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REGIONAL GROWTH IN TUNISIA: ECONOMIC GEOGRAPHY FORCES AND INDUSTRIAL STRUCTURE

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Abstract

The purpose of this paper is to explain regional growth and agglomeration of industrial activities in Tunisia between 2000 and 2005. Based on the contributions of the new economic geography, and the theoretical approach dealing with the relationship between externalities and regional growth, an econometric model is considered to test the impacts of the industrial structure, the agglomeration effects and the opening of the border in Tunisia on regional growth. On the one hand, the results show that a competitive environment and a diversity of the industrial activities are favorable to the regional growth. On the other hand, the forces of agglomeration play an important part, but do not prevent the appearance of convergence between the regions (even if overall coastal areas always benefit from a more considerable growth than the interior of the country). Lastly, the results also show that foreign direct investments play an important part in the development of concentrated areas. These findings have some policy implications related mainly to technological spillovers associated to foreign investments.

ملخص

تهدف الورقة إلى تفسير النمو الإقليمي وتكرس النشاطات الصناعية في تونس بين عام 2000 و2005. واعتماداً على إسهامات الجغرافيا الاقتصادية الجديدة والأسلوب النظري في التعامل مع العلاقة بين النمو الداخلي والخارجي فإن نموذج قياس اقتصادي قد استخدم لقياس تأثيرات البنية الصناعية وتأثيرات تكرس الصناعات وفتح الحدود التونسية على النمو الإقليمي. فمن ناحية تشير النتائج إلى أن البيئة التنافسية وتنوع النشاطات الصناعية تعد من الأشياء المواتية بالنسبة للنمو الإقليمي، ومن الناحية الأخرى فإن قوى تكرس الصناعة تلعب دوراً مهماً لكنها لا تمنع ظهور التقاء بين الأقاليم (رغم أن استفادة المناطق الساحلية تفوق على الدوام النمو في المناطق الداخلية) وأخيرا تظهر النتائج أن الاستثمارات الخارجية المباشرة تلعب دوراً مهما في تطوير المناطق كثيفة السكان. ولهذه النتائج بعض التأثيرات على السياسات التي تتعلق أساساً بتدفق التكنولوجيا الذي يصاحب الاستثمارات الخارجية.

I. Introduction

Regional development is a long-standing concern in Tunisia. Since independence, there have been persistent disparities between coastal and interior areas. Density of population, urban network, public, social and cultural infrastructures constitute, along with private and public investments, the important factors of localization for regional growth. These disparities are highlighted by the traditional problem of rural migration towards large cities and in particular the capital city (Régnault, 1995) and also recently by the increasing flows of foreign capital. Foreign direct investment (hereafter referred to as FDI) is located in the areas of agglomeration as sources of externalities. These factors explain the development of the coastal areas at the expense of other areas of Tunisia.

The main studies carried out on regional growth conclude that there is an important concentration of private and public investment in coastal areas (Rmili, 1990; Domecq and Régnault, 1990; Métral, 2003). Other research suggests an extension of coastal areas towards the closest urban centers inland (Royoux and Signoles, 1988; Chebaane, 1990). Yet the process of regional growth has become even more complex, owing in part to several traditional factors such as the state of infrastructure, geographical localization, demographic size, density of the population, local potential, etc... (El Bekri, 2000). Unfortunately, evidence on the likely effects of FDI and industrial structure on regional economies remains scant and inconclusive. A clear vision of how FDI has an impact on local economies is especially important when considering it as a manifestation of the forces of globalization. Although there is empirical evidence on the attractiveness of Tunisia for FDI (Karray and Toumi, 2007), there are only a few studies about the impact of FDI and local industrial structure on regional growth.

This paper aims to enrich the empirical evidence in explaining regional growth by focusing especially on the experience of Tunisia. More specifically, we estimate a model similar to those developed by Glaeser et al. (1992) and Henderson et al. (1995) in order to explain the growth of regions in Tunisia between 2000 and 2005. The originality of the model proposed in this paper is in taking into account, besides variables relating to the industrial structure and the economies of agglomeration, a set of variables which stress the role of FDI in generating regional growth. The model of city growth we are considering stresses the role of: externalities (and more specifically knowledge spillovers), agglomeration economies (related to localization of firms and people) and FDI (as the main manifestation of transition to a market economy in Tunisia). These foreign investments contribute to making up geographical concentration and regional specialization (Karray and Driss, 2006).

The paper is divided into five sections. The following section of the paper briefly presents the theoretical foundation for our analysis, in particular literature on endogenous growth and new economic geography. Section III deals with empirical issues such as econometric specification of the model, data source and measurements of variables. Section IV presents and analyses results relating to the econometric estimates. A final section (V) summarizes the findings and illustrates their implications for government policy.

II. Agglomeration Economies, Externalities and Regional Growth

Economic literature survey shows two main sources for regional growth according to the nature of externalities. On the one hand, geographic forces, and consequently agglomeration economies related to pecuniary externalities introduced by the new economic geography (Krugman, 1991), explain concentration of firms and people. On the other hand, externalities related to technological knowledge spillover are introduced by Glaeser et al. (1992) and Henderson et al. (1995) in order to explain regional growth.

Fundamental contributions of new economic geography (Krugman, 1991 ; Krugman and Venables, 1995, 1996) explain how increased globalization in world economy affects localization of industrial firms when taking into account both agglomeration and dispersion forces in economies. Geographical concentration of manufacturing is based on the interaction of economies of scale with transportation costs. However, this concentration process is slowed down by centrifugal forces such as those relating to international trade costs (transport costs, customs rates, exchange rate risk and all forms of barriers).

