Recent tendency in Tunisian industrial firms' location

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This study analyzes the regional determinants of new industrial firms' location choices in Tunisia. After introducing neighborhood effects and spatial simultaneity into the empirical model, Estimation result consistency is assessed using data on 501 new manufacturing firms established in Tunisia's 153 delegations between 2016 and 2019. Agglomeration variables such as sectoral specialization, sectoral competition and diversity indexes, a human capital indicator, regional amenities, and physical and information and communications technology (ICT) infrastructure indicators are recognized. Results indicate that agglomeration economies, industrial land availability and industrial adapted infrastructure provided in developed industrial zones are the main factors driving entrepreneurs' decisions. Interior delegations are more attractive to Food and Construction industries. The knowledge-intensive sectors, Electronics and Mechanical, are attracted to internet infrastructure available in metropolis peripheries. Textile firms are more attracted to metropolitan delegations. Estimates of the spatial model components indicate that spillovers taking place between delegations (inter-delegations' spatial effects) influence the firms' location decisions.

Keywords:
discrete choice,
agglomeration economies,
firms' location,
spatial IV Tobit model,
regional attractiveness

Introduction

The location of industrial activity is characterized by the spatial clustering (Duranton–Overman 2008, Ellison–Glaeser 1997, Head–Mayer 2004, Krugman 1997). Marshall (1988) showed that the economic factors which cause this agglomeration are "The benefits of agglomeration ultimately reflect gains that occur when proximity reduces transport costs" (Ellison et al. 2010, p. 1195). As indicated by Marshall (1920): agglomeration decreases three distinctive transportation costs: Firms locate close to input suppliers to save on delivery costs, economic activities clustering allows for labor market pooling, and enables knowledge spillovers (Egri–

Tánczos 2018). In recent years, the analysis of industrial firms' geographic agglomeration pattern in Tunisia has received an increasing empirical interest (Amara–Ayadi 2014, Ayadi–Mattoussi 2014, Ben Said–Jamoussi 2015, Karray–Driss 2009).This recent literature on industrial activity agglomeration documented that the spatial disparity of economic activity in Tunisia is characterized by an unbalanced repartition of firm localization and job opportunities between coastal and interior regions. This unbalanced regional concentration has influenced the spatial agglomeration of economic activity. More than 83% of firms are located in the coastal region, while 40% of these firms are concentrated in the two metropolises of Tunis and Sfax. Just as a geographic centralization of firms, for the most part, there is likewise a grouping of industrial sectors in specific districts. To overcome this unbalanced development scheme, post-revolution authorities tend to enhance power decentralization by reinforcing regional and local authorities' powers. In order to strengthen balanced regional development, the investment legislation will be driven toward the adoption of new incentives and encouragement for the regional development areas. These incentives solicit the promotion of high added-value sectors taking into account regional labor market characteristics, economic development elements and regional comparative advantages. To support regional politics' aim to reduce territorial disparities, this study focuses on the role of regional factors in new industrial firms' spatial location choice.

Following recent trends in the empirical literature on the firm's agglomeration (Alamá-Sabater et al. 2011, Alfaro–Chen 2014 Arauzo-Carod et al. 2010, Bhat et al. 2014, Boudier-Bensebaa 2005), spatial discrete choice model is estimated. An econometric Instrumental Spatial Tobit model is used to understand decisions about location choice for new industrial firms. This discrete spatial model is inspired from (Bhat et al. 2014, Fingleton–Gallo 2008, Kelejian–Prucha 1998). The particularity of instrumental tobit model is that it deals with the simultaneity in the relationship between the agglomeration process and its spatial factors, discussed in (Billings–Johnson 2016, Ellison et al. 2010, Maré–Coleman 2011). This simultaneity in choice is generated by the reciprocal interaction between the benefits of agglomeration economies, which tend to attract new firms, who consecutively reinforce agglomeration economies by improving suppliers and customer services. The rise in the number of firms in an area will contribute directly to the inflow of new firms. In order to overcome this endogeneity problem, the endogenous lagged censored dependent variable is estimated via an instrumental equation that contains spatial lagged exogenous variables. (Betz et al. 2020, Etilé–Sharma 2015, Xu–Lee 2015). The Spatial Instrumental Tobit Model contribution is that it identifies the location choice heterogeneity and control for zero excess problems by using the spatially lagged variables as instrumental variables.

This paper is a continuation of this empirical literature and it is organized as follows. The literature review of theoretical and empirical studies relating

agglomeration economies and firm location choice is exposed in the second part. The third part is devoted to the variables' definitions and the econometric mode. Estimation results and interpretation are presented in the fourth part. The final part is devoted to the conclusion and policy recommendations.

Literature review

The factors that affect new firms' location decisions are the subject of a fertile research area in recent regional science. Many studies confirmed that the regional environment, specifically agglomeration economies, is a primordial factor of firms' location choices (Alcácer–Chung 2014, Boudier-Bensebaa 2005, Delgado et al. 2010, Klier–McMillen 2008). In his pioneer paper (Marshall 1988) distinguished three factors of agglomeration: "knowledge spillovers," input-output linkages and labor market pooling. The agglomeration economies constitute the advantages created by the concentration of competence and the technical interdependence between developed activities. The location of the firms favors the development of an industrial district that feeds itself through the attraction of its agglomeration economies and the effects of international specialization (Gauthier et al. 2003). These theoretical concepts of Marshall were extended to formal models by (Grossman–Helpman 1991, Krugman 1997).

