THE EMPLOYMENT INTENSITY OF GROWTH:
EVIDENCE FROM TUNISIA

MONIA GHAZALI AND RIM MOUELHI

*University of Tunis, Tunisia*
*University of Manouba, Tunisia*

The employment intensity of output growth or elasticity of employment with respect to output plays an important role in assessing the job creation ability of economic sectors. This research aims to focus on the Tunisian case in order to estimate the employment intensity of growth among Tunisian productive sectors and identify key sectors that are employment intensive. The data cover the period 1980-2012. Results suggest a significant decrease in aggregate employment elasticity over the period of study. At the sector level, we identify two categories of sectors. The first category involves low-productive sectors with high and increasing employment-output elasticities. The second category includes high-productive sectors with low and decreasing employment-output elasticities. The second stage of the analysis identifies the major determinants influencing total employment elasticity. The trade openness as well as selected macroeconomic policy variables contribute significantly to explain the elasticity evolution.

*Keywords*: Growth Employment Elasticity, Structural Change, Rolling Regressions, Labor Market

*JEL Classification*: E24, J01

1. INTRODUCTION

The employment intensity of output growth or elasticity of employment with respect to output is a measure used to assess the degree of employment growth associated with a given output growth. It is a relevant labor market indicator to the extent that it might assess the job creation ability of a wide range of subsectors unlike the unemployment rate. Furthermore, growth employment elasticity evolution allows to investigate the occurrence of a structural change in the economy.

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1 Following Kapsos (2006), this paper uses the terms “employment intensity of growth”, “job intensity of growth” and “employment elasticity” interchangeably.
The aim of the present research is to contribute to understand the evolution of aggregate and sector employment growth elasticity in Tunisia over 1980-2012 as well as the underlying determinants.

This research is of great interest from at least two perspectives. First, the main channel through which economic growth is transmitted to the poor is the employment opportunities it generates. Hence, understanding the determinants of employment elasticities is crucial for poverty alleviation and pro-poor economic growth promotion. Second, some stylized facts highlighted by the rare papers exploring world and regional trends of employment intensity of growth seem to be puzzling somewhat. They point out a decline in employment elasticity of growth both in many developed and developing countries.\(^2\) One would have rather expected a rise in this elasticity as trade liberalisation might lead to a shift in low-income countries’ industrial structure towards more labor-intensive industries. The increase in capital intensity induced by innovations and technological change seems to be one of the culprits.\(^3\)

Other macroeconomic and policy determinants as well as labour supply and economic structure characteristics might interfere in the employment outcome of growth. With that in mind, it is crucial to understand the driving forces behind the evolution of the employment intensity of growth in those countries.

Although researchers have deeply analysed the impact of various shocks on developing countries labor markets, only few studies seem to focus on the relationship between employment and output growth in these countries (Islam and Nazara (2000) for Indonesia; Ajilora and Yinsa (2011) for Botswana; N’Zué (2002) for Côte d’Ivoire; Sodipe and Ogunrinola (2011) for Nigeria; Yogo (2008) for sub-Saharan African countries; El Elwani and Elmegharbel (2009) for Egypt; Aydiner-Avsar and Onaran (2010), Yeldan (2013) and Erkan and Yeldan (2011) for Turkey). Furthermore, a limited literature has investigated the determinants of employment-output elasticities (Kapsos, 2006; Crivelli et al., 2012). Overall, these studies emphasize the relatively low employment intensity of GDP growth in such countries suggesting that growth performance is “jobless growth”.

This paper looks forward to make some improvements in these issues by focusing on the Tunisian case, which has received to this date little attention. Since 2011, Tunisia has experienced an unprecedented revolution after decades of profit-capture and repression by the political elite leading to a regime collapse. This uprising has been motivated by serious economic problems and social frustration: the rate of unemployment of young

\(^2\) Using data on 139 countries, Kapsos (2006) reveals a decline in the global employment intensity of growth (from 0.38 during 1995-1999 to 0.30 during 1999-2003). Regional trends show a similar decline in Western Europe and Japan. While the MENA region has some of the highest employment elasticities in the world, it also registered a decline during the same observation period (North African countries’ total employment elasticity for example declined from 0.74 to 0.51).

\(^3\) Section 4 involves a theoretical discussion about trade openness and technology impacts on employment, and more particularly on the employment intensity of growth.
workers in 2008 was estimated to be above 30%, and the unemployment rate among university graduates in 2007 was 40%. Although claiming a relatively high GDP growth in the years preceding 2011 (3.1% in 2009, 6.3% in 2007, 5.6% in 2006), the government had failed at turning this growth performance into job prospects (as youth employment has not grown beyond 2.6% in best cases). This implies to address efficiently the issue of unemployment, which underpinned the revolution and has become a nation-wide priority. To draw a relatively complete picture of labor market trends, it is crucial to examine the elasticity of employment with regard to output growth. The empirical strategy of this study involves two stages of analysis. First, we provide estimates of employment elasticities in different sub-sectors in order to assess the job creation ability of these sectors. Second, we rely on an econometric model to detect factors that might impact the total employment intensity of growth. Data cover the period 1980-2012 and are mainly provided by the Institute of quantitative economy and competitiveness (ITCEQ).

Sectors that exhibit relatively high and increasing employment-output elasticities appear to be respectively: non-manufacturing (extractive industries, water, electricity, etc.), construction, trade and tourism and agriculture & fishing. At the aggregate level, we find that total employment elasticity witnesses a significant decrease over the period of study from 0.61 in 1980-1989 to 0.57 in 1991-1999 and 0.48 in 2000-2012. Moreover, results point out a negative and highly significant relationship between employment intensity of growth and respectively inflation rate, trade openness and real average annual wages.

The rest of the paper is organized as follows: Section 2 provides a brief overview of the literature on the employment-growth relationship. Section 3 presents the data and the different approaches used for calculating employment elasticities. Section 4 explores determinants of the aggregate employment intensity of growth. Section 5 concludes and outlines the main policy implications of estimation results.

2. THE EMPLOYMENT-GROWTH RELATIONSHIP

2.1. Theoretical Background

The literature on the nature of the relationship between employment and economic growth derives from the so-called Okun’s law. In his seminal paper, Okun (1962) defines a coefficient that determines a stable empirical relationship between economic growth and the change in the rate of unemployment. More specifically, he demonstrates that an increase in the economic growth rate by 3% above the potential rate of growth\(^4\)

\(^4\) The potential rate of growth refers to the rate of growth of real GDP that could be sustained with the economy at full employment and steady inflation.
is expected to reduce the unemployment rate by 1% point.

The standard specification for estimating Okun’s law is:

$$\Delta U_t = \alpha_0 + \alpha_1 \Delta \ln Y_t + \nu_t,$$

where $\Delta U_t$ is the yearly change in the unemployment rate, $\Delta \ln Y_t$ is the yearly change in the ln GDP and $\nu_t$ is an error term.