According to this approach, agglomeration effects are also related to pecuniary externalities (associated with either demand or supply) which play an important role through two circular process of agglomeration (Krugman, 1991a). On the one hand, concentrated sites offer a great diversity of input (intermediate services and goods, qualification of workers) which allows better productivity for producers of final goods. In the same way, workers have more varied opportunities for employment. Manufacture production will tend to concentrate where there is a large market, but the market will be large where manufacture is concentrated. These backward linkages increase then the concentration of firms and workers. On the other hand, the preference of consumers for the diversity of goods leads them to move towards the agglomerations and this concentration of the consumers makes it possible for firms to widen the variety of their output. Other things equal, it becomes more desirable to live and produce near an agglomeration of manufacturing production because it will then be less expensive to buy the goods this central place provides. These forward linkages allow a finer pairing between products and consumers (Thisse and Van Ypersele, 1999). Backward and forward linkages are mutually reinforced to create geographical concentration of manufacture production. They enable us to better understand the relationship between agglomeration economies, region size and the localization process of firms.

The second category of externalities which explains regional growth is associated to knowledge spillover. Models of endogenous growth offer a suitable framework to explain agglomeration effects and consequently the city growth. This approach views the externalities (and more particularly externalities associated with technological diffusion) as "the engine of growth" (Romer, 1986; Lucas, 1988). If geographical proximity facilitates transmission of knowledge, then we should expect knowledge spillovers to be particularly noticeable in cities. According to these models, cities grow because people in cities interact with other people — either on their own or in other sectors — and learn from them. When a firm carries out a technological innovation, its R&D investment increases its stock of knowledge, but also benefits from neighboring firms through localization externalities, without appropriate compensation. We focus on three theories which deal with technological externalities. The theories of city growth that we present differ along two dimensions. Firstly, they differ in whether knowledge spillovers come from within the industry or from other industries. Secondly, they differ in their predictions of how local competition affects the impact of these knowledge spillovers on growth.

The Marshall-Arrow-Romer (MAR) externality focuses on knowledge spillovers between firms in an industry. This view says that the concentration of an industry in a city helps knowledge spillovers between firms and, therefore, the growth of that industry and of that city (such as computer chips in Silicon Valley). The city itself becomes a force of agglomeration as it generates externalities. The MAR theory also predicts, as Schumpeter (1942) does, that monopoly is better for growth than local competition because innovators internalize the externalities. If innovators realize that some of their ideas will be imitated or improved on by their neighbors without compensation, they will slow down their investment in R&D.

Porter (1990), like MAR, argues that knowledge spillovers in specialized, geographically concentrated industries stimulate growth. However, the effect of local competition is the primary difference between MAR's and Porter's models. According to Porter's model, although local competition reduces the returns to the innovator, it also fosters the pursuit and rapid adoption of innovation, and so generates industry growth. Because MAR and Porter agree that the most important technological externalities occur within industry, they also agree that regional specialization is good for growth both of specialized industries and of the cities they are in. However, MAR would argue that local monopoly is good because it allows internalization of externalities. In contrast, Porter would argue that local competition is good because it increases pressure to innovate.

The third theory that stresses knowledge spillovers is that of Jacobs (1969). Unlike MAR and Porter, Jacobs believes that the most important knowledge transfers come from outside the core industry. Variety and diversity of geographically proximate industries rather than geographical specialization is conductive to growth, because in diversified cities there is more interchange of different ideas. In the debate between local monopoly and competition, Jacobs favors local competition because, like Porter, she believes that it speeds up the adoption of technology.

These theories of dynamic externalities are extremely appealing because they try to explain simultaneously how cities form and why they grow. Despite their differences, all these theories have implications for growth rates of industries in different cities and for local specialization. Pecuniary and technological externalities can play an important role at both local and international levels. The international level of externalities is very little introduced in regional growth models. In this paper, we try to determine the nature of externalities (pecuniary/technological; local/international) that explain regional growth in Tunisia through the estimation of an econometric model.

III. Econometric Specification

III.1. Model Structure

The predictions of the theories considered can be examined using a simple economic model. More specifically, we estimate a model similar to those developed by Glaeser et al. (1992) and Henderson et al. (1995) in order to explain the growth of regions in Tunisia between 2000 and 2005. The originality of the model proposed in this paper is in taking into account, besides variables relating to the industrial structure and the economies of agglomeration, a set of variables which stress the impact of FDI on regional growth.

The model we estimate results from a simple economic model relating to Cobb-Douglas' production function. Assuming that a firm in a particular industry in one location has a production function given by:

$$A_t f(l_t) \tag{1}$$

where A_t represents the overall level of technology at time t measured nominally (so changes in A represent changes in technology and changes in price), and l_t is the labor input at time t. The production function abstracts from capital inputs because, unfortunately, we have no measure at the regional level. This is why we use, as a dependant variable, employment growth in an industry in a city rather than total factor productivity growth[1]. Each firm in this industry takes technology, prices and wages, w_t, as given and maximizes the profit function:

[1] Dekle (2002) estimates the impact of dynamic externalities, using direct measures of total factor productivity growth at the regional level (Japanese prefectural data).

$$A_t f(l_t) - w_t l_t \tag{2}$$

Therefore, the labor input is determined when the marginal product of labor is equal to wage:

$$A_t f'(l_t) = w_t \tag{3}$$

We can rewrite equation (3) in terms of growth rates as:

$$Log\left(\frac{A_{t+1}}{A_t}\right) = Log\left(\frac{w_{t+1}}{w_t}\right) - Log\left[\frac{f'(l_{t+1})}{f'(l_t)}\right] \tag{4}$$

If we set $f(l) = l^{1-\alpha}, 0 < \alpha < 1$, we get:

$$\alpha\, Log\left(\frac{l_{t+1}}{l_t}\right) = -Log\left(\frac{w_{t+1}}{w_t}\right) + Log\left(\frac{A_{t+1}}{A_t}\right) \tag{5}$$

The growth of employment is assumed to capture the changes in wages and technology. In the endogenous growth model, the level of technology At changes proportionally to knowledge capital depending on two kinds of technological externalities: local externalities from neighboring firms and international externalities related to international trade. So, the level of technology, At in a city-industry is assumed to have both local components and international components:

$$A = A_{local} A_{international} \tag{6}$$

The growth of At will then be the sum of the growth of local technology components in the industry and the growth of international technology component:

$$Log\left(\frac{A_{t+1}}{A_t}\right) = Log\left(\frac{A_{local,t+1}}{A_{local,t}}\right) + Log\left(\frac{A_{international,t+1}}{A_{international,t}}\right) \tag{7}$$

Local component of technology depends on agglomeration economies and on how technological spillovers play in a city-industry (MAR or Jacobs), which means industrial structure:

$$Log\left(\frac{A_{local,t+1}}{A_{local,t}}\right) = \varphi(specialization, local\ monopoly, diversity) \tag{8}$$

In equation (8), specialization is a measure of concentration of that industry in that city, which MAR and Porter believe increases the rate of technological progress. Local monopoly is a measure of whether innovation is appropriate or not, which raises technological progress according to MAR and reduces it according to Porter. Diversity measures the variety of activities that the city offers, which according to Jacobs speeds up technological externalities and progress.