In the literature, we distinguish three types of agglomeration externalities that affect industrial activities' location choice toward a specific location (Glaeser et al. 1992). The MAR (Marshall–Arrow–Romer) externalities (Arrow 1962, Romer 1986, 1990), which refer to benefits from inter-industry interactions (specialization); Jacobs (1969) externalities, which include benefits from the diversity of activities that allows the diffusion of technological externalities on the entire regional industrial fabric (intraindustries); and Porter externalities benefit from competition in a specialized regional structure within "industrial clusters", favoring the region's growth (urbanization economies). The new theory of geographic economy assumes that a microeconomic theory can explain agglomeration effects based on competition and economies of scale at the firm level (Fujita–Thisse 2013, Krugman 1997). According to this theory, the externalities due to the Marshallian-type localization economy (Marshall 1988) are of two factors. The first factor is due to the drop in input costs caused by the practical accessibility to specialized local suppliers of raw materials and the abundance of a qualified local workforce. The second factor is the externality of knowledge and the diffusion of experience, products and technology via the proximity of firms and the interaction of employees across firms.

Following this early voluminous theoretical literature, (Duranton–Puga 2004) have developed more coherent microeconomic models that reveal the interaction between agglomeration economies and location choice behavior. The others argued

that these mechanisms are based on sharing the gain and risk; matching externalities and improving labor force competition and finally learning which encompass training and research.

A wide empirical literature tried to identify factors that determine the location choice by using surveys and econometric tools (Blair–Premus 1987). The analysis of survey results indicates that the most relevant factors to location decision are the accessibility to growing market; the structure of the labor market; the existence of raw materials suppliers, the transportation access; land availability and costs and quality of life (Carlson 2000).

The main topics of empirical studies are the analysis of the agglomeration effect extent and the quantification of the spatial effects of this extent by testing the existence of difference among large and small firms (Rosenthal–Strange 2006). Early empirical study conducted by (Due 1961) confirmed that fiscal variables affect location decision and economic growth. (Carlton 1983) stressed, by using a logit model, that energy costs are primordial factor in location choice of new American branch plants. (Woodward 1992) used a conditional logit model to analyze the Japanese manufacturing plants' preference location toward US counties. The author concluded that Japanese plants are oriented toward counties characterized by assembling firms' concentration, low unemployment and poverty rates, and concentrations of highly skilled and productive workers. In the automotive corridor, Japanese manufacturers avoid counties "with high black population density, distressed (high unemployment) areas, and are less oriented toward urban sites than elsewhere in the United States". (Smith–Florida 1994) found that locations with larger populations, higher manufacturing density, and a higher level of human capital, better infrastructure and nearer to automotive assemblers are more attractive to automotive-related manufacturing establishments. Bhat et al. (2014) found that the decision of starting a business in Texas counties (supply side) depends on agglomeration economies, transportation infrastructure, fiscal conditions and industrial land characteristics. For more empirical studies on US manufactories see (Mota–Brandão 2013). In their study on the location choices of Japanese multinational firms in the European Union, (Head–Mayer 2004) showed that the potential market is a more important determinant than differences in labor costs or taxes. The potential market is found to be the major factor in the location choice of German firms (Buch et al. 2005). The availability of high-skilled workers, infrastructure and inter-industrial agglomeration economies are major factors of FDI attractiveness towards Hungarian counties (Boudier-Bensebaa 2005). Szabó (2017) showed that Hungarian firms are more attracted to highly export performant regions, located in the capital and in the border side of Western Europe. This economic polarization effects the firm economic performance. Access to market and the more flexibility of labor increase the attractiveness of foreign investment in European countries (Javorcik–Spatareanu 2005). In France; foreign firms operating

in computers, cars and machinery sectors are characterized by notable agglomeration economies. Clothing industries originating from nearby countries are less liable to clustering and more affected by labor costs in their location configuration. A training process of French market characteristics pushes foreign firms to situate near domestic consumers' markets, rather than markets with characteristics alike home markets (Crozet et al. 2004). Firms implanting in Spanish municipalities are attracted by the availability of suppliers, qualified employment and the industrial land availability (Alamá-Sabater et al. 2011, Viladecans-Marsal 2004). Empirical investigation on Italian industrial district resulted by (Ferragina–Mazzotta 2015) suggested that diversification and specialization carried on a positive effect on national firms, while urbanization economies exerted a negative effect on these firms. Foreign industrial firms have higher agglomeration premiums than Italian companies in urban zones and industrial districts, but do not benefit from specialization. (Amiti–Smarzynska Javorcik 2008, Head–Ries 1996) revealed that the prior existence of foreign firms and a high concentration of supplier firms are factors that play an important role in drawing investment to Chinese cities. The quality of transport infrastructure, especially deep berths that facilitate exportation, is a determining element in foreign investment attractiveness. (Chang 2015) indicated that foreign multinationals in China tend to expand their activities into non-coastal cities with the view to gain an early mover premium and evade competition.

