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Rawaa Laajimi

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Rawaa Laajimi. Analyse spatiale de la relation entre la mobilité des travailleurs et l'agglomération industrielle : cas de la Tunisie. Economies et finances. Université Bourgogne Franche-Comté; Université de Sousse (Tunisie), 2022. Français. NNT : 2022UBFCG002 . tel-04067105

HAL Id: tel-04067105

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Université de Sousse, Tunisie

**Université de Bourgogne Franche-
Comté, France**

Ecole Doctorale en Sciences Économiques et Gestion

Ecole Doctorale Droit Gestion Économie et Politique

**Faculté des Sciences économiques et de gestion de Sousse
(FSEG, Sousse)**

**Centre d'Économie et de Sociologie Appliquée à
l'Agriculture et aux Espaces Ruraux
(CESAER, UMR 1041)**

Thèse de doctorat

présentée par

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Soutenue publiquement le 20 juin 2022

En vue de l'obtention du grade de Docteur

Discipline **Sciences Économiques**

**Analyse spatiale de la relation entre la mobilité des travailleurs et
l'agglomération industrielle : Cas de la Tunisie**

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L'Université de Sousse n'entend donner aucune approbation ni improbation aux opinions émises dans cette thèse. Ces opinions doivent être considérées comme propres à l'auteur.

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« Aucune société ne peut prospérer et être heureuse, dans laquelle la plus grande partie des membres est pauvre et misérable. »

Adam Smith, 1776

« L'inégalité des conditions entraîne l'inégalité des richesses, mais l'inégalité des richesses n'amène pas l'inégalité des besoins. »

Jean Anthelme Brillat-Savarin, 1825

« Tant que la pauvreté, l'injustice et les inégalités flagrantes persisteront dans le monde, nul ne pourra prendre de repos. »

Nelson Mandela, 2005

Remerciements

La thèse est un voyage plein d'événements heureux et tristes, de moments de bonheur, de doute, de hauts et de bas, couronnés de patience, de persévérance et de rigueur. Même si mes années de thèse n'ont pas été faciles, j'ai eu la chance de trouver de la joie dans mon travail, heureuse de me réveiller chaque matin en sachant que je vais exercer ma passion, *la recherche*.

Parce que je n'aurais pas pu boucler cette thèse sans les personnes qui ont cru en moi et en ma thèse, qui m'ont accompagné, qui ont participé de près ou de loin, je suis reconnaissante envers ces personnes et tiens à leur exprimer mes sincères remerciements.

Tout d'abord, je tiens à exprimer ma profonde gratitude et mes remerciements les plus sincères à mes directrices de thèse, Mme Saloua BENAMMOU et Mme Julie LE GALLO, qui, chacune à leur manière, ont joué un rôle essentiel dans la réalisation de cette thèse.

Je remercie ma directrice de thèse Mme Saloua BENAMMOU qui, en tant que ma directrice depuis le master s'est toujours montrée disponible et à l'écoute, avec un esprit ouvert et compréhensif. Je vous remercie de m'avoir fait part de vos expériences et connaissances, de m'avoir encadrée depuis le master et de m'avoir laissé la liberté dans mes choix de recherche. Je vous remercie également pour votre confiance et votre compréhension.

Ensuite, mes remerciements s'adressent à ma directrice Mme Julie Le GALLO à qui je ne saurais jamais comment exprimer ma reconnaissance. Je vous remercie de m'avoir assuré les conditions nécessaires pour l'accomplissement de mes recherches. Je vous remercie également pour votre disponibilité, votre réactivité, votre encouragement et votre soutien durant toutes les années de thèse. Les mots sont parfois limités pour exprimer nos reconnaissances et gratitude, Merci à vous Julie LE GALLO !

Je tiens également à remercier chaleureusement les membres du jury pour le temps et l'importance qu'ils accorderont à mon travail.

Je souhaite remercier l'Université de Sousse et la Faculté des Sciences Économiques et de Gestion de Sousse de m'avoir accordé la bourse et ainsi assuré le financement nécessaire afin de mener à bien ce travail dans les meilleures conditions et bénéficier de toutes les qualités d'une thèse en cotutelle. Cette thèse n'existerait pas s'ils n'avaient pas accepté de m'accorder cette bourse, je vous en suis ainsi très reconnaissante.

Je remercie également tous les membres du Laboratoire « Centre d'Économie et Sociologie Appliquées à l'Agriculture et aux Espaces Ruraux » (CESAER) dont l'accueil chaleureux m'a permis de bénéficier de conditions de travail plus qu'excellentes. Je tiens à saluer tous les membres pour leur gentillesse et leur amabilité. Merci également pour les GTI qui ont contribué de manière significative à l'amélioration de mon travail.

Mes remerciements vont également à l'École doctorale Droit, Gestion, Économie et Politique (DGEP) de l'Université de Bourgogne Franche-Comté et l'École doctorale en Sciences Économiques et Gestion (EDSEG) de l'Université de Sousse pour le cadre de formation et d'accompagnement.

Une pensée reconnaissante va également à mes amis pour leur soutien et leur encouragement. Pour mes amis doctorants, nous faisons ce long chemin ensemble, je vous remercie d'être là à mes côtés, notamment dans la période de confinement, je n'aurais jamais passé cette période sans vous. Merci également de m'avoir

aidée à surmonter les moments de doute et d'avoir cru en moi. Je n'oublierai jamais les années passées dans des résidences universitaires de Dijon.

Un grand merci à mes parents, ma sœur, mon frère, ma grande famille pour m'avoir aidée à traverser les moments difficiles et pour m'avoir donné la force d'aller au terme de ce travail.

À vous toutes et tous, Je vous en remercie et vous en serai longtemps reconnaissante !!!

Résumé de la thèse

Analyse spatiale de la relation entre la mobilité des travailleurs et l'agglomération industrielle : Cas de la Tunisie

En Tunisie, les politiques publiques régionales mises en place depuis l'indépendance ont pour objectif majeur de réduire le déséquilibre structurel et économique entre ses régions et de favoriser la croissance dans les zones les moins développées. Cependant, au fil des années, le déséquilibre entre les régions du littoral et celles de l'intérieur et du sud s'est dramatiquement creusé, entraînant plusieurs tensions et soulèvements populaires. Par ailleurs, ce déséquilibre est considéré comme l'un des principaux déclencheurs de la révolution tunisienne du 14 Janvier 2011. Ainsi, cette thèse traite les principaux déterminants de la localisation des agents économiques et leurs conséquences sur les inégalités régionales en Tunisie. Trois sous-questions ont émergé de cette problématique : Quelle concentration géographique des industries manufacturières en Tunisie ? Quel rôle des politiques publiques territoriales dans les choix de localisation des activités manufacturières ? Quels sont les déterminants de la migration interne ?

D'un point de vue empirique, cette thèse vise à alimenter la littérature sur les configurations spatiales des agents économiques dans les pays en développement, particulièrement en Tunisie. D'un point de vue de politique publique, les résultats obtenus à partir de ces études empiriques fournissent des éléments de compréhension sur les différents mécanismes ayant une relation directe avec les disparités régionales, ce qui permet d'aider les décideurs politiques à mieux appréhender les configurations spatiales des agents économiques dans le cadre d'une politique de lutte contre les disparités régionales en Tunisie.

Dans le premier chapitre, nous analysons les configurations spatiales de diverses industries manufacturières en Tunisie à l'aide de données micro-géographiques et d'approches basées sur la distance, développées par Duranton et Overman (2005) et par Diggle et Chetwynd (1991). En utilisant un échantillon original de 5 405 usines en Tunisie en 2018, nos résultats montrent que la majorité des industries manufacturières en Tunisie se caractérisent par une concentration géographique à courte et moyenne distance. Ces concentrations sont principalement situées dans un rayon de moins de 30 km. Au niveau sectoriel, l'industrie textile se caractérise par une forte concentration géographique, et les industries de haute technologie sont également parmi les plus concentrées, confirmant l'existence de pools spécialisés dans les activités de haute technologie en Tunisie. Nous procédons à une analyse approfondie pour caractériser les configurations spatiales des sous-secteurs : usines totalement et partiellement exportatrices et usines nationales, mixtes et étrangères. Cette analyse montre que les usines totalement exportatrices et les usines étrangères et mixtes sont fortement concentrées géographiquement et dominent la distribution spatiale de l'industrie manufacturière en Tunisie.

Dans le deuxième chapitre, nous étudions la relation entre les choix de localisation des entreprises manufacturières et les politiques publiques territoriales. Pour atteindre cet objectif, nous réalisons une enquête auprès de 179 entreprises manufacturières du sud-est tunisien, basée sur une administration indirecte du questionnaire. Dans l'analyse empirique, nous mobilisons différentes méthodes : analyse factorielle multiple, classification ascendante hiérarchique et modèles probit. Ces méthodes confirment le rôle des incitations fiscales et financières dans les décisions de localisation de certaines entreprises manufacturières, mais soulignent également l'importance des facteurs traditionnels tels que la main-d'œuvre, la disponibilité des terrains et la proximité géographique. Les modèles probit indiquent que la considération des incitations fiscales et des subventions dans le choix de localisation manufacturière augmente de 15% la probabilité de s'implanter dans une zone fiscalement avantageuse.

Dans le dernier chapitre, nous examinons les déterminants de la migration interne en Tunisie, en nous concentrant sur le rôle des différences du capital humain. En exploitant les données des recensements réalisés par l'Institut National de la Statistique de 2004 et 2014 en Tunisie, nous estimons un modèle de gravité augmenté de deux proxys du capital humain (hautement qualifié et faiblement qualifié). Nous utilisons le différentiel de taux de chômage et la distance routière comme variables de résistance multilatérale et introduisons également des variables culturelles et de qualité de vie. Nos estimations montrent que les variables macroéconomiques sont les principaux déterminants des flux interrégionaux. Quant au capital humain, le niveau élevé de capital humain agit comme facteur d'attraction pour les migrants et le niveau faible de capital humain comme facteur de restriction de la migration vers les régions de destination. En outre, les variables non économiques jouent un rôle important dans les flux migratoires en incitant les individus à quitter leurs régions d'origine.

Mots clés : Industries manufacturières, Choix de localisation, Configurations spatiales, Capital humain, Méthodes spatiales, économétriques et multidimensionnelles, Politiques publiques régionales, Tunisie.

Abstract

Spatial analysis of the relationship between mobility of workers and industrial agglomeration: Case of Tunisia

Since independence in 1956, regional public policies in Tunisia have aimed to reduce the structural and economic imbalance between its regions and to promote growth in the less developed areas. However, over the years, the imbalance between the coastal regions and those in the interior and south has grown considerably, leading to several tensions and popular uprisings. Indeed, this imbalance is considered one of the main triggers of the Tunisian revolution of January 14, 2011. Thus, this thesis focuses on the main determinants of the spatial location of economic agents and their consequences on regional inequalities in Tunisia. Three sub-questions are particularly investigated: What geographical concentration of manufacturing industries in Tunisia? What is the role of territorial public policies in the location choice of manufacturing activities? What are the determinants of internal migration?

From an empirical point of view, this thesis attempts to contribute to the literature on the spatial patterns of economic agents in developing countries, particularly in Tunisia. From a political point of view, the results obtained provide insights into the different mechanisms linked to regional disparities, which helps policy makers to better understand the spatial patterns of economic agents in order to establish policies and strategies against regional disparities in Tunisia.

In the first chapter, we analyze the spatial patterns of manufacturing industries in Tunisia using micro-geographic data and distance-based approaches developed by Duranton and Overman (2005) and by Diggle and Chetwynd (1991). Based on an original sample of 5,405 plants in 2018, our empirical results show that the majority of manufacturing industries in Tunisia are characterized by a geographical concentration at short and medium distances. These concentrations are mainly within a radius of less than 30 km. At the sectoral level, the textile industry is characterized by a strong geographical concentration, and the high-tech industries are also among the most concentrated, confirming the existence of pools specialized in high-tech activities in Tunisia. We then analyze the spatial patterns of sub-sectors: totally and partially exporting plants and domestic, mixed and foreign plants. This analysis shows that totally exporting plants and foreign and mixed plants are highly geographically concentrated and dominate the manufacturing spatial distribution in Tunisia.

In the second chapter, we study the link between the location choices of manufacturing firms and territorial public policies. To achieve this objective, we conduct a survey of 179 manufacturing firms in the south-east of Tunisia, based on an indirect administration of the questionnaire. In the empirical analysis, we use various methods: multiple factor analysis, hierarchical cluster analysis and probit models. These methods confirm the role of tax and financial incentives in the location decisions of certain manufacturing firms, but also highlight the importance of traditional factors such as labor force, land availability, and geographic proximity. Probit models indicate that considering tax incentives and subsidies in the location choices of manufacturing firms increases the probability of locating in tax-advantaged areas by 15%.

In the last chapter, we examine the determinants of internal migration in Tunisia, focusing on the role of differences in human capital. Using data from censuses conducted by the National Institute of Statistics in 2004 and 2014, we estimate a gravity model augmented with two human capital proxies (high skilled and low skilled). We use the unemployment rate differential and road distance as multilateral resistance variables and also introduce cultural and quality of life variables. Our estimates show that macroeconomic variables are the main determinants of interregional flows. As for human capital, high human capital acts as a pull factor for migrants, while low human capital is a limiting factor for migration to destination regions. In addition, non-economic variables play an important role in migration flows by encouraging people to leave their origin region.

Keywords: Manufacturing industries, Location choice, Spatial patterns, Human capital, Econometric and multivariate methods, Regional public policies, Tunisia.

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Introduction générale

0.1. Les inégalités spatiales en Tunisie : constat et politiques publiques

0.1.1. Disparités régionales en chiffres...

Depuis l'indépendance en 1956, la Tunisie s'est fixée pour objectif de combler le fossé économique entre ses régions à l'aide notamment d'un ensemble de politiques publiques visant à réduire ce déséquilibre et à favoriser la croissance dans les zones les moins développées. Ce déséquilibre structurel se manifeste essentiellement entre les régions côtières orientales (11 gouvernorats¹ sur un total de 24) et les régions de l'intérieur et du sud en termes de réseaux urbains, d'infrastructures publiques, sociales et culturelles, et d'investissements privés et publics. Au fil des années, ce déséquilibre s'est dramatiquement creusé, générant des tensions sociales et une situation socio-économique instable. En effet, les inégalités régionales ont contribué au déclenchement de la révolution du 14 janvier 2011 et ont également entraîné, avant et après la révolution, plusieurs soulèvements populaires, principalement dans les régions considérées comme les moins développées en Tunisie.

Statistiquement, les indicateurs socioéconomiques montrent des écarts très flagrants entre ces régions. En 2010, le taux de pauvreté varie entre un minimum de 8% à 9% dans les régions côtières orientales et un maximum de 26 % à 32% dans les régions du nord-ouest et du centre-ouest (World Bank, 2014 ; Amara et al., 2018). D'après les statistiques du recensement de l'Institut National de la Statistique (INS) de Tunisie, le taux de chômage est inégalement réparti sur le territoire tunisien. Certaines régions atteignent des niveaux de chômage très importants. Le taux de chômage moyen dans les régions côtières orientales s'élève à 13,16% en 2004 et 12,81% en 2014, alors que cet indicateur dépasse les 16% en 2004 et les 19% en 2014 dans les régions de l'intérieur et du sud avec une valeur maximale de 26,2% en 2014. Quant au taux de chômage des jeunes diplômés universitaires, l'écart entre les taux de chômage moyens est également très important et se monte à 15%. En 2014, plus de 23% des jeunes diplômés sont au chômage dans les régions de l'intérieur et du sud, tandis que 8,4% de ces jeunes sont au chômage dans les régions côtières orientales.

La répartition spatiale des entreprises privées est révélatrice de la profondeur de ces inégalités. La concentration géographique des entreprises privées se situe principalement dans les 11 gouvernorats littoraux. En effet, en 2019, 74 % du total des entreprises privées² se localisent dans ces gouvernorats, alors

¹ Tunis, Ariana, Ben Arous, Manouba, Bizerte, Zaghouan, Nabeul, Sousse, Monastir, Mahdia et Sfax.

² Ces statistiques sont issues du répertoire national des entreprises (édition 2020), produit par l'Institut National de la statistique en Tunisie.

que le reste du pays n'en contient que 26 %. La décomposition des entreprises privées selon les secteurs se caractérise également par une répartition spatiale inégale. Les 11 gouvernorats littoraux comprennent plus de 79% des firmes du secteur manufacturier en 2019. Conséquence directe à cette répartition spatiale des entreprises manufacturières, la majorité des parcs industriels créés par divers organismes publics pour accueillir les projets industriels sont situés dans les gouvernorats côtiers, ces décisions stratégiques étant prises en fonction de la forte demande pour ces parcs dans la région littorale orientale. En outre, en 2006, quatre pôles de compétitivité ont été désignés comme axe principal d'une nouvelle stratégie industrielle, menée par le Ministère de l'Industrie afin d'introduire une stratégie de clusters industriels qui assure et améliore le niveau d'innovation industrielle en Tunisie. Toutefois, trois de ces pôles sont situés dans des gouvernorats côtiers tandis qu'un seul pôle est situé dans un gouvernorat de l'intérieur.

La part des régions du littoral dépasse les 73% des entreprises du secteur touristique en 2019. Par ailleurs, ces 11 gouvernorats totalisent plus de 88% des entreprises du secteur financier au cours de la même année. L'investissement privé est nettement plus élevé dans les régions du littoral que dans celles de l'intérieur et du sud. La répartition spatiale des investissements étrangers se caractérise par la même tendance : une forte concentration des investissements directs étrangers dans la région littorale de l'Est. Seules 3% des entreprises étrangères et mixtes s'installent dans les régions de l'intérieur et du sud en 2019, tandis qu'en 2014, 10% de ces entreprises s'y localisent.

Les déséquilibres régionaux du pays se posent également en termes d'investissements publics. Le réseau routier est bien plus dense sur la bande côtière, tandis que la répartition spatiale des aéroports est quasi-équitable entre les régions : les quatre aéroports sont situés dans les 11 gouvernorats les plus développés et cinq dans le reste du pays. En 2014, le taux de branchement des ménages au réseau d'eau potable varie de 99,86% dans la capitale « Tunis » contre 54,3% dans le gouvernorat de Jendouba considéré parmi les gouvernorats les moins développés. Environ 20% en moyenne des ménages ne bénéficient pas d'eau potable dans les régions de l'intérieur et du sud contre 6% dans les 11 gouvernorats. En termes de couverture numérique, plus de 32% des ménages ont accès à internet dans les gouvernorats du littoral, contre moins de 20% des ménages dans les régions profondes : plus de 77% des abonnés au réseau téléphonique fixe résident dans ces 11 gouvernorats en 2014.

Les inégalités régionales en Tunisie sont également flagrantes au niveau démographique. La part de la population dans les zones rurales est passée de 60 % en 1966 à 33 % en 2014 (Amara et al., 2018). Selon les données du recensement réalisé par l'INS en 2014, plus de 61% des individus résident dans les 11 gouvernorats littoraux, la métropole tunisoise comprenant à elle seule 24% de la population tunisienne en 2014. Selon cette source, les flux migratoires suivent également cette tendance, en effet, la Tunisie se caractérise par une migration massive des régions de l'intérieur et du sud vers les régions du littoral. Entre 2009 et 2014, 79% des individus ont migré vers les gouvernorats côtiers, tandis que 21% ont migré en sens inverse. Environ 90,2% des ménages ruraux déclarent en 2012 qu'au moins un membre de leur petite famille a migré vers les zones urbaines (Drissi, 2014).

Concernant des indicateurs sociaux, des écarts importants sont également observés en termes d'éducation. Le taux moyen d'analphabétisme dans les 11 gouvernorats tourne autour de 16%, tandis que dans les régions de l'intérieur et du sud, il est plus élevé de 30% dépassant largement la moyenne nationale de 19% selon les données du recensement de 2014 pour la population de plus de 10 ans. En termes de capital humain qualifié, les régions côtières détiennent les taux les plus élevés avec environ 69% de la population plus de 10 ans ayant une éducation universitaire, contre 31% dans le reste du pays.

Ce cadrage reflète un besoin fondamental d'approfondir l'analyse des inégalités régionales en Tunisie. En effet, aucun des indicateurs statistiques mentionnés ne montre de signe de convergence permettant de percevoir un processus de rattrapage par rapport au développement régional. De surcroît, à une échelle spatiale plus fine, au niveau des délégations, ces inégalités sont également importantes. Même au sein des gouvernorats du littoral, ces indicateurs socioéconomiques sont inégalement répartis dans leurs délégations.

0.1.2. Evolution des politiques et stratégies économiques

L'histoire économique de la Tunisie peut être caractérisée par deux grandes phases des politiques de développement régional : avant et après les années 1990. Les politiques mises en œuvre dans les années 1960 étaient une nécessité pour rompre avec l'héritage colonial. Ainsi, l'Etat a pris en main le plein contrôle public sur la gestion de la situation socioéconomique du pays et a commencé la mise en place de politiques et de stratégies afin de résoudre les problèmes sociaux et économiques. Le problème des disparités régionales est apparu pour la première fois en 1961 (Perspectives décennales de développement, 1961) (Ben Salah, 1961 ; Amin, 1966) et une attention particulière a en effet été accordée aux conséquences néfastes de ces disparités.