International component of technology is influenced by the development of both international trade (Grossman and Helpman, 1991, 1995) and foreign capital inflows (Blomström and Kokko, 2003):

$$Log\left(\frac{A_{international,t+1}}{A_{international,t}}\right) = \psi(international\ \ exchanges) \tag{9}$$

To assess the intensity of technological externalities at an international level, we use two measures: the first is related to trade (import and export of goods) while the second measure is related to foreign capital inflows.

Indeed, economies of scale, as considered by the economic geography, have a direct impact on marginal productivity of firms (Krugman, 1991a; Krugman and Venables, 1995, 1996). According to this literature, the externalities that sometimes lead to emergence of core-periphery pattern are pecuniary externalities associated with either demand or supply linkages (local demand, economic size of regions…). At the same time, opening up country boundaries (which leads to international specialization, access to larger markets, reduction of costs associated to barriers to trade) also have an impact on individual productivity of firms.

If we combine equations (5), (6), (7), (8) and (9) and we take into account the impact of local economies of scale, we obtain:

$$\alpha \log\left(\frac{l_{t+1}}{l_t}\right) = -\log\left(\frac{w_{t+1}}{w_t}\right) + \varphi(\textit{specialization}, \textit{local monopoly}, \textit{diversity}) + \psi(\textit{international exchanges}) + \rho(\textit{local economies of scales}) \quad (10)$$

where $\rho(\textit{local economies of scales})$ refers to variables which promote industrial agglomeration process.

This last equation suggests that employment growth may depend on wage growth, industrial structure, intensity and nature of international exchanges, and a set of variables related to local economies of scale. The next section describes database sources and measurements of variables.

III.2. Specification of Data and Variables

Our data set was constructed from the database of API, FIPA, INS and BCT[2] between 2000 and 2005[3]. Our unit of observation is an industry in a city. The sample includes 216 observations on the nine two-digit industries in 24 cities (defined here by administrative boundaries)[4].

Dependant variable in equation (10) is employment growth (with log) in an industry j in a city r between 2000 and 2005 ($Gr - Emp_{jr}$).

Independents variables are gathered into four groups:

a) Variables of Industrial Structure

As Glaeser et al. (1992), we define three indexes to characterize industrial structure.

Our measure of specialization of an industry in a city is the fraction of the city's employment that this industry represents in that city, relative to the share of the whole industry in national employment (in 2000).

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[2] Data sources are: FIPA (Foreign Investment Promotion Agency in Tunisia), API (Industrial Promotion Agency in Tunisia), BCT (Central Bank of Tunisia) and INS (National Institute for Statistics in Tunisia).

[3] The globalization process began in Tunisia in the 1970s, but real measures of liberalization of trade and capital were taken at the middle of 1990s, in particular with the membership of Tunisia at the WTO and the signing in 1995 of the free trade agreement Tunisia – European Union. The impact of this liberalization has only really been observed since the beginning of the year 2000. This is why we have chosen the period 2000-2005 where the lapse of time enables us to examine dynamic externalities. Certainly a more wide period is generally required (7 years according to Henderson (1997) for seeing such externalities), but the framework of our analysis justifies the period chosen.

[4] See annex 1 for the list of industrial activities and cities.

$$Specialization_{jr} = \frac{Emp_{jr} / Emp_{r}}{Emp_{jn} / Emp_{n}}$$

This variable measures how specialized a city is in an industry relative to what one would expect if employment in that industry was scattered randomly across the country. The predictions of both MAR and Porter are that high specialization of an industry in a city should speed up growth of that industry in that city.

Local competition of an industry in a city $(Competition_{jr})$ is measured by the number of firms per worker in this industry in this city relative to the number of firms per worker in this industry in this nation.

$$Competition_{jr} = \frac{nber\ of\ \ firms_{jr} / Emp_{jr}}{nber\ of\ \ firms_{jn} / Emp_{jn}}$$

One interpretation of the value greater than one is that the industry in the city is locally more competitive than it is elsewhere in Tunisia. This measure is certainly simple and does not take into account competition out of the city. This variable enables us to examine the relative impacts of technological externalities and local monopoly power. On the one hand, a lower value of this variable means that firms maximize their monopolistic means by horizontal integration in order to profit from technological spillovers from competitors (MAR). On the other hand, entry of new firms increases innovation in the industry. Therefore, according to Porter (respectively MAR), a higher value (respectively lower value) of this measure of competition should be associated with faster growth.

Finally, to address Jacob's theory, we use the Hirschman-Herfindahl index to measure the variety of industries in the city outside the industry considered $(Diversity_{jr})$.

$$Diversity_{jr} = H_{r} = \sum_{k \neq j} \left(\frac{Emp_{kr}}{Emp_{r}} \right)^{2}$$

The lower this index, the more diverse the city is and the faster the industry should grow according to Jacobs.

b) Variables Related to Local Economies of Scale

Indexes of industrial structure capture technological externalities whereas variables of demand are testing pecuniary externalities and cumulative process as developed in the economic geography. We use four alternatives measures: total employment in industry j in city r in 2000 (Emp_{jr}), expense per capita in the city in 2000 (Exp/kr), size of population of the city in 2000 (POPr), and population growth between 2000 and 2005 (Gr-POPr). All these variables reflect the importance of local demand and economic size of cities5. These variables are introduced alternately because of high correlation between them. The first one shows the impact of initial stock of human capital on growth of city whereas the others show the role of local demand. According to the economic geography, a higher value of all these measures should be associated with city growth.

c) Variables Related to International Exchanges

We distinguish two kinds of variables. On the one hand, trade may be a source of technological spillovers and learning on imported goods (Grossman and Helpman, 1995).