The Okun’s law has been the focus of a large body of literature as it has implications for macroeconomic policy, particularly in determining the optimal or desirable growth rate, and as a prescription for reducing unemployment, (Ajilore and Yinusa, 2011). In the last two decades, a large number of empirical studies have investigated the validity of this law. Many studies introduced the idea of the possible asymmetry of the relationship (Courtney, 1991; Palley, 1993; Lee, 2000; Viren, 2001). In fact, they consider that expansions and contractions in output could not have the same absolute effect on unemployment which implies that Okun’s coefficient might be different over the business cycle. Arguments invoked regard fluctuations in factor capital-labor substitution during cycles, in multi-factor productivity and female labor supply behaviour. Besides, several empirical studies have been carried out to assess the stability of Okun’s relationship across time and space criticizing the omission of prices role (e.g., Flaig and Rottman, 2000), institutional factors (e.g., Revenga and Bentotila, 1995) or exchange rate volatility (e.g., Stirböck and Buscher, 2000) that may influence the link between employment and growth. Despite the foregoing, the Okun’s law has been considered as useful in forecasting and policy-making.

In the same vein, a growing body of literature has been interested in exploring the employment-growth relationship from the perspective of correlation, rather than causality effect (Kapsos, 2006). These studies rely upon the familiar concept of the elasticity of employment with respect to output growth. This elasticity measures the percentage point change in jobs associated with an economic growth of one percentage point and is mainly used in analyzing how economic growth and employment growth develop jointly and the extent to which the labor market is sensitive to changes in overall economic conditions (El Ehwani and Megharbel, 2009). According to Perugini (2008), the employment-elasticity of growth has some attractive advantages compared to the Okun’s coefficient measurement. First, it allows to avoid some measurement problems of the unemployment rate, particularly those due to different definitions of unemployed person and to potential interactions between unemployment and labor force participation. Second, employment (and employment intensity) may be distinguished into a wider set of sub-groups in comparison to unemployment: male/female, age class...
employment, permanent/temporary, part-time/full-time and skilled/unskilled groups. Third, the sector composition of employment can also be used to determine industry-specific elasticity.

The less complex formulation of the elasticity does not exclude to investigate its major determinants (such as labor supply, inflation rate, trade openness, labor market flexibility, etc.).

2.2. The Measurement of Growth-employment Elasticity

Two methodologies are frequently used for calculating elasticities. The first is a simple arithmetic method that divides the percentage change in employment \((L)\) by the corresponding percentage change in Gross Domestic Product \((Y)\) during a given period, as given below:

\[
\varepsilon = \frac{(L_1 - L_0)/L_0}{(Y_1 - Y_0)/Y_0}. \tag{2}
\]

This is the arc-elasticity of employment computed between two different points in time 0 and 1. Variables to be used could be aggregate or sectoral. While this methodology seems relatively simple, it provides a highly fluctuating elasticity which prevents comparative and forecasting purposes.

The alternative method which provides point-elasticity involves a regression analysis of a double-log linear equation relating employment and GDP. Its basic form is given by the following equation:

\[
\ln L = \beta_0 + \beta_1 \ln Y, \tag{3}
\]

where \(\ln\) is the natural logarithm of the variable, and the regression coefficient \(\beta_1\) refers to the employment elasticity with respect to GDP. It gives the percentage change in employment when GDP changes by values close to zero. This provides more stable values which is useful from an economic policy perspective.

\[
\beta_1 = \frac{d\ln L}{d\ln Y} = \frac{dL/L}{dY/Y}. \tag{4}
\]

This second method of estimation offers another advantage according to Islam and Nazara (2006). It allows one to control the ‘beta coefficients’ with other variables \(z\) that may affect the employment-growth relationship as it is given by the general form of the above equation:

\[
\ln L = f(\ln Y, Z). \tag{5}
\]

These variables may take the form of dummy variables (e.g., different degree of
industrialisation among various regions in a given country) or technological progress indicators, policy relevant variables, etc.…

It is also possible to consider employment elasticity at the sectoral level which implies that equation (5) takes the following form:

\[ \ln L_i = f(\ln Y_i, Z). \]  

This means that sectoral GDP, \( Y_i \), and other variables affect employment in sector \( i \). It is possible to interpret the \( Z \) variable as incorporating the effect of total GDP(\( Y \)) on sectoral employment. Thus, changes in employment will be related to changes in both \( Y_i \) and \( Y \).

2.3. Employment Growth Versus Productivity Growth

An elasticity value of 1 implies that every 1% of GDP growth is associated with a 1% increase in employment. Hence, the elasticity generated from the methodology described in equation (3) reveals the response of employment in quantity to GDP growth. However, Islam (2004) argues that both the growth of employment and rising productivity contribute to economic growth. Therefore, one needs to be cautious in interpreting the relationship between employment elasticities, employment growth and productivity growth.

In this regard, Kapsos (2006) provides an arithmetic identity to show the proportionality of the economy’s total output, \( Y \), to the product of the labor force employed \( L_t \) and labor productivity \( P_t \) (output per worker), as follows:

\[ Y_t = L_t \times P_t. \]  

Equation (7) implies that for small changes in output, the following holds:

\[ \Delta Y = \Delta L + \Delta P. \]  

Hence, for a given amount of output growth, any increase in the rate of employment growth must be related to an equal and opposite decrease in labor productivity growth.

Dividing equation (8) by output growth yields to:

\[ 1 = \frac{\Delta L}{\Delta Y} + \frac{\Delta P}{\Delta Y}. \]  

Therefore:

\[ \varepsilon = 1 - \frac{\Delta P}{\Delta Y}, \]

where
\[ \varepsilon = \frac{\Delta L}{\Delta Y}. \] (10)

Table 1. Employment Elasticities and Productivity Evolution

<table>
<thead>
<tr>
<th>Employment elasticity</th>
<th>Positive GDP growth</th>
<th>Negative GDP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \varepsilon &lt; 0 )</td>
<td>(-) employment growth</td>
<td>(+) employment growth</td>
</tr>
<tr>
<td>( 0 \leq \varepsilon \leq 1 )</td>
<td>(+) employment growth</td>
<td>(-) employment growth</td>
</tr>
<tr>
<td>( \varepsilon &gt; 1 )</td>
<td>(+) employment growth</td>
<td>(-) employment growth</td>
</tr>
</tbody>
</table>

Source: Kapsos (2006)

Table 1 below gives the different scenarios one has to take into consideration when formulating interpretations regarding employment elasticities values. The productivity side of the relationship as emphasised in equation (10) is important especially from an economic policy perspective.

Table 1 points out that in economies with positive GDP growth, employment elasticities ranging between 0 and 1 correspond with an “ideal” scenario where both employment and productivity increase. However, a rise of elasticities beyond this range is associated to a more “employment intensive” growth and to productivity deterioration. This draws attention to an important aspect of growth strategies in developing countries which is the necessity to balance employment growth and productivity growth.

2.4. Literature Review

Although researchers have deeply analyzed the impact of various shocks on developing countries labor markets, only a few studies seem to focus on the relationship between employment and output growth in these countries.