Dans les années soixante, l'administration centrale vise à rééquilibrer le poids économique des régions tunisiennes et à établir une organisation de l'espace économique plus équitable à travers une politique nationaliste guidée par l'intervention publique. Entre 1960 et 1970, les politiques publiques visant à réduire le déséquilibre régional se sont notamment concrétisées par la création de pôles industriels dans les régions intérieures en retard. Dans la même période, le secteur public a entrepris de grands projets dans l'intérieur rural tunisien, tels que la raffinerie de sucre à Beja, la transformation de l'usine de cellulose et d'Alfa³ à Kasserine et les usines chimiques à Gabès. En outre, ce système nationaliste a mis l'accent sur le rôle des entreprises publiques et leur développement dans tous les secteurs économiques (Morrisson et Talbi, 1996). En revanche, ces politiques n'ont pas tenu compte des différentes caractéristiques et spécificités régionales. En effet, à cette époque, les pouvoirs publics étaient centralisés, la distribution des activités économiques s'est ainsi effectuée verticalement et les politiques de développement régional étaient fortement contrôlées et planifiées par l'administration centrale (Rallet, 1995 ; Zidi, 2013).

Les années 1970 ont été marquées par la fin de l'expérience du nationalisme fort et de la domination de l'Etat dans les activités économiques et par la transition vers une économie du marché (Dlala, 1994, Zidi,

³ L'alfa, également appelée Stipa tenacissima, est une plante monocotylédone qui pousse dans les régions arides et qui est principalement utilisée pour la fabrication de papiers d'impression.

2013). Une nouvelle politique industrielle a été établie, fondée sur la promotion des petites et moyennes entreprises (PME), des exportations ainsi que de l'attractivité de l'investissement direct étranger. Des textes juridiques ont été promulgués afin de promouvoir les exportations et d'améliorer la compétitivité des entreprises dans un environnement mondial dynamique et concurrentiel, telles que la loi 72-38 en 1972 (spécifiant les conditions de travail), la loi 74-74 en 1974 (décrivant les codes d'investissement pour les entreprises manufacturières) et le décret 74-793 en 1974 (mentionnant la décentralisation industrielle et la promotion des petites et moyennes entreprises). En outre, divers organismes ont été créés et placés sous la tutelle du Ministère de l'Industrie. La création de l'Agence de Promotion des Investissements (API) en 1973 visait à revitaliser le secteur manufacturier, à améliorer les services aux investisseurs étrangers et nationaux ainsi qu'à simplifier les procédures administratives. L'Agence Foncière Industrielle (AFI) a également été créée en 1973, sa mission principale est la conception, le développement et la commercialisation de zones industrielles dans le pays. Ces changements ont eu lieu au niveau national. En revanche, les politiques de développement régional étaient toujours gérées par l'administration centrale, suivant la même logique adoptée dans les années 1960 (Rallet, 1995).

En 1986, un plan d'ajustement structurel a été adopté en accord avec le Fonds Monétaire International (FMI). L'objectif de ce plan était de mettre en place un ensemble de dispositifs et de réformes, de modifier les structures de l'économie tunisienne en les rendant plus compétitives au niveau mondial, ainsi que d'encourager davantage le secteur privé par le transfert total ou partiel de certains services publics au profit de banques ou de groupes privés (Rallet, 1995). À partir de cette date, la Tunisie est passée d'une économie nationaliste pilotée par l'intervention publique à une économie plus libérale et ouverte sur l'extérieur. En outre, la Tunisie s'est engagée dans un processus d'ouverture des frontières et d'intégration aux niveaux régional et mondial suite à son adhésion au GATT en 1990 et à l'Organisation Mondiale du Commerce en 1994, et à la signature des accords de libre-échange avec l'Union Européenne en 1995 (Karray et Driss, 2006 ; Amara et Thabet, 2012). Cette libéralisation a nécessité une rupture avec les anciennes politiques nationalistes et essentiellement avec la politique de développement régional, fortement contrôlée par l'administration centrale. En conséquence, elle a généré un changement fondamental dans le schéma des politiques publiques régionales et également dans le poids économique des régions (Rallet, 1995 ; PNUD, 1999).

En raison de ces nouvelles exigences, les politiques de développement régional ont connu plusieurs inflexions impliquant un passage du contrôle de l'administration centrale à celui de l'administration régionale et locale (Ministère du Plan et du Développement Régional, 1990, 1993). En effet, les potentialités et capacités de chaque région tunisienne deviennent le cœur du schéma de développement régional. Ce nouveau schéma de développement régional nécessite l'implication des conseils régionaux dans la prise de décision et un nouveau découpage administratif adapté au développement régional du pays afin de garantir l'optimalité dans les enjeux de développement régional et l'équilibre du poids économique entre les régions (Amara et Thabet, 2012 ; Karray et Driss, 2006). Pour autant, suite à cette libéralisation et malgré la décentralisation des politiques publiques, les disparités régionales se sont considérablement accentuées

(Kriaa et al., 2011). L'hétérogénéité en termes de niveaux de croissance, de chômage et de répartition spatiale des activités économiques a augmenté entre les régions du littoral et celles de l'intérieur et du sud. En effet, même si cette ouverture contribuait au développement industriel et à l'augmentation du nombre d'entreprises, notamment dans le secteur manufacturier, elle produisait une redistribution spatiale inégale des activités économiques et une forte polarisation géographique en faveur des régions côtières (Belhedi, 1992 ; Dlala, 1999 ; El Bekri, 2000 ; Amara, 2009 ; Amara et al., 2010).

En outre, une stratégie industrielle, lancée officiellement en 2006, vise à construire des pôles de compétitivité afin d'assurer l'innovation et le progrès technique. Quatre pôles de compétitivité ont été désignés : le pôle du secteur textile et habillement dans les gouvernorats de Monastir et de Manouba, le pôle du secteur agro-alimentaire dans le gouvernorat de Bizerte, le pôle du secteur mécanique et électronique dans le gouvernorat de Sousse et le pôle multisectoriel dans le gouvernorat de Gafsa. L'objectif de ces pôles n'est pas de promouvoir le développement régional ou de réduire les disparités régionales, mais d'améliorer la compétitivité des entreprises manufacturières et de services tertiaires et de soutenir les projets d'innovation dans tout le pays. La politique de localisation de ces pôles s'appuie ainsi sur les différences de situations socio-économiques entre les régions tunisiennes ; par exemple, les différences dans la spécialisation et le nombre d'entreprises concentrées et dans les ressources naturelles, physiques et humaines. Seul le pôle du gouvernorat de Gafsa fait exception en s'intégrant dans le programme de développement régional au profit des régions moins développées.

Après la révolution du 14 janvier 2011, le débat sur les inégalités régionales, axé sur les dimensions économiques, a suscité davantage d'intérêt de la part des économistes et décideurs politiques. La réduction des déséquilibres régionaux apparaît aujourd'hui une priorité absolue dans les nouvelles stratégies de développement. En revanche, la Tunisie a connu plusieurs changements de gouvernement dans un laps de temps très court après la révolution, ce qui entraîné un manque de cohérence de ces nouvelles politiques et stratégies de remédiation aux inégalités régionales.

Même si la Tunisie a expérimenté différentes politiques de développement régional au fil des années et si les préoccupations de développement régional sont toujours présentes dans les discours officiels des multiples gouverneurs après la révolution, elle est toujours confrontée au problème des inégalités régionales. En outre, la fracture socioéconomique entre les régions de l'intérieur et du sud et les régions du littoral de l'Est s'élargit provoquant des instabilités sociales et des griefs politiques principalement dans les zones les plus défavorisées ainsi qu'une massive migration vers les régions côtières. Au vu de ces disparités régionales persistantes, il importe de comprendre les mécanismes économiques sous-jacents et notamment, le rôle des choix de localisation des agents économiques dans la formation de ces inégalités.

0.2. Inégalités régionales et choix de localisation des agents économiques

Les inégalités régionales se manifestent sous plusieurs formes : économique, sociale, démographique, culturelle etc. Les raisons de se pencher sur cette question sont multiples. L'une des raisons principales est que les inégalités interrégionales produisent des tensions politiques et ethniques, qui minent la cohésion sociale et la stabilité politique (Kanbur et Venables, 2005), ce qui peut conduire à des conflits internes et à des guerres civiles dans les cas extrêmes (Deiwiks et al., 2012, Buhaug et al., 2012). En outre, ces inégalités peuvent générer des conflits au niveau individuel, elles s'accompagnent souvent d'inégalités interpersonnelles indésirables (Lessmann, 2014).

Dans la littérature économique, les travaux de Kuznets en 1955 et de Williamson en 1965 avec la courbe en U inversé incarnent les premiers travaux sur les inégalités (Lessmann, 2014). D'après ces auteurs, le processus de développement national nécessite d'une certaine manière une augmentation du niveau des inégalités, au moins dans les premières phases du développement (Lundberg et Squire, 2003). La littérature économique est par ailleurs très abondante sur les questions liées à la répartition des richesses et des agents économiques dans l'espace. Pour les mercantilistes, la richesse des régions engendre systématiquement l'appauvrissement des autres régions. En revanche, pour Smith et Ricardo, avec les théories des avantages absolus et comparatifs, l'économie peut assurer la croissance dans toutes les régions et l'accumulation de richesses dans certaines régions ne conduit pas nécessairement à la perte de richesses dans d'autres. D'après la nouvelle économie géographique (Krugman, 1991a, 1991b), la concentration des activités économiques s'explique par des forces inhérentes aux caractéristiques des régions telles que les coûts de transport et de main-d'œuvre dans ces régions (Krugman, 1998). En effet, cette théorie montre comment un mécanisme circulaire et cumulatif peut conduire à un modèle « centre- périphérie » dans lequel les entreprises et les travailleurs se concentrent dans le centre où les forces d'agglomération sont présentes. Par conséquent, ce mécanisme attire de plus en plus d'entreprises et de travailleurs vers le centre, générant un déséquilibre caractérisé par des différences de salaires et de prix entre le centre et la périphérie.

La performance économique d'un pays est fortement liée au niveau des inégalités régionales et à la répartition des richesses et des activités économiques entre ses régions (Persson et Tabellini, 1991). En effet, les inégalités régionales sont toujours au centre de l'attention des décideurs politiques, du fait qu'un déséquilibre flagrant entre les régions d'un pays peut entraver la cohésion nationale ou la croissance économique (Fratesi et Percoco, 2014).

De nombreux travaux apportent des éléments explicatifs sur les choix de localisation des agents économiques afin de mieux comprendre les mécanismes des disparités régionales et les conséquences sur la structure spatiale des territoires de la répartition spatiale inégale des individus et des activités économiques. Ainsi, dans les trois sous-sections suivantes, nous fournissons un ancrage théorique à notre travail en abordant les thématiques suivantes : les choix de localisation des activités économiques, la migration interne des individus et le rôle des politiques publiques territoriales, en mettant l'accent sur leur relation avec les inégalités régionales.

0.2.1. Inégalités et localisation des activités économiques

Comprendre les agglomérations des activités économiques et ses forces motrices est essentiel pour la formulation des politiques de développement régional et constitue une question clé pour les politiques régionales (Rathelot et Sillard, 2008). La répartition de ces activités n'étant pas homogène (Krugman, 1991a, 1991b), une littérature économique importante s'intéresse aux déterminants des configurations spatiales des activités économiques. La littérature qui examine les déterminants de la localisation des activités économiques, provient notamment des travaux de Von Thünen (1826), suivis par les travaux de Weber (1909), de Marshall (1920) et de la nouvelle économie géographique (Krugman, 1991a).

La nature et les dotations initiales ne sont pas négligeables dans la distribution spatiale des activités économiques (Krugman, 1991a). Plusieurs chercheurs (par exemple, Maurel et Sédillot, 1999 ; Ellison et Glaeser, 1999 ; Kim, 2000 ; Decrop, 2002) ont insisté sur l'importance des avantages naturels dans l'élaboration des stratégies de localisation industrielle. Selon Marshall (1920), la proximité des avantages naturels constitue la première source d'agglomérations des agents économiques. Cronon (1991) considère que les inégalités sont le résultat de deux natures, la première est liée aux dotations naturelles et la seconde est le résultat des actions des individus afin de développer la nature où ils se situent. Pour Diamond (1997), les inégalités régionales sont liées aux dotations différentielles des régions en faune et flore.

La nouvelle économie géographique apporte une nouvelle compréhension de la répartition inégale des activités économiques dans l'espace. Cette théorie étudie les choix de localisation des agents économiques, ainsi que l'impact de ces choix sur l'organisation territoriale et la croissance économique régionale (Fujita et Thisse, 1997). Elle repose essentiellement sur l'hypothèse que la distribution spatiale des activités économiques est le résultat d'une confrontation de forces centripètes avec des forces centrifuges. Les forces centripètes comprennent tous les facteurs qui mènent à l'agglomération des industries tels que les faibles coûts fonciers et de moyens de transport, la proximité de la clientèle et des fournisseurs, un large bassin de main-d'œuvre, etc. En outre, la tendance à l'agglomération industrielle est renforcée par l'existence des externalités d'informations dans un endroit spécifique (Decrop, 2002). Ces externalités sont le résultat d'un transfert de connaissances et d'idées entre firmes agglomérées dans une même zone par le biais de réseaux informels et de la rotation de la main d'œuvre.

Ces externalités font partie des économies générées par l'agglomération des industries, définies comme des retombées d'une structure spatiale concentrée. Plusieurs études empiriques et théoriques ont souligné l'importance du rôle joué par les externalités d'agglomération dans la croissance régionale et la productivité des entreprises. Ces économies d'agglomération renforcent l'attractivité d'une région par la boule de neige (Fujita, 1989) : d'une part, un mécanisme appelé « Forward linkages » (liens en aval) explique qu'une grande variété de produits offerts attire la demande locale, ce qui accroît le marché de clientèle et par conséquent motive l'implantation de nouvelles firmes afin de bénéficier d'économies. D'autre part, ces nouvelles implantations élargissent le bassin d'emploi et attirent ainsi davantage de travailleurs à la recherche

d'opportunités d'emploi plus nombreuses et variées, ce phénomène est connu sous le nom de « Backward linkages » (liens en amont).

Le processus de localisation des activités économiques dans l'espace est essentiellement un phénomène dynamique (Arbia et al., 2010). Ainsi, les choix de localisation sont loin d'être aléatoires (Békés et Harasztosi, 2013). Divers facteurs influent sur les choix de localisation des activités, et cette influence peut varier d'une décision de localisation à l'autre en fonction de la période et de la région. Dans l'impossibilité de lier les répartitions spatiales des activités économiques à un facteur unique, de nombreux facteurs ont été avancés. La nouvelle économie géographique accorde une grande importance à l'héritage historique comme source de l'émergence d'une concentration géographique de certaines activités économiques dans des régions spécifiques (Krugman, 1991a ; Fujita et al., 1999).

Dans ces facteurs, le rôle de la main d'œuvre dans la formation des configurations spatiales des industries a fait l'objet d'une attention particulière. Un bassin de main-d'œuvre important permet d'attirer de nouvelles firmes afin de profiter des avantages de ce bassin et réduire le coût de la recherche de main d'œuvre (Henderson, 1986). Ces agglomérations industrielles créent, en effet, une concurrence entre les firmes pour attirer les travailleurs les plus qualifiés, ce qui entraîne une hausse des salaires. En outre, ces agglomérations offrent des opportunités variées et multiples aux travailleurs, ce qui amène ces derniers à valoriser leurs qualifications (Gagné et Goffette-Nogot, 2008). Les industries qui dépendent de compétences spécifiques de la main d'œuvre, sont alors spatialement concentrées dans une zone où se trouvent les compétences souhaitées. Dumais, Ellison et Glaeser (2002) soutiennent que les firmes manufacturières ont tendance à se localiser à proximité d'autres firmes, lorsqu'elles partagent le même type de main d'œuvre.

À l'origine, la localisation des industries était liée à la disponibilité des matières premières. Cependant, aujourd'hui, notamment avec l'évolution des besoins des firmes et des moyens de transport et les nouvelles conditions de mobilité de la main-d'œuvre, la prise de décisions de localisation est devenue complexe et multidimensionnelle. Comprendre les déterminants des choix de localisation contribue à améliorer l'efficacité et l'efficience des politiques publiques de développement industriel et régional.

0.2.2. Inégalités et migrations

La compréhension des flux migratoires apparaît comme centrale dans la mesure où la migration interne est une réponse sociale, économique et culturelle aux inégalités et à la pauvreté (Amara et Jemmali, 2018), jouant un rôle prépondérant dans de nombreuses stratégies de développement (Lewis, 1954 ; Lucas, 1997). La migration interne est ainsi un mécanisme essentiel par lequel les ressources en main-d'œuvre sont réparties géographiquement en réponse à l'évolution des forces économiques et démographiques (Greenwood, 1997) et cherchant à réduire les écarts entre leurs régions d'origine et de destination. De fait, l'augmentation de la population suite à ces mouvements migratoires permet d'accroître le niveau des activités économiques et de garantir aux industries les rendements d'échelle croissants, ce qui souligne le rôle important des études sur la migration pour mieux comprendre les critères de population.

La migration peut être un signe révélateur d'inégalités régionales, en termes de revenus ou d'opportunités sur le marché du travail (Amara et Jemmali, 2018). Comme les individus sont mobiles, selon Krugman (1991a, 1991b), ils se déplacent et se localisent en fonction des différences de salaires réels (Combes et al., 2006). Certains chercheurs soutiennent l'idée que le développement alimente et stimule la migration plutôt que de la réduire, du moins à court et moyen terme (Lucas, 2014). En revanche, d'autres considèrent la migration comme un stimulus pour le développement régional (Phan et Coxhead, 2010) et qui peut, en effet, être un mécanisme d'ajustement des disparités régionales (Kirdar et Saracoglu, 2008).

La théorie économique sur la migration peut être divisée en deux approches principales avec des prédictions opposées : la théorie néoclassique et la nouvelle économie géographique (Piras, 2017). La première approche met en évidence que les différences de niveau d'aménités expliquent les différences de salaires (Graves et Linneman, 1979 ; Graves et Mueser, 1993). Ainsi, la migration est un mécanisme d'ajustement, capable d'égaliser les différences économiques entre les régions, à mesure que les individus se déplacent des régions à faible revenu vers celles à revenu élevé (Fratesi et Percoco, 2014). Par conséquent, ces déplacements conduisent à une convergence des salaires et à une disparition du chômage (Basile et al., 2018).

La seconde approche affirme que les différents niveaux d'aménités n'expliquent pas suffisamment le mécanisme de migration, qui s'explique, en revanche, par les niveaux d'opportunités offertes d'emploi par les différentes régions (Greenwood, 1985 ; Greenwood et Hunt, 1989 ; Evans, 1990). Les modèles d'économie géographique initiés par Krugman (1991a) et approfondis par Fujita et Thisse (2002) soutiennent cette idée. Dans les modèles centre-périphérie, la migration renforce l'agglomération, les régions les plus riches attirent la main-d'œuvre et accroissent ainsi leurs marchés locaux, ce qui augmente les externalités positives et favorise les agglomérations industrielles (Fratesi et Percoco, 2014). En effet, ces agglomérations attirent de plus en plus de firmes et de travailleurs, en particulier des travailleurs hautement qualifiés qui recherchent des salaires plus élevés en réponse à leurs compétences et expériences.

De nombreux débats se sont tenus autour de la fuite des cerveaux même au sein d'un pays. Pour les décisions de migration, les personnes hautement qualifiées et moins qualifiées réagissent différemment aux différentes situations économiques et sociales (Fratesi et Percoco, 2014). En raison de la migration des personnes qualifiées, les régions d'origine sont privées des compétences dont elles ont besoin (Aydalot, 1985) et perdent une part considérable de leur capital humain au profit des régions d'accueil (Beine et al., 2001 ; Mountford et Rapoport, 2006). La migration peut alors conduire à des disparités régionales plus importantes, notamment lorsqu'elle est sélective en termes de compétences (Fratesi et Percoco, 2014). En outre, les flux migratoires de personnes qualifiées peuvent modifier les critères du marché du travail, en effet, la forte demande de travailleurs qualifiés est considérée comme l'une des principales causes de l'augmentation des inégalités de revenus (Freeman, 1995 ; Gottschalk et Smeeding, 1997 ; Acemoglu, 2003).

0.2.3. Inégalités et politiques publiques territoriales

La littérature économique souligne le rôle essentiel des pouvoirs publics dans les stratégies de localisation des activités économiques (Maurel et Sédillot, 1999). Les politiques publiques peuvent intervenir par différentes actions : directes et indirectes dans le processus de développement régional (Aydalot, 1985). L'action directe se manifeste dans les dépenses publiques régionales, l'organisation de l'administration économique (centralisée ou décentralisée) ainsi que la mise en œuvre et l'amélioration des grands projets publics. Ainsi, ces actions directes constituent des interventions publiques sous forme d'investissements en fournitures et équipements pour les industries tels que les infrastructures routières, les réseaux d'énergie, d'eau, et de télécommunications. Elles jouent un rôle crucial dans le fonctionnement de l'économie et dans le paysage économique régional d'un pays (Munnell, 1990). D'un point de vue économique, les biens publics peuvent générer des rendements croissants, permettant d'accroître la rentabilité et la productivité des firmes (Duranton, 1997), ce qui en fait une source d'attractivité pour les investissements du secteur privé, notamment les investissements étrangers, conduisant ainsi à des agglomérations industrielles.

