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Abstract

Since the mid-1980s, Tunisia has conducted a structural adjustment program characterized by more privatization and economic opening. This transition has created unequal growth in the economic performance and the employment opportunities between coastal and interior regions (inland areas). The January 14th revolution has started as a reaction against unequal economical and employment opportunities. In this study, we seek to answer the following key question: why does employment grow in one region and not in other? We attempt to assess the impact of institutional factors and industrial structures on location choices of manufacturing activities, which crucially affects local employment growth. We focus on the interaction between agglomeration forces and government policies to analyze the local employment growth. Using panel data on five manufacturing sectors associated with 138 Tunisian coastal small localities along six years (2002-2007), we will give some empirical evidence on regional employment growth. We use a dynamic spatial panel data model in order to consider the spatial and temporal effects in the analysis of local employment growth. Our results show that high -tech industries spillovers have a range of 15 km against 50 km for low-tech industries. Agglomeration and education have positive effect on local manufacturing employment growth. Competition has a negative effect in the short term, but a positive one on the long run.

ملخص

منذ منتصف الثمانينات ، تبنت تونس برنامجا للتكيف الهيكلي تميز بالمزيد من الخصخصة والانفتاح الاقتصادي. وقد خلق هذا التحول نموا غير متكافئ في الأداء الاقتصادي وفرص العمل بين المناطق الساحلية والداخلية (المناطق البرية). الامر الذى اشعل ثورة ال 14من يناير كرد فعل لعدم المساواة في الفرص الاقتصادية وفرص العمل. وفي هذه الدراسة، نسعى للإجابة على السؤال التالي: لماذا تزيد معدلات التشغيل في منطقة دون الا خرى؟ و فى هذا السياق نحاول تقييم أثر العوامل المؤسسية والهياكل الصناعية على اختيار مواقع الأنشطة الصناعية، الامر الذى يؤثر بشكل حاسم على نمو العمالة المحلية. لذا و من خلال هذه الورقة سوف نركز على التفاعل بين قوى التجمعات والسياسات الحكومية لتحليل نمو العمالة المحلية و ذلك باستخدام لوحة بيانية عن قطاعات صناعية خمسة مرتبطة ب 138 منطقة محلية تونسية ساحلية صغيرة فى الفترة من (2002-2007) ، سنقدم بعض الأدلة التجريبية على نمو العمالة الإقليمية. و بإستخدام هذا النموذج لتحديد الآثار المكانية والزمانية في تحليل نمو العمالة المحلية تشير النتائج انه فى بعض الصناعات الكثيفة التكنولوجيا مجموعة من الآثار غير المباشرة على بعد 15 كيلومترا في مقابل 50 كيلومترا لصناعات قليلة التكنولوجيا. الامر الذى يشير الى ان للتجمع والتعليم تأثير إيجابي على نمو التشغيل في الصناعة التحويلية المحلية. بينما نجد ان للمنافسة تأثير سلبي على المدى القصير ، ولكنه إيجابي على المدى الطويل.

1. Introduction

Nowadays regional development in Tunisia represents one of the main development goals. The Tunisian revolution was a reaction to regional disparities on economical and employment opportunities. Since the mid-1980s, the previous regime has made a structural adjustment program characterized by more privatization and economic opening (Ayadi et al., 2007) which has been associated to an upgrading program ("mise a niveau" and industrial modernization), intended to reinforce the potential of firm performance and their technological and marketing capabilities (Diop, 2008). However these policies affected the spatial structure of economic activities, it has increased inequalities in economic performance and employment opportunities between coastal and interior regions. More than 90% of the total employment is still generated in the coastal part of the country (Dlala, 1997; Amara, 2009).

Krugman (1991) shows that "decline in transport costs increase the economies of scale and the mobility of the specialized labor, reinforce agglomeration of firms and extend regional disparities". Regional disparities are associated with the interaction between market or agglomeration forces and governmental policies. World Bank Report stands that, "Markets favor some places over others, some places-cities, coastal areas, and connected countries are favored by producers" (World Bank, 2009). The evaluations of spatial spillovers affecting firms' locations choices are crucial if we look for the identification of local employment growth factors.

World Development Report 2009: Reshaping Economic Geography discusses how governments can tailor policies to integrate areas within nations, while reducing poverty everywhere. Spatially targeted interventions are just a small part of what government can do to help places that are not doing well (World Bank, 2009). We will discuss in this paper about the influence of geography on economic opportunity, to analyze the drivers of the changes in employments opportunities and identify market forces that deliver convergences. We will propose some integration economical principals to guide policy makers.

Several academic papers have focused on local employment growth determinants in Tunisia (see for example Dlala, 2007 and Ben Ayed Mouelhi, 2007). Whereas, little attention has been given to spatial effects on employment growth, they ignore firm location effects. Interests of previous studies are largely focused on a firm's characteristics regardless of their location, ignoring factors that might affect a firm's location choice such as peer effect, interaction between firms, spillovers, and spatial externalities. This paper attempts to fill this gap. We attempt to analyze determinants of local employment growth, considering both its spatial and dynamic aspects. Neighborhoods matter, a region's prosperity is sooner or later shared with those nearby. We found that, as production cost increases in the governorate of Tunis, Sousse and Sfax, some activities are delocalized in specific neighboring governorates: Zaghouan, Nabeul and Mounastir, but never in further ones. Thus we will identify the market forces, depending on economic geography, that best support the concentration of employment opportunities, therefore helping to identify new ideas for convergence of employments levels across different locations. On the other hand, when we distinguish between industrial sectors our results show that spillovers are significantly effective only within a range of 15 km for high -tech industries against 50 km for low-tech. Our econometric result stand that agglomeration and education have positive effect on the local employment manufacturing growth. However, competition has a negative effect in the first year, but positive one on the long run.

The rest of the paper is organized as follows. In the next section we will consider the Tunisian context giving more illustration on spatial inequalities. Section 3 represents our spatial dynamic econometric model, considering the appropriate covariates and estimation

methods. Section 4 depicts statistical and econometric results, giving their economical interpretations. Section 5 concludes.

2. Tunisian context

2.1 Goals of Regional Development Programs

Since Tunisia gained its independence in 1956, regional development has represented one of its of main development goals. Such program's goals should have led to the reduction of poverty and inequality at global and local sides, the modernization of basic infrastructures, and the valorization of human resources. Such policies have enabled the manufacturing sector to achieve real growth (reaching 10.2%)[1]. However, regional inequality has not changed and the poor performance of these programs has led policymakers to restructure the development programs in the sense of a genuine regional policy, followed by the 10th development plan.

Regional Development Strategy for the 10th Plan focuses on five key issues: (1) Improving the competitiveness between regions; (2) The strengthening complementarities between regions; (3) Improving the conditions of priority regions; (4) Improving the performance of private sector; (5) Regional Decentralization Strengthening.