Investigating the Ivorian modern private sector, N’Zué (2001) finds that employment and economic growth do not move together in the long run which gives evidence for a jobless growth. El Ehwani and Megharbel (2012) focus on the Egyptian case measuring employment elasticities of overall economic growth during 1980/81-2004/05 as well as in six major sectors over the same period to analyze both the job-creation capability of these sectors, and the significance of structural change (agriculture, manufacturing, petroleum, etc.). Conclusions suggest that the manufacturing and mining sector has the greatest employment elasticity of growth during the observation period, followed by social services, then construction and building while agriculture ability to generate jobs appears to be relatively weak.\(^6\)

Sodipe and Ogunrinola (2011) examine the employment and economic growth

\(^6\) Sector elasticities computed do not exceed 0.5.
relationship in the Nigerian economy using a simple model of employment estimated with the Ordinary Least Squares technique. Results show a negative relationship between employment growth rate and the GDP growth rate.

Pattanaik et al. (2011) investigate the employment intensity of service sector growth in India and examine its fundamental macroeconomic determinants. The results indicate that over the years, while output growth rate in service sector has increased, employment growth rate has decelerated significantly leading to considerable fall in employment elasticity. Furthermore, there is predominance of low productive and unskilled labor based activities in service sector. Regression results based on the time-series data from 1960-61 to 2004-05 point out the importance of investment friendly environment, better public expenditure management, effective labor policies and proper structural transformation in achieving higher employment elasticity.

Yogo (2008) provides a theoretical and empirical survey on the link between employment and growth in sub-Saharan African countries. Three main conclusions emerge from his study. First, the employment issue in sub-Saharan Africa is mostly a matter of quality than quantity. Secondly, the reason of weak employment performances could not be found in labor market rigidities. Third, the observed increase of working poor could be explained by the weakness of growth and downward labor demand.

Regarding the Tunisian case, to our knowledge, little attention has been dedicated to that issue. Nevertheless, to draw a relatively complete picture of labor market trends, it is crucial to examine the elasticity of employment with regard to output growth. This research aims to fill this gap by providing estimates of the employment intensity of growth in Tunisia for different sectors and identifying its key determinants.

3. TUNISIAN EMPLOYMENT GROWTH ELASTICITY ESTIMATION

3.1. Data Description and Stylised Facts

We use industry-level data provided by the Tunisian Institute of Quantitative Economics and competitiveness (ITCEQ) over the period 1980-2012.7

The dataset covers the whole economy which we classify into 10 sectors as defined by the ITCEQ classification and the international standard industrial classification: agriculture and fishing, manufacturing, non-manufacturing, public utilities, construction, trade, hotels and restaurants, transport storage, communication and finance. It includes annual data on gross value added at both current and constant prices (1990 prices) and data on employment. Employment is defined as “all persons employed”, which accounts for wage-earners, but also self-employed and family workers. Tables A and B in appendix give some descriptive statistics related to our variable of interest.

7 It would have been interesting to extend the observation period. However, we are seriously prevented by data limitations.
Figure 1. Employment and GDP Evolution at the National Level, 1980-2012

Figure 2. Employment and GDP Growth Evolution in Tunisia, 1980-2012
We start by looking at the dynamics of employment and value added at the national and sector level. Figures 1 and 2 show that employment and GDP display a rapid and steady growth during the observation period excepting in 2011 which corresponds to the Tunisian popular uprising. The GDP increases at a greater rate than employment averaging 5% as against 2% which reflects an economic growth mainly driven by productivity gains.

Figure 3 provides a picture of sector-specific value added and employment trends. Almost all sectors show a faster increase in value added relatively to employment with the exception of non-manufacturing industries, which suggests an important loss of productivity. It is worth noting that this sector involves state owned industries (extractive industries, water, electricity, etc.). Some of them are suffering from lack of competitiveness and over-staffing. The highest degree of volatility in value added growth is experienced by sectors such as agriculture & fishing (largely dependent on volatile weather conditions), non-manufacturing (dependent on price volatility and world economic environment) and telecoms (large privatisation plan in 2000s).

Figure 3. Employment and Value Added Evolution at the Sector Level

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8 Tunisia experienced also a negative GDP growth, respectively in 1982 and 1986 due to social unrest, internal imbalances, economic mismanagement (Ayadi and Mattoussi, 2016) and the decline in world oil prices (Layachi, 1998). In 1986, a first structural adjustment program has been negotiated with IMF.
Figures 4 and 5 present the sectoral composition of employment and value added for the years 1980, 1990, and 2010. Tunisia experienced an important decline in agricultural employment and value added shares. The employment share of agriculture in total employment decreased from 31% in 1980 to 21% in 1995 and to 18% in 2012. Manufacturing experienced a modest decrease in employment share from 20% in 1995 to 18% in 2010. Finance services experienced expansion in terms of employment share and value added share. Tourism and retail sectors experienced a modest increase in employment shares while their value added shares stagnated during the same period. This means that these sectors have become less productive over time.

Despite the stagnation in the employment share of the transport sector over the studied period, its value added share increased between 1980 and 2010. The telecom sector registered an increase in its value added share in 2000s more proportionate to the increase in its employment share. This suggests that these sectors have become more productive over time. Technological innovations and the boom in demand for telecommunication services contribute to explain 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 that continued moderately in 2000s.
3.2. Employment-growth Elasticities Estimation for Tunisia

This section presents results of different estimation methods of the employment growth elasticity. First, we display results of arc elasticity estimation at the national and sector level. This is followed by econometric approach results given by respectively: an Ordinary Least Squares (OLS) estimation of a multivariate log-linear model and a rolling window estimation.

3.2.1. The Arc Elasticity of Employment

The evolution of annual arc employment elasticity regarding the whole economy is shown in Figure 6. Figure 7 presents the employment elasticity by sector. Computation has been performed following equation (2). We can notice that arc elasticity witnesses wide fluctuations from year to year which prevents the depiction of a clear trend or the formulation of policy recommendation.
Figure 6. Arc Elasticity of Employment in Tunisia, 1980-2012

Figure 7. Arc Elasticity of Employment by Sector in Tunisia, 1980-2012
3.2.2. Econometric Estimates of Employment Elasticity: Ordinary Least Squares (OLS)-based Results