L'action sur la localisation des activités économiques est considérée comme une action indirecte sur les entreprises privées. Les pouvoirs publics disposent d'un moyen d'orienter les décisions de localisation par le biais des différentiels d'impôts locaux (Buss, 2001 ; Papke, 1991). Ces dernières mesures peuvent jouer un rôle non négligeable dans le développement territorial des pays où les taux d'imposition et les incitations publiques sont différenciés d'une région à une autre (Aydalot, 1985). Les décideurs politiques divisent le pays en zones dotées de régimes fiscaux différents qui permettent aux entreprises privées s'y implantant de bénéficier des avantages fiscaux et financiers. Ils mettent en place des politiques fiscales, basées sur un découpage territorial dans le but d'attirer de nouvelles firmes, d'améliorer la croissance économique ainsi que de créer des nouveaux emplois dans certaines régions (Chaurey, 2017 ; Liu et al., 2018).

Les avantages et inconvénients des politiques territoriales fondées sur la différenciation fiscale entre les régions sont largement débattus par les économistes (Chaurey, 2017 ; Parchet, 2019). Cependant, alors que l'exonération fiscale est généralement la politique commune des gouvernements locaux pour attirer de nouveaux investisseurs (Liu et al., 2018), la littérature économique n'est pas concluante sur la relation entre les incitations fiscales et les choix de localisation des firmes. Cette relation alimente d'intenses débats dans les milieux universitaires et politiques (Giroud et Rauh, 2019).

Sur le plan théorique, il n'y a pas de consensus sur l'impact des incitations fiscales et financières sur les configurations spatiales des activités économiques. D'une part, la fiscalité peut avoir un impact important sur le choix discret de localisation des entreprises (Devereux et Griffith, 2003 ; Auerbach, 2006). Les impôts sont considérés comme un facteur de coût majeur pour les entreprises et jouent, en effet, un rôle clé dans leurs décisions d'investissement et de financement. Afin de réduire le niveau d'imposition, de nombreuses entreprises s'engagent dans diverses activités exonérées d'impôt, telles que l'implantation dans des zones bénéficiant d'incitations fiscales ou de subventions financières. La réduction des taux d'imposition dans des régions spécifiques peut attirer de nouvelles firmes, ce qui entraîne une augmentation de leur rentabilité

(Rohlin et al. 2014). En effet, une région caractérisée par un faible taux d'imposition rend ses régions voisines relativement moins attractives pour les investisseurs (Zodrow et Mierkowski, 1986 ; Wildasin, 1988, 1991 ; Wilson, 1991, Rathelot et Sillard, 2008).

D'autre part, cette réduction peut avoir un effet négligeable lorsque les firmes préfèrent bénéficier des aménités naturelles ou des économies d'agglomération. En conséquence, ces firmes situées dans les agglomérations industrielles peuvent être confrontées à des charges fiscales plus élevées que celles dispersées ou situées dans des régions fiscalement avantageuses (Brülhart et Simpson, 2018), en espérant bénéficier des externalités positives générées par les agglomérations (Guimaraes et al., 2003 ; Crozet et al., 2004 ; Cohen et Paul, 2005). De ce fait, les économies d'agglomération peuvent conduire à des agglomérations spatiales d'activités économiques qui ne peuvent pas être manipulées par des différentiels d'imposition (Brülhart et al., 2012).

Certaines études empiriques confirment l'efficacité des politiques fiscales territoriales en montrant un impact significatif des exonérations fiscales et des subventions à l'investissement sur les décisions de localisation (Harris, 1983 ; Begg et McDowell, 1987). D'autres, en revanche, remettent en cause cette efficacité et pointent la non-existence d'une relation claire entre exonérations fiscales et choix de localisation. Les firmes décident de s'implanter dans des régions où il y a une forte agglomération d'activités économiques, malgré le niveau élevé d'imposition (Brülhart et al., 2012, Brülhart et Simpson, 2018).

Étant donné que les inégalités régionales déstabilisent la cohésion sociale d'un pays et nourrissent l'instabilité et l'inefficacité d'un système économique, aborder ces différentes thématiques permet de mettre en lumière les mécanismes des disparités régionales ainsi que les raisons du développement des différentes régions à des rythmes différents.

0.3. Objectifs et Plan de la thèse

Afin de surmonter les obstacles à la croissance régionale en Tunisie, il importe d'abord de comprendre les mécanismes conduisant au maintien, voire à l'aggravation de la fracture entre les régions côtières de l'est qui demeurent les plus développées et les régions de l'intérieur et du sud. Par conséquent, l'objectif de cette thèse est de contribuer à la littérature sur une analyse spatiale des disparités régionales en Tunisie. Plus précisément, la question centrale de la thèse s'articule autour de la question suivante : **Quels sont les principaux déterminants des choix de localisation des agents économiques en Tunisie et les conséquences sur les inégalités régionales ?**

La réponse à cette question conduit à trois sous-questions liées conduisant à un déroulement en trois étapes de la thèse. La figure 0.1 ci-dessous illustre ces enjeux et les relations entre eux. Dans la première étape, la sous-question est la suivante : Quelle concentration géographique des industries en Tunisie ? Nous entamons le travail par une analyse spatiale de l'agglomération industrielle afin de schématiser les disparités

régionales en termes d'activités manufacturières. Nous répondons à cette question à travers une étude empirique sur les choix de localisation d'un échantillon d'entreprises manufacturières basée sur différentes mesures en espace continu. Deuxièmement, nous apportons des éléments de compréhension sur ces configurations spatiales des activités économiques en nous focalisant sur les facteurs des choix de localisation des activités manufacturières et en particulier sur le rôle des politiques publiques territoriales fondées sur différents régimes spatiaux fiscaux dans ces choix de localisation que nous éclairons avec une enquête. Dans la dernière étape, nous nous concentrons sur les individus, en raison de leur rôle primordial en tant que force motrice de l'agglomération industrielle. Cette étape porte sur les facteurs qui affectent la migration interne et sur l'effet du capital humain régional sur ces flux interrégionaux.

Pour répondre à ces différentes problématiques, nous exploitons différentes bases de données : données primaires (enquête de terrain) et secondaires et nous mobilisons différentes méthodologies empiriques : méthodes de statistique spatiale (processus ponctuels), méthodes multidimensionnelles et méthodes économétriques sur modèle gravitaire et sur données d'enquête. Ainsi, l'enchaînement de ce travail conduit à une organisation de la thèse en trois chapitres :

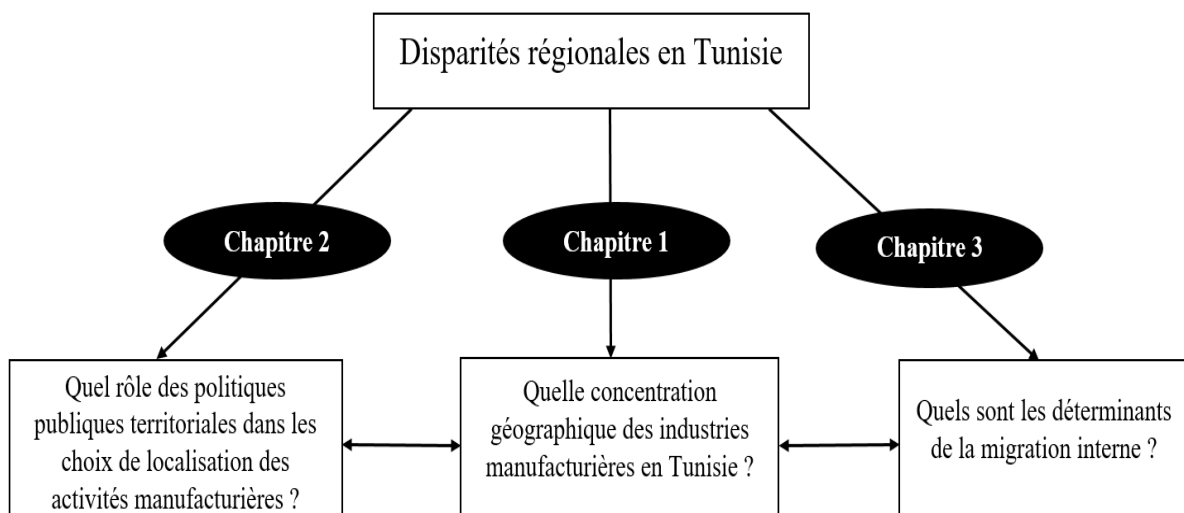


Figure 0.1: Structure de la thèse

Source : cette figure est réalisée par les auteurs

Le premier chapitre intitulé **“What geographical concentration of industries in Tunisia? Empirical evidence using distance-based measures”** a pour objectif d'évaluer la concentration géographique des entreprises manufacturières ainsi que d'identifier les industries manufacturières les plus concentrées et les plus dispersées en Tunisie. Compte tenu des inégalités de la structure manufacturière tunisienne, une analyse détaillée des schémas spatiaux des entreprises manufacturières est en effet cruciale pour quantifier et évaluer le poids industriel dans toutes les régions tunisiennes. Nous avons alors recours à différentes mesures en espace continu, fondées sur les distances : Fonction de Duranton et Overman (2005), Fonction de Diggle et Chetwynd (1991) et Fonction bi-variée de Duranton and Overman (2005, 2008) afin de caractériser la concentration géographique des industries dans tout le pays. Pour mobiliser ces mesures, nous avons besoin

des coordonnées géographiques de chaque entreprise manufacturière (l'unité de production, l'usine) en Tunisie. Ainsi, nous avons collecté manuellement les adresses exactes des usines dans toute la Tunisie ainsi que diverses informations telles que le nombre d'emplois, le secteur manufacturier, la date de début de production, le régime d'exportation, la nationalité de l'usine à partir du site web de l'Agence de Promotion de l'industrie et de l'innovation (APII) en septembre 2018. Les informations obtenues sur ce site web se limitent aux entreprises manufacturières comptant 10 employés ou plus. Notre base de données comprend 5405 usines avec 509741 emplois et divisées en neuf secteurs manufacturiers. Dans ce chapitre également, nous présentons une revue de littérature sur les mesures de la concentration géographique et consacrons une section à la description de l'évolution des différentes politiques industrielles en Tunisie.

L'utilisation de différentes mesures en espace continu est justifiée par le fait que chaque mesure fournit des informations différentes, ce qui nous permet d'appréhender le schéma spatial industriel en Tunisie de différentes manières. Chaque mesure analyse la concentration géographique d'une manière différente. La fonction de Duranton et Overman (2005) est une méthode absolue qui calcule la proportion de voisins appariés dans un secteur industriel choisi tandis que la fonction de Diggle et Chetwynd (1991) appartient à la famille des méthodes topographiques qui évaluent la densité d'une industrie par rapport à la densité industrielle globale (Brühlhart et Traeger, 2005). Les fonctions bivariées permettent d'étudier les modèles spatiaux de co-agglomération entre deux secteurs industriels choisis, ce qui permet de mieux comprendre les interactions entre les entreprises de deux secteurs manufacturiers différents. En outre, l'avantage d'utiliser ces méthodes réside dans le fait que les mesures continues déterminent la distance exacte à laquelle se produit la concentration géographique, à une échelle spatiale choisie.

Les résultats de ces différentes méthodes spatiales indiquent que la tendance générale de la concentration géographique n'affecte pas toutes les industries de la même manière, chaque industrie affichant son propre schéma spatial. Cependant, la majorité des industries manufacturières en Tunisie se caractérisent par une forte concentration géographique à courte et moyenne distance, ces concentrations sont principalement situées dans un rayon de moins de 30 km. L'analyse de co-agglomération montre que le tissu manufacturier tunisien est caractérisé par une diversification industrielle, étant donné que les attractions spatiales les plus importantes détectées sont entre les entreprises manufacturières qui appartiennent à des industries complètement différentes en termes de production manufacturière. En outre, comme notre base de données nous permet de distinguer divers sous-secteurs, nous analysons les configurations spatiales des sous-secteurs manufacturiers : usines domestiques, mixtes et étrangères, ainsi que les usines totalement et partiellement exportatrices. Nous montrons que le régime totalement exportateur domine la répartition spatiale industrielle en Tunisie, cette concentration géographique d'entreprises exportatrices est détectée principalement le long des gouvernorats côtiers de l'Est. En outre, nos résultats illustrent que les entreprises manufacturières étrangères et mixtes ont une forte tendance à s'agglomérer en Tunisie.

Le deuxième chapitre intitulé **“Spatial tax regime and location choice of manufacturing firms: Firm-evidence in Southern Tunisia”** examine l'effet des régimes spatiaux fiscaux sur la distribution

manufacturière dans le sud-est de la Tunisie, plus précisément dans certaines délégations de quatre gouvernorats : Sfax, Gabes, Médenine et Tataouine. Ce chapitre propose initialement une revue de littérature théorique et empirique sur la relation entre choix de localisation et politiques publiques territoriales dans différents pays développés et en développement. L'objectif de ce chapitre étant d'étudier le rôle des incitations fiscales et financières dans les choix de localisation des entreprises manufacturières, nous avons mené une enquête auprès de 179 entreprises manufacturières installées dans quatre zones spatiales de cette région, chacune caractérisée par un régime fiscal spatial différent. En fait, la Tunisie est spatialement divisée en quatre zones, chacune d'entre elles étant caractérisée par un régime fiscal spécifique. L'unité spatiale utilisée pour schématiser ces zones est la délégation. Ainsi, chaque régime spatial fiscal est présenté dans différentes délégations à travers le pays. La première zone n'offre aucun avantage fiscal ou financier, et comprend majoritairement les délégations côtières orientales appartenant aux gouvernorats les plus développés. Pour les autres zones, les avantages fiscaux et financiers sont mis en place de manière ascendante, en fonction des conditions de chaque délégation. La quatrième zone concerne les délégations les plus défavorisées et prioritaires en matière de développement régional. Nous avons choisi cette région car elle contient des délégations avec les quatre régimes fiscaux, caractérisées par des conditions régionales très similaires en termes de marché du travail local, d'infrastructures et de proximité des mêmes ressources naturelles. Cette enquête est basée sur un questionnaire qui comprend cinq sections et 26 questions principales. Nous avons conçu un questionnaire en français comportant principalement des questions fermées et quelques questions ouvertes. Le mode d'administration du questionnaire choisi est l'administration indirecte, qui consiste à laisser le questionnaire à l'usine avant de le retirer à la fin du temps convenu. Enfin, pour la période du 29 octobre 2019 au 30 novembre 2019, 179 usines ont répondu à notre questionnaire.

À l'issue de cette enquête et après la saisie des données, nous testons la cohérence interne de notre questionnaire à l'aide du coefficient de fiabilité de Cronbach (Nunnally, 1978). La valeur de ce coefficient indique une assez bonne fiabilité de nos données recueillies par cette enquête, par conséquent, ce test garantit au moins la fiabilité interne de notre enquête. Par la suite, diverses méthodes empiriques sont mobilisées pour analyser les données de notre enquête : l'analyse factorielle multiple (AFM) suivie de la Classification Ascendante Hiérarchique (CAH) et d'un modèle probit. Les résultats de l'AMF suggèrent des dimensions intéressantes, notamment la première et la deuxième dimension. La première dimension, nommée « Facteurs de localisation traditionnels » est corrélée aux facteurs traditionnels pris en compte lors du choix d'une localisation, tels que les caractéristiques de la main-d'œuvre, la disponibilité des terrains et bâtiments et la proximité géographique d'un voisinage particulier, qui peut être la proximité des fournisseurs, la proximité des clients ou la proximité du centre-ville. La deuxième dimension, nommée « Facteurs institutionnels », identifie le rôle des incitations fiscales et des subventions financières. Nous parvenons ainsi à identifier l'impact des avantages fiscaux et financiers sur la répartition spatiale industrielle dans le sud tunisien. La CAH montre également le rôle de ces avantages dans les décisions de localisation en détectant trois clusters intéressants. Le premier cluster comprend les entreprises manufacturières qui s'appuient sur des opinions

familiales pour choisir la localisation de leurs unités de production. Le deuxième cluster confirme l'impact des incitations fiscales et financières sur les choix de localisation des entreprises manufacturières en choisissant de se localiser dans les zones bénéficiant d'avantages fiscaux et financiers. Le dernier cluster englobe des entreprises manufacturières modernes qui s'appuient sur des facteurs inhabituels tels qu'une très bonne qualité de vie ainsi que des terrains ou des bâtiments prestigieux lors du choix d'une localisation. Le recours au modèle probit permet de réaliser une analyse économétrique montrant les variables susceptibles d'augmenter la probabilité de s'implanter dans les zones bénéficiant d'un régime spatial avantageux. Différents résultats intéressants sont trouvés. Plusieurs variables exhortent et encouragent les entreprises manufacturières à se localiser dans les régions caractérisant par un régime fiscal avantageux comme le régime partiellement exportateur, la taille de l'usine entre 21 et 50 emplois et le statut juridique « Affaire personnelle ». La prise en compte des incitations fiscales et des subventions financières lors du choix de localisation augmente de 15 % la probabilité de se localiser dans une zone fiscalement avantageuse.

Le dernier chapitre intitulé **“Push and pull factors in Tunisian internal migration: The role of human capital”** étudie les déterminants de la migration interne en Tunisie en se focalisant sur le rôle du capital humain. La structure régionale des qualifications et compétences ne peut être ignorée lors de l'analyse des déterminants de la migration interne en Tunisie, étant donné que les flux interrégionaux tunisiens impliquent également un grand nombre de migrants ayant une éducation secondaire et universitaire. Nous entamons ce chapitre par une revue de littérature théorique et empirique sur les déterminants de la migration interne et le rôle du capital humain dans ce mécanisme, tant dans les pays développés que dans les pays en développement.

Pour répondre à cette problématique, nous nous appuyons sur le modèle de gravité développé par Piras (2017). En effet, le modèle de gravité explique le rapport de force entre les facteurs fournis dans les régions d'origine et ceux requis dans les régions de destination et permet d'étudier les effets des variables sur les deux directions des flux migratoires. Avec ce modèle, nous sommes également en mesure de détecter si les effets des déterminants de la migration sont symétriques ou asymétriques, ce qui signifie que lorsque les coefficients estimés sont égaux dans les régions d'origine et de destination, un effet symétrique est détecté. Inversement, l'effet asymétrique suit la non-similarité de l'effet d'une variable dans les régions d'origine et de destination.

Traditionnellement, ce modèle repose sur une fonction de la distance entre les régions d'origine et de destination ainsi que sur des variables liées aux caractéristiques de ces deux régions (LeSage et Pace, 2009). Les flux migratoires sont inversement corrélés à la distance géographique et corrélés positivement à la taille de la population et aux niveaux de revenu dans les régions d'origine et de destination. La distance géographique est considérée comme la principale variable de résistance multilatérale utilisée dans la littérature sur les modèles de gravité, les variables de résistance multilatérale étant définies comme des barrières à la migration et négativement corrélées aux flux interrégionaux. Cependant, le choix d'une variable de résistance multilatérale reste un défi dans la littérature empirique (Yotov et al., 2016). Ainsi, Piras (2017)

introduit le taux de chômage comme variable de résistance au lieu de la distance géographique. Dans notre étude empirique, nous considérons toutes ces critiques. En conséquence, nous construisons trois différentes spécifications, pour chaque spécification, nous modifions la variable de résistance multilatérale. La première spécification inclut le différentiel de taux de chômage, la deuxième la distance routière. Nous optons pour une troisième spécification où les variables de résistance sont à la fois le différentiel de taux de chômage et la distance routière. L'utilisation du taux de chômage comme résistance multilatérale est particulièrement pertinente dans le contexte tunisien. En effet, la distance géographique représente une distance physique tandis que le taux de chômage décrit une distance économique.

En outre, Piras (2017) introduit dans la formulation de son modèle, une variable de capital humain avec les variables traditionnelles du modèle de gravité. Notre contribution réside dans le fait que nous désagrégeons la variable de capital humain proposée par Piras (2017) afin de distinguer le niveau de capital humain peu qualifié et le niveau de capital humain hautement qualifié. Nous considérons que chaque région contient les deux niveaux de capital humain et nous étudions comment ces deux proxys influencent les directions de migration. Nous construisons ces proxys sur la base de la classification internationale type de l'éducation élaborée par l'Organisation des Nations Unies pour l'éducation, la science et la culture afin d'obtenir finalement deux indicateurs, l'un décrivant les personnes hautement qualifiées ayant une éducation secondaire ou universitaire et l'autre concernant les personnes peu qualifiées ayant une éducation primaire ou aucune éducation. Notons que notre objectif est d'étudier l'effet des différences de capital humain des résidents, et non des migrants, dans les régions d'origine et de destination sur les flux interrégionaux.

Les données sur la migration sont issues du recensement national couvrant deux périodes : 1999-2004 et 2009-2014. Les données sur les autres variables sont collectées à partir de différentes documentations réalisées par l'Institut National de la Statistique (INS) en Tunisie pour les deux années 2004 et 2014. De ce fait, une variété de variables sont introduites dans notre modélisation : économiques, culturelles et de qualité de vie. Nous utilisons un proxy original du PIB régional : un indicateur de la lumière nocturne construit par le Earth Observation Group (EOG) du National Environmental Information Center, cette mesure est considérée comme un moyen alternatif de mesurer le niveau des activités économiques (Ghosh et al., 2010).