Government intervenes by promoting decentralization and alleviates concentration along the coast through legislation and regulations as well as through fiscal and monetary policy. Since 1993, the Tunisian legislation allows some advantages for investments carried out by companies established in the deprived zones, defined as "priority zones":[2]

- Full tax exemption on profits for a period of ten years and a 50 % reduction on taxable ceiling for another ten year period;
- Full tax exemption on profits and reinvested gains;
- State coverage of a social security contribution (equalling to 15.5 % of the salary) for the first five years, and a partial contribution (from 20 % up to 80 %) for the next five years, for the work created out of projects being set up in priority regional development zones;
- Possibility of a state involvement in the infrastructure expenditure.

Efforts are moving in this direction to ensure the decentralization of employment from the coast to the regional development zones such as Kasserine, Gafsa, Siliana, and El Kef … and to develop logistic and transport infrastructure (see tables 6 and 7 for zone classification).

2.2 Goals versus reality

In opposition to the goals announced by the previous regional development program, Tunisian coastal areas and especially the Great Tunis remain the main industrial zones. These efforts did not have the expected results, since more than 90% of total employment is still produced in the coastal part of the country (Dlala, 1997). This configuration can be explained by at least two factors. Firstly, Tunisia inherited a considerable infrastructure for production and distribution facilities concentrated in coastal zones, which had been set up by the French protectorate. Secondly, private capital investment, competitive poles, companies and jobs are characterized by a regional over-concentration along the coast (Figure 1). There is a relative immobility of human capital of coastal zones towards non-coastal ones.

Concentration of infrastructures and human capital in coastal zones has facilitated the development of industrial structures and services and consequently the relatively fast growth of the Tunisian economy. Ayadi et al., (2004) argued that if the government had invested a little more in the interior zones of Tunisia rather than in the coastal zones, regional inequality have been reduced in broader proportions, but total growth would have suffered.

1 National Institute of Statistics – Tunisia (INS).

2 The Investment Code in Tunisia, Law No. 93-120 of December 27, 1993 - Act No. 2006-85 of December 25, 2006, on Finance Law for 2007 - Changes relating to the Finance Act 2007.

The Tunisian's unemployment rate rose from 11.5% in 1984 to 13.9% in 2004. Unemployment among young people (aged from 25 to 29) raised from 12.6 per cent in 1984 to 25.2 percent in 2008.3 In addition, unemployment among young graduates exploded, which is an alarming situation: unemployment rate for graduates of higher education rose from 0.7% in 1984 to 9.4% in 2004 and reached 19% in 20074.

The spatial inequality of economic activities and employment opportunities has been emphasized during the last decade. Tunisian's unemployment rate is characterized by important regional disparities between governorates. Table 1 shows that the highest unemployment rates are located in interior areas with more that 20% unemployment, against unemployment rates fewer than 11% in the coastal areas.

Figure 2 plots the log of unemployment (U) and log of vacancies (V) for two groups of governorates. The first group is composed of the three largest agglomerations of the coastal area (Tunis, Sousse and Sfax), while the second group is comprised of three governorates from the interior area (Béja, Le Kef and Medenine). As seen in this Figure, vacancies and unemployment have grown at increasing rates for the first group, while the number of unemployment shows a dramatic decline for the second group.

2.3 Market forces and local inequalities: Costs versus attractiveness in coastal areas

We can conclude from Figure 3 that, as production cost increases in the governorate of Tunis, Sousse and Sfax, some activities are delocalized in specific neighboring governorates: Zaghouan, Nabeul and Mounastir, but never in further ones. Relocating and decentralizing employment and firms from Tunis, Sfax and Sousse (the three largest agglomeration in Tunisia) is due to their negative externalities (increased Costs, pollution…) as well as the instrumental policies; government incentives can affect a firm's location. Nabeul, Mounastir and Zaghouan are characterized by their geographical proximity to Tunis, Sfax and Sousse and their attractive externalities, such as their relatively low labor cost and land price. Therefore, we notice that attractiveness is strongly affected by the spatial location, which is a market force. Consequently, we will take into account the market forces, that depend on economic geography and best support the concentration of employment opportunities, in order to identify new ideas for convergence of employments levels across different locations.

3. Model for local employment analysis

3.1 Factors of local employment

Following Shearmur et al., (2007) local employment growth can be attributed to three different factors. First, the local institutional context (specific actors, inter firm dynamics and knowledge spillover) can induce employment growth at a local level. But as these factors include a substantial qualitative component, they are difficult to be measured. We approximate them by education and wage levels, which measure stock of knowledge and spatial differences in local non-human endowments (geographical features, natural resources or some other local endowments like public or private capital, local institutions and technology). The second set of factors that can affect local employment growth is the industrial structure of a region. Several local measurable attributes are used in the literature to test the impact of industrial structure on local employment growth, such as specialization, diversity and local competition. The third lot of factors are the geographical and historical structures. Geographic location (for example proximity to market) and historical trends have been put forward as having greater effect on local employment growth. To test the impact of

3 Economic Report on Africa 2010, Promoting high-level sustainable growth to reduce unemployment in Africa.

4 National Institute of Statistics – Tunisia (INS).

the geographic structure, we use the density of industrial zones and the total regional size. We consider the historical structure by using lagged variables.

3.1.1 Institutional factors (Education, wage levels)

Education

Production effectiveness and a region's success are strongly related to high-skilled jobs. Indeed, accumulation of skilled workers generates a positive externality and training effects, which stimulate a higher level of productivity. Interactions and communications between workers can give rise to externalities of knowledge (or spillovers) and create new ideas (Duranton & Puga, 2004).

Glaeser et al. (1995); Simon (1998); Simon & Nardinelli (2002) show that "smart cities" grow faster than unskilled ones, they found a robust positive correlation between the initial employment share of college educated workers and subsequent total employment/population growth in the US. Sudekum (2008) found a similar relation for West Germany NUTS3-regions (1977-2002). However, Sudekum (2008) shows that local share of high-skilled workers is negatively related to subsequent growth of high-killed employment, due to the existence of a convergence of the skill composition of employment across West Germany regions over time.

In order to test the high-skilled workers effect on employment growth, we use the high-skilled employment share in delegation d at time t, $educ_{d,t}$, defined as:

$$educ_{d,t} = \frac{cadre_{d,t}}{emp_{d,t}} \tag{1}$$

where $cadre_{d,t}$ is the total number of high-skilled workers in delegation d at time t and $emp_{d,t}$ is the employment rate in area d at time t.

Wages

Information on wage differences across areas is fundamental to explain the formation of economic agglomeration and migration flows between regions. The New Economic Geography (NEG), initiated by Krugman (1991), identifies wage differences as one of the major determinants of firms' location decisions and the emergence of a core periphery structure. Krugman (1991) considered a two-region, two-sector, and two-factor economy. The first factor (un-skilled labour) is spatially immobile and used as the input in the traditional sector; when the second (skilled labour) is spatially mobile and used as the input in the industrial sector.