In order to produce a more stable series of sectoral employment elasticity, we rely on OLS estimation of a multivariate log-linear regression model with time dummy variables, \( DD \), interacted with \( \ln Y \) as given in equation (11) below.\(^9\)

\[
\ln L_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 (\ln Y_t \times D_D) + \beta_3 D_D + \mu_t, \tag{11}
\]

where \( Y \) refers to value added and \( L \) to employment. The inclusion of a set of dummy variables for the following decades: 1980’s, 1990’s and 2000’s allows to capture the evolution of employment growth elasticity and makes it easier to compare estimation results with findings of other studies linked to the Tunisian context. Furthermore, the time periods chosen involve important developments that are expected to influence employment-growth elasticities: 1-the adoption of the structural adjustment plan after the economic crisis reaching a peak in June 1986. Numerous actions were taken to re-establish the market forces by deregulating the domestic market, removing price controls and increasing efficiency and investments. This “free market” program included also external reforms, especially the reduction of trade barriers which signed the start of the Tunisian trade liberalisation process. 2-In 1990, Tunisia signed the GATT agreements. The adherence to the WTO was achieved in 1995. Reflecting the government’s objective to comply with the GATT/WTO negotiated rates, Tunisia witnessed over the period 1990-1998 an increase in the nominal protection rates on agricultural final goods because of non-tariff protection transformation. This led to an increase of the effective rate of protection for a majority of products (the ERP attained 56% in 1995 and 71% in 1998). In 1996, Tunisia also ratified the EUROMED agreements that imply the establishment of a free trade zone including the majority of industrial products over a period of 12 years. The prospect of duty-free admission of European products by 2008 has paved the way for reforms seeking to increase the competitiveness of Tunisian products. Hence, private Tunisian firms have been subject over the period 1996-2006 to an “upgrading program” that provided support to almost 2000 private companies (Bougault and Filipiak, 2005). This programme aimed to support modernizing investments, new technologies and know-how adoption, firm competitiveness enhancement and human resources skills improvement. Financial incentives were offered to firms to implement this programme (10% to 20% of investments in physical assets and 70% of intangible investments). 3-2000s reflect the strengthening of the Tunisian trade liberalisation process given that the effective rate of protection decreased from 71% in 1997 to 49% in 2002.

Equation (11) is estimated for each sector as well as for the whole economy. The

elasticity of employment with respect to value added in a given sector is given as \( \beta_1 + \beta_2 \). In fact, differentiating both sides of equation (11) and solving for \( \frac{\partial L}{\partial Y} \) yields to:

\[
\frac{\partial L}{L} = (\beta_1 + \beta_2)\left(\frac{\partial y}{Y}\right).
\]

Then

\[
\frac{\partial L}{\partial y} \left(\frac{Y}{L}\right) = \beta_1 + \beta_2, 
\]

(12)

where \( \beta_1 + \beta_2 \) represents the change in employment associated with a differential change in output. Thus, an elasticity of 1 implies that every 1% of value added growth is associated with a 1% increase in employment. Results are shown in Table 2.

| Table 2. OLS Estimations of Employment Elasticities to Value Added, 1980-2012 |
|---------------------------------|-----------------|-----------------|-----------------|
| Agriculture and Fishing         | 0.02            | 0.20            | 0.28            |
| Manufacturing                   | 0.04            | 0.56            | 0.36            |
| Non manufacturing              | -0.02           | 0.90            | 0.91            |
| Public offices                  | 0.61            | 0.60            | 0.35            |
| Telecoms                        | 0.21            | 0.93            | 0.29            |
| Trade                           | 0.42            | 0.69            | 0.98            |
| Transport                       | 0.21            | 0.79            | 0.53            |
| Finance                         | 1.20            | 1.10            | 0.51            |
| Construction                    | 0.08            | 0.80            | 0.80            |
| Tourism                         | 0.75            | 0.82            | 0.89            |
| Overall economy (estimations based on GDP) | 0.61            | 0.57            | 0.48            |

Source: Authors’ computations

3.2.3. Econometric Estimates of Employment Elasticity: Rolling Estimation-based Results

We estimate a double-log linear equation relating employment and GDP as specified in equation (3) by using a technique called “rolling regressions” which allows to estimate a relationship over many different sample periods. The periods have the same temporal dimension (or window size). This technique has been performed by many studies (Perman and Tavera, 2005; Knotek, 2007) to assess the Okun’s law and estimate the change in the Okun’s coefficient over time. If the relationship is stable over time, then the estimated coefficients are relatively similar. When the estimated parameters are considered to be different from one regression to another, the coefficient of interest can be seen as a time-varying parameter.
We choose a window size corresponding to 14 years.\textsuperscript{10} Hence, the first rolling regression would estimate the employment-growth elasticity (given by $\beta$ coefficient) using the sample period from 1980 to 1993. The sample period is then moved forward one year, and the regression is re-estimated to produce a second set of estimates of $\beta$, using data from 1981 to 1994. This process is repeated until the final estimates are made using the sample period from 1999 to 2012. We make the assumption that estimates of $\beta$ match the last year of each sample period. Consequently, the first estimate of employment-growth elasticity is related to 1993 and the last one corresponds to 2012. Estimation results are shown in Table 3 (see Appendix) as:

\textbf{Figure 8.} Rolling Estimations of Employment Growth Elasticities, 1993-2012

\textbf{3.3. Interpreting the Estimation Results of Growth Employment Elasticity}

Comparing the three methods used previously to assess the employment-growth elasticity, it is possible to conclude that values turn out to be much more stable using econometric regressions. Results given respectively by OLS and rolling estimations

\textsuperscript{10} Knutek (2007) uses 13-year moving window and considers that selecting a different length for the moving window, such as 10 or 15 years, has a minimal impact on the results.
show many similarities. OLS estimates demonstrate that total employment elasticity witnesses a significant decrease over the period of study from 0.61 in 1980-1989 to 0.57 in 1991-1999 and 0.48 in 2000-2012. This means that for every 1% of additional GDP growth, total employment has grown by 0.61% during the 1980s, 0.57% during the 1990’s and 0.48% during 2000s. Therefore, economic growth has been increasingly driven by productivity enhancement rather than by labor supply. On average, the strongest employment growth is registered during 1991-1999 which is also the period that depicts the highest economic growth. The rolling technique confirms the employment intensity declining trend (0.58 in the 1990’s and 0.51 during 2000’s). At the sector level, we should point out that elasticity to output gives an indication of whether growth in the sector’s output is primarily attributable to employment growth or productivity growth. In our case, agriculture and fishing, non-manufacturing, construction, trade and tourism exhibit an upswing pattern. However, elasticities in the manufacturing sector, public offices, transport, telecommunication and finance, seem to be in constant decline. Agriculture & Fishing shows an important increase in the employment intensity of value added in the 1990s from 0.02 to 0.2 corresponding to the adoption of the second generation of integrated rural development plan (1992-2002) aiming to improve living conditions in the rural world whose impact resulted in projects such as the agro-pastoral development programme in the south-east, boosting agricultural products competitiveness and reducing rural exodus via the attraction of young people to take up employment in the sector. Manufacturing and non-manufacturing industries experienced also an important upswing in the 1990s. A 1% change in manufacturing output was associated to 0.04% change in employment during 1980-1989 which increased to 0.56% in the 1990s. Non-manufacturing industries were characterized by a very poor job absorptive capacity in the 1980s which dramatically reversed during the 1990s reaching 0.9. The initiation of the structural adjustment plan in 1986, after the intervention of international financial institutions might have largely contributed to such a result.