Dans un premier temps, nous estimons, un modèle empilé en exploitant la méthode des Moindres Carrés Ordinaires (MCO) et inférence statistique robuste. Dans un deuxième temps, nous estimons un modèle empilé dans lequel nous introduisons des interactions entre nos variables explicatives et des dummies de temps afin de distinguer l'impact des variables sur les flux interrégionaux en 2004 et en 2014. Nos résultats indiquent que les variables macroéconomiques ont un fort impact sur les flux interrégionaux, notamment la taille de la population qui agit comme un facteur favorisant la migration depuis les gouvernorats d'origine et attire également les migrants vers les gouvernorats de destination. Concernant nos variables d'intérêt « les proxys du capital humain », notre étude montre que ces deux niveaux de capital humain fournissent des résultats mitigés dans les gouvernorats d'origine, tandis que dans les gouvernorats de destination, les flux interrégionaux sont positivement liés au niveau élevé d'éducation et négativement liés au niveau faible

d'éducation. En outre, nos résultats illustrent le rôle important des variables culturelles et de qualité de vie dans la migration interne en Tunisie. En effet, les Tunisiens quittent leurs régions d'origine non seulement à la recherche d'emplois mais également à la recherche de meilleures conditions de vie dans les gouvernorats de destination.

À travers ces différentes analyses empiriques, notre thèse apporte des éléments de compréhension sur les principaux déterminants de la localisation des agents économiques et leurs conséquences sur les inégalités régionales en Tunisie. Ainsi, cette thèse examine les configurations spatiales des entreprises manufacturières ainsi que des individus afin de fournir des études empiriques et des résultats qui servent à la lutte contre les inégalités régionales en Tunisie.

1. What geographical concentration of industries in Tunisia? Empirical evidence using distance-based measures

This chapter examines the location patterns of manufacturing industries in Tunisia. We use detailed micro-geographic data and distance-based approaches developed by Duranton and Overman (2005) and Diggle and Chetwynd (1991). Based on an original sample of 5,405 plants in Tunisia in 2018, our results show that significant geographical concentrations of manufacturing firms are mainly located within a radius of less than 30 km. At the sectoral level, the textile industry shows a high degree of geographical concentration, and high-tech industries are also among the most concentrated, confirming the existence of specialized pools in high-tech activities in Tunisia. We also exploit a bi-variate function developed by Duranton and Overman (2005, 2008) to analyze industrial co-agglomeration between manufacturing sectors in Tunisia. We find that the most important spatial attractions are detected between manufacturing firms in two completely different sectors in terms of production. We further analyze the location patterns of manufacturing sub-sectors: totally and partially exporting plants and domestic, mixed and foreign plants. This analysis shows that totally exporting plants and foreign and mixed plants exhibit strong geographical concentration and dominate the manufacturing spatial distribution in Tunisia.

Note: A short version of this chapter focusing on the Sahel region has been published:

Laajimi, R., Le Gallo, J., Benammou, S., 2020, What geographical concentration of industries in Tunisian Sahel? Empirical evidence using continuous measures, *Tijdschrift voor economische en sociale geografie*, forthcoming.

It was also the subject of two presentations:

7th International PhD Meeting in Economics, Thessaloniki, Greece (2019)

10th International Conference On Economics, Budapest, Hungary (2019)

1.1. Introduction

January 14, 2011 is a crucial date in the modern history of Tunisia: it is the day of the Tunisian revolution. One of the main reasons for this revolution is the persistent strong regional structural imbalance causing continuous social tensions and an unstable social and economic situation (Karray and Driss, 2014). In fact, since independence in 1956, regional development has been a major and collective concern in Tunisia. As early as the 1960s, various policies already aimed at reducing this structural imbalance. In the mid-1990s, Tunisia engaged in a process of opening borders and global integration as a result of the accession to the World Trade Organization and the enforcement of free trade agreements with the European Union (Karray and Driss, 2006; Amara and Thabet, 2012). While this evolution has made an impressive contribution to the growth of industry concentration, it has also resulted in further unequal spatial distribution of economic activities and a strong geographical polarization in favor of the Tunisian coastal regions (Belhedi, 1992; Dlala, 1999; El Bekri, 2000; Amara, 2009; Amara et al., 2010). For instance, about 70 percent of the firms are located in the coastal regions of Tunisia (Kriaa et al., 2011).

Therefore, Tunisia is subdivided into two regions in terms of economic development: the coastal region as the most developed and the interior and southern regions as the least developed. The coastal region includes 11 governorates out of a total of 24: Tunis, Ariana, Ben Arous, Manouba, Bizerte, Zaghouan, Nabeul, Sousse, Monastir, Mahdia, and Sfax. 74.1% of firms are located in this region in 2017. This region also contains 66% of the labor force in 2014, 90% of the number of offers for executives (university graduates) in 2016 and 70% of the number of employees in all sectors in 2017. This imbalance is further characterized by the existence of modern public infrastructure, social and cultural support, high density of regional population and strong urbanization in favor of the coastal regions (Karray and Driss, 2006). This imbalance has been the subject of several research studies (for example El Bekri, 2000; Montacer et al., 2010; Kriaa et al., 2011 etc.). After the revolution, economists and policymakers have given even more attention to spatial inequalities, despite all the government's efforts to reduce these inequalities and eradicate the classic "Coastal-Interior" division. This phenomenon has shown no serious tendency to change after the revolution (Karray and Driss, 2014). A detailed analysis of the location patterns of manufacturing firms is then crucial to assess the unequal manufacturing structure in Tunisia. In this paper, we implement spatial point pattern methods to characterize the geographical concentration of these industries.

The assessment of geographical concentration of economic activities, that is, the spatial grouping of establishments in a specific area, country, region or industrial zone, has known a growing interest in recent years. In particular, Ellison and Glaeser (1997) have developed a widely applied index that has desirable properties but is insensitive to the relative location of the geographical units. As the distribution of these activities is not homogeneous (Krugman, 1991a), a large literature in economics and geography is interested in the configuration of the geographical concentration of economic activities. To the best of our knowledge,

few studies have analyzed geographical concentration in Tunisia. Two papers (Karray and Driss, 2014; Amara, 2009) aim at uncovering the geographical concentration of manufacturing industries in order to characterize the existing regional disparities in Tunisia. Karray and Driss (2014) measure the geographical concentration of manufacturing industries in all Tunisian governorates for the years 2000, 2005, 2010, 2012⁴ using a Herfindahl's measure, an Ellison and Glaeser's measure and exploratory analysis of spatial data. They find that the industrial structure suffers from an unequal distribution across the governorates of Tunisia. Amara (2009) analyzes only the distribution of manufacturing sectors in 2005 among the 45 delegations of the metropolis of Grand-Tunis, again using discrete measures (Herfindahl, Gini, and Ellison and Glaeser) as well as spatial autocorrelation statistics (Global Moran and Local Moran statistics) to take into account the effects of proximity. His work shows an inequality in the distribution of plants and jobs between the delegations of the metropolis of Grand-Tunis.

These empirical studies use administrative spatial units and, even if Amara (2009) analyzes geographical concentration at a finer discrete spatial scale than Karray and Driss (2014), these geographical divisions can hide disparities within the studied areas. Indeed, these studies suffer from the well-known modifiable areal unit problem (MAUP) that affects all empirical studies based on discrete administrative divisions: the results are highly sensitive to the spatial scale and shape at which the indices are computed. Therefore, the major contribution of our paper consists in using distance-based approaches applied on detailed micro-geographic data, which includes the exact addresses of plants to neutralize the effect of spatial aggregation as they don't necessitate pre-defined administrative units. To the best of our knowledge, while this approach has been largely applied for developed countries (e.g. Behrens and Bougna, 2015; Jacobs et al. 2013), the literature for developing countries is scarce.

Our objective is then to assess the spatial concentration of economic activities and to identify the most concentrated and dispersed manufacturing industries. We exploit the micro-geographical nature of our data to estimate various measures in continuous space: function k_d by Duranton and Overman (2005) and function D by Diggle and Chetwynd (1991). Such an analysis is important, since, as pointed out by Jacobs et al. (2013), it informs on the extent of agglomeration economies which, through their effect on firm performance and location decisions, may endogenously foster regional economic growth. Our focus on the firm level is then particularly interesting: as argued by Howard et al. (2016), it is more relevant in developing countries to consider the firm as the source of agglomeration economies.

Based on an original sample of 5,405 plants in Tunisia in 2018, our empirical results show that the majority of manufacturing industries in Tunisia are characterized by a geographical concentration at short and medium distances. Furthermore, as our dataset allows to distinguish various subsectors, we analyze the location patterns of manufacturing sub-sectors: domestic, mixed and foreign plants as well as totally and partially exporting plants. In the latter case, focusing on plants involved in international business provides relevant information from a policy perspective, as pointed by Behrens and Bougna (2015), these plants are

⁴ Karray and Driss (2014) select the year 2012 to take into account post-revolution effects in Tunisia.

perceived as fundamental in local employment growth. In addition, we exploit the bivariate function of Duranton and Overman (2005, 2008) to analyze industrial co-agglomeration in Tunisia. Indeed, industries may be similar along various dimensions but different along others (Ellison et al., 2010): some may collocate to employ similar labor while others might collocate because of input-output linkages. While our data do not allow to disentangle the strength of the three traditional Marshallian agglomeration benefits (e.g. sharing of inputs, labor and knowledge), such an analysis still provides some insights as to the mechanisms at work in location decisions.

The remainder of this chapter proceeds as follows. Section 2 briefly presents the main continuous measures we use. Section 3 provides a general overview of the history of industrial manufacturing interventions in Tunisia. Section 4 reports descriptive statistics from our database on Tunisian manufacturing characteristics. Section 5 highlights our empirical results: the geographical distribution of industries and co-agglomeration between industries. We perform in section 6 an additional analysis on the location patterns in manufacturing sub-sectors. In the last section, we conclude and discuss our results in connection with the political debate on clusters and regional development in Tunisia.

1.2. Measures of geographical concentration

Geographical concentration is defined as a spatial grouping of establishments in a specific area. Therefore, to quantify this concentration, it is necessary to define a measure that allows to analyze phenomena with a spatial dimension, such as the distribution of establishments in a territory, the comparison between sectors as well as the evolution of the location of establishments over time. For this purpose, the choice of a measure must be relevant in order to reliably show existing disparities between regions and to make robust comparisons between concentration levels.

There is a large literature dealing with the measure of geographical concentration of industries (Combes and Overman, 2004; Combes et al., 2006; Marcon and Puech, 2015). The empirical literature proposes different methodological requirements that must be met by each measure of concentration. Duranton and Overman (2005) introduce the first list of requirements. According to these authors, the measure: (i) must be comparable between all sectors, (ii) must control global agglomeration across industries, (iii) must distinguish geographical concentration from productive concentration⁵, (iv) must be unbiased with respect to the degree of spatial aggregation, and (v) allows a clear statistical significance test.

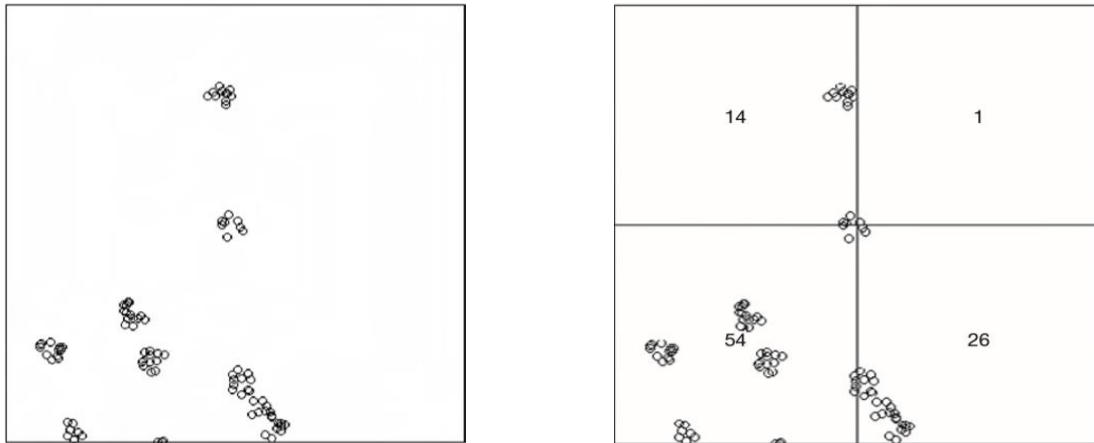
Kominers (2008) adds that a relevant measure must be computable from the data available and is virtually insignificant if not justified by an appropriate model. In other words, the measure must be derived from a theoretically justified methodology corresponding to the research question. This requirement is also

⁵ The concept of geographical concentration is often confused with the concept of productive concentration, which is also called industrial concentration. The difference between these two concepts is that productive concentration analyzes the spatial distribution of an industry without external reference, while geographical concentration analyzes the spatial distribution of an industry relative to the spatial distribution of all industries in a given territory. Productive concentration determines the distribution of jobs in a larger or smaller number of firms in a sector and can show whether the sector is dominated by few firms with large sizes.

mentioned by Combes and Overman (2004), Marcon and Puech (2015) and Thomas-Agnan and Bonneu (2015). The latter authors suggest four other requirements: (i) the measure must be associated with a well-identified theoretical characteristic, (ii) it must take into account the spatial inhomogeneity of the studied sector which corresponds to a non-constant density of entities on a territory -indeed, this requirement is important to reproduce the character of the real world where objects are distributed in an inhomogeneous way (Schilcher and al., 2017), (iii) the measure must have a known and constant benchmark in the absence of concentration, (iv) and to test the spatial concentration, a null hypothesis must be correctly specified. The ability to meet these different requirements should provide a measure that effectively characterizes the geographical concentration of economic activities. Nevertheless, until today, no measure has been able to meet all these requirements (Kominers, 2008).

Geographical concentration measures can be divided into two groups: discrete measures and continuous measures. Until the 2000s, due to data availability, studies were limited to the use of measures based on discrete data at different spatial aggregation levels, such as Herfindahl, Gini, Ellison-Glaeser and Maurel-Sédillot's indices (Combes and al., 2006; Marcon and Puech, 2015). Discrete measures suffer from several well-known limitations related to their dependence on the availability of data for administrative definitions. In particular, they depend on the zoning and the aggregation level (Thomas-Agnan and Bonneu, 2015). In fact, these measures are refined to compare the structure of industries in large geographical units such as countries, regions or industrial zones, and therefore provide aggregate results on agglomeration patterns (Koh and Riedel, 2014). Moreover, these measures are invariant to neighborhood effects, which are considered as negligible. Consequently, if areas with important activity fractions are contiguous or far away, this has no influence on the results, which is problematic. By their very nature, discrete measures are also very sensitive to the definition of geographical units, their computation depends on the type of division of the studied territory. The degree of geographical concentration may vary according to spatial scale chosen (Rosenthal and Strange, 2001), it can be high when measured at aggregated regional levels and low at disaggregated regional levels (Arbia, 2001). Moreover, spatial aggregation can erase individual regional specificities (Marcon and Puech, 2015). Consequently, results can be biased due to spatial discretisation, both in terms of spatial scale and form (Briant and al., 2010; Marcon and Puech, 2015). This limit refers to the Modifiable Areal Unit Problem (MAUP), related to the definition of the predefined geographical division (Arbia, 2001). The use of aggregated regional levels can be explained by the unavailability of data, as the precise location of economic activities is not always available or accessible to researchers and therefore data can only be provided for aggregated geographical units such as administrative areas, cities, industrial zones etc. (Thomas-Agnan et Bonneu, 2015).

To better understand the limits that refer to the problem of Modifiable Areal Unit Problem, we replicate the example provided by Marcon and Puech (2014):



Source : Marcon, E., Puech, F., 2014, Mesures de la concentration spatiale en espace continu : théorie et applications, *Economie et Statistique*, 474, 105-131.

The first graph illustrates a spatial distribution of entities without spatial division. Treating space as continuous allows us to detect clusters of entities displayed in the first graph. The second graph shows the same distribution of individual units, but this time with a spatial division of square mesh. Space is divided into four cells of the same areas and shapes. In this case, these clusters are geographically divided. For instance, the cluster in the middle of the first graph becomes divided into four parts in the second graph by obtaining a single object in the Northeast cell. This spatial division then erases individual specificities of the studied territory. As a result, abandoning the use of spatial division is the main contribution of continuous measures in spatial analysis.

To avoid the problem implied by spatial aggregation and with the advent of micro-geographic data for which the precise location of economic activities is available, continuous measures or distance-based approaches have been developed that are not affected by the problems involved in aggregation and zoning. These measures are based on distances between establishments and treat space as continuous. This helps researchers to study the distribution of establishments in an individual and disaggregated way (Marcon and Puech, 2015) and to detect precisely the distances at which the spatial concentration of economic activities is concentrated.

Continuous measures are based on the literature on spatial point patterns in spatial statistics. In economics, they are used to analyze the spatial distribution of economic entities, defined as a spatial pattern of points (Arbia and al., 2012), characterizing each point by its spatial coordinates (Thomas-Agnan and Bonneu, 2015). These measures largely depend on the work of Ripley (1976, 1977) who developed the continuous “K-function” measure. It summarizes the cumulative characteristics of a spatial distribution and is able to test the presence of spatial concentration under the assumption of spatial homogeneity (Arbia et al., 2009). More precisely, it detects whether around each reference object, there are on average more or less other objects than there would be under the null hypothesis of a completely random distribution in homogeneous space (Marcon and Puech, 2015). Following Ripley (1976, 1977)’s function, various continuous measures

have been developed and have become the preferred and recommended way to analyze the spatial concentration of economic activities (Combes et al., 2006) as establishments' locations are naturally individualized data (Marcon and Puech, 2015).

To characterize the location patterns of manufacturing industries and assess regional disparities in Tunisia, we exploit two continuous measures: Duranton and Overman (2005)'s function k_d and Diggle and Chetwynd (1991)'s function D . Our choice is based first on the fact that they meet the majority of the requirements set in the literature (Combes et al., 2006; Marcon and Puech, 2015). Second, they analyze geographical concentration in two different ways. Duranton and Overman (2005)'s measure is an absolute method as it computes the proportion of neighbors pairing in a chosen sector. In contrast, Diggle and Chetwynd (1991)'s measure belongs to the family of topographic methods that evaluate the density of a sector relative to the overall manufacturing density (Brühlhart and Traeger, 2005), it quantifies the neighbors of a sector by surface.

Duranton and Overman (2005)'s function is by far the most used measure in empirical studies to characterize the location patterns of economic activities. These authors apply it to analyze various issues related to location patterns in the United Kingdom, such as entry and exits, affiliates and non-affiliates, domestic and foreign plants. Furthermore, using this function, Klier and McMillen (2008) analyze the evolution of spatial agglomeration in automobile supplier industries in the United States and Nakajima et al. (2012) examine manufacturing location patterns in Japan. Behrens and Bougna (2015) use both weighted and unweighted versions of this function (defined below) to describe the evolution of the spatial distribution of manufacturing activities in Canada for the period 2001-2009. This approach is also used to analyze service sectors as in Barlet et al. (2013) and Koh and Riedel (2014)'s studies.

Formally, Duranton and Overman (2005)'s function is based on the distribution of pairwise distances between all objects. It is compared to a distribution obtained under the hypothesis of spatial random distribution. A smoothing density kernel is applied to correct for the lack of precision of distance measure generated by the calculation of Euclidean distances (Duranton and Overman, 2005; Barlet et al., 2013). The estimator of the distribution of distances between pairs of establishments in a sector is defined as follows, for a distance r :

$$k_d(d) = \frac{1}{n(n-1)h} \sum_{i=1}^{n-1} \sum_{j=i+1}^n f\left(\frac{d-d_{i,j}}{h}\right)$$

where n is the number of plants; $d_{i,j}$ is the distance (in kilometers) between plants i and j ; f is a Gaussian kernel function and h is the bandwidth (smoothing parameter). $k_d(d)$ is interpreted as the density of all the neighboring plants around each reference plant. Duranton and Overman (2005) also define the weighted function $k_{emp}(d)$:

$$k_{emp}(d) = \frac{1}{h \sum_{i=1}^{n-1} \sum_{j=i+1}^n w(i)w(j)} \sum_{i=1}^{n-1} \sum_{j=i+1}^n w(i)w(j) f\left(\frac{d-d_{i,j}}{h}\right)$$

where $w(i)$ and $w(j)$ are the employment levels of plants i and j ; f is a Gaussian kernel function and b is the bandwidth as for $k_d(d)$. $k_{emp}(d)$ is the kd function weighted by the number of employees, otherwise the establishments are weighted by their number of employees to obtain a function that is interpreted as the density of neighbor employees around reference employees.

Duranton and Overman (2005)'s measure does not have a reference value as it is data-dependent. Therefore, the detection of a concentration is based on a comparison of the observed values with those obtained under the hypothesis of spatial random distribution. To help interpretation and compare between geographical concentration levels of industries, Duranton and Overman (2005) define an index of localization, noted $\Gamma(d)$, and an index of dispersion, noted $\psi(d)$. These indices are computed from the difference between the observed distribution and the upper and lower bands of the confidence interval:

$$\text{Index of localisation: } \Gamma(d) = \max(kd(d) - \overline{k(d)}, 0)$$

$$\text{Index of dispersion: } \psi(d) = \begin{cases} \max(kd(d) - kd(d), 0), & \text{if } \Gamma(d) = 0 \\ 0, & \text{else} \end{cases}$$

where $k_d(d)$ is the observed value, $\overline{k(d)}$ is the upper bound value of the confidence interval and $\underline{k(d)}$ is lower bound value of the confidence interval. These indices are also interpreted as “excess likelihood” to find another plant in the same industry at a certain distance, when the reference distribution is controlled with a 5% risk level.

