated in the next sections.

In a second stage, we focus on labor productivity in Tunisia and compare it with productivity in other countries. We also follow its evolution and the differences in productivity among sectors. Figure 3 presents productivity comparisons across some countries of different income levels. Labor productivity in Tunisia ($9.5 per capita in 2005) is 6 to 7 times lower than productivity in high income countries and in some Asian countries (France=$56, Italy=$51, Singapore=$62 in 2005); but it is almost twice higher than productivity in some African countries (Nigeria=$4.9, Senegal=$4.4 in 2005) (Mc Millan and Rodrik 2011).

Table 1 presents productivity by sector; large differences in labor productivity are found across sectors. This is particularly true for public utilities (a capital-intensive sector) and mining sectors where few people tend to be employed at very high labor productivity.

Productivity is high in public utilities and mining, but low in construction and agriculture. Labor productivity in public utilities is 20 times higher than in construction. The productivity

disadvantage of agriculture and construction is obvious. Labor productivity in transport and communication is four times higher than productivity in construction. Labor productivity in finance is very close to the level observed in manufacturing.

Figure 4**Error! Reference source not found.** shows the evolution of the coefficient of variation (in log) of sectoral labor productivities. An important decline in productivity gap between sectors is observed in the 1980s. It was relatively stable over a long term (1990-2005) but it tends to decrease at the end of the studied period. A small fall in productivity gap between sectors is observed at the end of the period. The level of this coefficient in Tunisia is high relative to coefficients observed in high income countries and in Asian countries but close to those in African countries (McMillan and Rodrik 2011) (0.047 in France, 0.058 in Italy, 0.12 in Thailand, 0.22 in Nigeria and about 0.23 in Tunisia in 2005).

Transport, communication and finance sectors are more productive than manufacturing, agriculture and construction. This high dispersion in productivity implies that job reallocations can contribute significantly to productivity growth.

The gaps in productivity levels are also large when we compare sectors with similar potential to absorb labor. The productivity gaps are high between manufacturing, construction and agriculture. Productivity gaps are also high between transport and communication, finance, and hotels.

We also calculate the annual productivity growth rate over the period 1983-2008 (**Error! Reference source not found.**). Transport and Communication is the sector with the fastest productivity growth rate (4.85 percent per annum between 1983 and 2008). At the other extreme, hotels restaurants commerce, and finance insurance and other services experienced negative productivity growth rates over the same period.

Figure 5 shows the evolution of productivity in the nine Tunisian sectors over the 1983-2008 period. Productivity stagnated or increased slightly in the majority of sectors over the period; it increased significantly in the mining, public utilities and transport and communication sectors at the end of the period, particularly post 2000.

Error! Reference source not found. presents simultaneously productivity and the share in employment in the nine Tunisian sectors in 2005. The sectors with high relative productivity, such as transport and communication and finance, are those with a very low share in employment. However, the sector with the highest employment share is agriculture where productivity is very low.

As illustrated in figure 6, Tunisia is still characterized by a large agricultural sector (about 20% employment share). However, productivity in manufacturing is almost twice as high as that of agriculture, and productivity in transport and telecom is more than three times higher than in agriculture.

Figure 7 shows simultaneously the evolution of productivity and share in employment in the nine Tunisian sectors over the 1983-2008 period. Sectors characterized by high productivity growth did not see their share in employment grow (transport and communication for instance), whereas sectors where the share in employment increased did not see their productivity rise (hotels and commerce).

3. Pattern of Structural Change in Tunisia (1983-2008)

We use the decomposition equation of labor productivity growth suggested by McMillan and Rodrik (2011) to calculate the within and the between components:

$$\Delta P_t = \sum_{i=1}^{n} \theta_{it-k} \Delta p_{it} + \sum_{i=1}^{n} p_{it} \Delta \theta_{it}$$

Where P_t and p_{it} refer to economy-wide and sectoral labor productivity levels, respectively, and θ_{it} is the share of employment in sector i at time t. Δ refer to changes between (t-k) and t.

Table 3 shows the within and between sector contributions to productivity growth in Tunisia during 1983–2008 period by sector and for the whole economy.

Between 1983 and 2008 Tunisia experienced a productivity change of almost 3 points, roughly all of which was accounted for by the within component via capital accumulation and technological change within sectors. The within contribution to growth is 2.88 points close to the overall labor productivity growth, while the contribution of structural change is positive but small, 0.14 points. Structural change has contributed little to the overall growth in labor productivity despite inter-sectoral productivity gaps during the studied period.

One of the reasons could be the absence of sector specific incentives in the investment code of 1993 or in the upgrading program which began in 1996. The structural change component is significant in the finance and hotels sectors where it has been growth enhancing and in the agriculture sector where it has been growth reducing.

The manufacturing and transport and communication sectors have made the greatest contribution to the overall productivity growth via the within component. The mining and public utilities sectors have made small and negative contributions to the overall productivity growth.

Table 4 shows the within and between sector contributions to productivity growth in Tunisia across different periods. Between 1983 and 1995, Tunisia experienced a low productivity change of 0.83 points, due, to a great extent, to the within component, the structural change contributing by about 20% to the overall productivity change. After 1995, Tunisia experienced a greater productivity change of 1.82 points with structural contribution near zero. The structural change component went from 0.16 during 1983-1995 to -0.004 during the 1995-2008 period. The within component of productivity growth increased significantly.

In sum, the contribution of structural change was very low until 2008. Productivity growth acceleration after 1995 is explained by productivity increases within sectors, not by reallocation of labor to more productive sectors. This is in line with our previous results indicating a low change in employment shares for the majority of sectors except agriculture, where the employment share decreased over the studied period, and the finance and hotels where the employment share increased despite the stagnation in productivity.

Productivity has grown in mining, public utilities and transport communication but the share of employment stagnated within these industries. Thus there is no significant correlation between change in employment shares and relative productivity levels in different sectors as indicated by the following graph 9 (end of 2008).

Error! Reference source not found.9 shows that the sector experiencing the largest employment growth is hotels and restaurants and commerce which are among the least productive. On the other hand, the transport and communication sector is among the most productive but this sector experienced almost no employment change. The manufacturing sector experienced a small gain in employment share even though it is not very productive. The finance sector experienced a large employment gain but it is also relatively not very productive. Agriculture is the sector with the largest relative loss in employment and it is also among the least productive sectors (with construction).

In sum, labor has moved slightly from the low productivity agriculture and construction sectors to modern sectors of the economy (finance, hotels…), but the productivity in these modern sectors was not high enough to produce overall growth enhancing productivity.

Table 5 shows a comparison of structural change with other countries. The pattern of productivity growth in Tunisia is somewhat like the pattern in Asian countries where the structural change has made a positive but small contribution to the overall productivity (McMillan and Rodrik 2011). The low structural change component in high income countries suggests that these countries have already defined their specialization pattern. The negative and high between component in African countries means that structural change was growth reducing in these countries; there was a move from high productivity sectors to less productive sectors.

3.1 Regression analysis: determinants of structural change

We carry out some regressions to try to explain the observed pattern of structural change in Tunisia.