Looking closely at the first category of sectors that demonstrate a decrease in employment intensity and computing the productivity elasticity to value added as (1-employment elasticity in the sector), one could notice they are among the most productive sectors in Tunisia while those with the lowest productivity face an increase in the employment-growth elasticity. This suggests a low level of structural change. However, to confirm this finding, we should compute another index which is the sectoral elasticity to GDP that shows the percentage change in sector employment associated with a one percent change in Total GDP. This allows to rule on if employment is growing or contracting in a given sector, in general and in relation to other sectors due to changes in total GDP, i.e., as a result of reallocation process. Table 4 reports sectoral elasticity to GDP using OLS estimations. It indicates similar trends than those
previously reported for employment elasticities with respect to value added. However, a decreasing value is observed for agriculture and fishing and tourism. Reallocation movements induced by a decline in total GDP might have outweighed the rising employment-value added elasticity effect. Overall, one can observe the contraction of the main high-productivity activities which gives further evidence regarding the weakness of the structural change.

Many reasons might be invoked to explain these stylized facts. In manufacturing for instance, the decreasing value added, as well as the lack of diversity and sophistication in industrial products are the main culprits (African Development Bank Report, 2012). In other sectors such as financial services and telecoms, regulations put up obstacles to free entry (World Bank, 2007) which impede firms and job creations and have also a negative impact on the rest of the economy as they induce higher production costs (Marouani and Mouelhi, 2012). Furthermore, the rigidity of the labor market, the lack of access to credit and its high cost and the deficit of structures supporting good governance could also explain the limited extent of structural change in Tunisia.

Table 4. OLS Estimations of Employment Elasticities to GDP, 1980-2012

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<thead>
<tr>
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<tbody>
<tr>
<td>Agriculture and Fishing</td>
<td>0.04</td>
<td>0.57</td>
<td>0.31</td>
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<tr>
<td>Manufacturing</td>
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<td>Non-manufacturing</td>
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<td>Public offices</td>
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<td>Finance</td>
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<td>0.73</td>
<td>0.66</td>
</tr>
<tr>
<td>Construction</td>
<td>0.07</td>
<td>0.71</td>
<td>0.72</td>
</tr>
<tr>
<td>Tourism</td>
<td>1.17</td>
<td>1.02</td>
<td>0.58</td>
</tr>
</tbody>
</table>

Source: Authors’ computations

4. DETERMINANTS OF TUNISIAN EMPLOYMENT INTENSITY OF GROWTH

A recent, though, limited literature has investigated the determinants of employment-output elasticities in developed countries, (Kapsos, 2006; Crivelli et al., 2012). Furthermore, the wide literature regarding employment and labor productivity growth provides a broad set of relevant theoretical determinants of employment intensity.

Trade openness has generated increasing interest among researchers in its effects on employment both in developed and developing countries. The impact of trade liberalization on employment and more particularly on the elasticity of employment with respect to output growth is apprehended by the Heckcher-Ohlin-Samuelson model. To explore this effect, let us consider a simplified world of two sectors, two production
factors (labor and capital) and two countries (a developed relatively capital-abundant country and a developing relatively labor-abundant-country). Under trade liberalization process, the increase of labor intensive good relative price will lead the developing country to specialize on the export of such a good and the import of the capital-intensive good. The Stolper-Samuelson theorem predicts that this price increase temporary raises the profits of the labor-intensive sector, which attracts additional firms until the restoration of the 0 marginal profit condition. The sector expansion enhances the demand for workers and thus, their real and relative wage. On the other hand, the contraction of import-competing sector implies a reduction of the demand for capital and a decrease of the rental return to capital in relative and real terms. Furthermore, the increase in the weight of the labor-intensive sector in the GDP would lead to a rise in the employment intensity of output of the developing country as a whole, (Islam, 2010; Khan, 2001). The impact of openness on employment intensity has been addressed by Bruno et al. (2001) who argue that economic openness might allow firms to use more capital equipment in production, which may lead to a reduction in the responsiveness of labor demand to economic growth. This relationship appears not to be statistically significant within OECD countries context.

However, under the assumptions of differences in technological capabilities between countries or imperfect goods and factor markets, the Heckscher-Ohlin Samuelson model turns to be inadequate especially for medium and long-term analysis (Lin and Chung, 2009). More particularly, relaxing the stringent constraint of identical technology makes it essential for developing economies to defy their comparative advantages and foster an industrial upgrading process (Saviotti and Pyka, 2004). This might be initiated by accumulating technological capabilities in new industries through R&D activities, training and production experiences as well as the support of the state, (Lin and Chung, 2009).

Furthermore, as underlined by Islam (2014), there are other factors that might distort the incentive structure, leading to an unexpected effect of trade liberalization on employment that is inconsistent with the comparative advantage of the country. The role of innovations and technological change has been largely emphasized to explain the unpredicted stylized facts. Yet, the specific impact of technology on growth-employment elasticity has been rarely documented in both theoretical and empirical

12 In turn, the capital-abundant developed country specializes on the export of the capital-intensive good and the import of the labor-intensive good
13 Islam (2014) points out that the employment elasticity of a country with respect to output is the weighted average of elasticities of the component sectors. Hence, a change in sectors structure might change the country employment elasticity: if the more labor-intensive sectors have a greater weight in the GDP, the overall elasticity would be higher than in a situation where more capital-intensive sectors are the overwhelming category.
14 It is also possible to consider within the standard Heckscher-Ohlin model skilled labor and unskilled labor as factors of production operating in skill-intensive and unskilled-labor-intensive manufactures.
literature. Osmani (2003) points out that the degree of elasticity depends on the choice of techniques, especially in the growing sectors. The implementation of labor-saving innovations at a sector level might decrease the related sector employment elasticity with respect to growth. Vivarelli (2014) shows that technological change always exerts a direct harmful effect on employment in absolute terms. However, it might also trigger various market compensation mechanisms in such way that they counteract the initial effect. Overall, there is no definitive statement about the final employment outcome of technology because of many counterbalancing effects. Meanwhile, beyond the unclear quantitative impact of technological change on employment, a wide range of studies have been investigating the qualitative impact of technology on skilled and unskilled workers providing a more clear-cut and robust evidences. Innovations are intuitively skill-biased. Haskel and Slaughter (1998) defines the skill biased technological change as any technological progress that raises the relative productivity and then the relative demand of skilled workers (supposed to complement the new technology) within sectors, at given relative factor prices. As such, the wages and employment of skilled workers increase relative to their unskilled counterparts. According to Vivarelli (2014), “in the presence of labor-saving and skill-biased process innovation, the scarcity of skilled labor can easily generate unemployment among unskilled workers, unless proper retraining policies are put in place” However, empirically, the net effect of technology on skilled and unskilled employment elasticities with respect to growth has been rarely explored.

Other factors related to macroeconomic policy, labor supply and economic structure might intervene in the response of employment to output growth. Focusing on the European Union, Walterskirchen (1999) finds out that a more rapidly expanding supply of labor should lead to a more employment-intensive growth as it induces lower average wages and hence, an increase in demand for labor following the classic economic notion. Döpke (2001) and Padalino and Vivarelli (1997) give evidence that the greater the share of services in real GDP, the higher is the employment intensity of growth.

Growth volatility and inflation are also given by Döpke (2001) as potential macroeconomic determinants of total employment intensity as uncertainty in respect of prices and economic activity may have a significant impact on growth and employment

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15 Vivarelli (2014) distinguishes the process innovation which is mainly labor saving from the product innovation which is “labor-friendly”. However, the author notes that they are complements. The organizational change has also a qualitative impact on employment.