Diggle and Chetwynd (1991)'s function has also often been used in spatial economics. For instance, Sweeney and Feser (1998) evaluate the relationship between plant size and industrial agglomeration, using this function. Feser and Sweeney (2000) test the degree of spatial concentration of firms linked to industrial agglomerations for the year 1996 in North Carolina. Marcon and Puech (2003) simultaneously analyze spatial distribution at different geographical scales, using data from manufacturing firms in France and distance-based approaches: Diggle and Chetwynd (1991)'s function and Besag (1977)'s function.

Diggle and Chetwynd (1991) introduce the first generalization of Ripley's function in the context of heterogeneous points. This function considers the density variations to compare the distribution of a particular sector to all other sectors. The well-known topographic measures, such as Ripley (1976, 1977), Besag (1977)' and Penttinen et al. (1992, 2006)'s functions, consider space as homogeneous: the likelihood of finding a point is always the same in all the area of study. This assumption of spatial homogeneity limits the usefulness of these functions as it does not allow to take into account the existence of non-constructible areas such as mountains, lakes, or places where no building is permitted, etc. (Marcon and Puech, 2014; Schilcher et al., 2017). Previous studies rarely mention this problem of the spatial heterogeneity (Schilcher et al., 2017). Following this issue, we use Diggle and Chetwynd (1991)'s since it controls the spatial heterogeneity and takes into account the non-constant density of establishments in space. However, Diggle and Chetwynd (1991)'s function is generated by point processes, in which each establishment is represented

by a point, without weight. This function can therefore not be weighted, which is the most important limitation from an economic point of view.

Formally, this function is constructed from the difference of the two topographic Ripley (1976, 1977)'s functions, as it compares the spatial distributions of two different sectors: establishments in the chosen sector, the "cases" and establishments in the other sectors, the "controls":

$$D(d) = K_{cases}(d) - K_{controls}(d)$$

K_{cases} is Ripley (1976, 1977)'s function of cases, $K_{controls}$ is Ripley (1976, 1977)'s function of controls. These two functions are defined as follows:

$$K_{cas}(d) = \frac{A}{n_s(n_s - 1)} \sum_{i=1}^{n_s} \sum_{j=1}^{n_s} w_{ij} I_d(d_{ij})$$

and

$$K_{controtes}(d) = \frac{A}{n_{\bar{s}}(n_{\bar{s}} - 1)} \sum_{i=1}^{n_{\bar{s}}} \sum_{j=1}^{n_{\bar{s}}} w_{ij} I_d(d_{ij})$$

where A is the area of study; n_s is the number of establishments in the chosen sector; $n_{\bar{s}}$ is the number of establishments that do not belong to the chosen sector; I_r is an indicator variable, it is equal to 1 if the distance between the two spatial positions d_{ij} is less than d and 0 otherwise; w_{ij} is a correction of edge effects, introduced for the reason that the presence of spatial edge effects could potentially distort the estimates near the boundary of the area A (Arbia and al., 2009). For establishments close to the boundary of the study area, the number of neighbors is underestimated because part of the circle is outside the study area and therefore does not contain any establishment (Marcon and Puech, 2003). The reference value of the Diggle and Chetwynd (1991)'s function is zero. If the observed value is positive, this function indicates topographic concentration and negative values signal topographic dispersion.

It should be noted that continuous methods identify neighborhood relationships between the studied establishments in a spatial pattern points, based on a given distance (d). These measures generate estimates for all possible distances. However, the computation of distances differs between the two measures. Diggle and Chetwynd (1991)'s function is estimated with the computation of distances less than or equal to a chosen distance (d), while Duranton and Overman (2005)'s function is measured for each distance (d) and estimates the likelihood of finding a neighbor in a chosen sector at a distance (d) from each point in the same sector. Thus, these measures detect a geographical concentration when points in a spatial pattern attract and gather to form an aggregate. In the cases where points are repelling, a geographical dispersion is detected. The third possible location pattern is a spatial random distribution in which the location choices are independent.

With respect to inference, we use confidence intervals generated by the Monte Carlo method under the null hypothesis of the random distribution of manufacturing firms. The results are presented as a curve and compared to two bands of the confidence interval. When the curve of observed values is above the upper

band of the confidence interval, we observe a significant spatial concentration. In this case, points in spatial pattern attract and gather to form an aggregate. Conversely, if it is below the lower band of the confidence interval, a significant geographic dispersion is observed and these points are repelling. Finally, if the curve is within the confidence interval bands, then we cannot reject the null hypothesis that the observed location pattern is consistent with a spatial random distribution.

1.3. Public manufacturing intervention in Tunisia

Tunisia is an Arab-African country, located in the extreme north of Africa, bordered by the Mediterranean Sea, Algeria and Libya and separated from Europe by the Mediterranean Sea. This country represents a population of over 10 million in 2014 and covers an area of 163,610 km². The Desert occupies between 33% and 40% of the territory. The capital is the governorate of Tunis, located in the northeast of the country. Tunisia is composed of 24 governorates which are divided into 264 delegations, as shown in the map of Figure 1.1: 13 governorates bordered by the Mediterranean Sea, 7 bordered by Algeria and 2 bordered by Libya. Geographically, the largest governorate is “Tataouine” which covers 24% of the total area of Tunisia (38 889 km²), this large surface is explained by the desert area in this governorate. The smallest governorate geographically is the capital “Tunis” which represents 0.18% of the total area of Tunisia (212,63 km²), while this governorate is the most populated, accounting for nearly 10% of the total Tunisian population in 2014.

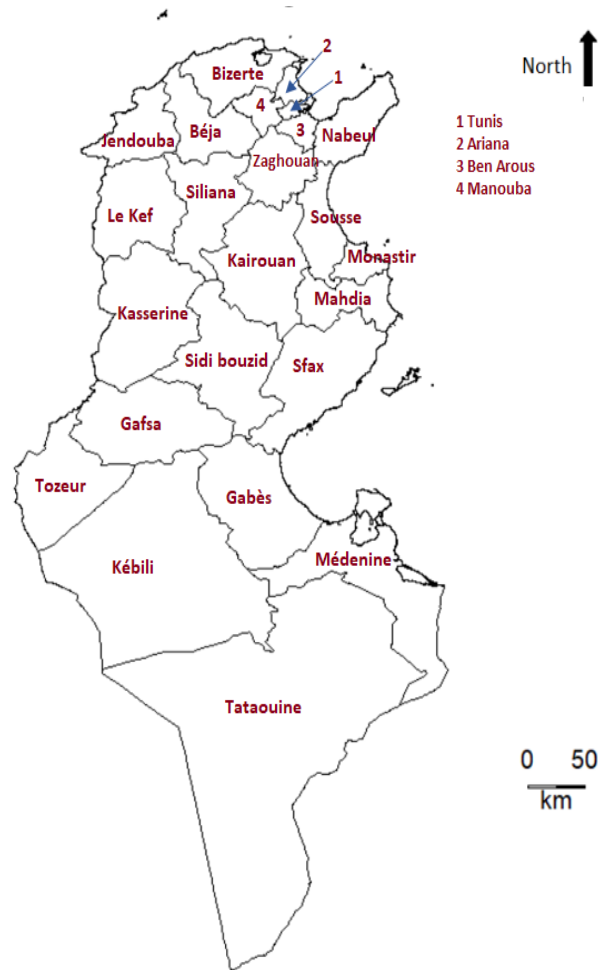


Figure 1.1: Administrative divisions of Tunisia
Source: made by the authors

We present in this section the main policies and strategies implemented in Tunisia in order to reduce these regional disparities. This section is divided into two subsections: the first highlights the different government policies and the second describes the evolution of the program and strategies of regional manufacturing development zones.

1.3.1. Public policies and regional disparities

The economic literature emphasizes the primordial role of public authorities in the location strategies of economic activities (Maurel and Sédillot, 1999). In general, the objective of public intervention is to introduce economic or regulatory instruments in order to address the country's specific issues. In a spatial context, public interventions appear mainly under the form of two policies: establishing strategies to guide location decisions and providing public goods and services and public transport. These interventions take two forms: central government interventions and regional government interventions (Mérenne-Schoumaker, 1991). From a theoretical point of view, the reason for public intervention is that the value and distribution of the wealth created are affected by the spatial organization of economic functions. This requires government interventions to ensure economic and social balance between regions.

In Tunisia, the government has established different policies and strategies in order to guide the location decision of private firms. To interpret the results obtained in this chapter, we need to understand the various industrial policies and strategies implemented over time in Tunisia as they can influence the location decisions of firms. The Tunisian economy has gone through various developments over the past decades. The most remarkable transition is that of an economy totally controlled by public policy (1962 -1971) to a liberal economy since the 1990s. The period 1962-1971 was characterized by a socialist orientation and devoted to the creation of a national industry that was conducted, controlled and largely funded by the government. Moreover, the public sector undertook the major projects and started with the implantation of these projects in the Tunisia rural interior, for example, the sugar refinery in Beja, the processing of the cellulose and *Alfa* plant⁶ in Kasserine and chemical plants in Gabes. This period has been characterized by the development of the first economic development plans in Tunisia in order to guarantee the social progress of the country and to achieve the desired economic growth.

In the following period from 1972 to 1981, Tunisia has seen its first steps towards a liberal economy by encouraging private initiative and the development of export sectors. This transition to a market economy is due to the very high rate of unemployment in Tunisia. As a result, the Tunisian government adopted an extroverted industrialization model in its industrial policy in order to improve growth rate and increase the size of the labor market. Therefore, the main objective was to import labor force that produced it (Dlala, 1999).

Laws and support programs for firms have been developed to promote exports and improve the competitiveness of firms to cope with the dynamic global environment and foreign competition. The main laws are as follows: Law 72-38 established in 1972 specified the working conditions, Law 74-74 established in 1974 dealt with the investment codes for manufacturing firms and Decree 74-793 established in 1974 mentioned the encouragement to industrial decentralization and the promotion of small and medium firms.

To ensure this new orientation, several organizations were created and placed under the supervision of the Ministry of Industry and also legal texts were promulgated during this period. The creation of the Investment Promotion Agency (API) in 1973 aimed to revitalize the manufacturing sector, improve services to foreign and domestic promoters as well as simplify administrative procedures. An export promotion center was also established to organize the relationship between Tunisian exporters and foreign customers. This center acts in the context of the national objectives of promotion of exports. The industrial land agency (AFI) was created to strengthen the industrial fabric and thus to organize the industrial planning of the territory. The main mission of the AFI is the design, development and commercialization of industrial zones throughout the country. In fact, the AFI contributes, since its creation, to the orientation of location choices of manufacturing firms, the manufacturing zones are developed in Tunisia mainly by this public body which has created various offers in the coastal delegations. These strategic decisions are taken based on the strong

⁶ The Alfa or *Stipa tenacissima* is a plant species of the northwestern Africa and the southern part of the Iberian Peninsula. It is a perennial herb that grows in arid regions and in dry conditions. This plant is in particular used in the production of high-quality printing papers.

demand for industrial land areas. The highest share of this demand (80-90%) is concentrated in the delegations of Grand-Tunis and littoral, and 10-20% in the delegations of the interior, especially the delegations located near coastal agglomerations (World Bank, 2010).

After a period of economic crisis that affected Tunisia for five years from 1982 to 1986, the main objective of public policies was to achieve economic stability and introduce measures of structural liberalization. In fact, in this period, Tunisia experienced its first year of negative growth accompanied by severe droughts in the country, a decline in oil revenues, a current account deficit, and a very high rate of external debt burdening public finances. In the period from 1987 to 1995, serious measures of structural liberalization were introduced as a result of cooperation with the International Monetary Fund and the World Bank. The industrial policies at that time focused on improving the competitiveness of products and comparative advantages ensure access to international markets and increase exports. From the year 1995, the industrial policy implemented economic reforms leading to a more inclusive process of economic openness and trade liberalization. Several important agreements have been concluded with various organizations: the accession to the World Trade Organization (WTO), the agreement with the European Union and the agreement of the Greater Arab Free Trade Area (GAFTA). Moreover, an upgrade program established (Programme de Mise à Niveau, PMN) after this date aimed at implementing part of the agreement with the European Union in order to gradually dismantle customs barriers and restructure 4,000 private companies to make them more competitive at the international level.

In the recent period, the Tunisian government has established a new industrial strategy prepared by the Ministry of Industry, introducing the industrial cluster strategy to ensure innovation and added value. As a result, the competitiveness poles program was inserted, which officially started in 2006. Four competitiveness poles have been designated in Tunisia as the main focus of the industrial strategy: the competitiveness pole of the textile and clothing sector in the governorates of Monastir and Manouba, the competitiveness pole of the agro-sector in the governorate of Bizerte, the competitiveness pole of the mechanical and electronic sector in the governorate of Sousse and the competitiveness pole with a multisector nature in the governorate of Gafsa. Three of these poles are located in coastal governorates while only one pole is located in an interior governorate. In fact, the aim of these poles is not to promote the regional development program or to reduce regional disparities, but to focus on economic growth by improving the competitiveness of manufacturing firms and services and by supporting innovation projects. Therefore, the location policy of these poles were based on the concentration and proximity of resources (firms specialized in these fields, laboratories, universities, training centers) and the existing labor pool in these regions. In fact, given the high number of textile firms as well as high-tech firms in the coastal neighboring governorates of Monastir and Sousse respectively, two competitiveness poles have been established in this region. The choice of the agro-food sector in the governorate of Bizerte is based on the fact that this governorate benefits from the environment of an important agricultural and fishing production and the proximity of the capital "Tunis" where the training and research establishments in the agro-food

industry and support institutions are also located in the immediate or nearby region. Only the pole in the governorate of Gafsa is an exception, it is part of the development program of the interior regions.

All these agreements and new strategies further strengthened the coastalisation of the Tunisian territory and the unequal distribution of economic activities between the coastline and the interior-south (Belhedi, 1992). In the next section, we discuss the role of investment incentive zone policies over time in reducing the manufacturing imbalance between these two regions.

1.3.2. Evolution of investment incentive zone programs

Several important developments also affected the evolution of manufacturing policies in Tunisia. The government established various policies of positive discrimination in order to encourage investment on the basis of on a delimitation of territorial zones and to provide advantages to eligible spatial zones through the Investment Incentives Code, which classifies less developed areas as regional and priority development zones. This program is granted to manufacturing, craft and certain service activities that decide to locate in interior areas and includes additional fiscal and financial benefits such as the exemption of certain taxes, investment premium in order to attract local and foreign investors.

These positive discriminations are realized in the context of two different policies. The first is the manufacturing decentralization established from 1968 to 1993, moving to a second policy since 1994: the promotion of regional development. The delimitation of investment incentive zones is based on a spatial administrative division; each new modification registered in the territorial administrative division, i.e. the planning of a new governorate or a new delegation, leads each time to create a new delimitation of the benefit zones. The regional development zones policy was introduced in 1994 following the promulgation of the new Investment Incentives Code in 1993. Before this date, the delimitation of the advantages zones occurred in the context of the policy industrial decentralization (1968-1994).

The delimitation of areas as part of a positive discrimination encountered several changes. The first delimitation of financial and fiscal advantages granted to investments established in 1977 and modified in 1979. This delimitation was based on the governorate as the spatial scale and then divided the governorates into three zones of advantages and one zone without advantages (The capital « Tunis » and some coastal delegations). The governorates of the interior and south belong to zones which benefit from various special fiscal and financial advantages, public spending on infrastructure as well as investment subsidies. However, the majority of the eastern coastal governorates benefit from national common advantages as all the governorates of Tunisia.

The second delimitation was implemented in 1981 and modified in 1986. This delimitation was based on delegation as a unit of division and organized the delegations into five zones of advantages. The third delimitation established in 1987, is completely different from the two previous ones since it is based on the implantation centers corresponding to the chief-governorates and chief-delegations. Indeed, the advantages

are divided into two categories: the first is related to the chief-governorates which are the governorates of the south and interior⁷ and the second is related to the chief-delegations for the rest of the country.

Since 1994, Tunisia has integrated a new policy of regional development incentive zones. Indeed, a new delimitation of advantages zones has been released and included the delegations of the governorates of the North-West (Beja, Jendouba, Siliana and Kef), the West-Central (Kairouan, Kasserine and Sidi Bouzid), the South-West (Tataouine, Gafsa, Kébili and Tozeur) and the North (Zaghouan). In 1999, this delimitation has been modified by creating two divisions concerning the regional development of manufacturing industries:

- The regional development incentive zones include one or two delegations of the governorates of Beja, Zaghouan, Sousse, Sfax and Gabes.
- The priority regional development incentive zones include all the delegations of the governorates of Jendouba, Siliana, Mahdia, Kef, Kairouan, Kasserine, Sidi Bouzid, Tataouine, Gafsa, Kebili and Tozeur and some delegations of the governorates of Kairouan, Beja, Zaghouan, Sousse, Gabes, Sfax, Mahdia, Bizerte and Medenine.

This delimitation was also modified in 2008 by the adoption of a new classification of regional development zones. Three regional development zones are as follows:

- Zone 1 consists of delegations of the governorates of Zaghouan, Beja, Sousse and Sfax.
- Zone 2 consists of delegations of the governorates of Zaghouan, Bizerte, Beja, Siliana, Mahdia, Sfax, Kairouan, Sidi Bouzid, Gabes and Medenine.
- Zone 3 is devoted to priority regional development zones and consists of delegations of the governorates of Beja, Siliana, Jendouba, Kef, Sfax, Kairouan, Sidi Bouzid, Gabes, Medenine, Tataouine, Gafsa, Tozeur and Kebili.

The last modification⁸ of this delimitation of financial and tax advantages zones was realized in 2011 after the revolution. This delimitation maintained the same division of the previous delimitation (2008) with the improvement of fiscal and financial advantages and the addition of a delegation of the governorate of Zaghouan and that of the governorate of Bizerte in zone 3. The map in Figure 1.2 shows the delimitation of financial and tax advantages zones established in 2011, which still prevails until today.

⁷ The governorates are Beja, Jendouba, Kef, Siliana, Kairouan, Kasserine, Sidi Bouzid, Gafsa, Tozeur, Kébili, Gabes, Medenine and Tataouine.

⁸ The last modification was recorded on the Website of the Agency for the Promotion of Industry and Innovation in February, 2019.

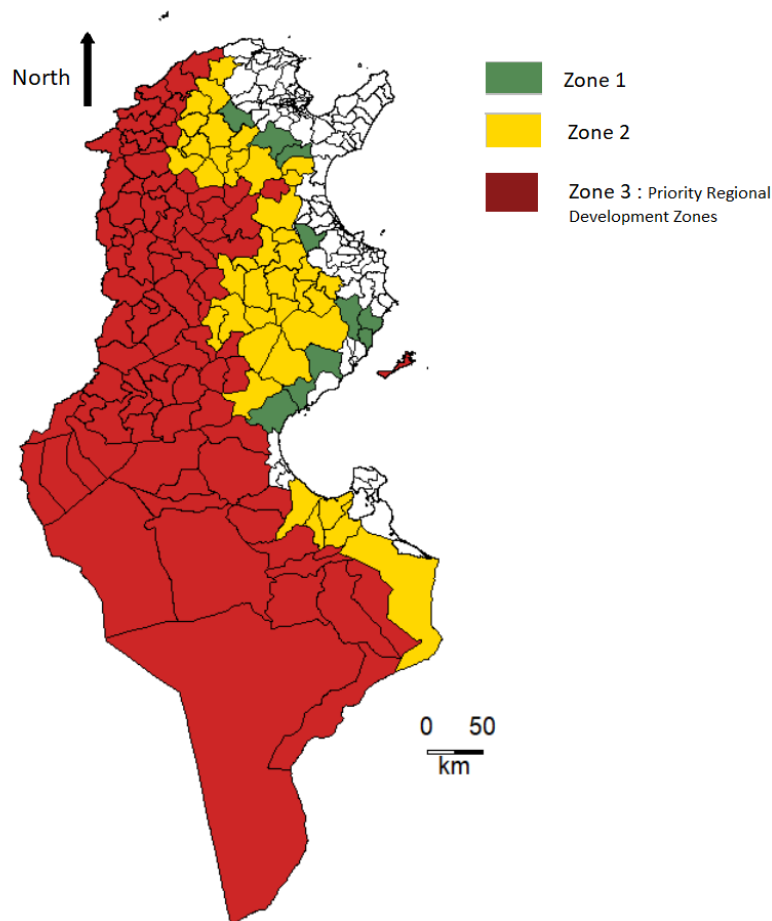


Figure 1.2: Delimitation of investment incentive zones (2011)
 Source: made by the authors

The investments projects implemented in the three regional development incentive zones benefit since 2011 from various advantages as follows:

- Fiscal advantages:
 - Exemption from corporation tax and personal income tax for the first 10 years and reduction (50%) of such income or profits for the next 10 years.
 - Total deduction of income or profits reinvested in the subscription of the initial capital or an increase, including reinvested profits within the company itself.
 - Exemption from contribution to the Housing Promotion Fund for Employees (FOPROLOS) during the first 5 years.
- Financial advantages:
 - Zone 1: an investment premium 8 % of the investment amount, including working capital with a ceiling of 500,000 Tunisian dinars.
 - Zone 2: an investment premium 15 % of the investment amount, including working capital with a ceiling of 1,000,000 Tunisian dinars.
 - Zone 3 (Priority regional development zone): (i) an investment premium 25% of the investment amount included with a ceiling of 1,500,000 Tunisian dinars. For new promoters, this premium is 30% with a

ceiling of 2,000,000 Tunisian dinars. (ii) Premium for government participation in the infrastructure costs necessary for the execution of the project. (iii) Coverage by the government of the patronal contribution to the legal social security system (CNSS) for the first 05 years of positive activity.