Krugman (1991) showed that, in the first, a larger market size (the presence of more firms) generates a higher demand for the industrial goods, which pushes nominal wages up. In the second, an agglomeration of more firms means a greater variety of local products as well as a lower local price index (Thisse, 2009). As a result, real wages should rise, and this region should attract new workers. This cumulative causation process leads to agglomeration of firms and skilled workers in a single region (the core of the economy), while other regions become peripheries (Thisse, 2009). Recently, this relation between wage differences and core-periphery structure has received considerable attention (see for example Combes et al. (2008); Blien et al. (2009); Combes et al. (2005); Kanbur & Rapoport (2005)).

Combes et al. (2008) proposed three broad sets to explain the origin of spatial wage disparities. First, spatial differences in the skill composition of the workforce directly affect wage disparities. Second, wage differences across areas are caused by differences in local non-human endowments (geographical features, natural resources or some other local endowments like public or private capital, local institutions, and technology). The third

interpretation considers that some interactions between workers or firms lead to productivity gains.

3.1.2 Industrial structure: diversity versus specialization

Specialization

According to specialization hypothesis, namely the Marshall-Arrow-Romer (MAR) theory, firms' agglomeration of the same sector produce positive externalities and facilitate the growth of all manufacturing units within the sector. These advantages, which are inter-firms and intra-sector, are based mainly on information sharing, a skilled labour market and intra-industry communication. According to Marshall (1890), the MAR theory increases the interactions between firms and workers, and speeds up the process of innovation and growth.

For each sector s, we measure the degree of industrial specialization in delegation d at each period t, using lagged dependent variable as in Blien et al. (2006). If the estimated coefficient of specialization is larger than one, we have a sector's growth.

Diversity

In order to measure the diversity of the surrounding industrial environment, we use a standard Krugman-diversification index that is defined by:

$$div_{s,d,t} = -\sum_{s'=1,s'\neq s}^{S} \left| \frac{emp_{s',d,t}}{emp_{d,t}} - \frac{emp_{s',t}}{emp_{t}} \right| \tag{2}$$

This index sums absolute differences of delegation d and costal employment shares of all sectors (without the one under consideration). This variable enables us to identify possible externalities known as Jacobs's externalities. Jacobs (1969) considers that a diversity of industries on the same territory involves growth in a greater proportion than specialization. Diversity constitutes an incentive for ideas and information exchanges, which facilitates knowledge adaptation. A firm can profit from the presence of other firms belonging to various sectors but located in the same operative space. Workers of such a diversified space have a weaker probability for unemployment than in a specialized space. Moreover, O'Donoghue (2002) stressed that "diversification causes growth because a greater range of employment opportunities would exist in a diverse economy leading to in-migration, thus attracting skilled workers who could not find employment elsewhere".

Local competition

As MAR, Porter (1990) underlined the importance of the knowledge externalities in economic growth. But, contrary to MAR theory, Porter supposes that local competition between firms has a positive effect on employment growth. Indeed, local competition facilitates innovation and supports the creation of new ideas. Following Batisse (2002), we defined the local competition index for sector s in delegation d at time t as:

$$com_{s,d,t} = \frac{nbre_{s,d,t} / emp_{s,d,t}}{nbre_{s,L,t} / emp_{s,L,t}} \tag{3}$$

where $nbre_{s,d,t}$ and $nbre_{s,L,t}$ are respectively numbers of firms in sector s at delegation d and at coastal area L, respectively.

3.1.3 Geographic structure

Industrial zones

The industrial zones can be considered as one of the local non-human endowments affecting employment growth and increasing attractiveness of a region. It might help firms, within industrial agglomeration, to be more successful. The industrial zones variable will be:

$$den\_zi_{d,t} = \frac{\sup\_zi_{d,t}}{\sup_d} \tag{4}$$

where $\sup\_zi_{d,t}$ and $\sup_d$ are respectively the surface (km2) of industrial zone zi and delegation d.

Total regional size: agglomeration

Industrial concentration of firms is influenced by different factors like natural resources, customers' proximity or by chance (Brenner, 2004). However, firms can be agglomerated even in the absence of these factors. Two regions with the same factor can have different attractiveness effects. This attractiveness can be explained by other mechanisms like spillovers, cooperation between firms, educational and training activities and informal contacts between firms within the same region (Brenner, 2004).

In order to test agglomeration effects on employment growth, we retain a measure defined in Blien et al. (2006). For each delegation d, this measure includes total employment $emp_{d,t}$ purged from particular sector employment $emp_{s,d,t}$ to avoid endogeneity bias.

$$size_{d,t} = emp_{d,t} - emp_{s,d,t} = \sum_{s'=1}^{S} emp_{s',d,t} - emp_{s,d,t} \tag{5}$$

3.1.4 Spatial externalities and path dependency

Spatial externalities

Knowledge spillovers and externalities are not locally bounded but can freely move across borders (firm, agglomeration, region and country). Firms' geographical proximity facilitates knowledge diffusion and motivates innovation and new ideas creation. Thus, employment growth in any area is influenced by the technological performance and the human capital of its neighbors. Spatial econometrics may be used to evaluate neighborhoods' effects. We can evaluate spatial spillovers effect by introducing,, among the explanatory variables of our model, the spatially lagged employment growth ($Wlemp_{s,d,t}$), where W is a spatial weight matrix which reflects geographical proximity.

Note that there are various approaches to define W going from a first order contiguity to a more complicated form like the *k*-nearest weight matrices (see Fernandez-Aviles Calderon (2009) for other forms of the weight matrix). In our study we use a simple first order contiguity matrix.

The off diagonal element of the contiguity weight matrix is a set of binary weights that assigns the value 1 if two localities have a common border and zero otherwise (see for example Lacombe, 2004 for other forms of the weight matrix). But since each observation by convention can't be its own neighbor the diagonal consists of zeros. These weights are then summarized in the spatial weights matrix W.

Path dependency

Previous industrial development of any area affects its present productivity and employment growth, as it accumulates knowledge and human capital. The past situation of the firm (cultural environment, age and other determinants) may have an impact on its future size and productivity. "An important reason for this path-dependency is the cumulative character of knowledge, i.e. new knowledge becomes particularly valuable if it is combined with an already existing knowledge stock. According to the characteristics of the existing knowledge stock, regions can have different capabilities and may therefore respond to a certain impulse in rather different ways" (Fritsch, 2004).

3.2 Model of employment growth

We based our econometric model on a specification used by Blien et al. (2006), who considered a dynamic panel model for West Germany. We extend this specification in order to integrate the spatial dimension used by Elhorst (2005) specifying a dynamic spatial panel data model. Our spatial panel data dynamic model will be:

$$lemp_{s,d,t} = \alpha + \rho Wlemp_{s,d,t} + \sum_{l=1}^{m} \beta_l lemp_{s,d,t-l} + \sum_{l=0}^{m} \delta_l X_{s,d,t-l} + f_{s,d} + \eta_t + \varepsilon_{s,d,t} \quad (6)$$

$lemp_{s,d,t}$ is the log of employment rate of sector s, ($s = 1,...,S$), in area d ($d = 1,...,n$) at time t ($t = 1,...,T$). $Wlemp_{s,d,t}$ is the spatially lagged dependant variable ($lemp_{s,d,t}$) and $lemp_{s,d,t-l}$ are the timely lagged dependent variables. $X_{s,d,t-l}$ are the current or lagged covariates (specialization, diversity, competition, agglomeration, size and wages). $f_{s,d}$ is a fixed time specific effect, η_t is a time effect and $\varepsilon_{s,d,t}$ is the standard error term.