16 If we consider the Hicksian distinction between neutral, labor-saving and capital saving technological change.

17 Vivarelli (2014) gives a critical literature review about these mechanisms. We can cite for example “the compensation mechanism via decrease in prices”, “the compensation mechanism via new investments”, “the compensation mechanism via decrease in wages.”

Though, exchange rate fluctuations do not seem to be related to lower employment intensity.

Labor market institutions are also put forth as a possible explanation for the varying employment intensity of growth across countries (Siebert, 1997; Revenga and Bentolina, 1995). In fact, more rigid labor market institutions are expected to obstruct job creation and the response of employment to economic activity. Nevertheless, related empirical results seem to be weakly significant (Nickell and Layard, 1999; Döpke, 2001).

In what follows, we attempt to take advantage of employment-growth elasticities estimates performed previously in order to investigate the macroeconomic determinants that might influence the Tunisian employment intensity of growth. By identifying robust correlates, we would be able in a next step to address the impending challenges and figure out the relevant policies to implement towards promoting employment.

For the purpose of the current empirical exercise, explanatory variables are chosen in the light of literature findings.

Equation (13) presents the model specification as follows:

\[
\text{ln} \varepsilon_t = \alpha + \beta_1 \ln l_f + \beta_2 \ln sces_t + \beta_3 \ln lnfl + \beta_4 \ln exch_t + \beta_5 \lnopenness_t + \ln wage_t + \mu_t,
\]

where \(\varepsilon_t\) is the dependent variable and denotes overall growth-employment elasticity at time \(t\) previously performed through rolling estimation. We deliberately choose the rolling estimation output as it provides a time variability which was not feasible with (OLS) estimates. Explanatory variables are respectively: the growth rate of the labor force (lf), the share of employment in services (sces), the annual inflation rate (lnfl), the nominal exchange rate (exch) (Tunisian dinar/US dollar), a trade openness proxy (openness) and the average annual real wage (wage) which is supposed to capture labor market features. All variables are expressed in logarithm. \(\mu_t\) is an error term. More details on these variables are provided in Appendix (see Table A4).

It would have been interesting to assess the technology impact on growth employment elasticity, which has been rarely addressed in macroeconomic empirical studies. The scarcity of such researches might be explained by the difficulty to find a relevant and fully available aggregate proxy of technological change.\(^{19}\) As mentioned by Vivarelli (2014), only microeconometric studies using firm-level data are able to capture accurate measures of innovation, both in terms of inputs and outputs and to relate them to quantitative and qualitative changes in employment. However, the unavailability of aggregate technology proxies, within the scope of this study, does not represent a serious shortcoming to the extent that technological change in developing countries like Tunisia is widely apprehended as an endogenous response to trade

\(^{19}\) Vivarelli (2014) reviews the relevance of many traditional technological change measures such as R&D activities and patents.
According to Vivarelli (2014), the dominant type of technological change within developing countries is the technological change embodied in the capital goods imported from the developed countries. For the particular case of Tunisia, Ghazali (2012) confirms the hypothesis of a trade-induced and skill biased technological change, using a firm-level database covering manufacturing and non-manufacturing sectors over the period 1998–2002. Therefore, the trade openness variable included in equation (13) as a determinant of growth-employment elasticity is considered as a channel through which technological change may indirectly affect employment elasticity. We use two trade openness proxies: the percentage of \((\text{exports} + \text{imports})\) in total GDP and the import penetration ratio computed as total imports relative to the domestic demand, where the domestic demand is the GDP minus exports plus imports.  

OLS estimations of equation (13) are performed over the period 1993-2012. Despite our relatively limited observation period, we apply the Arellano-Bond test which confirms the absence of serial auto-correlation. All standard errors are adjusted for heteroskedasticity using Huber–White correction.

Column (1) of Table 5 introduces the first set of variables representing macroeconomic features. The annual rate of inflation appears to be negatively associated with employment elasticity. This relationship is statistically significant at 1% level. As expected, inflation decreases the responsiveness of employment to growth by increasing volatility and price uncertainty. All else equal, an increase by 10% of the inflation rate yields to a decline of employment elasticity to growth by 0.3%. The coefficient associated to the logarithm of TND/USD nominal exchange rate is negative and highly statistically significant across all specifications. The impact of exchange rate on employment intensity of growth is transmitted through many channels: 1-the macroeconomic channel that affects competitiveness and hence, output and formal jobs. 2-The labor intensity channel which influences the cost of labor relative to capital. 3-The development channel that controls longer-term effects of exchange rate on employment via the economic competitiveness and the potential profitability of businesses. Column (2) includes the share of employment in services which is supposed to exert a positive

---

20 Acemoglu (2003) for example considers that trade liberalization increases developing countries imports of machines and high technology equipments that become less expensive. Pissarides (1997) also develops a model where trade liberalization allows Southern firms to boost their imports in capital goods from Northern countries. This would consequently enhance the incentives to learn and imitate new technologies. More details on the trade-induced technology adoption in developing countries might be found in Vivarelli (2014) and Ghazali (2012).

21 The domestic demand \(D = GDP - X + M\).

22 We should note that we include the exchange rate TND/USD as a macroeconomic determinant of employment growth elasticity and not a measure of the exchange rate volatility which would be a proxy for macroeconomic uncertainty.
effect on job intensity of growth. The related coefficient is statistically significant in 3 out of 4 specifications. Column (3) introduces a proxy for labor supply which is the growth rate of the labor force. This variable does not show a statistically significant relationship with employment intensity. We also introduce in the same column a conventional proxy for trade openness which is the percentage of (exports + imports) in total GDP. Results suggest that all else equal, an increase by 10% of the openness ratio implies an employment elasticity to growth that is 1.6% lower. An easier access to more productive capital goods and superior technology could explain this result. Columns (4) and (5) include the import penetration ratio. The related coefficients are negative and highly significant confirming that imports cause adverse effects on the employment-growth elasticity. Furthermore, lower average wages induce higher employment-growth elasticity as it is expected to increase labor demand.

### Table 5. Regression Results with Overall Employment Growth Elasticity as Dependent Variable

<table>
<thead>
<tr>
<th></th>
<th>1993-2012</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln average annual inflation rate</td>
<td>-0.073</td>
<td>-0.066</td>
<td>-0.021</td>
<td>-0.007</td>
<td>-0.017</td>
</tr>
<tr>
<td>Ln nominal exchange rate TND/USD</td>
<td>-0.235</td>
<td>-0.195</td>
<td>-0.090</td>
<td>-0.148</td>
<td>-0.125</td>
</tr>
<tr>
<td>Ln Share of employment in services</td>
<td>-0.098</td>
<td>0.192</td>
<td>0.211</td>
<td>0.545</td>
<td></td>
</tr>
<tr>
<td>Ln Growth rate of the labour force</td>
<td>0.021</td>
<td>0.038</td>
<td>-0.013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln ((X+M)/GDP)</td>
<td>-0.233</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln (M/D)</td>
<td>-0.295</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln average annual real wage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>R²</td>
<td>0.69</td>
<td>0.70</td>
<td>0.57</td>
<td>0.72</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Note: Standard errors between parentheses: * Significant at 10%; ** significant at 5%; *** significant at 1%. All standard errors are adjusted for heteroskedasticity using Huber–White correction. Arellano-Bond test of no-serial autocorrelation has been performed for all the regressions. It confirms the null hypothesis of no autocorrelation in the Arellano-Bond test for AR (1). We have also applied the Durbin Watson (DW) test for serial correlation which confirms the absence of autocorrelation at the 95% confidence level.