We have 25 observations of the within component of productivity and structural change by year (1983-2008). We regress the structural change component on a labor market flexibility index and on some trade openness and foreign competition measures (customs duties (DD) and imports). We have to note that there are several difficulties in undertaking this analysis. One of these difficulties is the availability and consistency of data on policy reforms by sector, another one is the fact that reforms are often implemented simultaneously and it is hard to disentangle and to isolate the effects of different reforms. For example, a second reform of the labor code happened in 1996, so we could consider this year as a dummy for labor flexibility. However, the free trade agreement with Europe entered into force the same year.

3.2 Labor market flexibility

Labor market flexibility can contribute to the movement of jobs and workers from less competitive sectors to more competitive ones. The labor market in Tunisia operates under government regulations covering job security, minimum wage laws and collective bargaining. Firing a permanent worker in Tunisia is a particularly time consuming process. Tunisia undertook labor code reforms in 1994 and in 1996 with the goal of increasing labor market flexibility while preserving some form of protection for workers.

For labor market rigidity we use an indicator variable (D96) which is equal to 1 after reforms (after 1996) and zero otherwise. The estimation results suggest that structural changes decelerated after 1996, which means that the labor market reforms had a negative impact on structural change. However, this approach (before-after) might attribute productivity variation originating from some other shocks occurring simultaneously with the labor code reform, to labor market reform.

3.3 Foreign competition: customs duties and taxes on imports

The theoretical literature is generally positive about the effects of a greater trade exposure on productivity. By reducing protection, trade liberalization lowers domestic prices, potentially forcing high cost and low productivity producers to exit the market and leads to more entrants with higher productivity. Melitz (2003) shows that trade liberalization leads to an exit of less productive firms and a reallocation of output to more productive plants, which contributes to sectoral productivity growth. Some contributions also analyzed empirically the impact of trade liberalization on productivity in developing countries. Fernandes (2007) finds a positive effect of trade openness on productivity. The less competitive industries seem to be the main beneficiaries of productivity growth. Bottini and Gasiorek (2009) show also a positive effect of trade openness on productivity. However, this increase in productivity has a negative impact on job creation and job destruction, which they explain by the government incentives to invest in capital intensive sectors.

The effective rate of protection average[1] in Tunisia fell from 555 in 1985 to 56 in 2001 for the agrofood sector, from 203 in 1985 to 67 in 2001 for the textile and clothing sector and from 203 in 1985 to 50 in 2001 for the chemical industries. Disaggregated by industry, the percentage declines in effective rates of protection, particularly between 1986 and 1990, are impressive in all industries.

Yet, according to our econometric results, the fall in tariffs and taxes on imports in Tunisia (openness and foreign competition) had no effect on structural change. The rise in imports in Tunisia had a low and negative effect on structural change; import and foreign competition could lead some industries to contract and release labor to less productive activities and informality.

Tunisia adopted a gradual liberalization program. In its initial stage, liberalization was mainly for equipment and inputs. Furthermore, import procedures and customs clearance procedures remained slow and technical inspections remained complex and lengthy until 2001. Many quantitative import restrictions were also imposed. This constitutes one of the main factors responsible for the stagnation of imports (Marouani and Lahouel 2003). This is mainly due to the government's concern with maintaining employment and social stability and preparing companies for competition**.** Since 2001, Tunisian customs have been carrying out reforms to simplify import procedures. We have also to indicate that, in the last twenty-five years, there was a gap between the announced reforms and the facts.

However, the fall in tariffs and taxes on imports (openness and foreign competition) had positive and significant effects on the within component. The rise in imports also had a positive and very significant impact on the within effect. Lower prices and easier access to foreign machinery and technology provided an incentive for firms to adopt new technology and then to increase their productivity (within).

4. Structural Change in the Manufacturing Sector (1997-2002): Micro Data Analysis

In this section we use micro data on Tunisian manufacturing firms to analyze productivity gaps and structural change across manufacturing sectors. The available data is taken from the National Annual Survey Report on Firms (NASRF) carried out by the Tunisian National Institute of Statistics (TNIS). The data covers firms from different manufacturing sectors over the period 1997-2002 (the only period at our disposal). The survey looks at firms' accounts. We consider the period 1997-2002 as an interesting time to capture the effects of trade and economic reforms. Indeed, economic impacts of several measures implemented in Tunisia to liberalize trade and the economy since 1986, were generally not clearly visible before 1997.

In the first stage, the dataset is been "cleaned" from observations which could be seen as erroneous or which were clearly outliers. The empirical analysis was based on an unbalanced panel consisting of a sample of about 2,564 firms from the agro-food (IAA), the chemical (ICH), the ceramic (IMCCV), the "other industries" (IMD), the electric (IME) and the textiles, wearing, leather and footwear (ITHC) industries (see table 7). These firms were observed from between 1 and 6 annual and consecutive observations (to avoid the risk of false flows**)** over the period 1997-2002. The firm's activity is described by a one-digit Tunisian nomenclature of economic activities which leads to our six manufacturing sectors.

[1] The effective rate of protection is defined as the proportional increase in value added resulting from the imposition of protective measures**.** It measures the percentage by which value added can increase over the free-trade level as a consequence of a tariff structure. The effective rate of protection captures protection of intermediate and final goods. It also captures tariff or non-tariff protective measures. A negative rate implies that input industries are particularly favoured. These negative rates indicate higher tariffs on input imports than on final goods.

The dataset includes: value added (y) measured in constant prices (deflated by a four digit industry specific price deflator), tangible and intangible fixed assets, investment and labor (number of employees L). The number of employees is adjusted according to whether it is part time or fulltime equivalent employment.

To compute a capital stock proxy we followed Mairesse and Bronwyn (1996) by considering the tangible fixed assets deflated by the gross fixed capital formation deflator as a capital stock proxy.

The unbalanced panel dataset at our disposal contains also information on some firm characteristics such as: the "ownership", a private or a public firm, the percentage of foreign capital participation, the exporting rate which is the percentage of foreign sales. Table 8 presents some descriptive statistics and suggests that, despite our panel containing firms of different sizes (from 1 to 4,177), on average the observed firms are small (102).

However with the unbalanced panel dataset at our disposal we are not able to distinguish between newly created firms and firms that simply enter the pool at a given period but were already operating in the period before. The same problem arises when a firm exits the panel. We do not know if it is because it ceased production or if it did not respond to the survey. Thus we cannot calculate the exit rate. Our database does not allow us to identify the new entrants in each industry or to track their exit over time.

4.1 Measuring TFP: Olley and Pakes (1996) procedure

To analyze structural change in the Tunisian manufacturing sectors, we first derive estimates of firm level total factor productivity (TFP) using the Olley and Pakes (1996) approach.

The traditional methodology for estimating TFP followed the neoclassical growth accounting framework and used the Solow residuals from a production function regression as the measure of TFP. Olley and Pakes (1996) demonstrated that this methodology does not account for the possible endogeneity of inputs and suggested a method to correct for the associated biases. Their approach is designed to deal with both problems of simultaneity between the choice of inputs and the firm's productivity and the selectivity bias due to entry and exit in an unbalanced panel. A plant's private knowledge of its productivity affects its behavior on using inputs (simultaneously hiring or firing labor, investing in new capital or not, etc.).