3.3 Tests and econometric estimation procedure

3.3.1 Tests for spatial correlation

To deal with dynamic spatial correlation, we use an Exploratory Spatial Data Analysis (ESDA), proposed by Anselin (1996). The ESDA technique enables us to test and identify spatial configuration of industrial employment for each sector. The first step to deal with georeferenced data consists to check the presence of spatial dependence. Moran's I index is the most commonly used index detecting global autocorrelation of a variable of interest, x_i. Roughly speaking the Moran index is a cross product correlation measure that incorporates "space" through a spatial weight matrix W.

Formally, let n be the number of elementary spatial unit and x_i the employment at the i spatial unit. The Moran's index is defined as:

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{S_0 \sum_{i=1}^{n}(x_i - \bar{x})^2} \quad (7)$$

where $\bar{x}$ denote global mean, w_{ij} is the ij^{th} element of the spatial weighting matrix W and $S_0 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}$.

Spatial filtering

After detecting spatial autocorrelation using Moran's index, the question is how to handle it. One approach dealing with this problem is to spatially filter the data. This approach seeks to transform a spatially dependent variable into two components: the filtered variable and the purely spatial effect. In our analysis, we use the Getis's G_i specification to remove spatial effect. Getis's index is presented as:

$$G_i(d) = \frac{\sum_{j=1}^{n} w_{ij}(d)x_j}{\sum_{j=1}^{n} x_j}, i \neq j \quad (8)$$

Such that $d_{opt} = \min_d \left| z_I(X^F) \right|$ and $x_i^F = x_i \frac{\left[\frac{W_i}{(n-1)} \right]}{G_i(d)}$

Where $\frac{W_i}{(n-1)}$ is $E[G_i(d)]$ and $W_i = \sum_{j=1}^{n} w_{ij}(d)$. x_i^F is the spatially filtered variable. Distance d_{opt} is selected such that it minimizes the z-score value, z_I, of Moran's *I* for x_i^F (see Getis (1995) for more details).

This approach detects the range of spillovers for each sector (d_{opt}), and does not require any specific assumptions on the model (such as the assumption of normal distributed error terms) (Griffith, 2002, 2003; Elhorst, 2005; Griffith & Haining, 2006). After filtering the spatial effect, equation (6) becomes:

$$lempf_{s,d,t} = \alpha + \sum_{l=1}^{m} \beta_l lempf_{s,d,t-l} + \sum_{l=0}^{m} \delta_l X_{s,d,t-l} + f_{s,d} + \eta_t + \varepsilon_{s,d,t} \quad (9)$$

where $lempf$ is the filtered employment variable.

3.3.2 GMM Estimation

As the dependant variable $lempf_{s,d,t}$ in equation (9) is a function of the fixed time specific effect $f_{s,d}$, $lempf_{s,d,t-1}$ will be also a function of $f_{s,d}$. Then the lagged dependant variables $lempf_{s,d,t-l}$ may be correlated with $f_{s,d}$. Hence, ordinary least squares estimators (OLS) and generalized least squares estimators (GLS), i.e. fixed effects or random effects estimators, are biased and inconsistent (Baltagi, 2005). To avoid the endogeneity bias, we will estimate our model (equation 11) by the generalised method of moment (GMM) proposed and developed by: Arellano & Bover, 1995 and Blundell & Bond, 1998. However for a better choice of the instruments our estimation are done using the system GMM (GMM-SYS) of Blundell & Bond (1998).

Blundell & Bond (1998) show that the instruments of the GMM-DIF (first-differenced GMM estimator of Arellano & Bond, 1991) are poor, and show also that it may be improved by using lagged differences as instruments for equations in levels[5]. Their estimator is called system GMM (GMM-SYS).

4. Statistical and econometric results

4.1 Data

We consider Tunisia's coastal area, which includes eleven governorates (Bizerte, Tunis, Ariana, Ben Arous, Manouba, Zaghouan, Nabeul, Sousse, Monastir, Mahdia and Sfax) among twenty-four (see Figure 5). The coastal region covers 15% of the total area of the country but it includes more than 60% of the global population and 64% of total employment. The eleven governorates are organized administratively in 138 delegations corresponding to the spatial scale retained in this study.[6]

We use *Commissariat Général au Développement Régional* database. We have a panel of 138 delegations observed from 2002 to 2007. For each delegation we have information on

5 The first-differenced GMM estimator has been found to have poor finite sample properties, in terms of bias and imprecision, if the lagged levels are only weakly correlated with subsequent first-differences. Thus, the instruments used in the first-differenced equations are weak (Blundell & Bond, 1998).

6 Delegation is the smallest administrative area in Tunisia for which data is available.

total manufacturing employment by sector, the number of firms having at least 10 workers, infrastructure facilities (roads, quality of the industrial parks), human capital (share of high skilled workers) and the average delegation's wage level.

Figure 4 depicts distribution of manufacturing employment and number of firms for six years. We can see that the employment rate by delegation slightly increases between 2002-2007. However, its distribution is strongly unequal. We consider five manufacturing industries: agro-food industry (IAA); pottery, glass and other non-metallic mineral industry (IMCCV); mechanical, electrical and electronic industry (IME); chemical industry (ICH); and textiles, wearing apparel, leather and footwear industry (ITHC).

Table 5 in the appendix gives employees' numbers and employment shares of each sector in the coastal area, between 2002 and 2007. We can see that 50 per cent of all manufacturing employment of the coastal areas is in ITHC. IMCCV and ICH sectors have the smallest share (about 5% of manufacturing employment). IME and IAA have 17 % and 11 % of total coastal manufacturing jobs respectively.

4.2 Spatial test, spatial filtering and spillovers ranges

According to the Moran's test (Table 2), we reject the null hypothesis of non-spatial autocorrelation, except for the two sectors: Glass and other non-metallic mineral (IMCCV) from 2002 to 2004 and Chemical industry (ICH) from 2003 to 2007. This result confirms our hypothesis of spatial externalities between each delegation and their neighbours.

Anselin et al. (1997) showed that spillovers have been found to be significantly effective only within a range of 50 km. Our results (Table 2) show that IAA and IMCCV industries present the largest range of spillovers (44.54 km and 44.51 km respectively). Less range spillovers effects has been detected for the two sectors: mechanical, electrical and electronic (19.65 km) and chemical industry (22.39 km). These first results go in the same direction as those of (Badinger et al., 2004; Duranton & Overman, 2005; Anselin et al., 1997). Indeed, technological externalities for high technology industries (mechanical, electric or chemical industries) propagations are limited to the closest neighbours. However, for traditional industries (textile, agro-food and construction), these technological externalities can affect more distant areas in Tunisia.