[5] We have no data of GDP at the regional level, so we use data related to expenses to estimate the regional demand.

International trade intensity (ITI) is measured by the growth of the following ratio between 2000 and 2005:

$$ITI_j = \frac{X_j + M_j}{GDP_j}$$

where X_j, M_j *and* GDP_j are respectively the values of exports, imports and gross domestic product in the industry j. Because we have no data about trade at local level, this measure is made at national level.

On the other hand, FDI is considered as a vector of technological spillovers (Blomström and Kokko, 2003). Foreign capital can decisively promote the economic restructuring of local economies through the provision of capital, modern technologies and work organization practices (Fazekas, 2005). Indeed, because of the role played by FDI in agglomeration process of manufacturers6, we use a set of measures based on foreign firm's employment. Data related to FDI is available at local level. We use four alternatives measures: the log of FDI stock in industry j in city r in 2000 (FDI_{jr}), the growth of FDI stock between 2000 and 2005 ($Gr-FDI_{jr}$), employment (with log) created by FDI in that industry in that city in 2000 (Emp_{jr}^{FDI}), and the growth of employment created by FDI in that industry in that city between 2000 and 2005 ($Gr-Emp_{jr}^{FDI}$). Because of high correlation between these measures, they are introduced alternately. According to the economic geography, a high value of these measures should be associated with faster growth.

d) Control Variables

We include as controls in the regressions dummy variables relating to cities and industries. For cities, we use a more aggregate level (regions instead of cities) to reduce the number of dummy variables from 24 to 6 (see annex 1).

Finally, wage data is available only at industrial level and so it cannot reflect the impact on city growth. As noted by Glaeser et al. (1992), growth in nationwide industry employment is assumed to capture changes in nationwide technology and prices. Workers are assumed to participate in a nationwide labor market so that wage growth will just be a constant across city-industries. For these reasons, wage growth will not be introduced in estimations.

Thus, employment growth (with log) in an industry j in a city r between 2000 and 2005 ($Gr-Emp_{jr}$) is estimated according to the following reduced form of the equation:

$$\begin{aligned} Gr-Emp_{jr} &= \alpha_1 Specialization_{jr} + \alpha_2 Competition_{jr} + \alpha_3 Diversity_{jr} \\ &+ \alpha_4 (Gr-ITI_j, FDI_{jr}, Gr-FDI_{jr}, Emp_{jr}^{FDI}, Gr-Emp_{jr}^{FDI}) \\ &+ \alpha_5 (Emp_{jr}, Exp/k_r, POP_r, Gr-POP_r) \\ &+ \alpha_{6j}(industry_j) + \alpha_{7r}(city_r) + \varepsilon_{jr} \end{aligned} \qquad (11)$$

where ε_{jr} is a residual term verifying classical hypothesis. The signs j, r and n are for industry, city and nation respectively.

[6] In a previous work (Karray and Driss, 2006), we concluded that FDI play a significant role in developing agglomeration areas.

IV. Results and Issues

The estimates of the model are realized by the method of Generalized Least Squares (GLS). Table 1 shows results of different estimates of the basic model which stress the impact of initial industrial structure and geographical forces on regional growth. The results relating to the role played by variables of international trade are presented in Table 2.

IV.1. Industrial Structure and Geographical Forces

Three models are estimated for the equation of reduced form. The first and the second ones are related to the sequential taking into account of variables of regional economies of scale (POPr, Gr - POPr)7, the last one relates to coastal areas only. Indeed, regional growth in Tunisia primarily benefits to coastal areas. The majority of industrial activities are barely represented inside the country. In the same way, the presence of foreign firms is strongly concentrated on coastal areas of the country. By removing from the sample all observations relating to areas located at the West of the country, we have been able to better validate our results. The explanatory capacity of the model is rather satisfactory according to R2 values which very between 0,29 and 0,39. The analysis of the results of Table 1 shows the importance of the industrial structure as explanatory factor of regional agglomeration. Indeed, the indices of structure, except for the index of specialization, show significant effects.

The coefficient on the competition variable is positive and very significant. More firms per worker in a city-industry relative to the national average leads to higher growth of that city-industry, consistent with Porter's and Jacob's hypothesis. These results are also consistent with those of Glaeser et al. (1992), Henderson et al. (1995), Combes (2000), and Gauthier et al. (2003). In the same way, the coefficient on the diversity variable is significant but negative (M2 and M3). The negative sign indicates that a low value of this index supports the regional growth. However, this index is all weaker when the industrial activities of the same area are diversified. This result suggests that not having dominant industries as neighbors, or alternatively having a greater variety of neighbors, helps own growth. This finding is consistent with the importance of knowledge spillovers stressed by Jacobs from outside the industry. These results are in conformity with studies of Glaeser et al. (1992), Henderson et al. (1995). On the other hand, the non-significant effect of specialization variable can appear as surprising when one thinks of the growth of the majority of cities in Tunisia center as a result of the development of textile activity in this location. However, the aggregation level of activities is high (9 industrial activities) so that one activity of industry includes at the same time complementary goods and substitute goods. Thus, the index of specialization does not manage to capture specialization effects within more homogeneous under-sectors. We should note that regional growth process in Tunisia is different from that of Morocco where local growth is related rather to specialization than to diversity (Catin et al., 2007).