In developing countries, the pattern remains different from that of developed countries. The location choice is influenced by incentives and public investment in infrastructure to reduce the gap between regions and improve interregional connectivity (Funderburg et al. 2004, Goodspeed et al. 2011, Lall–Mengistae 2005). The location choice in Brazilian regions depends on the accessibility to market, urbanization economies were more relevant for industries that depend on local supply and demand (Funderburg et al. 2004). Abundant electric power sources were considered as the important factor affecting the location choice of Indian cities (Sridhar–Wan 2010). Small and medium firms in Bangladesh were interested in transport infrastructure, land cost, industrial agglomeration, proximity to residence and the existence of local loan facilities (Rahman–Kabir 2019).

Our empirical strategy is drawn on a discrete-choice model largely used in empirical studies dealing with firm location choice. The particularity of these models is that they consider the error independence assumption which "leads to the independence of irrelevant alternatives" (Carlton 1983). As noted by (Arauzo-Carod et al. 2010), the Discrete Models are more appropriate than count models if the unit of interest in the analysis is the firm. Count Data Models are used if the unit interest is a spatial unit area (county, municipality …). Many variants of the Discrete models are used, Nested logit model (Alamá-Sabater et al. 2011, Ferragina–Mazzotta 2015, Javorcik–Spatareanu 2005), Ordered logit model (Sridhar–Wan 2010), Negative Binomial Model (Mota–Brandao 2013). Poisson model for Count Data is used by

(Bhat et al. 2014, Herger–McCorriston 2013). The Tobit model used in recent studies (Iimi 2018, Luo–Bu 2018, Shehata–Mickaiel 2013) as an alternative approach that can deal with the left censorship of the dependent variable with Excess Zero. This characteristic of the Tobit model allowed to overcome the problem of zero registered in delegation with no firm entry.

Data and econometric model

Data

The data set used in the estimation of the econometric equation is compiled from numerous sources. The Agency of Industry Promotion (API) application programming interface data provides information about firms with ten employees and more operating in the industrial sector. The API directory contains information on localization, sectors of activity, initial investment amount and employees' number of 5,260 firms operating in the legal system. For data availability reasons, variables are compiled for year 2015. This year is characterized as an economic boosting caused by the attenuation of the political tension and social tension, triggered after the revolution of 2011. This economic growth paved the way for the establishment of new firms in the interior regions, benefiting from government incentives granted to reduce regional inequalities. The new firm's establishment, in 2016–2019 for the 263 delegation[1], is considered. Data on regional infrastructure are collected from the General Commissariat of Regional Development (CGDR) directory and data on population characteristics are collected from the national census of 2014 conducted by the National Institute of Statistics (INS).

Variables definitions

Agglomeration economies: "Agglomeration economies" represent gains from industrial concentration. The proximity of companies engaged in similar activities increases the chances of meeting and the circulation of information on industry-specific innovations and technologies, which would encourage the emergence of knowledge-based agglomeration economies. Industrial diversity is associated with the so-called urbanization economies of agglomeration. It would allow the accumulation of tacit knowledge from a variety of sources, while promoting the diversity of interactions and access to a volume of information from different industries. All these new ideas and knowledge that emerge from a sector can be applied in different industrial sectors and thus enable productivity gains (de Groot et al. 2009, Rosenthal–Strange 2006). (Isard 1956) argued that positive externalities of urbanization economies are the results of the qualified and diversified labor concentration, a good well-adapted

[1] The delegation is the second level administrative section populated by 50,000 inhabitants on average.

infrastructure such as university research units that generate knowledge and innovation and local markets leading to lower transaction costs.

Agglomeration economies indexes: Three indexes; the Herfindahl-Hirschman Index (*HHI*) (Duranton–Puga 2004), the specialization index (*SPEC*) index and competition index (*COMP*) are used to detect specialization impacts.

The specialization index for the sector *s* in the delegation *i* is defined as the percentage of employment in the delegation normalized by the percentage of businesses in the same sector for the entire nation (Gauthier et al. 2003):

$$SPEC_{Si} = \frac{Empl_{is} \Big/ \sum_{s=1}^{5} Empl_{si}}{Empl_{sTotal} \Big/ Empl_{total}}$$

LQ permits identifying specialization effects on the firm location choice. It' is a sector-specific measure of specialization of a delegation relative to the entire nation's specialization in the sector. LQ value greater than one implies that this delegation is highly specialized in the sector (s) compared to the nation. In contrast, a value between zero and one implies a lower degree of specialization in sector s in this county. The LQ index is a relative measure of sector specialization markedly different from the localization economies based on agglomeration, which corresponds to the absolute density of firms in a sector. Thus, a delegation can have a high level of the LQ index in a particular sector, even if the number of businesses in that sector in the delegation is low. This can happen if the delegation's total number is so small that the relative specialization in a particular sector is even higher than the nationwide specialization in that sector. LQ detects the same effects of localization economies. The concentration of firms in one sector and one region will result in an abundance of the skilled and willing labor force in that sector. In addition, the economies linked to the concentration of suppliers of raw materials and other services encourage companies (and delegation) to invest more in a sector that the region has a high index of specialization.