All these different delimitations of advantageous zones show that the government treats the interior and south of the country as an obligatory priority for regional development. In contrast, the majority of the coastal zone delegations are excluded from this tax and financial advantages policy.

After this presentation of the evolution of industrial policies over time, we describe our collected data and the spatial distribution of the different manufacturing sectors in the Tunisian territory.

1.4. Descriptive statistics

Our analysis relies on a micro-geographic dataset of industries collected from the website of the Agency for the Promotion of Industry and Innovation (APII). This website provides various information on employment, capital, sector of activity, type of production, date of entry into production, regime, nationality of firms and address of each firm. This information is limited to firms with 10 or more employees. We manually collected our data for the entire period of September, 2018. The website is updated every month, consequently, we automatically lose all data for previous months. Thus, in our case, it is not possible to undertake an analysis including a temporal dimension. Our dataset includes the sector of activity, the exact location address, the regime, the nationality and the number of jobs for each plant in Tunisia. Our database allows us to provide an overview of the situation of manufacturing private firms in Tunisia.

Based on this dataset, we present some descriptive statistics on the Tunisian manufacturing fabric, which contains 5,405 plants with 509,741 jobs and divided into nine sectors of activity. Tables 1.1 and 1.2 indicate industry-level details of our data.

Table 1.1: Summary statistics for plants in Tunisia

Industries	Number of plants	%
Agro-food industry	1102	20.39%
Building materials, ceramics and glass industry	418	7.73%
Mechanical and metallurgical industry	646	11.95%
Electrical, electronics and appliance industry	346	6.4%
Chemical industry	573	10.6%
Textile and clothing industry	1592	29.45%
Wood, cork and furniture industry	195	3.61%
Leather and footwear industry	242	4.48%
Diverse industry ⁹	291	5.38%
Total	5405	100

⁹ The composition of the “diverse industry” category is listed in Table 1.19 the appendix 1.

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

Table 1.2: Summary statistics for jobs in Tunisia

Industries	Number	%	Min	Median	Mean	Max
Agro-food industry	74743	14.66%	10	20	68	1975
Building materials, ceramics and glass industry	28410	5.57%	10	27	68	893
Mechanical and metallurgical industry	45043	8.84%	10	26	69	1410
Electrical, electronics and appliance industry	93612	18.36%	10	66	271	8476
Chemical industry	53612	10.52%	10	32	94	6225
Textile and clothing industry	159312	31.25%	10	60	100	5000
Wood, cork and furniture industry	9506	1.86%	10	24	49	881
Leather and footwear industry	24826	4.87%	10	45	103	1147
Diverse industry	20677	4.06%	10	28	71	1980
Total	509741	100				

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

The textile industry represents the largest fraction in Tunisia for the number of plants (29.45%) and jobs (31.25%), while the wood, cork and furniture industry represents a small fraction for the number of plants (3.61%) and jobs (1.86%). The number of plants in an industry is not necessarily correlated with the number of jobs in the same industry. For instance, the electrical, electronics and appliance industry creates a high number of jobs (18.36%), the second after the textile and clothing sector, nevertheless, it comprises a small number of plants (6.4%) since it is composed of firms with large sizes. Table 3 shows the size distribution of plants in our data. The manufacturing fabric in Tunisia tends towards a strong implantation of small and medium sized plants (Table 3): more than 61% comprise between 10 and 50 jobs and 30% between 51 and 200 jobs. About 2.5% of plants are characterized by a large size between 501 and 5000 jobs and only two plants include more than 5,000 jobs throughout Tunisia in 2018. In addition, the median of jobs for each sector confirms this trend (Table 2), it is between 20 and 66 plants for all industries. At the sectoral level, small firms also dominate the structure of each manufacturing sector as illustrated in Tables 1.20 and 1.21 in the appendix 1.

Table 1.3: Industry size distributions

Size of plants	Number of Plants	%
[10-20]	1752	32.41%
[21-50]	1541	28.51%
[51-100]	988	18.28%
[101-200]	616	11.4%
[201-500]	374	6.92%
[501-1000]	90	1.67%
[1001-5000]	42	0.78%
> 5000	2	0.04%
Total	5405	100

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

The maps in Figures 1.3 and 1.4 show the spatial distribution of plants and jobs by governorate. Plants and jobs almost display the same spatial distribution which is unequally distributed among governorates. The most important fraction of plants and jobs are located in the eastern coastal areas, mainly in 11 coastal governorates: Tunis, Ariana, Ben Arous, Manouba, Bizerte, Zaghouan, Nabeul, Sousse, Monastir, Mahdia, and Sfax. These maps clearly display the spatial disparities between the littoral region and the interior and southern region.

Table 4 displays the governorate shares in terms of plants and jobs. The share of these entities in the coastal region is extremely important, covering 82% of all plants and 86% of all jobs over-all Tunisia in 2018. While the governorate of Mahdia is a coastal governorate, it includes a very small number of plants and jobs compared to other coastal governorates and even lower compared to some interior and southern governorates (governorates of Beja and Kairouan).

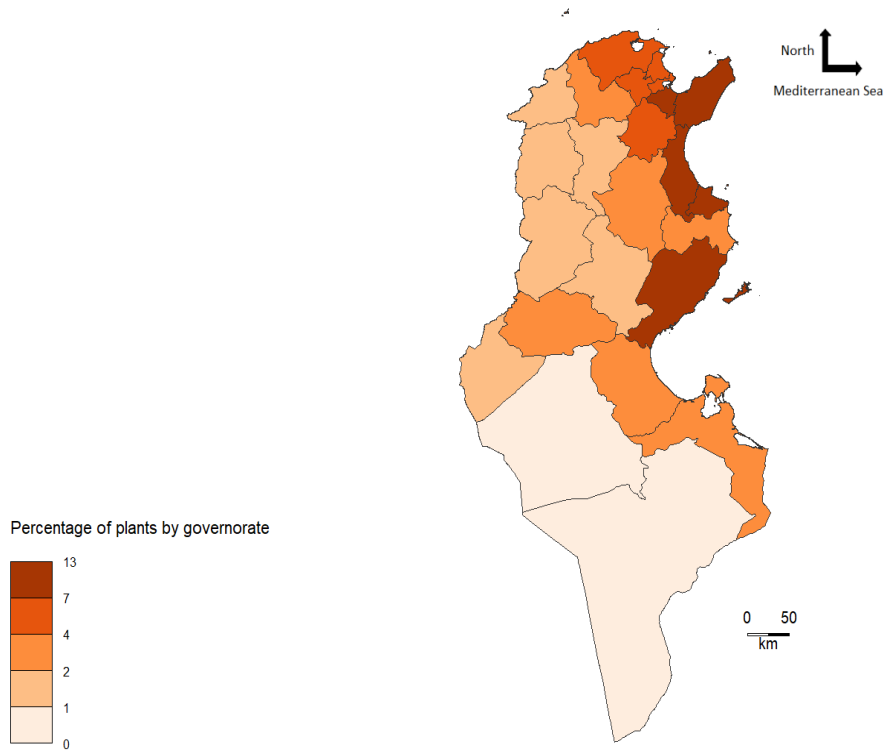


Figure 1.3: Spatial distribution of plants by governorate
 Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

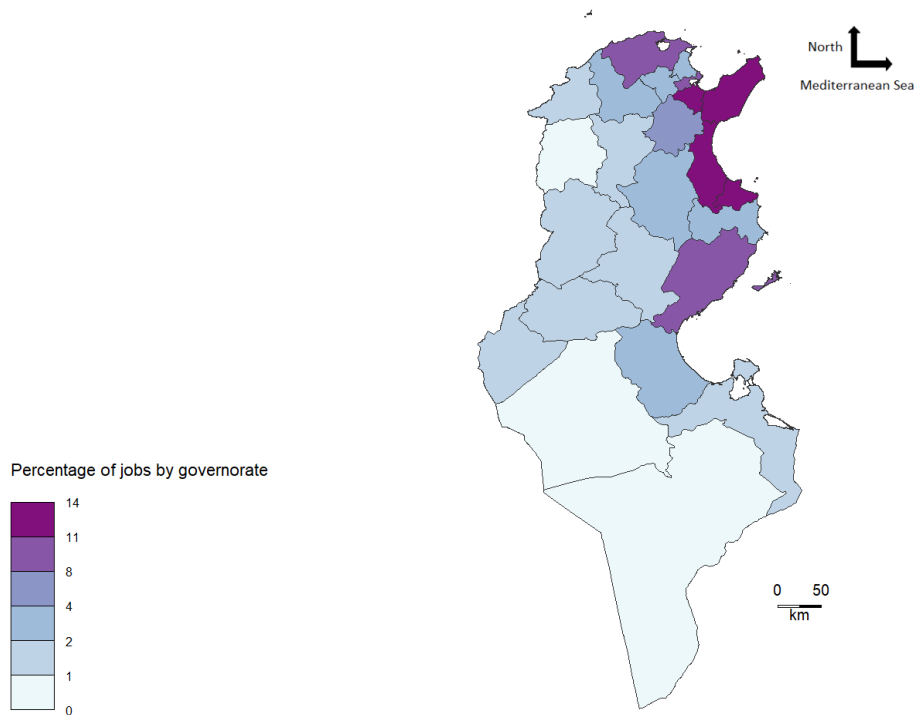


Figure 1.4: Spatial distribution of jobs by governorate
 Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

Table 1.4: Plants and jobs per governorate

Governorates	Number of plants	Percentage	Number of jobs	Percentage
Tunis	340	6.3%	38612	7.6%
Ariana	277	5.1%	15995	3.1%
Ben Arous	510	9.4%	55072	10.8%
Manouba	195	3.6%	17736	3.5%
Nabeul	596	11%	69996	13.7%
Bizerte	250	4.6%	47422	9.3%
Zaghouan	261	4.8%	23619	4.6%
Béja	145	2.7%	14432	2.8%
Jendouba	72	1.3%	6648	1.3%
Le Kef	46	0.9%	2241	0.4%
Siliana	61	1.1%	5979	1.2%
Sousse	509	9.4%	54042	10.6%
Monastir	608	11.2%	58633	11.5%
Mahdia	137	2.5%	13096	2.6%
Sfax	724	13.4%	43029	8.4%
Kairouan	162	3%	8336	1.6%
Sidi Bouzid	41	0.8%	3185	0.6%
Gabes	115	2.1%	8756	1.7%
Médenine	85	1.6%	3451	0.7%
Tataouine	15	0.3%	2073	0.4%
Gafsa	103	1.9%	6250	1.2%
Kasserine	74	1.4%	4663	0.9%
Tozeur	54	1%	4875	1%
Kébli	25	0.5%	1600	0.3%

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

Figure 1.5 shows the spatial distribution of the 5,405 manufacturing firms in Tunisia. Plants remarkably tend to cluster in specific areas, notably in the eastern littoral governorates. This map also shows that there does not seem to be any important manufacturing cluster in the rest of the Tunisian territory, plants seem dispersed in the interior and southern regions. The manufacturing sectors also display almost similar location patterns (Figure 1.6). Their plants seem dispersed in the interior and south of the country and clustered in the eastern coastal regions. Moreover, the distribution of population shows the same spatial configuration;

the littoral regions is characterized by the high density of population (Figure 1.7). However, the spatial distribution of airports and ports in Tunisia is almost equitable between regions as shown in Figure 1.8.

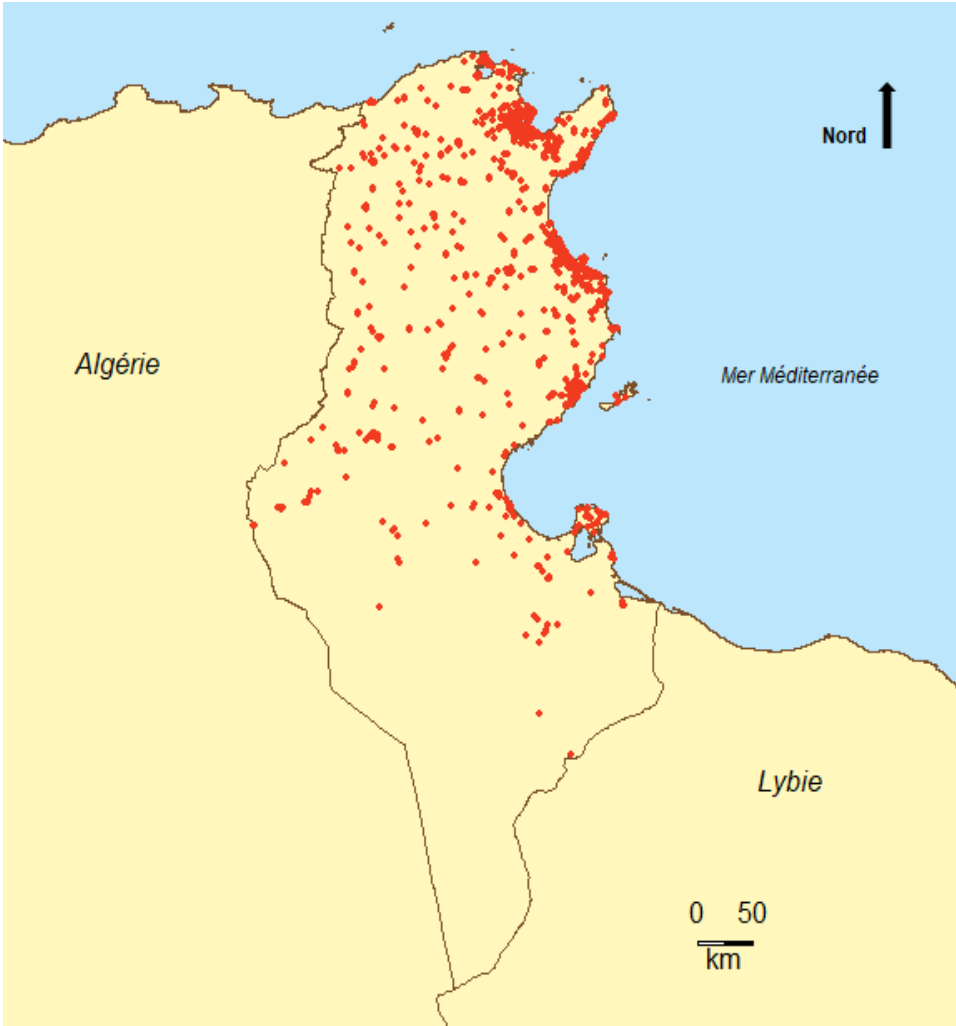
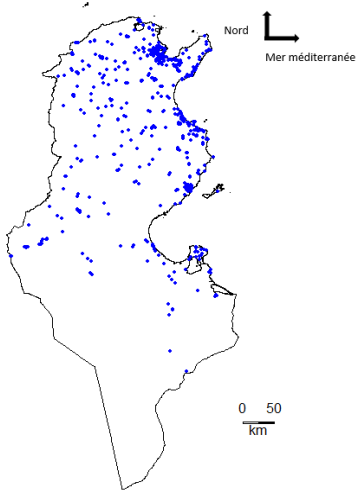
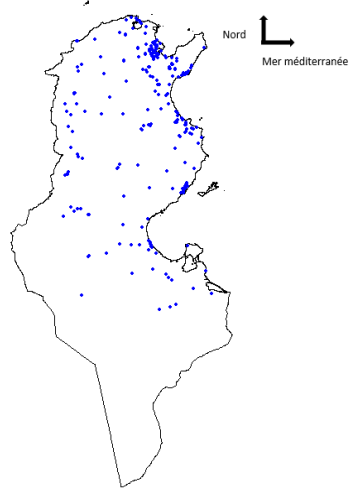


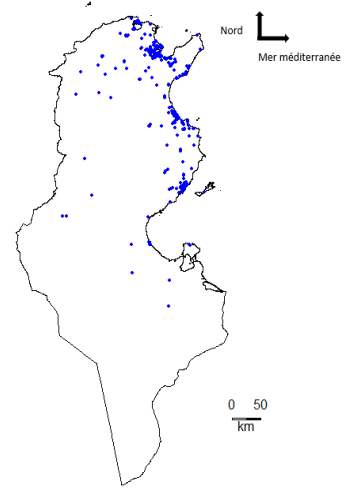
Figure 1.5: Location of the 5,405 manufacturing firms in Tunisia
Source: made by the authors



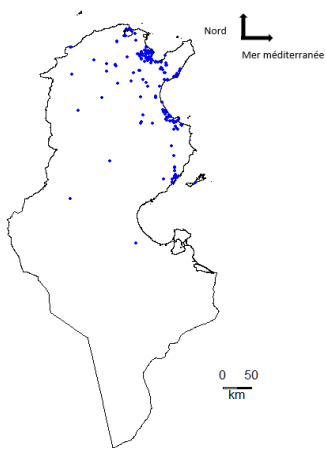
Agro-food industry



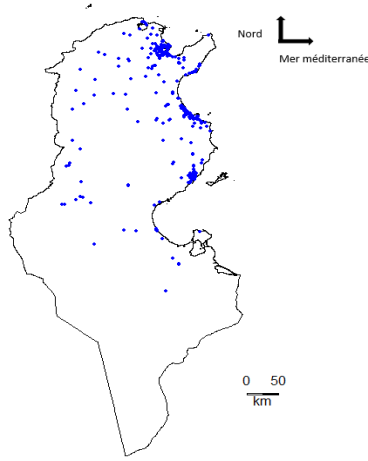
Building materials, ceramics and glass industry



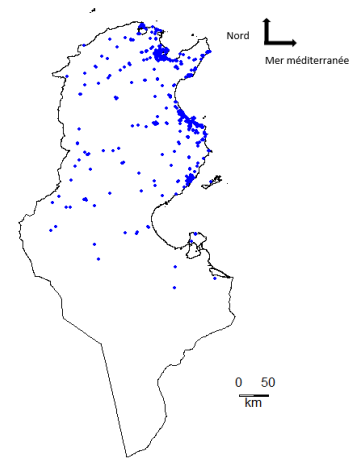
Mechanical and metallurgical industry



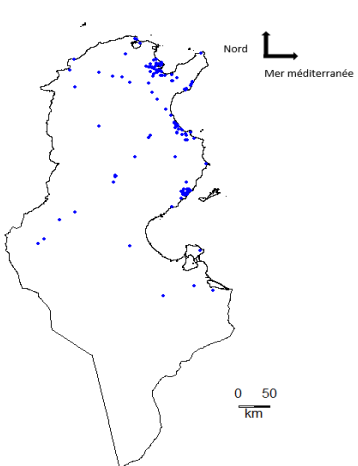
Electrical, electronics and appliance industry



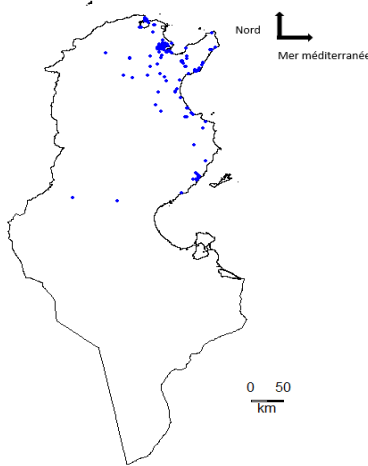
Chemical industry



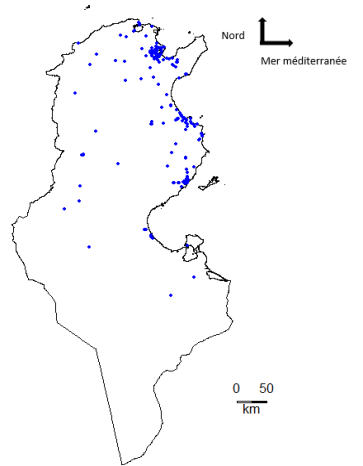
Textile and clothing industry



Wood, cork and furniture industry



Leather and footwear industry



Diverse industry

Figure 1.6: Distribution of each manufacturing industry in Tunisia
 Source: made by the authors

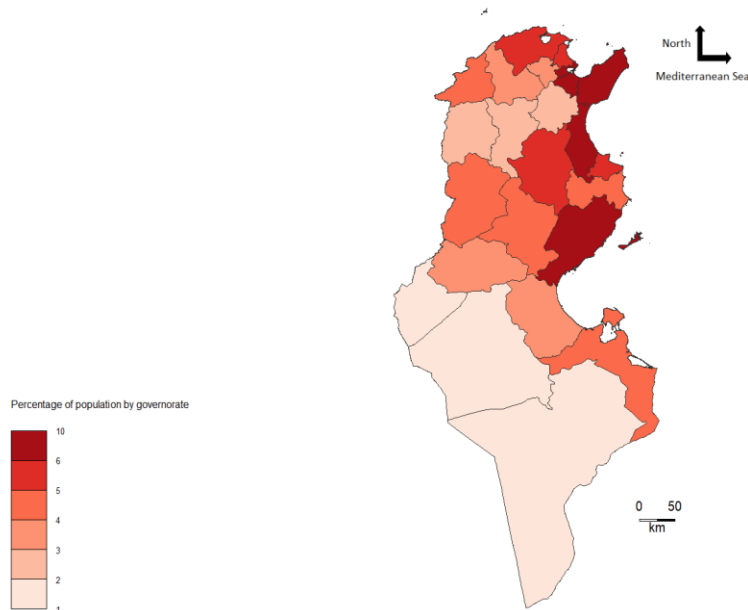


Figure 1.7: Spatial distribution of population in Tunisia (2014)
Source: authors based on data provided by the censuses of Tunisian National Institute of Statistics (2014)

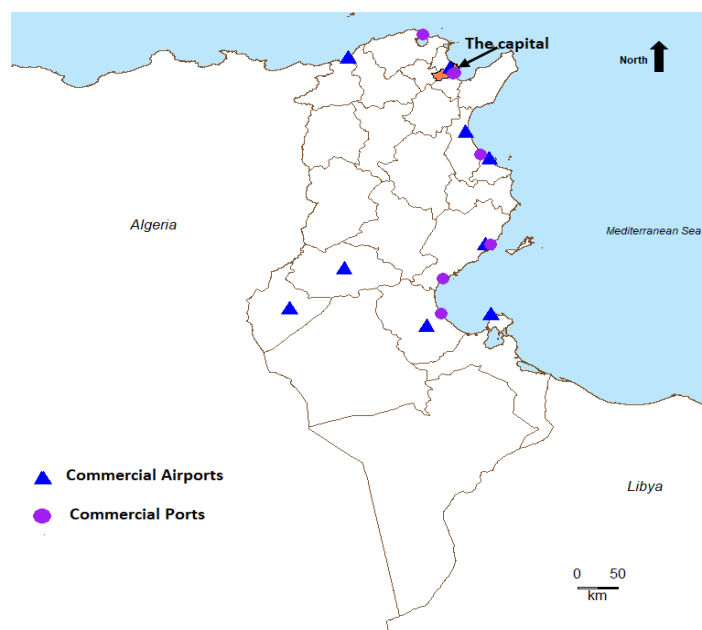


Figure 1.8: Airports and Ports in Tunisia
Source: made by the authors

Our data cover 2,356 exporting manufacturing firms (44%) with 63% of total jobs in Tunisia. Firms integrated in international trade seem to be unevenly distributed among governorates as can be seen in Figures 1.22, 1.23, 1.24 and 1.25 in the appendix 1. The two governorates of Monastir and Nabeul alone account for 34% of total exporting firms and 30% of all jobs created by the manufacturing export sector. The 13

governorates of the interior and south contain only 11% of all exporting firms and 13% of jobs created by this sector. Note that the governorate of Tataouine does not include any exporting manufacturing firm.