We first assume that a firm-specific production function can be described by a Cobb-Douglas form as:

$$y_{it}=A_{it}^{\gamma} K_{it}^{\alpha} L_{it}^{\beta} \qquad (1)$$

Where *y* indicates the output, *K* and *L* are capital and labor inputs, respectively. α and β are parameters to be estimated, representing factor share coefficients. The subscripts *i* and *t* make reference to the *ith* firm and the *tth* time period. A allows for total factor productivity.

Specifying the production function in log linear form, the following equation may be written:

$$\ln y_{it} = cte + \alpha \ln K_{it} + \beta \ln L_{it} + w_{i\,t} + v_{it} \qquad (2)$$

w_{it} captures the productivity **s**hock and v_{it} captures all other shocks.

To deal with the problem of simultaneity between the choice of inputs and the firm's productivity, Olley and Pakes (1996) offer an approach which consists in using investments as a proxy of productivity shocks. The selection bias due to entry and exit is also controlled in the estimation of the production function.

9 presents the estimated coefficients of the labor and capital elasticities in the production function of different sectors. From this table, we can see that the results from the fixed effects method and from the Olley Pakes method are significantly different. The elasticities estimated by Olley and Pakes method are more accurate and are in conformity with many other results on Tunisian manufacturing (Goaied and Mouelhi 2003, Mouelhi 2007). Therefore, accounting for endogeneity of inputs and for selectivity bias seem to be important for the accurate estimation of firms' TFP.

The elasticities of output with respect to labor are higher than the elasticities of output with respect to capital, reflecting the high labor use in Tunisian manufacturing.

Once the input elasticities were consistently estimated, the plant level TFP was deduced using the following equation:

$$TFP_{it} = \frac{y_{it}}{L_{it}^{\beta} K_{it}^{\alpha}} \qquad (3)$$

Aggregate industry productivity is calculated annually as the share weighted average of the plant level productivity, using plant level output share as weights.

Figure 10 shows the TFP evolution over the period 1997-2002 by industry. On average, the weighted TFP has been higher in the chemical and IAA sectors than in the other manufacturing sectors. TFP in IMCCV sector on average is significantly lower than in the other sectors. It also appears from this graph that the TFP, on average, stagnated until 2000. It has increased gradually toward the end of the sample period in the IAA, ICH and ITHC sectors. Productivity growth over the studied period was limited. The productivity stabilization probably reflects the cost of the reorganization and restructuring process.

Differences in TFP are observed across sectors. ICH and IAA are the sectors with the highest TFP and the productivity-disadvantage of IMCCV is obvious. This would lead to a reallocation of output from less efficient to more efficient sectors and to productivity gains.

4.2 Productivity decomposition: Structural change

To check the importance of productivity gains stemming from the reallocation of resources from less to more productive firms we follow Olley and Pakes (1996) and decompose the industry productivity measure. In a given year, the aggregate industry productivity measure (P_t) is a sum of the unweighted average of firms' productivity and a weighted average of firms' individual productivities TFP_{it} with an individual firms' weight *pmit* corresponding to its output share in total industry, in a particular year.

$$P_t = \overline{TFP}_{it} + \sum_i \Delta pm_{it} \Delta TFP_{it} \quad = \quad \text{within effect} \quad + \text{between effect} \qquad (4)$$

$\overline{TFP}_{it}$ is the unweighted average of firm-level productivity

pm_{it} is the share of firm i in the given sector at time t

TFP_{it} is the total factor productivity measure of an individual firm i at time t

Δ refers here to the deviations from the means,

With:

$$\Delta pm_{it} = pm_{it} - \overline{pm}_t \quad \text{and} \quad \Delta TFP_{it} = TFP_{it} - \overline{TFP}_t$$

And, $\overline{TFP}_t$ and $\overline{pm}_t$ represent unweighted mean productivity and mean output share, respectively.

The change in weighted productivity P_t depends, both on the change of any given firm's productivity (within effect) and on changes in aggregate productivity arising from firms' entry and exit flows (a reallocation of factors towards more productive firms). This is the "between" or "turnover effect", a sample covariance between productivity and output share. This represents the contribution, of the reallocation of market share and resources across plants with different productivity levels to the aggregate weighted productivity. Thus, if there is a reallocation of resources within industries from less to more productive plants, the latter measure should be positive and increasing over time.

Table 10 presents the within and the between components of productivity and their evolution over the period 1997-2002, by industry. It shows that the within effect is significantly higher than the between effect in all sectors. The within component, such as internal restructuring and organizational change, was the most important source of productivity in Tunisian's firms. The unweighted productivity increased between 1997 and 2002 in the IAA (4.2%), ICH (1%), ITHC (4.7%) and ID (1.76%) and it decreased in IMCCV (-3.3%) and in IME (-0.27%). Between 1997 and 2002 Tunisian manufacturing experienced a productivity growth of almost 1.5 percent, roughly all of which was accounted for by the within component. These were due to some increases in the unweighted productivity (within). However, the reallocation component has stagnated and, in some cases, declined (only ITHC shows an increase in the structural change component between 1997 and 2002). The restructuring process was not important and not sufficient to lead to a more significant increase in the overall productivity.

The results also suggest that the weighted average productivity (the between component) has not changed significantly over the studied period. The reallocation of output from less productive firms to more productive firms was not very important.

We used labor productivity instead of total factor productivity to test the robustness of our results. The results from the decomposition of labor productivity were very similar to those obtained with TFP. Structural change has not been very important and has not varied significantly over the period and it has declined in four sectors. The increase in the overall productivity is due to the within component.

In sum, while heterogeneity in productivity is a common finding in sectoral data and in firm-level micro data, these differences were not exploited in a way that contributes to aggregate productivity growth. Obstacles to free entry and exit, among other factors, hinder the reallocation process and are likely to slow productivity growth.

5. Policy analysis

The low level of structural change in Tunisia may be due to obstacles to growth in the size of firms throughout the whole economy and barriers to entry in some specific sectors but also to labor market inefficiencies and bad governance.

5.1 Political economy issues

A recent firm survey (IEQ 2008 cited by World Bank 2010) points out the problems of anti-competitive behavior from firms that do not pay taxes or social security (their owners being protected by the Government or informal firms). Given the non-independence of the judiciary system, protection of property rights is not guaranteed. Thus, it is rational that some firm owners prefer keeping their business small to avoid having to lose its control to the ruling families (most big businesses in Tunisia ended being controlled directly or indirectly by these families). Moreover, corruption, arbitrariness and discretion in the links with the public administration create a climate of uncertainty that does not favor investment.

There are also obstacles to free entry in some regulated sectors such as transport and telecom or financial services (World Bank 2007). These barriers impede firms and slow down job

creation in these sectors and also have a negative impact on the rest of the economy as they induce higher production costs. For example the monopoly of *Tunisie Telecom* on landlines had a negative impact on internet providers development and consequently on backbone services development in Tunisia.