The competition index evaluates the effect of a large local intra-sector concurrence on the location choice of firms.

$$COMP_{si} = \frac{number\ of\ firms_{si} \Big/ employement_{si}}{Total\ firms_{s} \Big/ Total\ Employement_{s}}$$

High levels of the competition index imply high intra-sector *s* concurrence in the region *i* (Gauthier et al., 2003).

The second index is (*HHI*) or the diversity index, which measures the overall level of specialization independently of sectors; it is calculated as follows.

$$HHI = \sum_{S}^{5} \left(\frac{Empl_{Si}}{Empl_{Tot\ i}} \right)^2$$

HHI takes values between zero and one. The higher the index is, the less diversified the local economy is. A unit diversity index means that all jobs are concentrated within a single branch in a given region. This index reveals the presence of inter-industrial economies: the diversity of a region, according to Jacobs (1969), contributes to increasing economic growth, through the creative expansion of a large number of mutually enriching sectors.

Human capital: Firms seek to locate in delegations with substantial human capital, thus benefiting from a skilled workforce to carry out their production and other similar activities. The county guarantees its applicants a paid job. In previous studies, higher education indicators are used as a proxy of human capital (Mota–Brandão 2013). The percentage of persons 18 years or above with university degree (SUPERIOR) is used as a proxy variable that detects the human capital effect.

The Tunisian government develops industrial zones and paid incentives to firms that decide to locate in regional development zones according to activities in the sectors of industry. These actions seek to reduce inequalities between regions and improve development in interior regions. These incentives are fiscal and financial advantages granted to industrial and craft businesses and to certain service activities. They cover tax exemption for 10 years, financial advantages that go from 8% to 25% of the total investment, including working capital, and the payment of the employer's contribution to the social security fund. The industrial zones offer incentives, well adapted infrastructure with high internet broadbands and high-tension electric power and proximity to flexible employment. The variable (ZONESUP) is considered to examine the effect of these policy incentives on the location choice of industrial firms toward suburban delegation and interior delegations. Another major problem faced by post-revolution governments is postgraduate unemployment. The (UMPOSTGR) variable is introduced to analyze the capacity of new investments to absorb this type of labor and to help politicians overcome this problem.

For the purpose of identifying the role played by the three metropolitan cities[2] on location choice, this study considers the linear distance in kilometers between delegations' centroids and the three metropolitan Center of Business District (CBD) delegations (DISTCH). This variable is used as a proxy of metropolitan market size and the availability of high-quality infrastructure such as highways, airports, seaports and administration facilities (Holl 2004, Mota–Brandão 2013). The length of asphalt roads in kilometers (*LROAD*) is used to capture the impact of overland transport infrastructure on the attractiveness of new firms.

Employment density (DENEMPLOY) is used as a proxy of the human capital stock in a delegation. It represents the labor force endowment as a type of comparative advantage. This variable captures the effect of initial production concentration in a delegation on the location choice. The number of bank branches

[2] The Three CBD delegations are: Soukra for delegations in North; Sousse Medina for delegations in the center and Sfax Medina for southern delegations.

(BANK) is correlated to the amount of commercial and financial transactions in a delegation. This variable is considered as a proxy of the demand market size.

The literature on location choice has pointed out that firms may find it advantageous to choose locations in peripheral areas to avoid the diseconomies of locations in large urban centers. The adoption of information and communication technology (ICT) is a means of overcoming the relative isolation experienced by firms that have opted for decentralization (Mack et al. 2011). ICT is seen as a productivity booster for the firms that use them, given their significant impact on production, logistics and warehousing as well as their power to reduce market failures correlated to information asymmetries (Biagi 2013). In a recent study (Lados et al. 2020) recognized that the network connection is the major installation factor for solar power plants. Knowledge incentive firms that use ICT tend to locate in delegation where internet infrastructure is available to overcome the distance problem and to seek proximity near more productive industries. The number of firms with websites in a delegation (*NB_WEB*) is used to capture the relevance of ICT infrastructure to firm location strategies and to identify knowledge-intensive sectors.

Econometric model

The model used in this study is an Instrumental Spatial Tobit model (IV Tobit) (Shehata–Mickaiel 2013) that deals with spatial interactions with censored data. This type of model permits to address three major problems in a spatial or social setting. The first is the problem of zero excessed and censored variables. This problem arises when the best firm's location decision response can be a corner solution given other firms' decision strategies. The second problem is the spillover effect across nearby delegations. The third issue is that of endogeneity that arises because explanatory variables, that make a delegation attractive, are spatially correlated. Therefore, the omission of any variable from the estimated equation make any other spatially lagged variable included in the equation and measuring surrounding characteristics, correlated with the error term (Irwin–Bockstael 2001).

Suppose that the dependent variable is unobserved variable y* and the econometric model is

$$y^* = X\beta + u \tag{1}$$

where the error term $u|\mathbf{x} \sim$ Normal $(0, \sigma^2)$: X is the matrix of explanatory variables and β is the vector of variables' coefficients.