4.3 Econometric results

Table 3 depicts the GMM (GMM-SYS) estimation results of the dynamic model for five different sectors, using the spatially filtered variables. But table 4 give us results of some validation tests.

Model Validation

Statistical test of serial correlation (,AR(1) and AR(2) Arellano-Bond test (Arellano & Bond 1991)[7]) and over-identification Sargan test, (Sargan (1958)) are presented in Table 4. Statistical tests regarding serial correlation (AR(1) and AR(2)) reject the absence of first order serial correlation for (IAA), (ICH) and (ITH) at 5%, but not second order serial correlation. The Sargan tests do not reject the overidentifying restrictions.

Specialization

Results of Table 3 show that all the parameters on the lagged dependent variables are less than one, we can't reject the specialization hypothesis.[8] This result is not surprising. Thus, Henderson (2003) shows that in the short term of cluster development specialized clusters

7 AR(1) and AR(2) test, respectively, the first and the second-order autocorrelation in the first differenced residuals.

8 An industry is regarded as specialized if the parameter on the lagged dependent variable is greater than 1 (Blien et al., 2006).

seem to be well able to reap benefits from localization economies, while diversification effects persist far longer. According to this hypothesis, specialization loses its significant effect over time. This finding is confirmed in our case study: estimation results of Table 3 show that the effect of specialization (the lagged dependant variable) decreases from $t-1$ to $t-2$.

Diversity

Diversity (Jacob externalities) does not seem to have the same effect on employment growth for the five sectors. The impact of diversity is positive and significant for the two sectors agro-food and textile (0.264 and 2.3 respectively), while it is negative and significant for IME sector. This result proves the existence of urbanisation economies for the first two sectors. Following Batisse (2002), a positive impact of the variable can be explained as "the reflection of the existing commercial relations between the sectors rather than the division and the exploitation of technological complementarities between sectors" but these urbanization economies generally refer to externalities occurring through the inter-industrial repercussions (knowledge spillovers). These relations encourage the appearance of virtuous circles in the transmission of innovative ideas, so firms can benefit from the proximity of the other manufacturing units.

Competition

The immediate effect of the competition indicator is significant and negative; while it has a significant positive one-period lagged effect, except for mechanical, electrical and electronic industry (IME). This result shows that firms in a competitive area will be more productive in the future. This is consistent with Bun & Makhloufi, (2007) for the case of Morocco, who found that the lagged effects of competition indicator are significantly positive. So, a competitive market is likely to increase the firm's productive capacity. Porter, (1990) argues that, at long term, competition between firms drives growth and forces firms to be innovative and to improve and create new technology. He considers that Government cannot create competitive industries; only firms can do that.

Agglomeration effect

Agglomeration or market size effects are important for the employment growth for low levels of development when countries have low knowledge accumulation and limited capital. However desirability of high agglomeration declines with development. From Table 3, agglomeration is found to matter in the short run, with a positive and significant effect. However, the lagged effects are negative and significant especially for the two sectors (agro-food and textile).

Education

Education has a significant positive impact on employment growth: IAA (1.462), IME (1.635) ITH (0.717). This finding is consistent with general human capital theory, and shows that performances of firms in high-tech sector are more influenced by skilled workers (it is the case of the IME sector with the highest coefficient (1.635)). The impact of this variable is also positive and significant with a 2-year time lag (except for ceramic sector). This result is also confirmed by observing Figure 1 where skilled workers are more concentrated along the coastal areas.

Wage

Finally, the short run effect of the regional wages is negative and significant (at 1% level) only for the textile sector. There is a significantly negative effect with a 1-year time lag for textile, ceramic and electric and a significantly negative effect with a 2-year time lag for textile, agro-food and electric. These results show that higher delegation wages reduce employment growth.

5. Conclusion and policy implications

This paper has tried to identify different sources of manufacturing employment growth in Tunisian coastal area. Examining the employment trends over a six-year period, we found that industrial employment decreased in metropolitan areas (Tunis, Sousse and Sfax) although surrounding areas (Bizerte, Zaghouan and Mounastir) become more attractive and subsequently their industrial employment levels increased. Our analysis also provides evidence supporting the spatial spillover effects. Less range spillovers effects (15 km) has been detected for high-tech sectors (mechanical, electrical, electronic and chemical industry), as technological externalities for those sectors need face-to-face contacts and are limited to the closest neighbours. However, for the traditional sectors (textile, agro-food and construction), externalities can affect more distant areas (50 km). Our empirical results suggest also that market size and education have positive and significant impacts on manufacturing employment growth. Low wage levels attract firms and investors. Firm's competition has negative and significant instant effects, but positive one-year lagged effects.

In terms of policy recommendations, previous results will help us to identify the impact of local economical structure, which is currently one of the crucial issues for policymakers attempting to draw up specific regional development programs. Thus, one of the recurring questions concerning policy adopted by local authorities is to develop the territorial attractiveness and to increase local employment. In order to assess these regional programs, further studies on the local employment growth are necessary to comprehend the selection process and regional development programs while respecting the characteristics of each region. Given the economic and political situation after the January 14th revolution, Tunisia needs to think seriously about solutions at local scale that can reduce unemployment rate and the social exclusion in the non-coastal area. Policy discussion should be framed not at the national level, but it should be framed at the local level such as delegations or villages. The concentration of economic activity in a few delegations of the coastal zone is itself desirable however the spatial disparities in welfare associated with this process are mostly unwelcome.

Policy makers should reckon with the urbanisation degree of each community. For areas of incipient urbanisation (the case of most non-coastal areas of the country), the policy challenge should facilitate agglomeration forces and density. This step can give rise to a strong economic core in a suitable environment. For areas of intermediate urbanisation (like Zaghouan, Mehdia, Bizerte, and Mounastir from coastal area) government should build density and reduce economic distance. Distance measures how easily capital flows, labour moves, goods are transported and services are delivered between two locations (see chapter 2 of 2009 World Bank report, for more details). The infrastructure to support this situation must be put in place to provide connectivity and reduce the time coast between different areas. For areas of advanced urbanisation (Great Tunis, Sfax and Sousse) government should build density, overcome distance and control the negative externalities of agglomeration.