Concerning the effects of variables relating to agglomeration and dispersion forces at regional level, one notes that the level of employment in 2000 is non-significant. On the other hand, M1 and M2 models introduce alternately two variables of economic geography (POPr, Gr - POPr) in order to take account of market size and regional demand. Population size exerts a negative and very significant effect (M1), whereas the coefficient associated with population growth is positive and significant (M2). This means that the employment growth is less strong in cities initially of big size or developed, and it is larger in cities with strong growth. These results could indicate a spreading effect of industrial development towards less developed areas. These findings seem to confirm theoretical model of economic geography (Krugman and Venables, 1995, 1996) according to which the geographical concentration evolves like a "U" curve. More precisely, wage differences between less concentrated areas

[7] The variable expense per capita doesn't appear in results because it has no significant effect in all estimations.

and great areas of agglomeration play like a centrifugal force (Puga, 1996). At a certain point this gap becomes insupportable. This force of dispersion limits agglomeration and supports the extension towards other areas with low wages (Puga and Venables, 1996). In the same way, the land costs are relatively higher in great agglomerations, and exert a repulsion effect (Thisse and Van Ypersele, 1999).

For the different estimates relating to the basic model (and before stressing the role of liberalization of trade and capital flows), a variable relating to the stock of FDI in industry j in city r in 2000 in log (FDIjr) is introduced in order to take into account overall of the international integration. The coefficient associated with this variable is non-significant for the models M1 and M2.

The coefficients of controls variables show significant fixed effects for both industries and cities. For industries, they are associated to mainly mechanical engineering industries, metal and metallurgical whose growth is remarkable in center cities, electric and electronic industries having a remarkable development in north, and finally textile and clothing manufacturing as source of growth in center cities. The fixed effects relating to cities show the existence of specific regional growth in the North-East, the Center-East and more particularly the Center-West. Indeed, this last finding confirms the preceding results on regional convergence insofar as the Center-West experiences a recent development by spreading effect of industrial growth in neighboring regions (Center-East).

Persistent disparities between coastal areas (located at the East of the country) and interior areas (located at the West of the country) involve a certain dispersion of observations in the database. Indeed, several industrial activities are not represented in the interior areas of the country (such as for example the absence of industries MMI, EEEI, TCI in the cities of Tozeur, Kebili, Siliana, Kasserine and Tataouine). Thus, it seems interesting to only estimate the model on coastal areas (M3). The explanatory capacity of the model improves in a remarkable way passing to nearly 40%. The industrial structure always exerts a significant effect through the role played by competition and diversity indices. The initial size of the population preserves a significant and negative impact. The specific effects related on industries and areas are obviously less important (since one holds into account only coastal areas of the country). On the other hand, the coefficient of FDI stock variable, not having a significant effect in the preceding models, presents a positive and significant effect. This additional finding is foreseeable because foreign firms are mainly localized at coastal areas. The taking into account of the impact of free trade and FDI on regional growth will be examined in a more precise way in the following section.

IV.2. Regional Growth and Economic Integration

Results for international exchanges effects on regional growth are reported in Table 2. Four models are retained for the estimates: For M4 to M6 models, we introduce in a sequential way variables relating to international exchanges. The last model (M7) will be estimated only for coastal areas of the country. The explanatory capacity of the model (R2) varies from almost 24% (M4) to nearly 50% (M7) while passing by 34% and 42% (for M5 and M6 respectively).

The results of the estimates show overall that the industrial structure exerts a significant effect through the significant role played by competition and diversity variables8. One also notes the presence of fixed effects related to some industrial activities, most important associated to industries of textile and clothing. The fixed effects related to cities are

[8] Index of specialization is not introduced in estimations because this variable has no significant effect. Also, results related to stock of FDI and of employment created by FDI are not presented because they have no significant effect.

significant for mainly the district of Tunis, the North-East and the Center-East with a spreading process towards the Center-West.

What about the effect of free trade and foreign capital flows? The results suggest that the driving force of regional growth was the fast integration of the country into the world economy and the massive inflows of FDI into some regions of the country (and not international trade). Indeed, the growth of international trade intensity, the initial stock of FDI, as well as foreign firm's employment, have non-significant effects on regional growth. On the other hand, the growth of FDI inflows (which have a slightly significant coefficient) and the growth of foreign firm's employment (having a strongly significant coefficient) exert a significant and positive effect on regional growth. Foreign employment is concentrated in industrial regions with a favorable geographical location and a high level of urbanization (Karray and Driss, 2006). The growth of FDI inflows is accompanied by an important creation of employment which accentuates the process of regional agglomeration. These results are consistent with those of Fazekas (2005) for the Central European Countries. Location of foreign firms increases geographical concentration of industrial activities and often raises wages in host regions (Figlio and Blonigen, 2000). In the same way, one of the expected effects of FDI in developing countries is knowledge spillovers to local firms.

Technological externalities associated to FDI are not only sources of growth and regional agglomeration, but also of economic performance and productivity improvement at the regional level (Mullen and Williams, 2005). Further, spillovers benefits may accrue to local firms as they imitate technologies and hire workers trained by foreign affiliates, or through intangibles assets such as managerial skills and organizational designs. For a country like Tunisia, where the FDI are primarily vertical (re-exporting the products towards the domestic country of the multinational firm), learning and technological spillovers are done less on goods, but rather through workers and upstream-downstream linkages with the foreign firms.

V. Conclusion and Policy Implications

The principal objective of this research was to understand and analyze the determinants of regional growth in Tunisia. More precisely, we focus on impacts of industrial structures and agglomeration economies on regional growth. This study also aimed at checking if the fast integration of the country into the world economy, and more particularly the massive inflows of FDI into certain regions of the country, accentuates the process of geographical concentration. Our results can be briefly summarized. Our findings show that agglomeration economies associated to industrial structure explain regional growth. In particular, local competition and city diversity promote growth; this result supports Porter's and Jacobs's view. Moreover, agglomeration economies related to local demand seem to exert a significant effect on the development of urban Center. The agglomeration process is accompanied by some economic convergence in favor of the close areas (for example Center West area knows recent growth by spreading effect coming from Center-East area). Thus, the economic structure of regions in Tunisia seems to be the result of the play of both concentration forces (agglomeration economies) and dispersion forces. Lastly, the results show that FDI (considered as the main manifestation of globalization and liberalization in Tunisia) contribute to regional growth in Tunisia by the means of employment creation and knowledge spillovers.