The observed dependent variable is $y = \max(c, y^*)$ or $y = \min(c, y^*)$: where c is constant.

The spatial Tobit model is:

$$y = Wy + X\beta + u \tag{2}$$

W is a spatial weighted matrix; Wy is the spatially lagged y.

The spatially lagged variable Wy seized the effect of nearby delegation characteristics on the firm's location choice, indeed any omitted variable in exogenous

variable generate the endogeneity problem. In this case, instrumental variables (IV) estimation can be used to obtain more consistent estimates. Lagged explanatory variables should be used as a valid instrument because they are strongly correlated with *x*, and completely uncorrelated with the error term (Shehata–Mickaiel 2013).

The spatial weight matrix constructed in this study is based on the inverse distance between region *i* and *j* as adopted by Alamá-Sabater et al. (2011):

$$\begin{cases} w_{ij} = \dfrac{d_{ij}^{-1} I_{(d_{ij} \le R)}}{\sum_{i=1}^{j} d_{ij}^{-1} I_{(d_{ij} \le R)}} & if \ i \neq j \\ = 0 & if \ i = j \end{cases} \quad (3)$$

d_{ij} is the Euclidean distance between delegation *i* and *j*; $I_{(\,)}$ is an index function that equals 1 when the delegation *j* is within a circle with radius R and center in the delegation *i* , zeroes otherwise.

The spatial weight matrix *W* is defined in terms of the inverse Euclidean distances among delegations. One approach advocated in the literature (Kelejian–Prucha 1998) uses exogenous variables plus their low order exogenous spatial lags as instruments. This procedure is usually suggested for an endogenous spatial lag variable.

Estimation results

The IV Tobit model was used to reveal the location decision-making behavior of more than 501 new manufacturing firms established in 156 Tunisian delegation among 263, between 2016 and 2019. The econometric model's explanatory variables are agglomeration variables such as sectoral specialization and diversity indexes, a human capital indicator, regional amenities and regional infrastructure indicators.

Estimated model

$$NEWFIRMS_i = c + \varrho\, W\_NEWFIRMS_i + a_2\, COMP_{Si} + a_3\, SPECS_i + a_4\, HHIs_i + a_5\, BANKs_i + a_6\, DENEMPLOY_{Si} + a_7 \mathrm{UNEMPOSTGR}_{Si} + a_8\, ZONESUP_{Si} + a_9\, DISTCH_{Si} + a_{10}\, SUPERIOR_{Si} + a_{11}\, LROADS_i + a_{12}\, NB\_WEB_{Si} + u_{Si} \quad (4)$$

The first stage estimated instrumental equation is :

$$(W\_NEWFIRMS_i = c + a_{2'}\, COMP_{Si} + a_{3'}\, W\_SPEC_{si} + a_{4'}\, W\_HHIs_i + a_{5'}\, W\_BANKs_i + a_{6'}\, W\_DENEMPLOYS_i + a_{7'}\, W\_UNEMPOSTGRs_i + a_{8'}\, W\_ZONESUPs_i + a_{9'}\, W\_DISTCHs_i + a_{10'}\, W\_SUPERIORs_i + a_{11'}\, W\_LROADS_i + a_{12'}\, W\_NB\_WEBs_i + \epsilon_i) \quad (5)$$

W is the weighted spatial matrix calculated following the equation (3). This matrix generates the spatially lagged variables.

Results

Equations (4) and (5) are estimated for the 6 sectors, estimation results are presented in Table 1.

Table 1

The estimation results, 2016–2019

SECTOR	CHEMICAL	TEXTILE	ELECT-RONIC	MECHA-NICAL	CONSTR	FOOD
W_NEWFIRMS	**21,350**	**1,943**	–5,533	**15,219**	**13,840**	**10,779**
	(0.000)	(0.000)	(0.364)	(0,004)	(0,092)	(0,001)
COMPS	0,114	0,037	0,019	**0,186**	**0,448**	0,106
	(0,115)	(0,788)	(0,596)	(0,025)	(0,000)	(0,208)
SPECS	–0,113	**0,709**	**0,391**	–0,332	0,013	**0,235**
	(0,371)	(0,006)	(0,004)	(0,193)	(0,812)	(0,021)
HHI	–0,228	**–1,680**	–1,505	–0,913	0,260	**–1,310**
	(0,727)	(0,056)	(0,121)	(0,223)	(0,686)	(0,069)
BANK	0,008	–0,012	**–0,034**	–0,013	–0,001	**–0,047**
	(0,595)	(0,460)	(0,006)	(0,513)	(0,976)	(0,041)
DENEMPLOY	0,002	**0,001**	0,001	0,002	0,000	0,001
	(0,124)	(0,014)	(0,455)	(0,261)	0,673	(0,220)
UNEMPOSTGR	0,015	0,013	**–0,080**	0,027	0,016	**–0,078**
	(0,552)	(0,664)	(0,007)	(0,315)	(0,592)	(0,001)
ZONESUP	**0,020**	0,001	**0,012**	**0,010**	**0,027**	**0,011**
	(0,000)	(0,828)	(0,014)	(0,001)	(0,000)	(0,008)
DISTCH	0,006	**–0,017**	–0,002	–0,003	–0,002	0,002
	(0,174)	(0,007)	(0,610)	(0,615)	(0,636)	(0,583)
SUPERIOR	0,011	0,000	**–0,062**	0,002	–2,913	0,166
	0,529	0,988	0,007	0,919	(0,649)	0,976
LROAD	**0,372**	**0,637**	**0,496**	**0,767**	0,787	**0,479**
	(0,071)	(0,013)	(0,008)	(0,000)	(0,00)5	(0,018)
NB_WEB	0,002	0,020	**0,078**	**0,044**	**–0,064**	0,018
	(0,928)	(0,354)	(0,000)	(0,013)	(0,049)	(0,306)
_CONS	–8,888	–3,038	–0,282	–8,994	–10,316	–7,180
	(0,000)	(0,044)	(0,840)	(0,000)	(0,000)	(0,003)
SAMPLE SIZE =	263,000	263,000	263,000	263,000	263	263,000
WALD TEST	64,1356*	77,556*	79,098*	61,070*	61.286*	36,929*
F-TEST	5,3446*	6,463*	6,592*	5,089*	5.1072*	3,077*
HAUSMAN LM TEST	73,845*	36,669*	64,366*	44,067*	54.937*	25,697*
SARGAN LM TEST =	6,378	4,621	10,357	11,513	10.687	11,199