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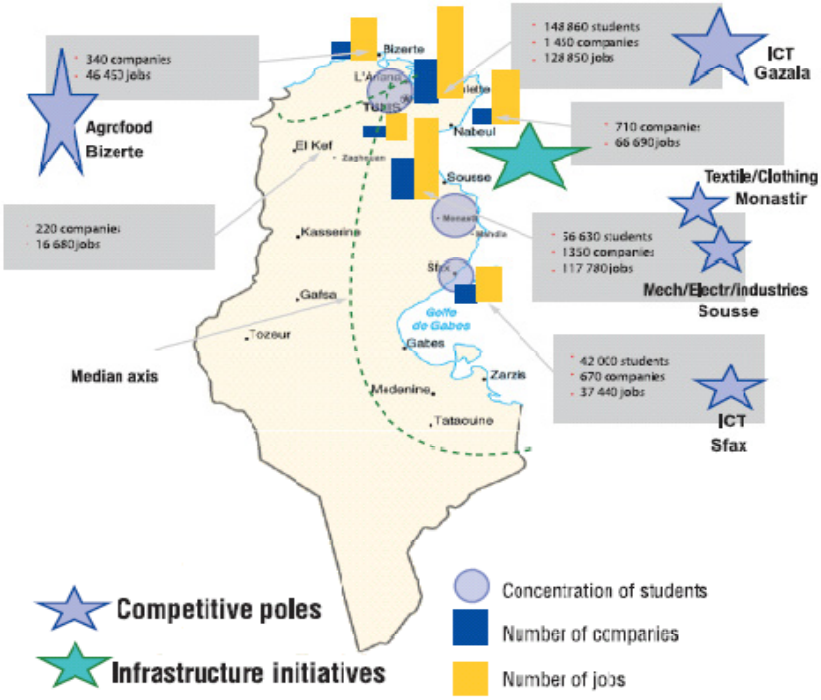
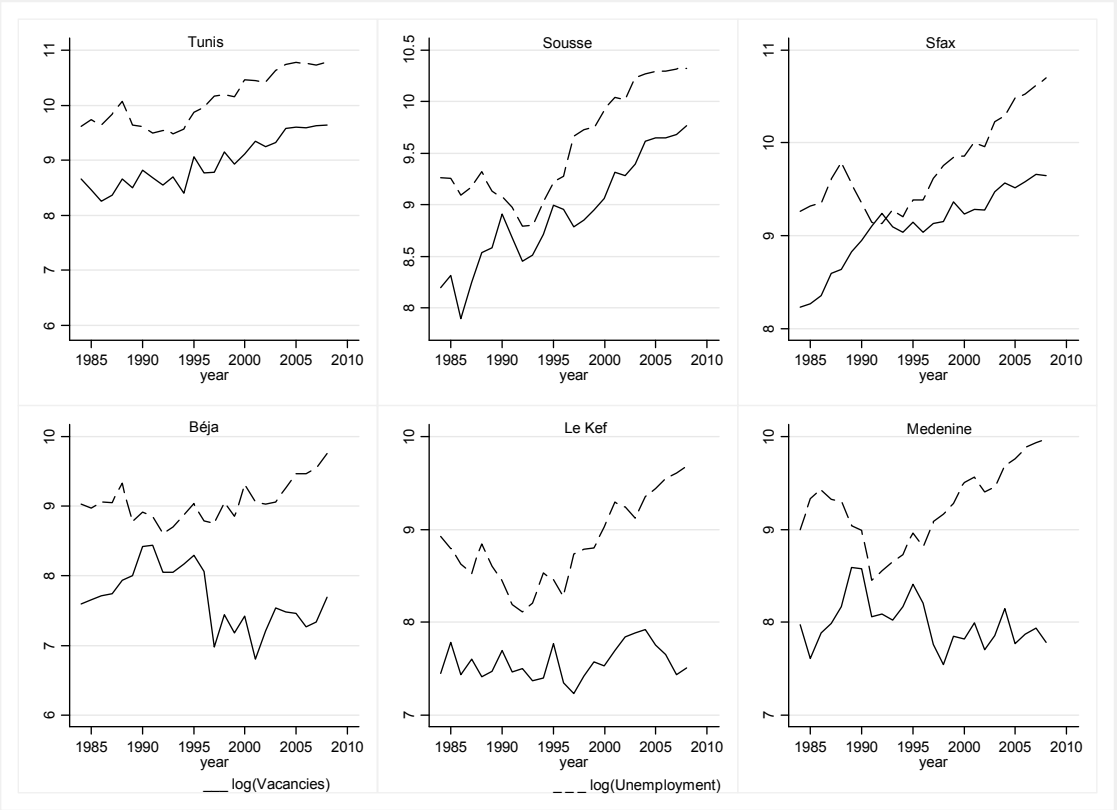
Figure 1: Geographical Distribution of Competitive Poles, Infrastructure Initiatives, Students, Jobs and Companies



Source: Study initiated by the Ministry of industry, Energy and Small/Medium Businesses (Tunisia) in 2009, National industrial strategy for the years leading up to 2016.

Figure 2: Stocks of Unemployment and Vacancies



Source: Amara et al., 2011

Figure 3: Evolution of Manufacturing Employment and Number of Firms in Coastal Areas

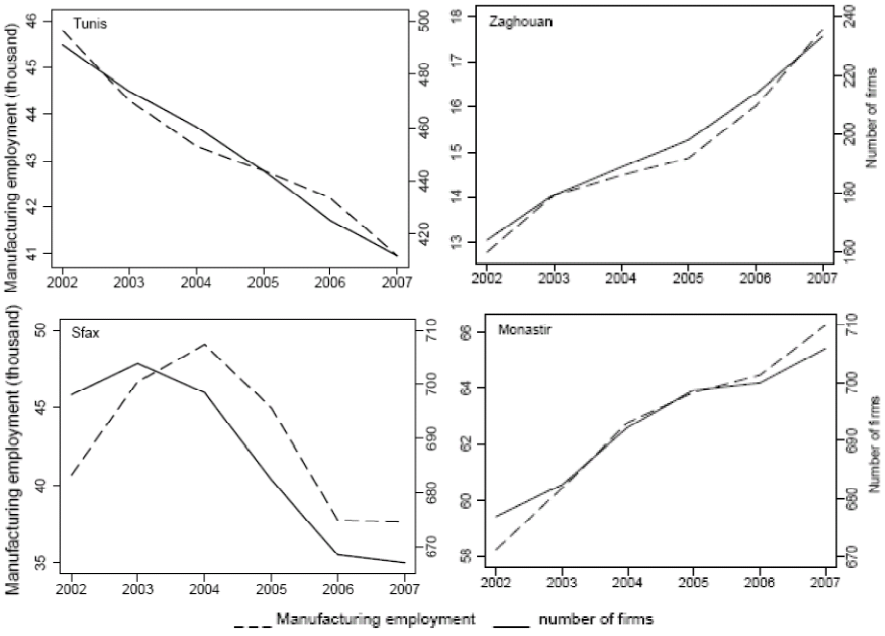
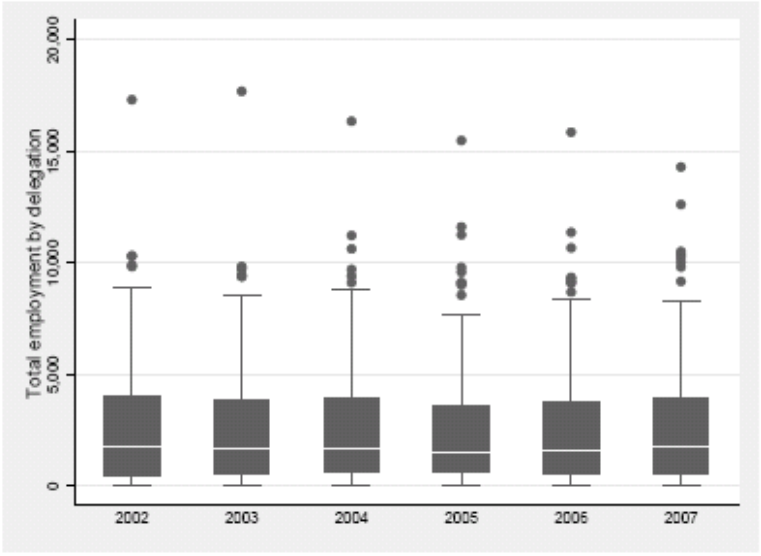