Table 1.5: Number of plants and jobs per governorate according to the export regime

Governorates	Number of totally exporting plants	Jobs created by totally exporting plants	Number of partially exporting plants	Jobs created by partially exporting plants
Tunis	123 (5.2%)	22413 (6.9%)	217 (7.1%)	17725 (9.5%)
Ariana	117 (5%)	9842 (3%)	160 (5.2%)	6153 (3.3%)
Ben Arous	172 (7.3%)	25820 (8%)	338 (11.1%)	29252 (15.7%)
Manouba	112 (4.8%)	10052 (3.1%)	83 (2.7%)	7684 (4.1%)
Nabeul	366 (15.5%)	50493 (15.6%)	230 (7.5%)	19503 (10.5%)
Zaghouan	88 (3.7%)	14961 (4.6%)	173 (5.7%)	8658 (4.6%)
Bizerte	161 (6.8%)	39382 (12.2%)	89 (2.9%)	8040 (4.3%)
Beja	42 (1.8%)	8514 (2.6%)	103 (3.4%)	5918 (3.2%)
Jendouba	17 (0.7%)	4809 (1.5%)	55 (1.8%)	1839 (1%)
Le Kef	3 (0.1%)	244 (0.1%)	43 (1.4%)	1997 (1.1%)
Siliana	16 (0.7%)	4928 (1.5%)	45 (1.5%)	1051 (0.6%)
Sousse	309 (13.1%)	39373 (12.2%)	200 (6.6%)	14669 (7.9%)
Monastir	428 (18.2%)	45517 (14.1%)	180 (5.9%)	13116 (7%)
Mahdia	91 (3.9%)	9805 (3%)	46 (1.5%)	3291 (1.8%)
Sfax	138 (5.9%)	14473 (4.5%)	586 (19.2%)	28556 (15.3%)
Kairouan	29 (1.2%)	3601 (1.1%)	133 (4.4%)	4735 (2.5%)
Kasserine	25 (1.1%)	1661 (0.5%)	49 (1.6%)	3002 (1.6%)
Sidi Bouzid	13 (0.6%)	1667 (0.5%)	28 (0.9%)	1518 (0.8%)
Gabes	21 (0.9%)	5448 (1.7%)	94 (3.1%)	3308 (1.8%)
Medenine	5 (0.2%)	182 (0.1%)	80 (2.6%)	3269 (1.8%)
Tataouine	0 (0%)	0 (0%)	15 (0.5%)	547 (0.3%)
Gafsa	31 (1.3%)	4593 (1.4%)	72 (2.4%)	1657 (0.9%)
Tozeur	35 (1.5%)	4234 (1.3%)	19 (0.6%)	641 (0.3%)
Kebli	14 (0.6%)	1344 (0.4%)	11 (0.4%)	256 (0.1%)

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

The export regime dominates the structure of the textile and clothing sector with the highest share of plants (56%) and jobs (45%) (Table 6). As a result, this sector is characterized by strong integration into the international trading system and penetration of foreign markets.

Table 1.6: Summary statistics for sectors according to the export regime

Industries	Totally exporting		Partially exporting	
	Number of plants	Number of jobs	Number of plants	Number of jobs
Agro-food industry	211 (9%)	17338 (5.4%)	891 (29%)	57405 (31%)
Building materials, ceramics and glass industry	17 (1%)	707 (0.2%)	401 (13%)	27703 (15%)
Mechanical and metallurgical industry	178 (7%)	18276 (5.7%)	468 (15%)	26767 (14%)
Electrical, electronics and appliance industry	229 (10%)	84829 (26.3%)	117 (4%)	8783 (5%)
Chemical industry	135 (6%)	27282 (8.4%)	438 (15%)	26330 (14%)
Textile and clothing industry	1314 (56%)	144304 (44.6%)	278 (9%)	15008 (8%)
Wood, cork and furniture industry	22 (1%)	1651 (0.5%)	173 (6%)	7855 (4%)
Leather and footwear industry	174 (7%)	22042 (6.8%)	68 (2%)	2784 (2%)
Diverse industry	76 (3%)	6927 (2.1%)	215 (7%)	13750 (7%)
Total	2356	323356	3049	186385

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

The Tunisian manufacturing structure presents a higher number of domestic manufacturing firms (70%) than mixed and foreign ones (30%). In contrast, the mixed and foreign sector, with the small number of firms, creates an almost fair pool of jobs (49%) with domestic firms (51%). Indeed, the distributions of domestic firms and foreign and mixed firms are characterized by the same location pattern (Table 1.7), the majority of their plants are installed in the 11 littoral governorates of Tunisia (Figures 1.26, 1.27, 1.28 and 1.29 in the appendix 1). The governorate of Sfax has the highest number of domestic firms and jobs created by this sector compared to all governorates and it is characterized by a small number of mixed and foreign firms.

The textile and clothing sector also provides the largest share of mixed and foreign plants (41%) (Table 1.8). Even the electrical, electronics and appliance industry represents a small number of mixed and foreign plants, it creates an important number of jobs (30%).

Table 1.7: Number of plants and jobs per governorate according to the nationality of firms

Governorates	Number of domestic plants	Jobs created by domestic plants	Number of foreign and mixed plants	Jobs created by foreign and mixed plants
Tunis	235 (6.2%)	28121 (11.2%)	105 (6.6%)	12017 (4.64%)
Ariana	195 (5.1%)	8094 (3.2%)	82 (5.1%)	7901 (3.05%)
Ben Arous	315 (8.3%)	22617 (9%)	195 (12.2%)	32455 (12.53%)
Manouba	126 (3.3%)	11115 (4.4%)	69 (4.3%)	6621 (2.56%)
Nabeul	334 (8.8%)	26126 (10.4%)	262 (16.4%)	43870 (16.94%)
Zaghouan	162 (4.3%)	7539 (3%)	99 (6.2%)	16080 (6.21%)
Bizerte	135 (3.5%)	14758 (5.9%)	115 (7.2%)	32664 (12.62%)
Beja	115 (3%)	6499 (2.6%)	30 (1.9%)	7933 (3.06%)
Jendouba	53 (1.4%)	1623 (0.6%)	19 (1.2%)	5025 (1.94%)
Le Kef	39 (1%)	1929 (0.8%)	7 (0.4%)	312 (0.12%)
Siliana	53 (1.4%)	2320 (0.9%)	8 (0.5%)	3659 (1.41%)
Sousse	286 (7.5%)	17418 (6.9%)	223 (13.9%)	36624 (14.14%)
Monastir	378 (9.9%)	28145 (11.2%)	230 (14.4%)	30488 (11.77%)
Mahdia	107 (2.8%)	7521 (3%)	30 (1.9%)	5575 (2.15%)
Sfax	671 (17.6%)	36175 (14.4%)	53 (3.3%)	6854 (2.65%)
Kairouan	133 (3.5%)	4325 (1.7%)	29 (1.8%)	4011 (1.55%)
Kasserine	68 (1.8%)	4009 (1.6%)	6 (0.4%)	654 (0.25%)
Sidi Bouzid	37 (1%)	2180 (0.9%)	4 (0.2%)	1005 (0.39%)
Gabes	104 (2.7%)	7328 (2.9%)	11 (0.7%)	1428 (0.55%)
Medenine	78 (2.1%)	2709 (1.1%)	7 (0.4%)	742 (0.29%)
Tataouine	14 (0.4%)	532 (0.2%)	1 (0.1%)	15 (0.01%)
Gafsa	94 (2.5%)	4130 (1.6%)	9 (0.6%)	2120 (0.82%)
Tozeur	49 (1.3%)	4076 (1.6%)	5 (0.3%)	799 (0.31%)
Kebli	23 (0.6%)	1525 (0.6%)	2 (0.1%)	75 (0.03%)

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

Table 1.8: Summary statistics for sectors according to the nationality of firms

Industries	Domestic		Mixed and Foreign	
	Number of plants	Number of jobs	Number of plants	Number of jobs
Agro-food industry	992 (25.6%)	61162 (24%)	110 (7%)	13581 (5%)
Building materials, ceramics and glass industry	368 (9.7%)	22549 (9%)	50 (3%)	5861 (2%)
Mechanical and metallurgical industry	458 (12%)	24222 (10%)	188 (12%)	20821 (8%)
Electrical, electronics and appliance industry	128 (3.4%)	15689 (6%)	218 (14%)	77923 (30%)
Chemical industry	408 (10.7%)	33990 (14%)	165 (10%)	19622 (8%)
Textile and clothing industry	931 (24.5%)	65787 (26%)	661 (41%)	93525 (36%)
Wood, cork and furniture industry	164 (4.3%)	7188 (3%)	31 (2%)	2318 (1%)
Leather and footwear industry	134 (3.5%)	6940 (3%)	108 (7%)	17886 (7%)
Diverse industry	221 (5.8%)	13287 (5%)	70 (4%)	7390 (3%)
Total	3804	250814	1601	258927

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

We now focus on the location of manufacturing firms created after the revolution in order to display their spatial distribution, especially given all the efforts of the government to encourage investment in the interior and south of the country. The database records 1,563 manufacturing firms which are installed after the revolution and represent 11,3278 jobs over all Tunisia. Figure 1.9 shows the locations of these firms. Interestingly, they also tend to locate in the eastern coastal governorates. These governorates contain 77% of all firms created after the revolution in Tunisia and then have the highest number of firms (Figure 1.10) and jobs (Figure 1.11). Based on these descriptive statistics, the eastern coastal regions seem remain the most attractive after the revolution.

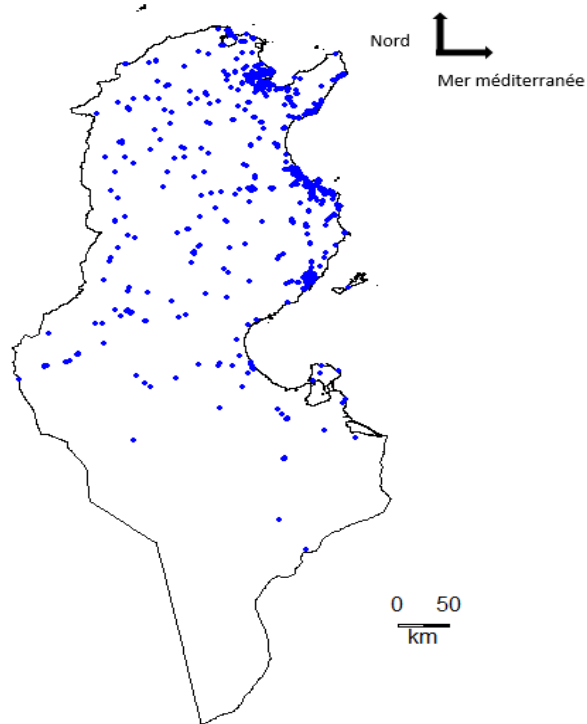


Figure 1.9: Locations of manufacturing firms created after the revolution

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

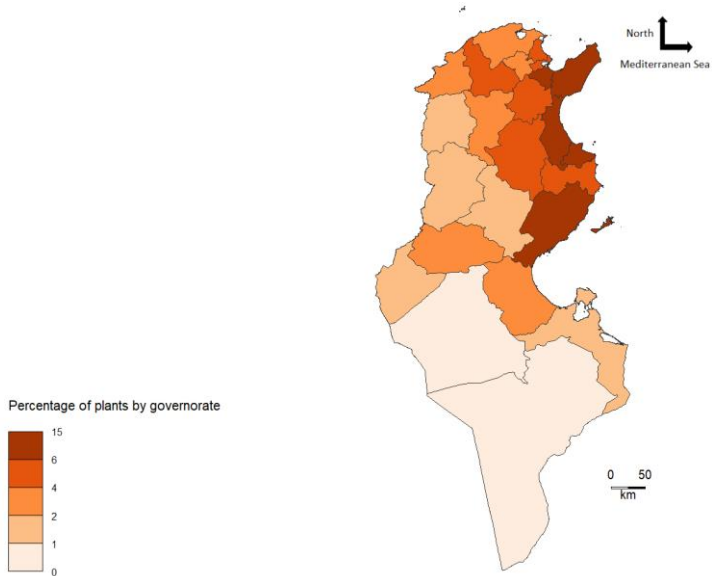


Figure 1.10: Spatial distribution of plants created after the revolution

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

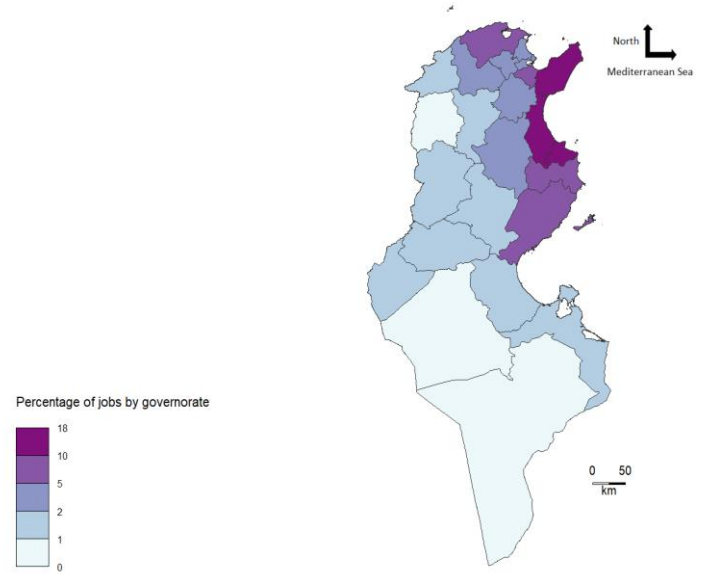


Figure 1.11: Spatial distribution of jobs created after the revolution

Finally, since the majority of firms are located in the eastern coastal area, we provide descriptive statistics on the distribution of plants and jobs in this area. Also in this case, plants and jobs seem to be unevenly distributed among the coastal delegations (Figures 1.12 and 1.13). These entities are massively concentrated in a small number of delegations and form three main zones of agglomeration: (i) some delegations of the governorate of Nabeul and of the Tunis metropolis region which consists of 4 governorates: Tunis, Ariana, Ben Arous and Manouba, (ii) some delegations of the governorates of Sousse and Monastir and (iii) some delegations of the governorate of Sfax, knowing that for jobs, the governorate of Bizerte can be considered as the fourth agglomeration zone.

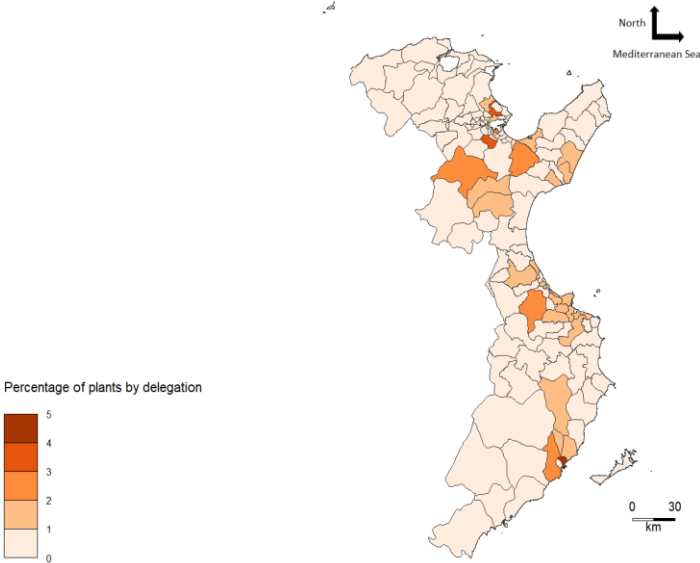


Figure 1.12: Spatial distribution of plants by delegation in the eastern coast

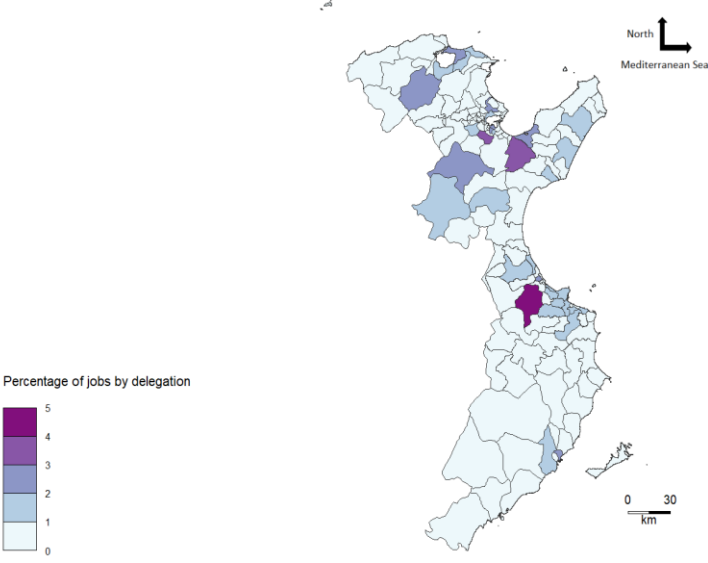


Figure 1.13: Spatial distribution of jobs by delegation in the eastern coast

Source: Website of the Agency for the Promotion of Industry and Innovation (2018)

1.5. Spatial patterns of industrial sectors in Tunisia

1.5.1. Absolute geographic concentration: k_d and k_{emp} functions

To assess the distribution of manufacturing industries in Tunisia, we first examine the concentration of plants using Duranton and Overman’s function k_d , then we estimate the weighted function k_{emp} that weights for manufacturing employees. Figures 1.14 and 1.15 display the results for k_d and k_{emp} respectively. As a reminder, the methodology of k_d function is to determine the distribution of the bilateral distances of each plant of reference sector with all plants in the same sector and to compare it with a random spatial distribution. The k_{emp} function follows the same methodology to evaluate the distribution of bilateral distances between employees in the same sector.

We compare the observed distribution and the confidence interval until 160km, which almost corresponds to the median distance between plants in Tunisia, following Duranton and Overman (2005, 2008). The choice of the median is not neutral, as these indicators can aggregate the results obtained for long distances at the cost of a precision loss in the information provided (Duranton and Overman, 2005; Barlet et al., 2013). Consequently, we set this distance at 160 km to calculate the indices of localization $\Gamma(d)$ and dispersion $\Psi(d)$. Then, we recalculate these indices at different distances: 0-25 km, 0-75 km and 0-125 km to show the evolution of concentration levels as a function of distance. Tables 1.9 and 1.10 display the most concentrated industries in terms of plants and employees at different distances according to these indices. To determine exactly the spatial scale which displays the highest share of a significant concentration and significant dispersion for plants and employees, we decompose the values of indices of localization and dispersion by spatial slices: 0-5km, 6-30km, 31-70km, 71-120km, 121-160km Tables 1.11 and 1.12 show these results.