The lack of access to credit and its high cost also seem to be severe constraints on investment (IEQ 2010, cited by World Bank 2010). Informal firms almost do not have access to it, but formal firms also suffer from favoritism, or the lack of, in access to credit. Due to the high rate of non-performing loans in Tunisia, the Central Bank has imposed high provisions on Tunisian banks which increased the credit rationing on Tunisian firms financing.

5.2 Inefficient capital and labor markets

The sluggish adjustment in productivity growth conforms to the imperfections in the Tunisian factors market. Various costs inhibit factor mobility in the Tunisian economy.

Where the capital market is concerned we have already pointed out the difficulty of access to credit. However, there is also a problem of irreversibility of investment due to the small size of the second-hand market in capital goods. Less efficient firms may not exit if they are cross subsidiaries to affiliates in other sectors. Firms that invest heavily in capital equipment may face significant costs if they wish to leave the market and are therefore forced to stay on even if productivity is low. Bankruptcy rules are also not well developed.

As for the Tunisian labor market, it is characterized by difficult and costly hiring/firing procedures for permanent workers which impedes their mobility from one activity to another rapidly. Moreover, the share of temporary contracts has recently increased dramatically. This give way to a very inefficient and dual labor market; there is a highly protected segment yet there is an increasing number of unprotected workers, and a high and increasing unemployment rate. The education and training systems seem to be non-reactive and inefficient in breeding specific skills needed for the new high productivity activities (World Bank 2008).

5.3 The firms upgrading program

This "*Programme de mise à niveau"* (PMN) was intended to help Tunisian firms compete with European firms after the implementation of the Free Trade Agreement with the EU in 1996. To our knowledge there is no independent evaluation of this program, based on a thorough selection of a control group to avoid selection (or auto-selection) biases when assessing the impact of the program. The sectoral distribution of the program intervention is dominated by three sectors, textiles and clothing (THC), the food industry and mechanical and electrical industry. THC alone represented 48% of the accepted applications in 2008 and 27% of the volume of investments (IEQ 2010). This high level of support granted to a sector suffering from an increased competition at the global level may contribute to explain the low level of structural change in the country. Services have been excluded from this program which is limited to manufacturing industries.

The positive impact of the PMN seems to be the increase of immaterial investment (mainly in technology) and the development of the export potential [60% of treated firms in the sample which have never exported before exported in 2002 (Bougault and Filipiak 2005)]. However, the authors emphasize the risk of grants hunting by some firms given that these grants are not linked to productivity improvements but to investment realizations.

5.4 Sophistication and export composition

The analysis of the technological sophistication of Tunisian exports can help to understand the evolution of productivity and the specialization process. Tunisia tends to specialize in products and industries that exhibit less linkages, spillovers and potential for productivity.

According to Diop and Ghali (2012), the share of high-tech products is low in Tunisia in comparison to other emerging countries, however the share of medium-tech products is higher than some of them (such as India or Indonesia). The sophistication of exports seemed to increase steadily since 2004.

Using the methodology developed by Hausman et al. (2007), Hausman and Bustos (2012) find Tunisia on the regression line when they analyze the relationship between the export basket sophistication (EXPY) and income per capita. Meanwhile high-growth countries have EXPY levels much higher than the regression predictions.

The authors also compute the Economic Complexity Index (ECI), following the methodology developed by Hidalgo and Hausmann (2009), who show that the distance between the country and the regression line (EPI and income per capita) is a strong predictor of growth due to higher production capabilities than their current income per capita. Hausman and Bustos (2012) find that Tunisia is below the trend line, which means higher growth potential in the future.

However, the increase in the technological content of exports has an impact on the whole economy if there are strong links between exporting firms and the rest of the economy. In Tunisia, the offshore sector is largely disconnected from the onshore sector which seems to face higher constraints and has lower productivity (World Bank 2007). Exporting companies remain apart from the rest of the economy because they are not allowed to sell locally and are not motivated to buy their inputs on the domestic market (free tariffs on their imports). This enclave economy prevents any spillover effects to the rest of the economy (Ben Romdhane 2007).

6. Conclusion

The aim of this paper is to analyze the evolution of productivity and the contribution of structural change to productivity growth in Tunisia since the mid-eighties. The analysis is conducted on sectoral and firm data.

Although lower than the levels observed in Asia, productivity growth in Tunisia has been relatively high in the last twenty-five years (1983-2008) if compared to the main regions in the world (Africa, LAC, etc.). If we subdivide this period in two (before and after 1995) we notice that productivity growth has more than doubled in the latter period. This means that the reforms implemented have had a positive effect on productivity. However, these effects were concentrated on the within sector component of productivity. Structural change was very low before 1995 and nil since, while we would have expected trade liberalization and labor market reforms to enhance the inter-sectoral movement of resources. This observation based on sectoral data analysis is confirmed by the regressions of structural change on policy reform variables and by the analysis based on firm data of the manufacturing sector.

Regulatory, unofficial barriers to entry in some sectors and bad governance seem to be the main reasons behind the low structural change in Tunisia. The inefficiency of capital and labor markets also contributes to slowing the inter-sectoral reallocation of resources. The dominance of a traditional specialization patterns and the absence of incentives to diversify to higher productivity activities also explain the small magnitude of factors reallocation. Finally, the firms' upgrading program was only targeted at the sectors endangered by the free trade agreement with Europe and the dismantling of the Multifiber Agreement, and thus the program ignored some dynamic service sectors which could have absorbed more skilled labor and contributed more to total productivity growth.

References

Bottini, N., and M. Gasiorek. 2009. Trade and job reallocation: Evidence for Morocco. ERF Working Papers 492.

Ben Romdhane, M. 2007. Trade and development strategies : The case of Tunisia. CAPC, work in progress, Economic Commission for Africa, vol.53, 5–42.

Bougault, H., and E. Filipiak. 2005. Les programmes de mise à niveau des entreprises Tunisie, Maroc, Sénégal. Mimeo, French Development Agency, Research Department, 1–173.

Diop, N., and S. Ghali. 2012. Are Jordan and Tunisia's exports becoming more technologically sophisticated? Analysis using highly disaggregated export databases. Working Paper Series 54. Middle East and North Africa Department, The World Bank, 1–32.

Fernandes, A. M. 2007. Trade policy, trade volumes and plant-level productivity in Colombian manufacturing industries. *Journal of International Economics* 71:52–71.

Goaed, M. and R. Mouelhi. 2003. « Efficiency measure from dynamic and stochastic production frontier : Application to Tunisian textile, clothing and leather industries », Econometric Reviews, Vol. 22, No. 1, pp. 93-111, 2003.

Hausmann, R., and S. Bustos. 2012. Comparative study of export policies in Egypt, Morocco, Tunisia and South Korea. Chapter I, Structural transformation in Egypt, Morocco and Tunisia: A comparison with China. Mimeo, African Development Bank 33–83.

Hausmann, R., J. Hwang, and D. Rodrik. 2007. What you export matters. *Journal of Economic Growth* 1(12):1–25.

Hidalgo, C., and R. Hausmann. 2009. The building blocks of economic complexity. *Proceedings of the National Academy of Sciences* 106:10570–75.