What can we expect in the future and what should be done to stop further disparities between regions and the increasing of core-periphery division between coastal and interior areas? A number of policy implications are so evident. Traditionally policies are related to local institutions and infrastructures. The quality of institutions is likely an important determinant of growth, particularly for less-developed regions such as interiors cities in Tunisia. To the extent that poor institutions lead to poor infrastructure, firms are not encouraged to locate

their manufacturing activities in rural regions. Despite of the incentives measures in favor of interior areas of the country, firms prefer coastal cities and agglomeration areas unless these incentives are complemented with measures to improve local infrastructures of transport and communication.

More specific policies concern FDI flows to developing countries like Tunisia. Based on the argument that foreign firms can promote economic development and growth through knowledge spillovers, many countries (like Tunisia) have introduced several investment incentives to encourage foreign firms to invest in their market. But spillovers are not automatic; they depend crucially on the conditions for local firms. The potential for spillovers is not likely to be realized unless local firms have the ability and motivation to learn from foreign firms and to invest in new technology. Consequently, investment incentives aiming to increase the potential for spillovers may be inefficient unless they are complemented with measures to improve the local learning capability and to maintain a competitive local business environment.

Policymakers should consider the relative importance of FDI in regional performance as a guide to economic development initiatives. For example, regions with anemic FDI stocks might attempt to uncover precisely what local features remain unattractive to foreign investors. Alternatively, regions flush with FDI might consider additional creative strategies, such as improving labor productivity to attract and maintain investment spending regardless of origin source. Also, local FDI promotion should focus on those sectors where the payoff from technology transfer is likely to be greatest. For example, it would be better to encourage foreign capital that is complementary to domestic stocks. This type of FDI is more likely to enhance local competitiveness and productivity, and less likely to merely replace domestic investment spending.

Our conclusions must be considered by taking into account the important limitations relating to the database. Initially, the number of observations is relatively reduced, but it should be stressed that Tunisia is a small country (geographically and economically) and that the data is not available for a level of finer space cutting (for example delegation instead of governorship). Moreover, the relatively important dispersion of the observations for the interior areas and the south of the country make the results more fragile. Thus, it would be more relevant instead to study the effect of agglomeration per industry than simultaneously analyzing all the industrial activities within the same estimate. Moreover, certain agglomeration economies can be specific to one activity. Another possible extension for this work consists in holding account the role of governments in regional development through incentives and institutional measurements. Lastly, it would be interesting to analyze the dynamics of agglomeration suitable for an area. Such an analysis would make it possible on the one hand to better understand regional industrial logic and agglomeration economies which are specific to this region, and on the other hand to check the potential effects of shocks related to the industrial structure. The case of Center-East region is particularly interesting to study because of its strong specialization in the activities of Textile and Clothing. A strong regional specialization in traditional activities reinforces the vulnerability of the cities toward the shocks and reveals the importance of competitive and diversified industrial structure for better capturing the effects of the international opening.

References

Arrow, K.J., (1962), "The Economic Implications of Learning by Doing," *Review of Economics Studies*, vol. 29, pp. 155-173.

Audretsch, D.B., Feldman, M., (1996), "R&D Spillovers and the Geography of Innovation and Production," *American Economic Review*, vol. 86, pp. 630-640.

Baldwin, R.E., Martin, P., (2004), "Agglomeration and Regional Growth," in Henderson, J.V., Thisse, J.F., (eds), *Handbook of Regional and Urban Economics*, vol. 4, pp. 2671-2711.

Blomström, M., Kokko, A., (2003), "The Economics of Foreign Direct Investment Incentives," NBER, *Working Paper*, n°9489.

Catin, M., Hanchane, S., Kamel, A., (2007), "Structure Industrielle, Externalités Dynamiques et Croissance Locale au Maroc," Région et Développement, n°25, pp. 45-63.

Chebaane, H., (1990), *La décentralisation industrielle*, Rapport, Tunis

Cohen, W.M., Levinthal, D.A., (1989), "Innovation and Learning: the Tow Faces of R&D," *the Economic Journal*, vol. 99, n°3, pp. 569-596.

Combes, P.P., (2000a), "Marshall-Arrow-Romer Externalities and City Growth," CERAS, *Working Paper*, n° 99-06.

Combes, P.P., (2000b), "Economic Structure and Local Growth: France, 1984-1993," *Journal of Urban Economics*, vol. 47, pp. 329-355.

Dekle, R., (2002), "Industrial Concentration and Regional Growth: Evidence from Prefectures," *The Review of Economics and Statistics*, vol. 84, n°2, pp. 310-315.

Domecq, J.P., Régnault, H., (1990), "Tunisie : D.I.T., Développement Littoral, Stagnation Intérieure," *Revue d'Economie Régionale et Urbaine*, n°4, pp. 523-533.

El Bekri, F., (2000), "Disparités Régionales et Développement en Tunisie," *Revue d'Economie Régionale et Urbaine*, n°5, pp. 887-914.

Fazekas, K., (2005), "Effects of FDI Inflows on Regional Labour Market Differences in Hungary," *Economie Internationale*, vol. 102, pp. 83-105.

Figlio, D.N., Blonigen, B.A., (2000), "The Effects of Foreign Direct Investment on Local Communities," *Journal of Urban Economics*, vol. 48, n°2, pp. 338-363.

Gauthier, B., Lapointe, A., Laurin, F., (2003), "Les Economies d'Agglomération et La Croissance des Régions dans l'Union Européenne," *Revue d'Economie Régionale et Urbaine*, n°2, pp. 209-234.

Glaeser, E.L., Scheinkman, J.A., Shleifer, A., Kallal, H.D., (1992), "Growth in Cities," *Journal of Political Economy*, vol. 100, n°6, pp. 1126-1153.