23 This would reflect according to Kapsos (2006) greater flexibility and dynamism of this sector.
5. CONCLUSION AND POLICY IMPLICATIONS

Since January 2011, Tunisia has been implementing a transition to democracy. The aim of the present research is to contribute to understand the evolution of aggregate and sector employment growth elasticity in Tunisia over 1980-2012. We use first an arithmetic method consisting on dividing the proportionate change in employment by the proportionate change in output. Second, we rely on an econometric approach (regression of a multivariate log-linear model and a rolling window estimation).

At the aggregate level, we find that total employment elasticity witnesses a significant decrease over the period of study from 0.61 in 1980-1989 to 0.57 in 1991-1999 and 0.48 in 2000-2012. This converges with Kapsos (2006) that emphasizes a decline in the world employment intensity of growth since 1999 due to poor employment performance following the global economic slowdown that took shape in 2001. More generally, the growth rate of labor productivity during past decades has been faster than the rate of output growth, (Nayyar, 2014). The main culprit is seen as the skill-biased technical change, which is “a shift in the production technology that favours skilled over unskilled labor by increasing its relative productivity and, therefore, its relative demand”.24 The biased direction of technological change is supposed to have accelerated the substitution of unskilled workers, hence, contributing to the recent deceleration in economic growth.

At the sector level, we identify two categories of sectors. The first category involves sectors that exhibit relatively high and increasing employment-output elasticities: non-manufacturing, construction, trade, tourism and agriculture & fishing. These sectors are promising in terms of high unskilled job absorptive capacity in a low-skill abundant country such as Tunisia. However, they are among the less productive sectors in Tunisia (Marouani and Mouelhi, 2016) and suffer from a low ability to create, transmit and absorb technology. Work in these sectors is characterized by low wages and/or poor conditions, (Hull, 2009). Therefore, they fail to create “good jobs” and to initiate “the virtuous circle of links between growth, employment and poverty reduction” emphasised by Islam (2004). Decisions makers need to think about the usefulness of internal and external training of workers that can significantly enhance firms’ productivity. Governmental support might take the form of direct subsidies or tax deductibility of training expenses (Wolf, 2007).

Furthermore, technical and technological upgrading should be processed by fostering technology transfer (through FDI, export activity, licensing, etc.) and adapting foreign advanced technolomedgy to local conditions to be able to improve productivity and provide decent jobs in these sectors. In the meantime, these sectors weight in the economy should be kept under control in an attempt to give priority to the most productive ones.

The second category of sectors emphasised by this study involves manufacturing, transport, telecommunication and finance. These sectors exhibit relatively low and decreasing employment-output elasticities, however they are among the most productive in Tunisia and are able to create decent jobs particularly for the huge mass of young university graduates if a serious industrialisation strategy is implemented. The main challenge is to make the transition from lower to higher product sophistication (UNIDO, 2009), boosting the transfer of competences and expanding the relative contribution of these sectors in the economy. This requires a more targeted FDI policy by developing an effective foreign investment promotion agency (African Development Bank Report, 2012) that is in charge of improving the investment climate particularly in manufacturing, transport and telecoms.

Overall, the government should rethink the employment policy by fitting relevant strategies to each category of the observed sectors: high employment intensive sectors with low-productivity level should implement a state-monitored technological upgrading program. However, high-productivity sectors with low job-absorptive capacity should expand while reinforcing their strengths.

Furthermore, economic leaders need to think about realizing a long-term sustainable economic growth by creating employment opportunities along with fostering higher productivity, (Choudhry and Van Ark, 2010).

According to Nayyar (2014), this depends, among other things, on the nature of the link between the supply side and the demand side. A well-functioning chain means that output expansion may lead to the introduction of more productive technologies and the realisation of dynamic scale economies and an increase in labor productivity. The induced cost reduction is transmitted to consumers in the form of lower prices which would stimulate demand expansion in domestic and foreign markets (consumption demand and more interestingly investments) as well as job creation. This increase in market size could once again initiate scale economies and, as a matter of fact, lowers prices. Therefore, a virtuous circle of demand expansion would be activated. In brief, changes in productivity growth should yield to a significant demand expansion and a more important employment expansion.

This study points out also the weakness of the structural change observed from the 1990s as we notice a shift of the economy towards low-productivity activities. Accelerating structural change implies to implement a strategy increasing the share of capital investment in GDP (Choudhry and Van Ark, 2010) and promoting a dynamic and competitive private sector. This could be achieved by further liberalizing the economy and eliminating administrative and institutional barriers to entry notably in sectors with high productivity potential. Labor regulations involving minimum wages, social insurance contributions and restrictions on firing should also be readjusted to guarantee more labor market flexibility. This would facilitate labor mobility from low-productivity sectors to higher productivity sectors as well as exit of inefficient firms. However, jobs

---

25 By creating decent, high-productivity jobs that improve living standards.
displacements might also result in structural unemployment as well as high social costs, particularly when released workers are unable to find work in new industries with different skill requirements (textile workers experience difficulties moving to Information and Communication technology (ICT) sectors or financial sectors). Workers might exhibit geographical immobility, as well (i.e. they are reluctant to move to areas with high employment opportunities). Medhurst and Henry (2011) suggest a set of proactive measures in order to reintegrate people in the labor market ranging from improving job matching to providing recruitment incentives for firms (wage subsidies and training schemes). The government is also expected to provide a financial support for retraining/reconversion programs along with a jobseeker allowance. Furthermore, the state can offer incentives to firms to relocate towards declining rural areas as well housing subsidies for displaced workers willing to move to areas with job shortage.

Overall, as underlined by Medhurst and Henry (2011), structural economic change is a “dynamic and turbulent process associated with very substantial changes of growth and contraction at the sectoral and business levels which yield small, but persistent, net economic benefits over the long-term.” Ultimately, as emphasized by Choudhry and Van Ark (2010), in the short and medium run, a trade-off between productivity growth and employment growth might be expected, especially in developing countries. Labor productivity is intended to increase due the use of capital-intensive methods and ICT as well as the redeployment of superior technological innovations in the production process. This mechanism might lead to job destruction. However, productivity gains might also stimulate employment creation due to cost and price reduction, which increases demand and help expanding the scale of production and the product markets as well as capital investments, generating a self-reinforcing virtuous loop. Therefore, policy leaders need to take appropriate actions to foster labor productivity along with short and medium-term measures to absorb effectively and efficiently the new labor market entrants, (Choudhry and Van Ark, 2010). This would lay the foundations of a sustainable long-term growth.