* p <0,01; P-value in brackets.

The realized sample of 501 new establishments consists of 198 firms acting in the Textile (40%): 153 firms acting in Food industry (30%): 50 firms acting in Mechanical sector (10%): 38 firms acting in construction industries (7,6%): 41 firms acting in the chemical sector (8%) and 14 firms acting in Electronic industry (3%). These 6 sectors represent 90% of firms operating in industries and 85% of these firms are located in the three metropolitan cities of Tunis, Sousse and Sfax (Annex Figure 6).

Before the interpretation of the estimated coefficients results, an assessment of the consistency of the estimation procedure should be done. (Hausman 1978) test results indicate that the Instrumental variable estimates are most consistent than the Ordinary Least Square estimates. This test rejects the null hypothesis of no endogeneity which means that both OLS and Instrumental Variable technique are consistent. The Sargan test of the validity of instruments accepts the null hypothesis of independence and supports the alternative hypothesis that included instruments are not correlated with the error term. This condition must be satisfied to provide consistent estimates.

The estimation results presented in table 1 confirm findings of recent empirical studies using discrete models in location choice analysis (Bhat et al. 2014; Ferragina–Mazzotta 2015). The coefficient of the variable W_NEWFIRM is positive and significant for five sectors; revealing the existence of spatial autocorrelation and spillover effect across Tunisian delegation for industrial sectors except the Electronic sector. New firm establishment in a delegation attracts other new firms to nearby delegations and this process induces a spatial clustering of firms operating in the same sectors. In Tunisian area, textile firms are clustered in northern delegations and Central Eastern delegations (Annex Figure 1). Food industry's firms are clustered in the north, the center and the south side of the country (Annex Figure 2). Firms operating in the Mechanical sector are clustered in the Central East (Annex Figure 4). Firms operating in Electronic industry are concentrated in delegation around the two important metropolitan cities of Tuis and Sfax (Annex Figure 3). New establishments in the chemical sector are oriented to interior regions (Annex Figure 5) and firms acting in the construction industry privilege coastal delegations (Annex Figure 6).

The analysis of the results in Table 1 confirms the importance of the regional industrial structure as a determinant of agglomeration economies. The importance of vertical inter-industry relationships is supported. The estimated coefficients of the variable (SPEC) are significantly positive for Food, Textile and Electronic firms and not significant for Mechanical, Chemical and Construction industries. Firms operating in the three most important sectors in Tunisian industry are located close to their suppliers and customers. The positive and significant coefficient of the competition index (COMP) associated to Mechanical and Construction sectors reveals the tendency of firms operating in this sector to be installed in delegations

characterized by strong local competition. These delegations are situated in the three metropolitan cities. The entry of new firms in these competitive sectors would help to increase the stimulation of the innovation of competitors and thus the intensity of technological externalities and productivity growth (Gauthier et al. 2003).

Estimated coefficients of the diversity index (*HHI)* divulge the preference of food and textile firms toward delegations marked by the diversity of activities. These firms seek to take advantage of agglomeration economies resulting from locating close to businesses in other sectors. These advantages due to the local interaction between firms include accessibility to complementary services, the availability of an abundant-skilled and low-paid workforce with multiple specializations.

The variable (*BANK)* that detects the size of local market and particularly retail market and the volume of financial and non-financial transactions in a delegation show that high concentration of bank branches in a delegation discourages new births in Electronic and Food sectors. A recent study on the firm's location choice in developed countries like Sweden suggested that the proximity to bank branches is a key factor for new firms' birth (Ho–Berggren 2020). These results bring out that the partnership efforts to involve the public and private sectors, mainly private banking sector, adopted as a development promotion strategy in the regions have not yet revealed their results.