Institut Tunisien de la Compétitivité et de l'Economie Quantitative (ITCEQ), sectoral data from 1983 to 2008.

Mairesse, J., and H. Bronwyn. 1996. Estimating the productivity of R&D: An exploration of GMM methods using data on French and US manufacturing firms. NBER Working Papers 5501.

Marouani A., and M. Lahouel. 2003, Les accords euro-méditerranéens: les enseignements du cas tunisien. Working paper.

McMillan, M., and D. Rodrik. 2011. Globalization, structural change and productivity growth. NBER Working Paper 17143, 1–54.

Melitz, M. J. 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica* 71:1695–725.

Mouelhi, R. 2007. Impact of trade liberalisation on firm's labour demand by skill : the case of Tunisian manufacturing. Labour Economics, vol 14, issue 3, june 2007, pages 539-563 ;

National Annual Survey Report on firms. National Institute of Statistics, 1997-2002.

Nickell, S., and R. Layard, 1999. Labor market institutions and economic performance. In *Handbook of Labor Economics*, ed. Orley C. Ashenfelter and David Card, Ch. 46, 3029–84. Elsevier.

Olley, S., and A. Pakes. 1996. The dynamics of productivity in the telecommunications equipment industry. *Econometrica* 64:1263–97.

ITCEQ 2010. Evaluation du programme de mise à niveau, Résultats de la septième enquête sur le Programme de Mise à Niveau, 5–112.

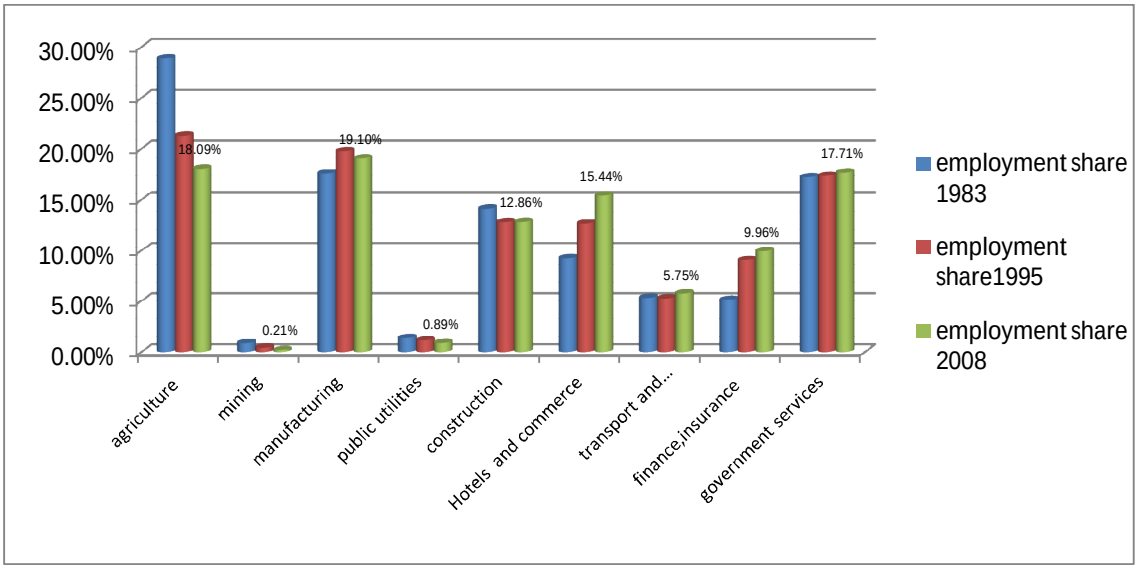
World Bank 2010. Development policies review: Towards an innovative growth. Economic and Social Development Group: MENA Region Report No. 50487, 5–98.

World Bank. 2009. From privilege to competition unlocking private-led growth in the Middle East and North Africa. MENA Report number 243.

World Bank. 2008. Tunisia labor demand, skills supply and employment: Towards an integrated strategy for job creation-phase II., Policy Note Middle East and North Africa social development group (MNSHD), The World Bank, 1–84.

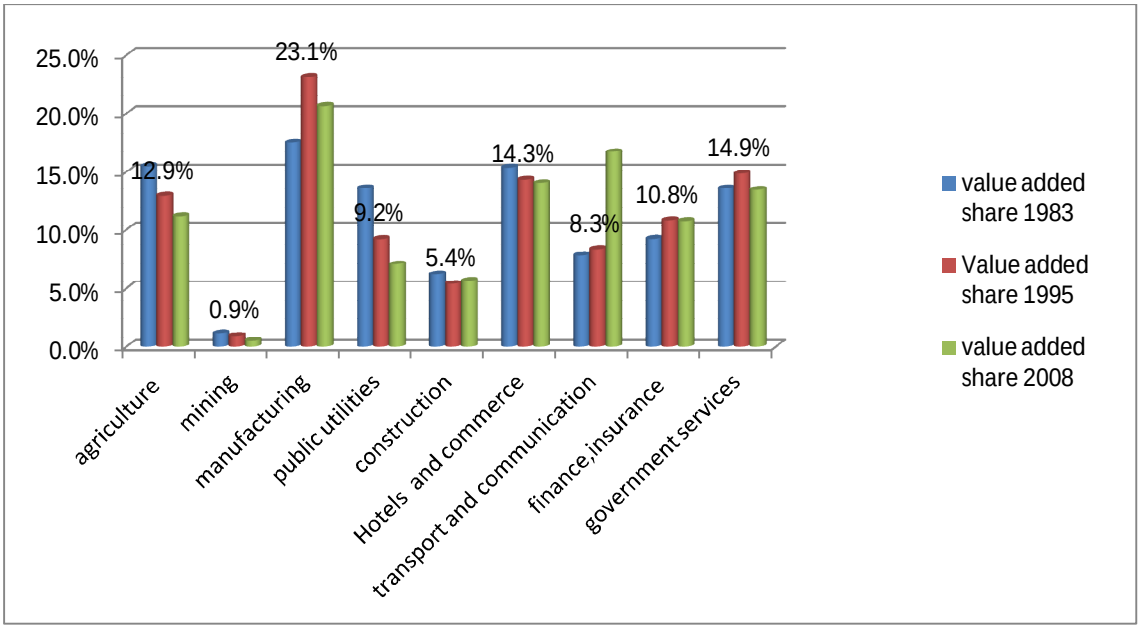
World Bank. 2007. Tunisia global integration: Second generation of reforms to boost growth and employment. MNSED Report n°40129-TN.