In a second step, we investigate through an exploratory analysis the linkages between the growth-employment elasticities produced by rolling estimations and a set of variables such as the annual inflation rate, the nominal exchange rate, a trade openness proxy, the share of employment in services, the growth rate of the labor force and the average annual real wage over 1993-2012. Results point out a negative and highly significant coefficient associated to inflation rate. All else equal, an increase by 10% of the inflation rate yields to a decline of employment elasticity to growth by 0.3%.

26 Kongsrud and Wanner (2005) highlight the fact that ‘Some personal and distributive services offer lower pay than manufacturing even for workers with comparable skills and other characteristics’. Dismissed workers could find themselves trapped in the informal sector (Choudhry and Van Ark, 2010). This might expand social inequalities.

Therefore, policy makers should take into consideration that a macroeconomic climate of uncertainty dampens employment through many channels of which employment intensity of growth. Measures to control inflation are urgently needed to be set up. Findings also support the notion of a positive relationship between the employment share in services and the employment elasticity with respect to output growth. Results also show that all else equal, an increase by 10% of the openness ratio implies an employment elasticity to growth that is 1.6% lower. This might contribute to explain the decline of Tunisian total employment intensity of growth as well as export-oriented sectors’ elasticity such as manufacturing as Tunisia has initiated an active trade liberalisation process since mid 1980’s. Besides, findings confirm that higher average annual real wages reduce employment-growth elasticity. The pressure exerted by Tunisian trade union delegates to increase wages and provide generous nonwage benefits to workers in all sectors would certainly improve active workers employment conditions but could be a serious brake on further growth-induced employment opportunities.

Much additional work is needed to identify macroeconomic and institutional determinants of overall employment intensity of growth as well as to distinguish and estimate female, skilled and unskilled employment elasticities.

APPENDIX

Table A1. Descriptive Statistics on Value Added Variable, 1980-2012

<table>
<thead>
<tr>
<th>Sector</th>
<th>Observations</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Fishing</td>
<td>33</td>
<td>2965.567</td>
<td>1044.577</td>
<td>1391.185</td>
<td>4685.628</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>33</td>
<td>3003.047</td>
<td>1157.352</td>
<td>1197.402</td>
<td>4987.327</td>
</tr>
<tr>
<td>Non manufacturing</td>
<td>33</td>
<td>1873.49</td>
<td>626.0363</td>
<td>1257.662</td>
<td>3637.229</td>
</tr>
<tr>
<td>Construction</td>
<td>33</td>
<td>1348.712</td>
<td>564.0036</td>
<td>587.1618</td>
<td>2382.91</td>
</tr>
<tr>
<td>Tourism</td>
<td>33</td>
<td>1540.133</td>
<td>674.5744</td>
<td>606.924</td>
<td>2648.297</td>
</tr>
<tr>
<td>Trade</td>
<td>33</td>
<td>2217.219</td>
<td>1107.222</td>
<td>652.1204</td>
<td>3886.625</td>
</tr>
<tr>
<td>Finance</td>
<td>33</td>
<td>4913.349</td>
<td>2279.437</td>
<td>1910.932</td>
<td>9393.023</td>
</tr>
<tr>
<td>Public offices</td>
<td>33</td>
<td>4427.986</td>
<td>2245.091</td>
<td>1600.382</td>
<td>9021.457</td>
</tr>
<tr>
<td>Transport</td>
<td>33</td>
<td>2392.599</td>
<td>1009.502</td>
<td>944.891</td>
<td>4177.09</td>
</tr>
<tr>
<td>Telecoms</td>
<td>33</td>
<td>1019.632</td>
<td>1109.8</td>
<td>239.1855</td>
<td>4074.234</td>
</tr>
<tr>
<td>Overall economy</td>
<td>33</td>
<td>27512.48</td>
<td>11554.4</td>
<td>12820.01</td>
<td>48194.49</td>
</tr>
</tbody>
</table>

Source: Authors’ computation.

Note: The value added variable is given in millions of Tunisian dinar.
Table A2. Descriptive Statistics on Employment Variable, 1980-2012

<table>
<thead>
<tr>
<th>Category</th>
<th>Observations</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td>Agriculture and Fishing</td>
<td>33</td>
<td>506.8298</td>
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<td>Manufacturing</td>
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<td>449.7493</td>
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<td>602.613</td>
</tr>
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<td>Non manufacturing</td>
<td>33</td>
<td>343.656</td>
<td>71.48355</td>
<td>260.641</td>
<td>485</td>
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<tr>
<td>Construction</td>
<td>33</td>
<td>308.7728</td>
<td>72.30596</td>
<td>226.176</td>
<td>451.5</td>
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<td>Tourism</td>
<td>33</td>
<td>77.88333</td>
<td>31.24366</td>
<td>33.57</td>
<td>129.6</td>
</tr>
<tr>
<td>Trade</td>
<td>33</td>
<td>232.6962</td>
<td>96.69718</td>
<td>107.458</td>
<td>405.717</td>
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<tr>
<td>Finance</td>
<td>33</td>
<td>201.7492</td>
<td>84.25789</td>
<td>74.246</td>
<td>327.6</td>
</tr>
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<td>Public offices</td>
<td>33</td>
<td>418.1025</td>
<td>107.9867</td>
<td>249.022</td>
<td>592.1</td>
</tr>
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<td>Transport</td>
<td>33</td>
<td>108.9447</td>
<td>26.93266</td>
<td>73.202</td>
<td>157.64</td>
</tr>
<tr>
<td>Telecoms</td>
<td>33</td>
<td>19.40258</td>
<td>9.469618</td>
<td>9.987</td>
<td>37.36</td>
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<tr>
<td>Overall economy</td>
<td>33</td>
<td>2359.014</td>
<td>565.2097</td>
<td>1531.948</td>
<td>3277.4</td>
</tr>
</tbody>
</table>

Source: Authors’ computation.

Note: employment is given in thousands (1000).
<table>
<thead>
<tr>
<th>Year</th>
<th>Agriculture and Fishing</th>
<th>Manufacturing</th>
<th>Non manufacturing</th>
<th>Public offices</th>
<th>Telecoms</th>
<th>Trade</th>
<th>Transport</th>
<th>Finance</th>
<th>Construction</th>
<th>Tourism</th>
<th>Overall economy (based on GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>-0.01</td>
<td>0.25</td>
<td>-0.03</td>
<td>0.51</td>
<td>0.31</td>
<td>0.49</td>
<td>0.24</td>
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Table A3. Rolling Estimations of Employment Growth Elasticities, 1993-2012

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<td>Average annual exchange rate</td>
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<td>Share of employment in services</td>
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<td>Average annual real wage (TND)</td>
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Source: Authors’ computation.

REFERENCES

Choudhry, M.T., and B. Van Ark (2010), “Trade-off between Productivity and


Università di Perugia, Dipartimento Economia.


Mailing Address: ESSECT. 4, Rue Abou Zakaria El Hafsi-1089 Montfleury-Tunis, Email: moniaghazali@yahoo.fr.

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