Except for Textile sector, employment density variable (DENEMPLY) is statically not significant for the other sectors. The textile sector is labor-intensive and new births are more likely to happen in delegation with high employment density. This result is in concordance with (Carlton 1983) finding of the importance of employment concentration to small sized plants.

Delegations with low unemployment rates of university graduates (UNEMPOSTGR) are attractive to Electronics and Food industries. Low rates imply higher demand and higher market prices, these factors influence the location choice of food firms. Apropos of Electronic firms, low unemployment rates of graduates in a delegation imply highly skilled employees are more productive and more receptive to new technology and innovation. This result can be interpreted as a mismatch between university academic training and the requirements of the labor market. Additional training for university graduates may be required.

The variable (ZONESUP) reflects the tendency of firms to take advantage of the benefits of locating in regional development zones. These zones guarantee access to low-cost land and high-quality infrastructure. Developed industrial zones are preferred locations for firms operating in the chemical sector given the particularity of these firms which need adequate infrastructure for their pollutant waste. (Annex Figure 5) shows that chemical firms tend to locate in coastal industrial zones. The more attractive zone of chemical firms is the southern coastal zone of Gabes. Mechanical industry plants are geared zones characterized by intra-industrial competitiveness. Annex Figure 4 indicates that the old industrial zones of Messadin

and Agareb in the eastern center and the emerging zone of Beja in the North are more attractive to this type of industry. New businesses in food are oriented to interior delegations benefiting from the incentives granted to location in development regions (Annex Figure1). Industrial zones recently developed in the interior regions constitute a preferred destination for the electronics and construction industries (Annex Figures 3 and 6).

DISTCH estimated coefficients indicate that only Textile firms have a metropolitan setting in. The analysis of Annex Figure 1 reveals that the three metropolitan cities remain attractive to this industry. The seaports are the main attractive infrastructure for these firms.

The negative and significant coefficient of the variable (SUPERIOR) for Electronic sector indicate high proportions of highly educated population leads to a lesser attractiveness. This result is not surprising, even if this sector demands highly skilled employees. Annex Figure 3 shows that Electronic firms profit from the location in industrial zones developed near metropolitan cities. Commuting compensations are paid to highly skilled employees. Given the recent tendency of Electronic firms to take advantages from the location of the Human capital variable indicates that delegations with a high percentage of highly skilled employees are less attractive to firms operating in low-knowledge content sectors. The coefficient of the infrastructure variable, such as the length of existing roads in a delegation (LROAD) is positive and significant for all sectors. This finding indicates that the improvement of amenities and specially transport infrastructure in a delegation raises the probability of being attractive for new firms. The number of firms adopting websites is used to identify highly intensive knowledge sectors and reveal how they adopt ICT and websites to compensate its location far from delegations with high employment and population density. The estimation results of the variable NB_WEB recognize that Electronics and Mechanical industries tend to locate in delegations where the number of firms that use ICT is very important. More than 35% of firms acting in these sectors have a website against 8% of firms operating in the Textile sector. The existence of high-quality ICT infrastructure is important for these industries. This result explains the tendency of Electronic and Mechanical industries to be more attached to big cities and nearby medium cities than other sectors as shown in Annex Figures 3 and 4.

Conclusion

The preference of one destination over another is influenced by the choice of other firms that settle in neighboring delegations, the most dominant sectors in the Tunisian industry namely the Food sector and Textiles, promote sectoral specialization and diversity of activities. Textiles remain more rigid to decentralization, always preferring suitable infrastructure in metropolitan areas, in

contrast to the Food sector, which is more sensitive to the drop-off to interior delegations benefiting from government incentives for settlement in development regions. Industrial zones developed in delegations bordering metropolises are more attractive to the Electronics and Mechanical sectors. These sectors are more intensive in knowledge and they are looking for the availability of the internet. The chemical industry is influenced by transport infrastructure and the benefits of industrial areas developed around the old chemical centers. The choice of location of firms in Tunisia is insensitive to the availability and quality of human capital. This finding raises a major question about the effectiveness of the policies adopted to overcome the major problem of university graduate's unemployment. According to the results of this study, the policy-maker can be recommended grant incentives and facilities in proportion to its participation in job creations for high graduates, especially in interior regions.