Figure 1: Sectoral composition of employment 1983, 1995 and 2008



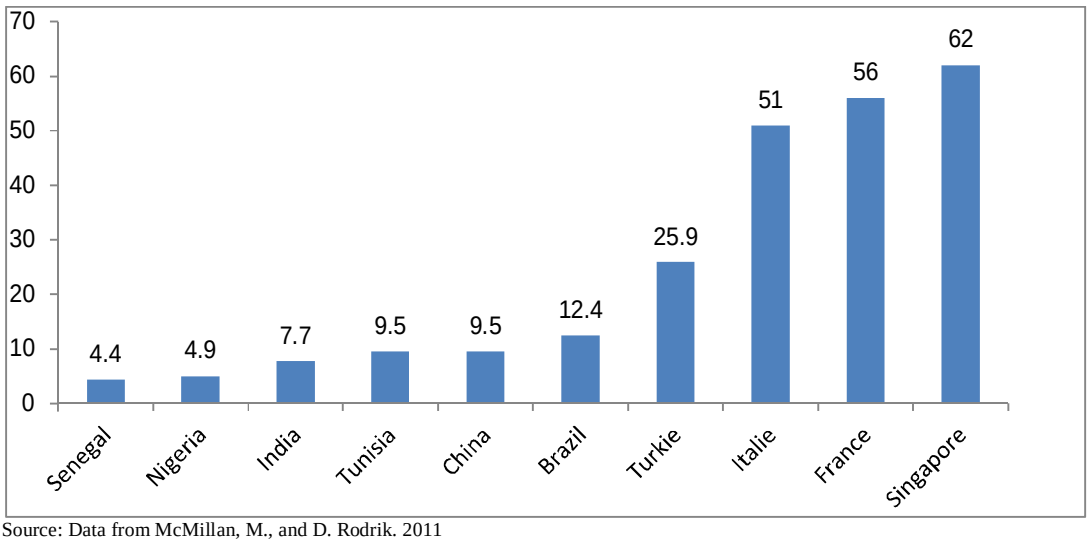
Source: Authors' calculation

Figure 2: Sectoral composition of value-added, 1983, 1995 and 2008



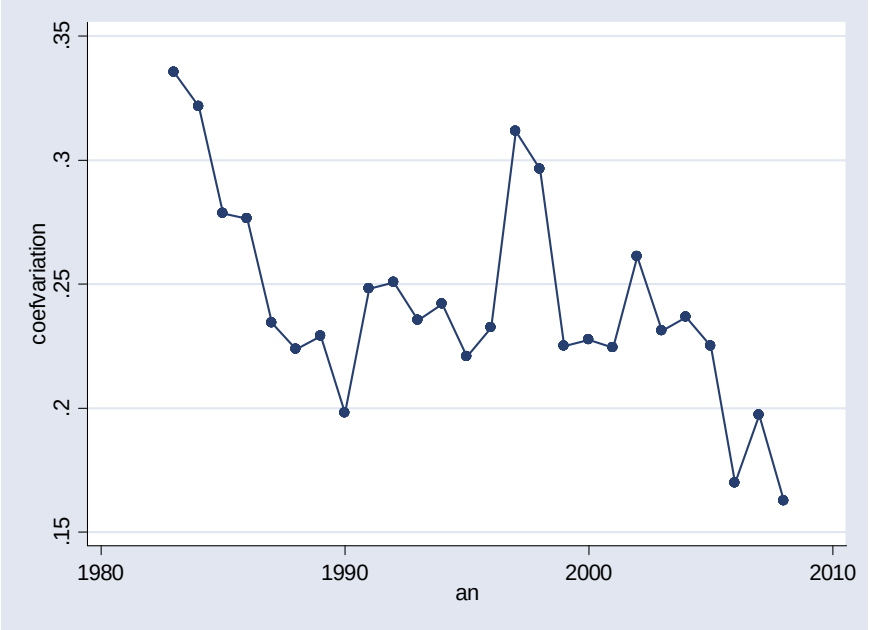
Source: Authors' calculation

Figure 3: Productivity Comparison across Countries (2005)



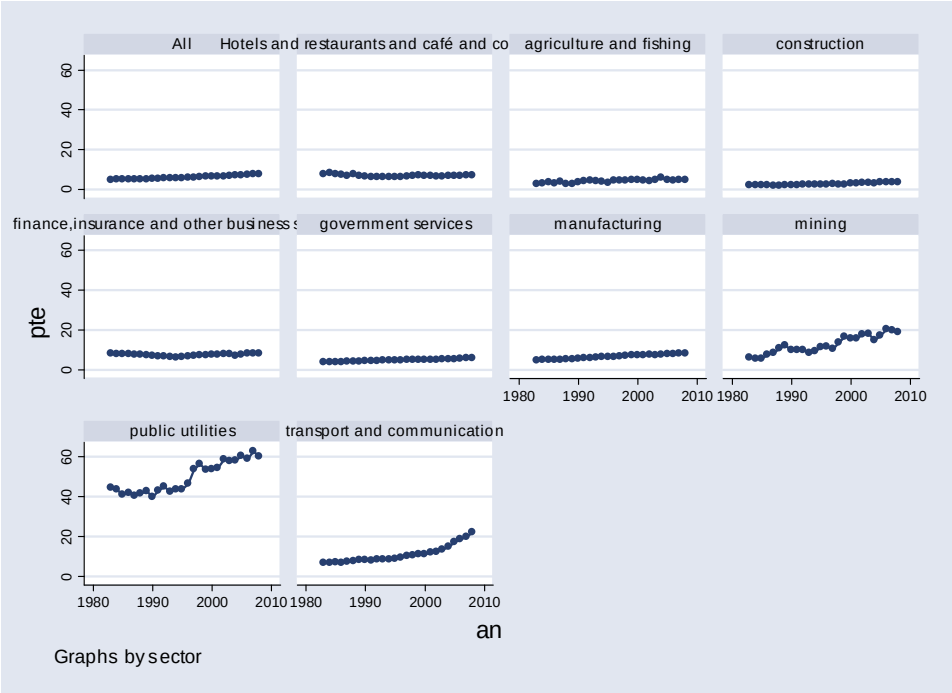
Source: Data from McMillan, M., and D. Rodrik. 2011