Figure 4: Evolution of total manufacturing employment and number of firms.



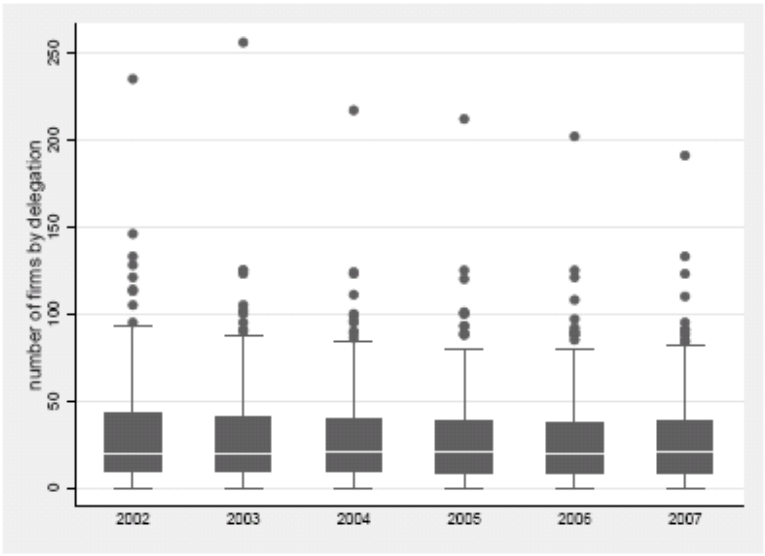


Table 1: Unemployment rate by Governorate

Area	Interior area (%)				Coastal area (%)			
Governorate	**Le Kef**	**Jendouba**	**Kasserine**	**Gafsa**	**Nabeul**	**Sousse**	**Monastir**	**Sfax**
Unemployment rate	22	20.4	20.9	21	9.7	11.1	7.4	11.2

Table 2: Moran's I test for original and filtered employment variables

	Total employment		**Agro-food**		**Ceramic**		**Electric**		**Chemical**		**Textile**	
Year	**Original**	**filtered**	**Original**	**filtered**	**Original**	**filtered**	**Original**	**Filtered**	**Original**	**filtered**	**Original**	**filtered**
2002	0.151***	0.042*	0.156***	0.044	0.019	-0.005	0.185***	0.148***	0.075*	-0.009	0.217***	0.057
	(2.794)	(0.864)	(2.881)	(0.911)	(0.466)	(0.031)	(3.391)	(2.752)	(1.458)	(-0.038)	(3.962)	(1.139)
2003	0.155***	0.079	0.168***	0.062	0.036	0.001	0.193***	0.145***	0.052	-0.025	0.232***	0.139**
	(2.873)	(1.53)	(3.102)	(1.222)	(0.772)	(0.139)	(3.541)	(2.692)	(1.055)	(-0.316)	(4.231)	(1.944)
2004	0.165***	0.064	0.179***	0.057	0.043	0.014	0.125***	0.04	0.063	-0.021	0.266***	0.071*
	(3.043)	(1.263)	(3.298)	(1.137)	(0.884)	(0.367)	(2.331)	(0.827)	(1.233)	(-0.239)	(4.823)	(1.375)
2005	0.155***	0.074*	0.175***	0.064	0.078*	0.041	0.115**	0.031	0.055	-0.018	0.278***	0.033
	(2.872)	(1.428)	(3.214)	(1.264)	(1.506)	(0.851)	(2.166)	(0.672)	(1.096)	(-0.193)	(5.032)	(0.704)
2006	0.143***	0.048	0.168***	0.057	0.073*	0.037	0.123**	0.026	0.057	-0.004	0.259***	0.057
	(2.662)	(0.975)	(3.091)	(1.139)	(1.417)	(0.778)	(2.297)	(0.592)	(1.139)	(0.059)	(4.705)	(1.135)
2007	0.164***	0.030	0.201***	0.068*	0.099**	0.025	0.139***	-0.011	0.048	0.012	0.292***	0.059
	(3.028)	(0.663)	(3.678)	(1.324)	(1.871)	(0.564)	(2.578)	(-0.062)	(0.982)	(0.344)	(5.291)	(1.179)

	Optimal distance by km					
Year	**Total employment**	**Aro-food**	**Ceramic**	**Electric**	**Chemical**	**Textile**
2002	12.7712	45.5243	50.0000	34.4443	15.2136	47.0940
2003	21.5667	49.4954	50.0000	28.0097	15.8088	48.1540
2004	20.5770	40.3747	50.0000	14.6588	16.1553	36.3846
2005	23.0269	49.1899	50.0000	13.3594	16.2197	21.0853
2006	16.7799	45.1787	50.0000	12.4297	20.9473	33.1339
2007	18.9585	37.4790	50.0000	14.0845	17.0621	37.7970

Table 3: A panel dynamic of employment with control variables (System GMM estimations)