Annex

New firms locations among Tunisian Delegations' maps

Figure 1

Textile new firms' location in Tunisia, 2016–2019

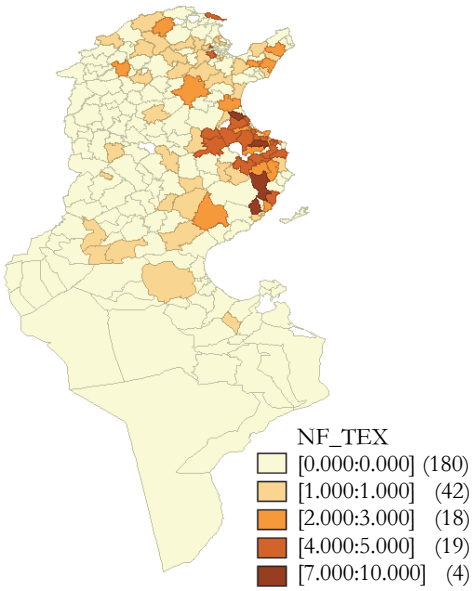


Figure 2

Food new firms' location in Tunisia, 2016–2019

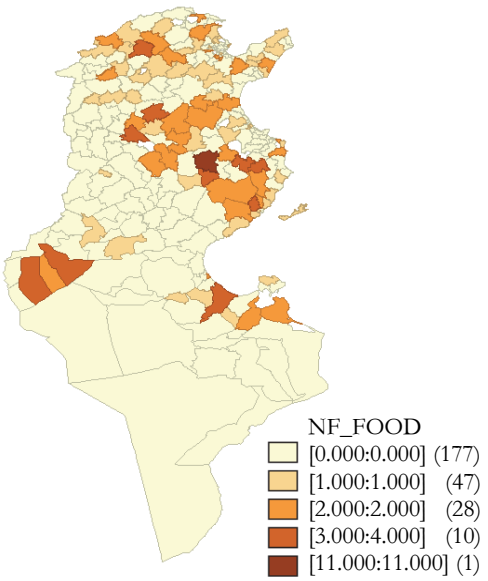


Figure 3

Electronic new firms' location in Tunisia, 2016–2019

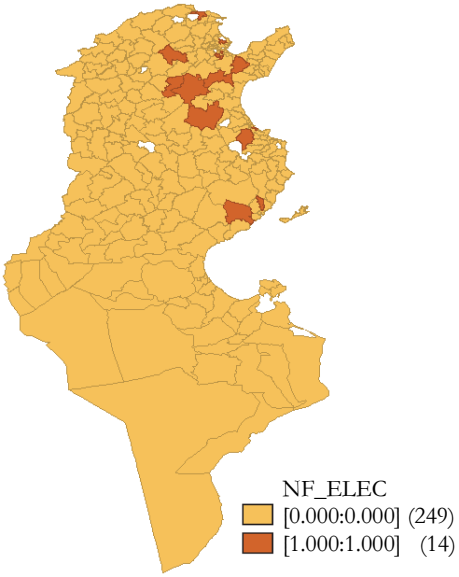


Figure 4

Mechanical new firms' location in Tunisia, 2016–2019

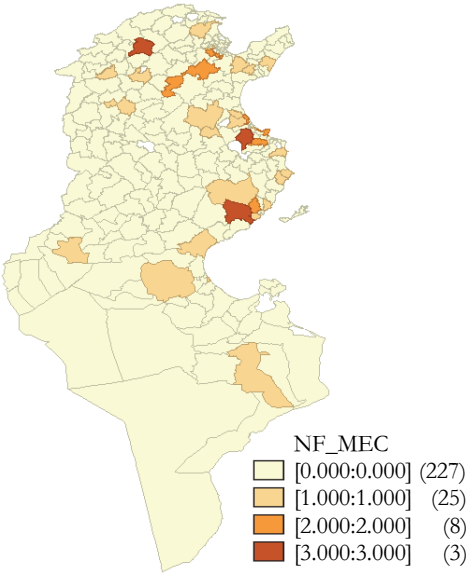


Figure 5

Chemical new firms' location in Tunisia, 2016–2019

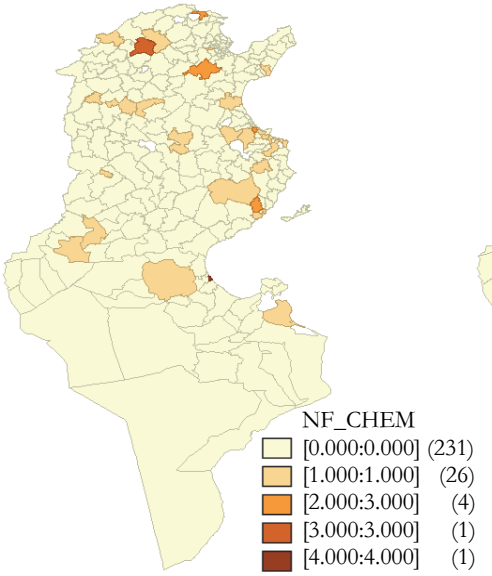
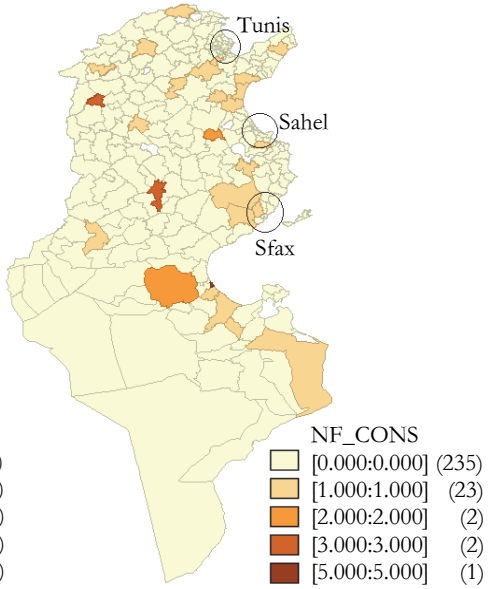


Figure 6

Construction new firms' location in Tunisia, 2016–2019



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