Greene, W.H., 1997, *Econometric Analysis*, 3ème édition, International Edition.

Grossman, G.M., Helpman, E., (1991), "Endogenous Growth: Trade, Knowledge Spillovers, and Growth," *European Economic Review*, vol. 35, pp. 517-526.

Grossman, G.M., Helpman, E., (1995), "Technology and Trade," in Grossman, G.M., Rogoff, K., (eds), *Handbook of International Economics*, vol. III, pp. 1279- 1335.

Hanson, G.H., (2000), "Scale Economies and the Geographic Concentration of Industry," NBER, *Working Paper*, n°8013.

Helpman, E., (1995), "The Size of Regions," *Working Paper*, n° 14-95, The Foerder Institute for Economic Research.

Henderson, V., (1997), "Externalities and Industrial Development," *Journal of Urban Economics*, vol. 42, pp. 449-470.

Henderson, V., Kuncoro, A., Turner, M., (1995), "Externalities and Industrial Development," *Journal of Political Economy*, vol. 103, n°5, pp. 1067-1090.

Jacobs, J., (1984), *Cities and the Wealth of Nations: Principles of Economic Life*, New York, Vintage.

Jacobs, J., (1969), *The Economy of Cities*, New York, Vintage.

Karray, Z., Driss, S., (2006), "Investissement Direct Etranger et Concentration Industrielle," *Revue Alfa, numéro spécial, les territoires productifs en question(s)*, IRMC, Tunisie, pp. 49-67.

Karray, Z., Toumi, S., (2007), "Investissement Direct Etranger et Attractivité : Appréciation et Enjeux pour la Tunisie," *Revue d'Economie Régionale et Urbaine*, n°3, pp. 479-501.

Krugman, P.R., (1991*a*), "Increasing Returns and Economic Geography," *Journal of Political Economy*, vol. 99, n°3, pp. 483-499.

Krugman, P.R., (1991*b*), "History versus Expectations," *Quarterly Journal of Economics*, n° 106, pp. 651-667.

Krugman, P.R., Venables, A.J., (1995), "Globalization and the Inequality of Nations," *Quarterly Journal of Economics*, n° 110, pp. 857-880.

Krugman, P.R., Venables, A.J., (1996), "Integration, Specialization and Adjustment", *European Economic Review*, vol. 40, pp. 959-967.

Lucas, R.E., (1988), "On the Mechanics of Economic Development," *Journal of Monetary Economics*, vol. 22, pp. 3-42.

Marshall, A. (1920), *Principles of Economics*, MacMillan, Londres.

Mata, D., Deichmann, U., Henderson, V., Lall, S.V., Wang, H.G., (2005), "Determinants of City Growth in Brazil," NBER, *Working Paper*, n°11585.

Mullen, J.K., Williams, M., (2005), "Foreign Direct Investment and Regional Economic Performance," KYKLOS, vol. 58, n°2, pp. 265-282.

Ottaviano, G.I., Puga, D., (1997), "L'Agglomération dans l'Economie Mondiale," *Economie Internationale*, n°71, pp. 75-100.

Ottaviano, G.I., Thisse, J-F., (2004), "Agglomeration and Economic Geography," in Henderson, J.V., Thisse, J.F., (eds), *Handbook of Regional and Urban Economics*, vol. 4, pp. 2563-2608.

Porter, M., (1990), *The Competitive Advantage of Nations*, New York, Free Press.

Puga, D., (1996), "The Raise and Fall of Regional Inequalities," *Discussion Paper*, n°314, Centre for Economic Performance, London School of Economics.

Puga, D., Venables, A.J., (1996), "The Spread of Industry: Spatial Agglomeration in Economic Development," *Journal of the Japanese and International Economies*, vol. 10, pp. 440-464.

Rmili, B., (1990), "Aspects de la Planification en Tunisie : Tendances et Evolution," Mimo, Faculté de Droit et des Sciences Economiques de Tunis.

Romer, P.M., (1986), "Increasing Returns and Long-Run Growth," *Journal of Political Economy*, vol. 94, pp. 1002-1037.

Romer, P.M., (1990), "Endogenous Technological Change," *Journal of Political Economy*, vol. 98, pp. 72-102.

Royoux, D., Signoles, P., (1988), "Les Complémentarités Urbaines des Villes Moyennes en Régions Peu Métropolisées : Exemples Comparés des Réseaux Urbains Français (Poiteau-Charentes) et Tunisiens (nord-ouest et centre-ouest)," *Revue d'Economie Régionale et Urbaine*, n°4, pp. 647-658.

Thisse, J.F., Van Ypersele, T., (1999), "Métropoles et Concurrence Territoriale," *Economie et Statistique*, n° 326-327, pp. 19-30.

Venables, A.J., (1996), "Equilibrium Locations of Vertically Linked Industries," *International Economic Review*, n° 37, pp. 341-359.

Table 1: Results of Econometric Estimates: Industrial Structure and Economies of Scale

Dependant Variable: Employment Growth in log ($Gr - Emp_{jr}$)