Figure 4: The Productivity Gap



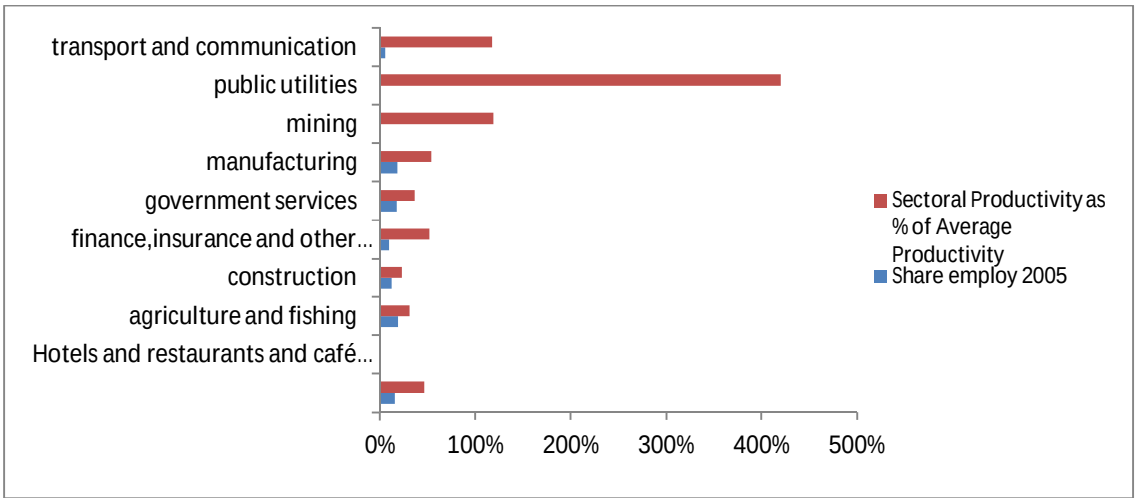
Source: Authors'calculation

Figure 5: Sectoral Productivity Evolution



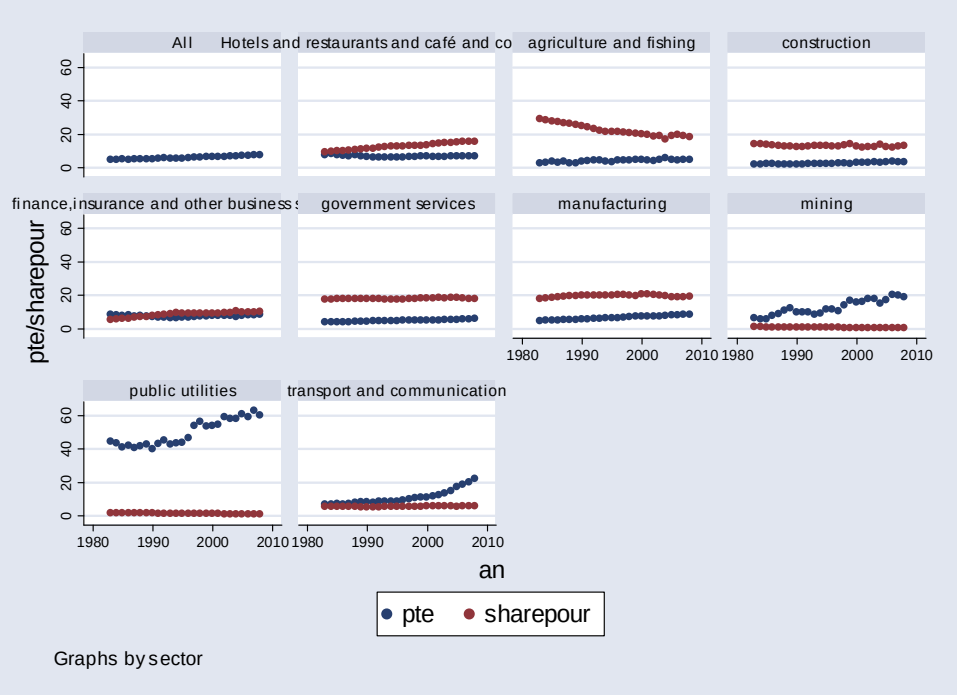
Source: Authors' calculation

Figure 6: Sectoral Share of Employment and Productivity



Source: Authors'calculation

Figure 7: Productivity and Share of Employment Evolution



Source: Author's calculation

Figure 8: Within and between Contribution in Productivity Growth

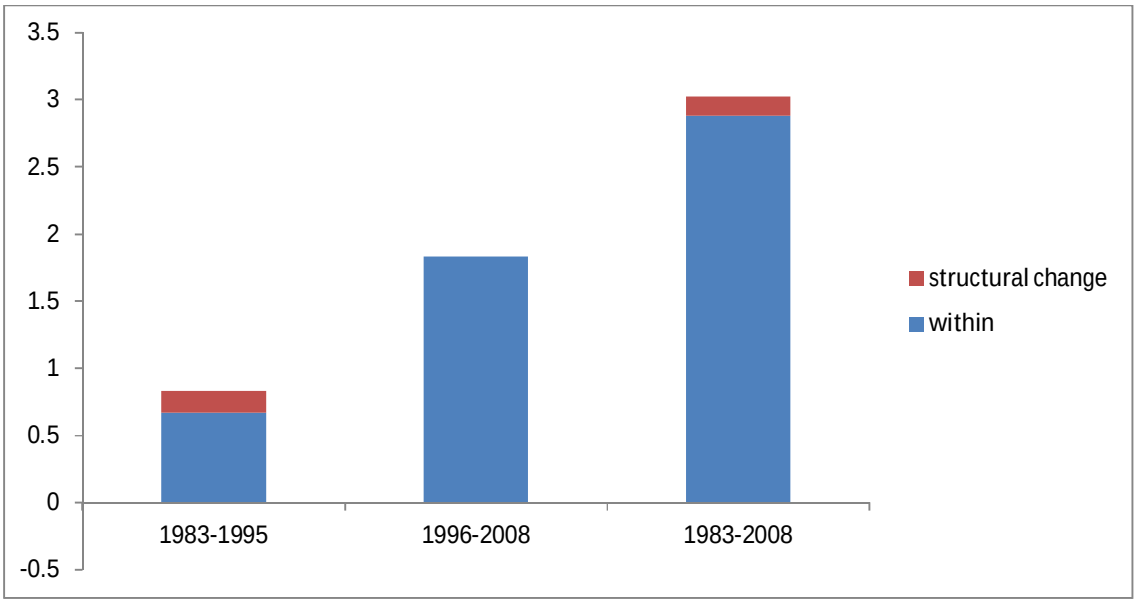


Figure 9: Relative Productivity of Sectors Against The Change in Their Employment Share