Variables		Agro-food	Ceramic	Electric	Chemical	Textile
Lempf	$t-1$	0.627***	1.360***	0.453***	0.255***	0.989***
		(0.062)	(0.220)	(0.106)	(0.108)	(0.035)
	$t-2$	-0.027	0.039	0.144***	-0.005	-0.103***
		(0.021)	(0.059)	(0.031)	(0.009)	(0.010)
Diversity	t	0.264*	-0.310	-0.285*	0.462	2.300***
		(0.160)	(0.667)	(0.156)	(0.176)	(0.170)
	$t-1$	0.225	0.710*	1.390***	-0.161	-1.352***
		(0.167)	(0.380)	(0.220)	(0.134)	(0.123)
Competition	t	-0.719***	-0.706***	-0.580***	-0.848***	-0.648***
		(0.080)	(0.152)	(0.161)	(0.050)	(0.051)
	$t-1$	0.476***	1.943***	0.250	0.366***	0.779***
		(0.084)	(0.241)	(0.171)	(0.134)	(0.058)
Agglomeration	t	0.301***	0.530***	0.695***	0.186**	0.361***
		(0.083)	(0.165)	(0.091)	(0.084)	(0.069)
	$t-1$	-0.077**	0.030	-0.001	0.198***	-0.455***
		(0.037)	(0.122)	(0.074)	(0.066)	(0.058)
Education	t	1.462***	0.435	1.635***	-0.481**	0.717***
		(0.195)	(0.371)	(0.526)	(0.220)	(0.193)
	$t-1$	0.380***	3.046***	-0.496	-1.000***	0.072
		(.121)	(0.228)	(0.345)	(0.208)	(0.098)
	$t-2$	0.985***	-2.772***	1.160***	0.581*	0.655***
		(0.202)	(0.657)	(0.447)	(0.351)	(0.158)
Industrial park	t	-0.004	-0.097	-0.377***	-0.002	-0.148***
		(0.036)	(0.115)	(0.048)	(0.015)	(0.025)
	$t-1$	0.030	-0.111***	0.102***	0.028	0.090***
		(0.021)	(0.039)	(0.028)	(0.020)	(0.024)
	$t-2$	-0.030	-0.027	-0.046	-0.044	0.056
		(0.022)	(0.056)	(0.046)	(0.025)	(0.037)
Wages	t	-0.045	0.285	-0.115	0.087	-0.295***
		(0.045)	(0.194)	(0.121)	(0.069)	(0.090)
	$t-1$	-0.089	-0.829***	-0.183**	0.157*	-0.115*
		(0.068)	(0.148)	(0.082)	(0.089)	(0.060)
	$t-2$	-0.234***	-0.198	-0.322***	0.036	-0.273***
		(0.087)	(0.130)	(0.096)	(0.060)	(0.051)
Observations		157	135	157	126	167

Notes: *** Significance at 1%, ** significance at 5%, and * significance at 10%.

Table 4: Sargan and Arellano-Bond Tests

Tests		**Agro-food**	**Ceramic**	**Electric**	**Chemical**	**Textile**
Sargan test	chi2(11)	32.261	30.421	27.195	14.874	33.192
	Prob > chi2	0.454	0.547	0.709	0.995	0.409
Arellano-Bond test	AR(1)	-1.649	-0.063	-0.302	-2.003	-1.971
	p-value	0.099	0.950	0.762	0.045	0.049
	AR(2)	0.778	-0.727	0.941	1.044	1.127
	p-value	0.437	0.467	0.347	0.297	0.209

Appendix

Figure 5: (1) Tunis; (2) Ariana; (3) Ben Arous; (4) Manouba; (5) Bizerte; (6) Zaghouan; (7) Nabeul; (8) Sousse; (9) Mounastir; (10) Mahdia; (11) Sfax; (12) Beja; (13) Jendouba; (14) Siliana; (15) El Kef; (16) Kairouan; (17) Kasserine; (18) Sidi Bouzid; (19) Gafsa; (20) Tozeur; (21) Gabes; (22) Kebili; (23) Medenine; (24) Tataouine.

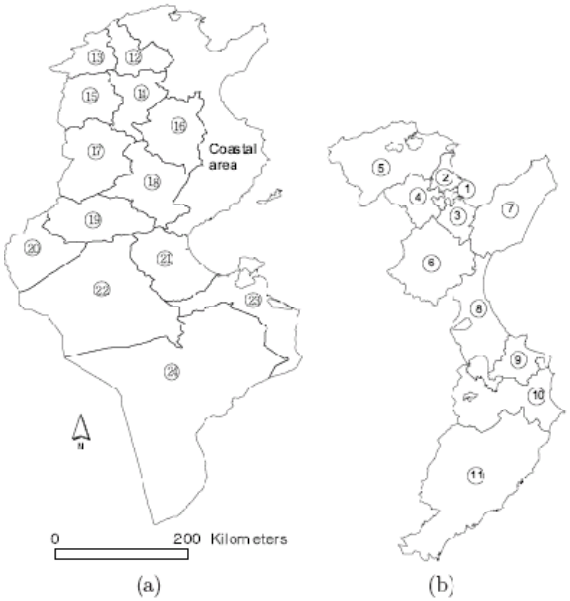


Table 5: Number and per cent distribution across employment sector

Year	IAA	IMCCV	IME	ICH	ITHC	Other Industries
2002	45382	23077	64200	22094	220663	24457
	(11.35)	(5.77)	(16.06)	(5.53)	(55.18)	(6.12)
2003	47591	22698	63609	26522	207471	32171
	(11.90)	(5.67)	(15.90)	(6.63)	(51.86)	(8.04)
2004	46701	22501	67448	26724	201640	37168
	(11.61)	(5.59)	(16.77)	(6.64)	(50.14)	(9.24)
2005	46639	20954	73532	27675	197902	37547
	(11.54)	(5.18)	(18.19)	(6.85)	(48.96)	(9.29)
2006	47312	20909	78050	28280	191971	40944
	(11.61)	(5.13)	(19.15)	(6.94)	(47.11)	(10.05)
2007	47643	20829	86948	30805	197932	42754
	(11.16)	(4.88)	(20.37)	(7.22)	(46.36)	(10.01)

Notes: Value between parentheses is the volume per cent of coastal manufacturing employment.

Table 6: Deprived zones in Tunisia

Governorate	Delegation as deprived zones	Total number of delegation
Beja	North of Beja, South of Beja, Medjez El Bab	9
Gabes	Mereth	10
Kairouan	North of Kairouan, South of Kairouan	11
Mahdia	Sidi Alouane, Melloulech	11
Sfax	Menzel Chaker	15
Sousse	Kondar	15
Zaghouan	Zaghouan El Hahs, Bir M'Cherga	6

Table 7 : Zones of priority development

Governorate	Delegation as `priority zones'	Total number of delegation
Beja	Nefza, Amdoun, Testour, Teboursouk, Goubellat, Thibar	9
Bizerte	Djoumine, Sejnane, Ghezala	14
Gabes	Old Matmata, New Matmata, El Hamma, Menzel El Habib	10
Gafsa	all delegations	11
Jendouba	all delegations	9
Tozeur	all delegations	5
Kasserine	all delegations	13
Kebili	all delegations	5
El Kef	all delegations	11
Sidi Bouzid	all delegations	12
Siliana	all delegations	11
Tataouine	all delegations	7
Kairouan	El Ala, Hajeb el Ayoun, Echebika, Sbikha, Haffouz, Nasrallah, Oueslatia, Bouhajla, Cherarda	11
Mahdia	Ouled Chamekh, Hébira, Essouassi, Chorbane	11
Medenine	Medenine North, South Medenine, Sidi Makhlouf, Ben Guerdane, Beni Khedeche	9
Sfax	El Ghraiba, El Amra, Agareb, Djebeniana, Bir Ali ben Khelifa, Skhira, Kerkennah	15
Sousse	Sidi el Hani	15
Zaghouan	Ez-Zriba, Ennadhour, Saouaf	6