Variables	M1	M2	M3 (out of int.)
Industrial Structure			
Specialization	-0,047	0,020	-0,007
	(-0,28)	*(1,24)*	*(-0,42)*
Competition	0,056**	0,065**	0,019**
	(1,93)	*(2,11)*	*(2,60)*
Diversity	-0,255**	-0,098	-0,312**
	(-1,98)	*(-0,77)*	*(-1,97)*
Regional Demand			
Emp_{jr}	$-4{,}99^{e}$-06	$-7{,}49^{e}$-06	$-4{,}85^{e}$-06
	(-1,28)	*(-1,32)*	*(-1,24)*
POP_r	-0,003***	–	-0,003***
	(-3,42)		*(-3,54)*
$Gr - POP_r$	–	0,707**	–
		(2,09)	
International Opening			
FDI_{jr}	-0,017	-0,019	0,022**
	(-1,30)	*(-1,59)*	*(1,95)*
Fixed Effects-Sector			
MMI	0,164**	0,140**	0,112
	(2,27)	*(2,08)*	*(1,65)*
EEEI	0,166*	0,142	0,119
	(1,78)	*(1,49)*	*(1,44)*
TCI	0,196**	0,233***	0,137*
	(2,55)	*(2,82)*	*(1,70)*
Fixed Effects-Region			
District of Tunis	0,204***	0,084	0,109
	(3,01)	*(0,86)*	*(1,08)*
North-East	0,359***	0,317***	0,266**
	(3,86)	*(2,76)*	*(2,38)*
North-West	0,110	0,133	–
	(1,28)	*(1,37)*	
Center-East	0,220***	0,094	0,147
	(2,85)	*(0,95)*	*(1,45)*
Center-West	0,266**	0,230**	–
	(2,64)	*(2,09)*	
Constant	0,200	-0,672*	0,458**
	(1,40)	*(-1,84)*	*(2,35)*
R^2	0,3555	0,2907	0,3922
Number of Observations	216	216	126

Statistics of Student are in parentheses.
* Significant coefficient at the level of 10%
** Significant coefficient at the level of 5%
*** Significant coefficient at the level of 1%

Table 2: Results of Econometric Estimates: Economic Integration and Liberalization

Dependant Variable: Employment Growth in log ($Gr - Emp_{jr}$)

Variables	M4	M5	M6	M7 (out of interior)
Industrial Structure				
Competition	0,015	0,059**	0,046*	0,019**
	(0,79)	*(2,03)*	*(1,77)*	*(1,93)*
Diversity	-0,017**	-0,233**	-0,239**	-0,269**
	(-2,09)	*(-2,01)*	*(-2,12)*	*(-2,08)*
Regional Demand				
Emp_{jr}	-3,08e-06	-6,07e-06	-5.79e-06	-6.78e-06*
	(-0,75)	*(-1,55)*	*(-1,52)*	*(-1,71)*
POP_r	-0,003***	-0,003***	-0,002***	-0,002***
	(-3,24)	*(-3,46)*	*(-3,29)*	*(-3,58)*
International Opening				
$Gr - ITI$	-0,242	–	–	–
	(-0,85)			
$Gr - FDI_{jr}$	–	0,002*	–	–
		(1,68)		
$Gr - Emp^{FDI}_{jr}$	–	–	0,075***	0,072***
			(3,39)	*(3,63)*
Fixed Effects- Sector				
FPI	0,278***	0,048	0,040	0,008
	(3,17)	*(1,02)*	*(0,75)*	*(0,15)*
CMCGI	0,124*	0,014	-0,011	-0,066
	(1,91)	*(0,28)*	*(-0,23)*	*(-1,26)*
MMI	-0,006	0,098	0,092	0,074
	(-0,04)	*(1,53)*	*(1,58)*	*(1,45)*
EEEI	0,065	0,107	0,104	0,084
	(0,80)	*(1,35)*	*(1,29)*	*(1,22)*
CHI	0,115*	0,068	0,051	-0,010
	(1,67)	*(1,03)*	*(0,81)*	*(-0,22)*
TCI	0,129	0,139**	0,147**	0,138*
	(1,64)	*(2,15)*	*(2,12)*	*(1,91)*
WI	0,030	0,096	0,004	0,066
	(0,23)	*(1,10)*	*(0,06)*	*(0,85)*
Fixed Effects-Region				
District of Tunis	0,111	0,179***	0,158**	0,064
	(1,09)	*(2,82)*	*(2,63)*	*(0,93)*
North-East	0,274**	0,331***	0,313***	0,217***
	(2,33)	*(3,83)*	*(3,99)*	*(2,78)*
North-West	0,124	0,112	0,131*	–
	(1,12)	*(1,43)*	*(1,71)*	
Center-East	0,058	0,204***	0,191***	0,109
	(0,57)	*(2,77)*	*(2,89)*	*(1,50)*
Center-West	0,148	0,246**	0,263**	–
	(1,43)	*(2,49)*	*(2,61)*	
Constant	0,449	0,107*	-0,001	0,163**
	(1,13)	*(1,68)*	*(-0,02)*	*(2,18)*
R^2	0,2333	0,3381	0,4209	0,4881
Number of Observations	216	216	216	126

Statistics of Student are in parentheses. Significant coefficient at the level of 10% ; ** Significant coefficient at the level of 5% ; *** Significant coefficient at the level of 1%*

Annex 1: Definition of Regions and List of Industrial Sectors

Table 1: Definition of Regions in Tunisia

Regions	Governorship (city)
District Tunis	Ariana, Ben Arous, Manouba, Tunis
North-East	Bizerte, Nabeul, Zaghouan
North-West	Béja, Jendouba, Le Kef, Siliana
Center-East	Mahdia, Monastir, Sfax, Sousse
Center-West	Kairouan, Kasserine, Sidi-Bouzid
South	Gabes, Gafsa, Kebili, Medenine, Tataouine, Tozeur

Graphic 1: Geographic Situation and Map of Tunisia

Table 2 : List of Industrial Sectors

Code of Sector	Activity
FPI	Farm – Produce Industry
CMCGI	Construction materials, Ceramic and Glass Industry
MMMI	Mechanics, Metallic and Metallurgic Industry
EEEI	Electric, Electronic and Electro mechanic Industry
CHI	Chemical Industry
TCI	Textile and Clothing Industry
LSI	Leather and Shoes Industry
WI	Wood Industry
DI	Diverse Industry

Annex 2: Data Sources

Data	Sources
- Employment per industry and per city - Number of firms per industry and per city	Database of Industrial Promotion Agency in Tunisia (API).
- Population per city - Expenses per capita and per city	Database of National Institute for Statistics in Tunisia (INS)
- Values of exports, imports and gross domestic product per industry	Annual report (2000 et 2005) of Central Bank of Tunisia (BCT)
- FDI stock per industry and per city - FDI employment per industry and per city	Database of Foreign Investment Promotion Agency in Tunisia (FIPA)