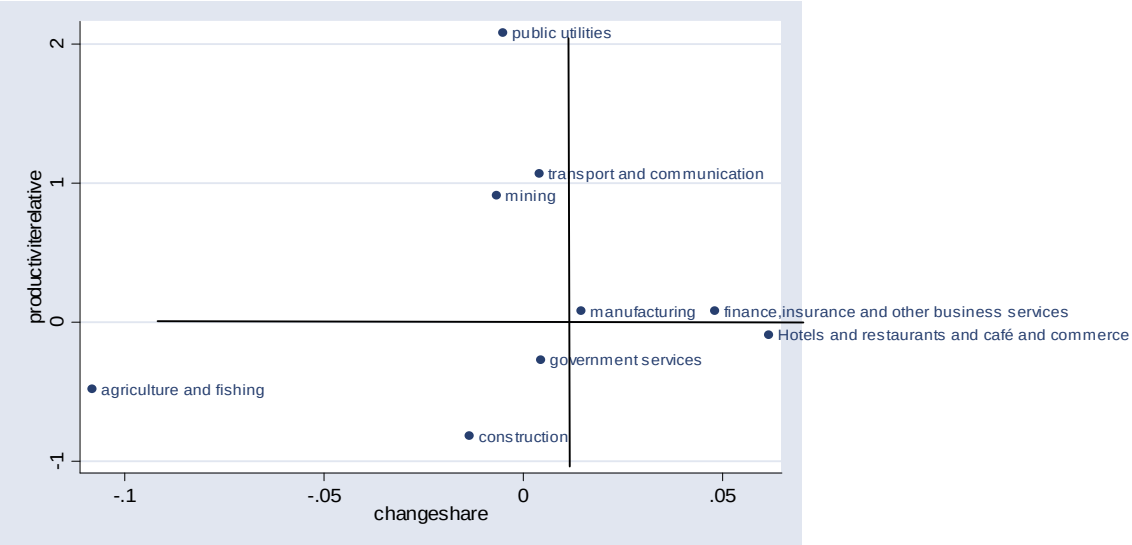


Figure 10: Evolution of Weighted Average Productivity by Industry

Table 1: Productivity by Sector

Sectors	Mean (1983-2008)	Standard Deviation	Min	Max	Productivity Level 2005	Productivity Annual Growth Rate (1983-2008)
Construction	**2.4**	0.5	1.8	3.4	3.3	**2%**
Agriculture	**3.9**	0.8	2.4	5.7	4.5	**2.6%**
Government services	**4.6**	0.6	3.6	5.7	5.2	**1.9%**
Manufacturing	**6.3**	1.2	4.5	8.1	7.8	**2.3%**
Hotels, restaurants, café and commerce	**6.6**	0.6	5.9	8.1	6.7	**-0.4%**
Finance, insurance other services	**7.3**	0.6	6.1	8.2	7.5	**-0.014**
Transport communication	**10.7**	4.3	6.6	21.9	17.0	**4.9%**
Mining	**12.4**	4.5	5.4	20.3	17.1	**4.6%**
Public utilities	**49.5**	7.8	39.8	62.7	60.5	**1.2%**
All	**5.8**	0.9	4.5	7.5	6.9	**2.%**

Note: The sectors are sorted according to their average labor productivity.
Source: Authors' calculation

Table 2: Sectoral Share of Employment and Productivity

Sectors	Employment Share (2005) %	Sectoral Productivity as % of Average Productivity
Hotels, restaurants, café and commerce	15.2	46.4
Agriculture and fishing	19.1	31.0
Construction	12.3	22.9
Finance, insurance and other business services	9.8	52.0
Government services	18.2	36.1
Manufacturing	18.9	54.1
Mining	0.2	119.1
Public utilities	0.9	420.6
Transport and communication	5.4	118.0

Source: Authors'calculation

Table 3: Decomposition of Productivity Change by Sector, 1983-2008

	Within	Between (Structural Change)	Total
Construction	0.18	-0.041	0.14
Agriculture	0.62	-0.46	0.16
Government services	0.37	0.029	0.39
Manufacturing	0.63	0.12	0.75
Hotels and restaurants and café and commerce	-0.063	0.42	0.39
Finance, insurance other services	-0.0011	0.39	0.39
Transport communication	0.81	0.098	0.9
Mining	0.1	-0.12	-0.02
Public utilities	0.21	-0.29	-0.081
All (Tunisia)	**2.88**	**0.14**	**3.02**

Table 4: Productivity decomposition in Tunisia across Two Periods

	Within	Between	Total
1983-1995	0.67	0.16	0.83
1996-2008	1.83	-0.004	1.82

Table 5: Decomposition of Productivity Growth by Region

	Annual growth rate of labor productivity %	Component due to within %	Component due to structural change %
Tunisia (1983-2008)	**2.0**	**1.9**	**0.1**
LAC (90-2005)	1.35	2.24	-0.88
High income	1.46	1.54	-0.09
Africa	0.86	2.13	-1.27
Asia	3.87	3.31	0.57

Table 6: Determinants of Structural Change Magnitude

Explanatory factors	**(1)**	**(2)**	**(3)**
D96	-0.078***		
(labor flexibility)	(-3.96)		
DD and taxes		0.01	
		(1.54)	
Imports			-0.000013**
			(-2.19)
Observations	25	25	25
R squared	0.4	0.093	0.17

Notes: Dependent variable: structural change component

Table 7: Number of Firms by Industry

Industry	IAA	IMCCV	IME	IHC	ITHC	ID	Total
Number of firms	319	189	407	201	1170	278	2564

Table8: Descriptive Statistics

Variable	**Mean**	**Std. Dev**	**Minimum**	**Maximum**	**Observations**
Value added	799105.3	3814494	7.28	1.51e+08	8103
Capital	1648626	9628098	1	5.73e+08	8123
Labor	102.3484	203.7456	1	4177	8303

Table 9: Parameter Estimates of the Production Functions in Manufacturing Sectors

	Dependent Variable: Log(y) Olley Pakes (1996) method			Sample Period: 1997-2002 Fixed effects model		
Sector	**ln L**	**ln K**	**Observations**	**ln L**	**ln K**	**Observations**
IAA	.5025 *** (.0786)	.2331 *** (.0591)	736	.1387 *** (.0484)	.1257 *** (.0267)	933
IMCCV	.6845 *** (.1107)	.2840 *** (.0812)	490	.4308 *** (.1143)	.1629 *** (.0431)	574
IME	.6528 *** (.0404)	.2593 *** (.0728)	1107	.3476 *** (.0512)	.0840 *** (.0234)	1296
ICH	.5271 *** (.0813)	.2235 *** (.0461)	633	.2209 *** (.0605)	.1120 *** (.0311)	719
ITHC	.7112 *** (.0276)	.2026 *** (.0290)	2996	.2711 *** (.0269)	.1118 *** (.0122)	3507
ID	.8192 *** (.0502)	.1949 *** (.0674)	743	.5228 *** (.0778)	.0895 *** (.0281)	900
TOTAL	.6357 *** (.0165)	.2090 *** (.0154)	6735	.2818 *** (.0197)	.1119 *** (.0090)	7902

Note: Standard error in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%. All computations are done using STATA.

Table 10: Productivity Decomposition by Industry and by Year

		1997	**1998**	**1999**	**2000**	**2001**	**2002**
IAA	Within	7.4	7.4	7.5	7.5	7.6	7.7
	Between	1.1	0.7	1.1	1.1	0.4	1.2
	Total	8.5	8.1	8.6	8.6	7.9	8.9
IMCCV	Within	6.1	6.0	5.8	5.9	6.1	6.0
	Between	1.1	0.9	1.0	1.1	1.1	0.9
	Total	7.2	6.9	6.8	7.0	7.2	7.0
IME	Within	6.8	6.6	6.8	6.8	6.8	6.8
	Between	0.6	0.6	0.6	0.6	0.6	0.6
	Total	7.4	7.3	7.4	7.4	7.4	7.4
ICH	Within	7.5	7.6	7.8	7.7	7.7	7.9
	Between	1.8	1.6	1.8	1.5	1.6	1.5
	Total	9.3	9.2	9.6	9.2	9.3	9.4
ITHC	Within	6.8	6.7	6.8	6.7	6.8	6.9
	Between	0.4	0.3	0.5	0.6	0.5	0.5
	Total	7.1	7.0	7.3	7.3	7.3	7.4
ID	Within	6.7	6.7	6.7	6.7	6.8	7.0
	Between	0.6	0.6	0.6	0.8	0.6	0.5
	Total	7.4	7.3	7.3	7.5	7.4	7.5
All	Within	6.9	6.8	6.9	6.8	6.9	7.0
	Between	1.0	0.9	1.2	1.0	0.9	1.0
	Total	7.9	7.7	8.1	7.9	7.8	8.0