Figure 1.14: Unweighted function k_d

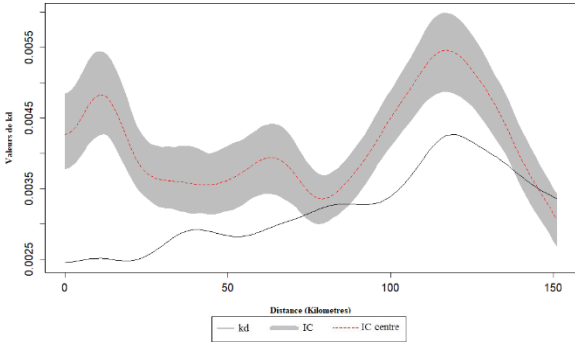
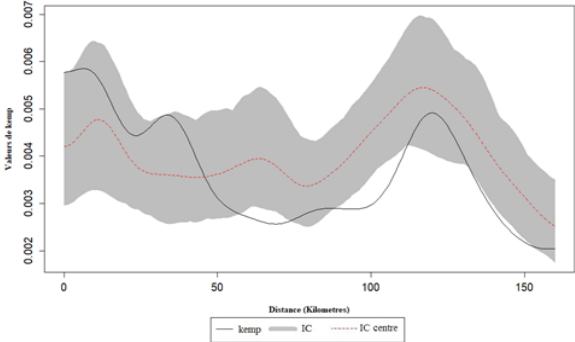
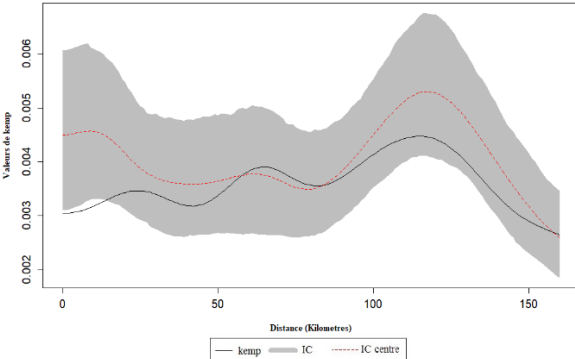
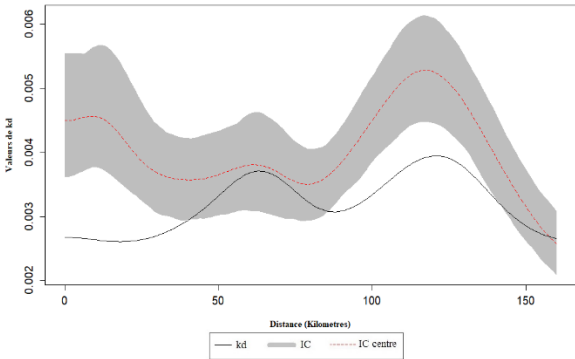


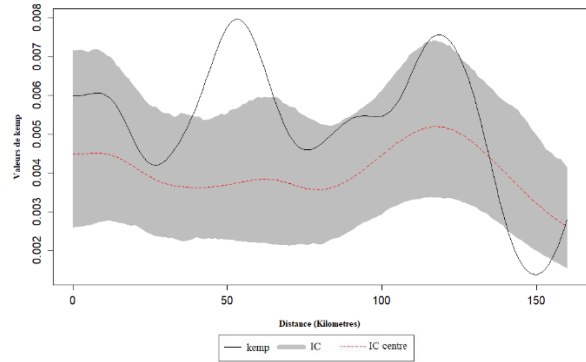
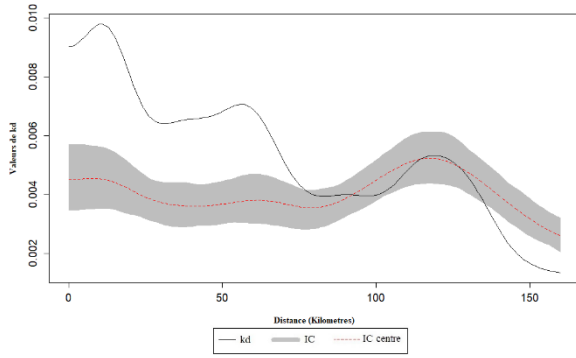
Figure 1.15: Weighted function k_{emp}



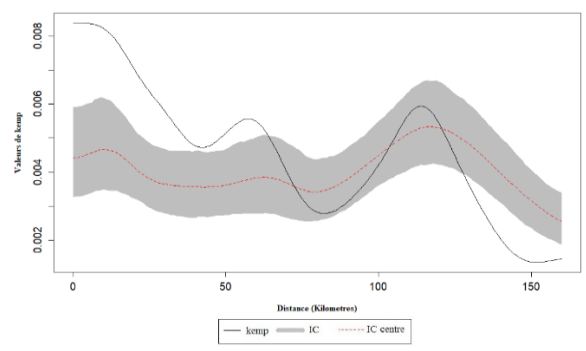
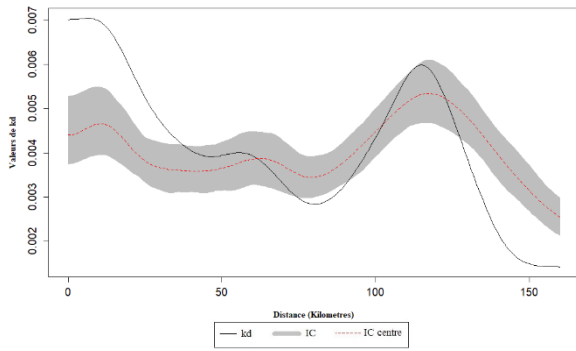
Agro-food industry



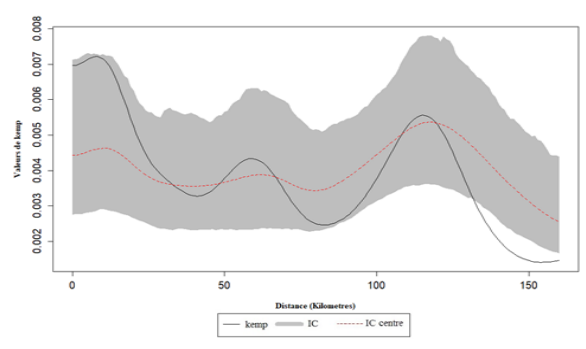
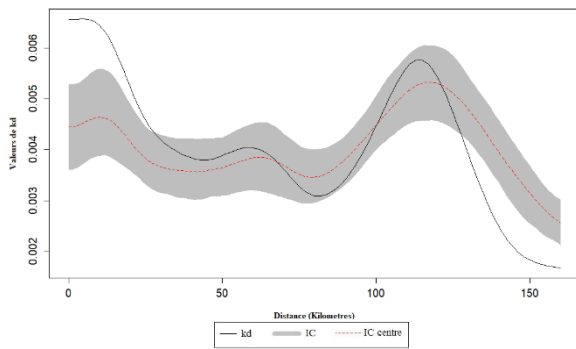
Building materials, ceramics and glass industry



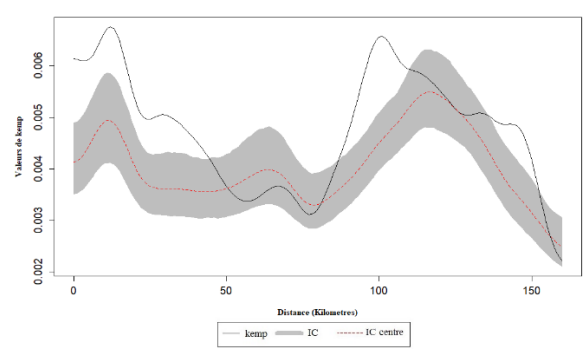
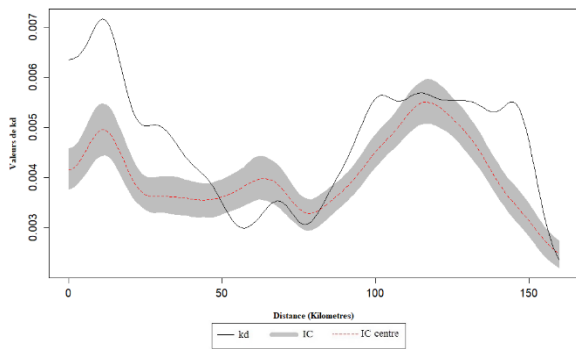
Electrical, electronics and appliance industry



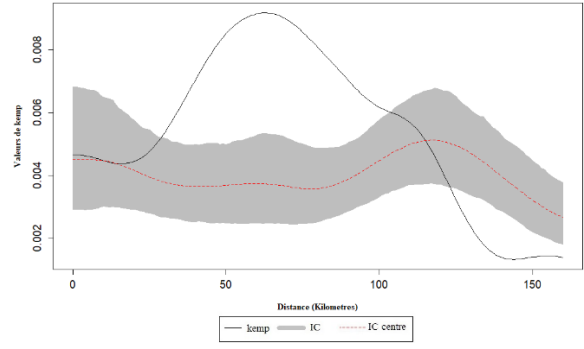
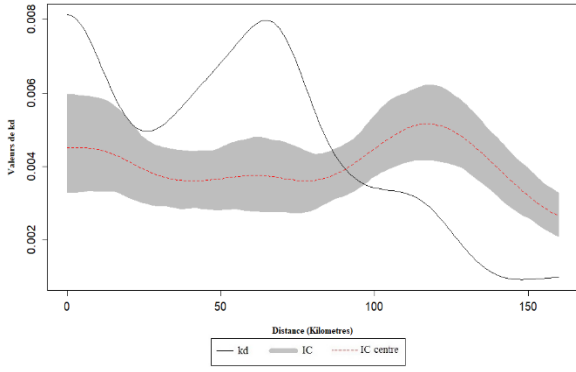
Mechanical and metallurgical industry



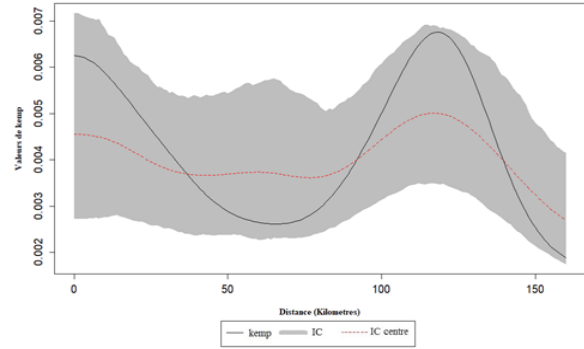
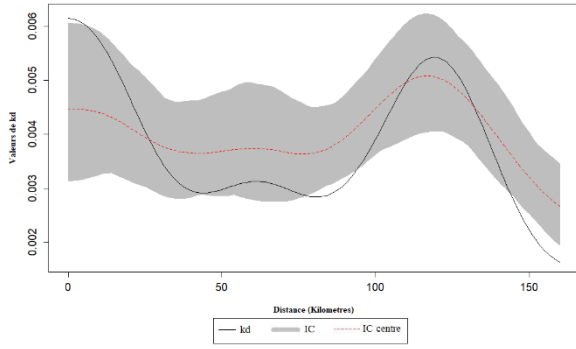
Chemical industry



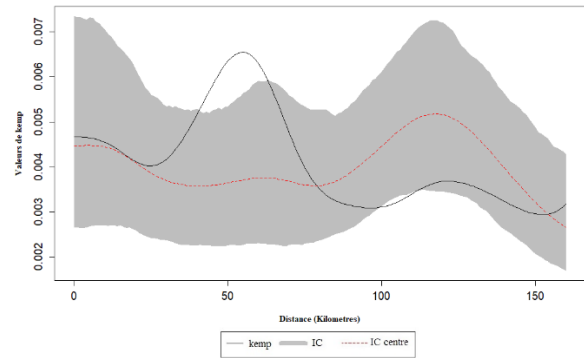
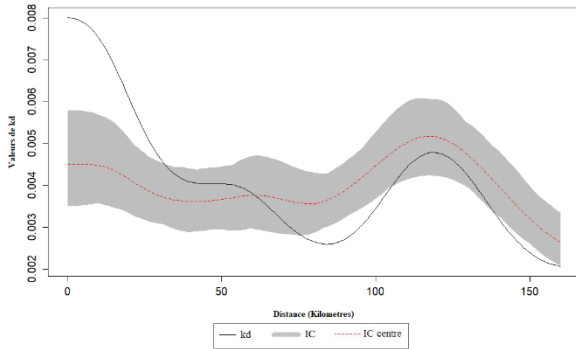
Textile and clothing industry



Leather and footwear industry



Wood, cork and furniture industry



Diverse industry

Table 1.9: Most concentrated and dispersed sectors in terms of plants in Tunisia

Industries	Index of localization $\Gamma(\mathbf{d})$			
	0-160km	0-25km	0-75km	0-125km
Electrical, electronics and appliance industry	0.183856	0.093692 (1)*	0.184486 (1)*	0.185727 (1)*
Leather and footwear industry	0.137385	0.032482 (5)	0.132935 (2)	0.140328 (2)
Textile and clothing industry	0.084791	0.039793 (3)	0.051409 (3)	0.060257 (3)
Diverse industry	0.041179	0.045003 (2)	0.043058 (4)	0.044066 (4)
Mechanical and metallurgical industry	0.040651	0.03916 (4)	0.042831 (5)	0.041304 (5)
Chemical industry	0.019113	0.022864 (6)	0.021163 (6)	0.021393 (6)
Wood, cork and furniture industry	0.002027	0.002127 (7)	0.000496 (7)	0.000784 (7)
Industries	Index of dispersion $\Psi(\mathbf{d})$			
	0-160km	0-25km	0-75km	0-125km
Agro-food industry	0.08062	0.038238	0.055277	0.077363
Building materials, ceramics and glass industry	0.053598	0.027119	0.031265	0.043574

**Sub-sectors that have a significant concentration are ranked in descending order*

Table 1.10: Most concentrated and dispersed sectors in terms of employees in Tunisia

Industries	Index of localization $\Gamma(\mathbf{d})$			
	0-160km	0-25km	0-75km	0-125km
Leather and footwear industry	0.190016	-	0.135984 (1)*	0.190574 (1)*
Mechanical and metallurgical industry	0.073332	0.050689 (1)*	0.069774 (2)	0.069938 (2)
Textile and clothing industry	0.057055	0.019755 (2)	0.02829 (4)	0.047597 (3)
Electrical, electronics and appliance industry	0.038242	-	0.03538 (3)	0.038789 (4)
Diverse industry	0.014544	-	0.012196 (5)	0.015465 (5)
Industries	Index of dispersion $\Psi(\mathbf{d})$			
	0-160km	0-25km	0-75km	0-125km
Chemical industry	0.013164	-	-	-
Agro-food industry	0.08062	0.036896	0.055115	0.077281
Building materials, ceramics and glass industry	0.001459	0.002341	0.001796	0.001239

**Sub-sectors that have a significant concentration are ranked in descending order*

Table 1.10: Distance shares of values of indices of localization and dispersion for plants

Industries	Shares of distances of value of index of localization					
	0-160km	0-5km	6-30km	31-70km	71-120km	121-160km
Mechanical and metallurgical industry	0.040651	25%	71%	3%	1%	0%
Electrical, electronics and appliance industry	0.183856	11%	43%	45%	1%	0%
Chemical industry	0.020561	37%	63%	0%	0%	0%
Textile and clothing industry	0.084791	12%	38%	9%	11%	30%
Leather and footwear industry	0.137386	9%	9%	64%	18%	0%
Wood, cork and furniture industry	0.002027	67%	33%	0%	0%	0%
Diverse industry	0.041179	31%	68%	1%	0%	0%
Industries	Shares of distances of value of index of dispersion					
	0-160km	0-5km	6-30km	31-70km	71-120km	121-160km
Agro-food industry	0.08062	10%	40%	18%	25%	7%
Building materials, ceramics and glass industry	0.050472	11%	42%	3%	35%	9%

Table 1.11: Distance shares of values of indices of localization and dispersion for employees

Industries	Shares of distances of value of index of localization					
	0-160km	0-5km	6-30km	31-70km	71-120km	121-160km
Mechanical and metallurgical industry	0.073332	20%	60%	20%	0%	0%
Electrical, electronics and appliance industry	0.038242	0%	0%	97%	2%	1%
Textile and clothing industry	0.057055	11%	33%	10%	34%	12%
Leather and footwear industry	0.190016	0%	1%	62%	38%	0%
Diverse industry	0.014544	0%	0%	100%	0%	0%
Industries	Shares of distances of value of index of dispersion					
	0-160km	0-5km	6-30km	31-70km	71-120km	121-160km
Building materials, ceramics and glass industry	0.001459	34%	66%	0%	0%	0%
Chemical industry	0.013164	0%	0%	0%	0%	100%

The general trend of geographical concentration does not affect all industries in the same way; each manufacturing sector presents its own spatial pattern. However, significant geographical concentrations of all sectors are detected at relatively short and intermediate distances. Using continuous measure allows to determine exactly the distance where the concentration and dispersion occurs, these concentrations are mainly located within a radius of less than 30 km for plants, and less than 70 km for employees, mainly between 31 and 70 km (Tables 1.11 and 1.12).

The weighted and unweighted functions give different results as the distribution of plants differs from the distribution of employees. The same industries are characterized by a high geographical concentration for

both plants and employees, even the ranking of the most concentrated employees is different than that of plants. Only the chemical industry is in the ranking of the index of localization for plants and in that of the index of dispersion for employees.

The electrical, electronics and appliance plants are the most concentrated at short, intermediate and long distances. For employees, at long distance, the leather and footwear industry display the highest concentration at short distance, the mechanical and metallurgical industry is the most concentrated at short distance. Interestingly, no spatial pattern of plants is characterized by a random spatial distribution. Thus, all plants in the same sector show a spatial link between them, either attraction or repulsion. For employees, only one spatial pattern is characterized by a random spatial distribution: the wood, cork and furniture industries. In fact, when there is a random distribution, there is no repulsion or attraction between these entities. In our case, this random distribution of this industry is explained by the small number of entities (in this case, employees) in this industry (Behrens and Bougna, 2015). Indeed, two pieces of information are inferred from the confidence intervals, the first by comparison with the observed distribution and the second by its width. The more a sector has a large number of entities, the more the confidence interval will be tight around the average random distribution (Barlet et al., 2013). As regards the spatial distribution of plants in this industry, they are geographically concentrated at the shortest distance when compared to other industries. This short distance (between 0 and 11km) explains the low value of index of localization, and the last in the rankings of the index of this industry. The concentration of this industry occurs essentially within a radius of 5 km (Table 1.11) which corresponds to a maximum distance between two plants in the same delegation or in neighboring delegations in Tunisia. Three delegations (Akouda, Sfax Sud, La Soukra) have the highest share of this industry and belong to the governorates which also have the highest number of firms: Sousse (11%), Sfax (21%) et Ariana (8%). Indeed, this strong localization in these delegations explains this short distance of spatial concentration.

The spatial pattern of leather and footwear plants represents the largest spatial scale of a significant concentration [0-86km]. In addition, this industry is the first in the ranking of index of localization for employees (Table 1.10) and the second for plants (Table 1.9). These results show that this industry is among the most concentrated industries in Tunisia. In fact, the majority of leather and footwear plants are located in the delegations of the governorate of Nabeul, 29% of the total plants in the sector. Moreover, the delegations, which are 86 km far from Nabeul, display 30% of firms in this sector. Hence, the spatial radius of significant concentration can be explained by the massive location of these plants in the delegations of the governorate “Nabeul” and those around it. In contrast, the spatial pattern of employees in this industry shows a significant concentration, only between 29 and 103 km, after a random spatial distribution at short distances. This stems from the fact that most pairs of plants located in this spatial scale, display, for one of each pair, a plant with a large size of employees.

The electrical, electronics and appliance industry is the first in the ranking of the index of localization for plants, this sector is the most concentrated manufacturing industry in Tunisia in terms of plants at all spatial

scales. Thus, its plants form well-defined clusters, two peaks of the k_d function are well distinguished: the first peak is observed at a distance of 11 km and the second at a distance of 56 km. These peaks correspond to the radius where the majority of plants in the same sector cluster together to form an aggregate. The spatial scale 0-76 km exhibits a significant concentration for the electrical, electronics and appliance industry, it corresponds to the distance where its plants are located in the delegations of neighboring governorates in the North of the country: Ariana, Ben Arous, Tunis, Bizerte, Beja, Nabeul and Zaghuan. More than half of the pairs of plants (47%) that are located in this spatial scale, show a significant concentration in all Tunisia. Subsequently, beyond 76 km, the k_d function curve moves below the confidence interval to display a random spatial distribution and then below the confidence interval, showing that plants of these industries are geographically dispersed. Note that if the distribution is initially above the confidence interval, it will pass mechanically under the confidence interval at longer distance. Therefore, it is not useful to interpret the information provided by long distances (Barlet et al., 2013).

The electrical, electronics and appliance industry is considered among the high-tech industries in Tunisia with the mechanical and metallurgical industry and the chemical industry. These two last industries also show a significant spatial concentration for plants, at short distances (less than 40 kilometers), nevertheless, they appear at the bottom of the ranking of the index of localization (Table 1.9). The most interesting point in the spatial patterns of these three industries is that a peak of their curves of the function k_d is detected at the same distance (11 km). This distance can be represented as the radius where these industries form a high tech cluster and also corresponds to a maximum distance between two plants in the same delegation or in neighboring delegations in Tunisia. In fact, the most important share of plants in these industries is located in the delegations of the governorates of Ben Arous and Nabeul (32%), which explains this intense concentration at this distance. This spatial concentration is beneficial and a source of attraction for other high-tech firms, related to technological externalities and transfer of information generated by plants located in agglomerated units. In addition, high-tech industries depend on a high-quality workforce, suggesting that the effects of labor pooling are an important factor in the agglomeration for these industries. Since a high share of the population is located in the coastal zone (Figure 1.7), this helps to provide the workers needed. In contrast, the employees of high tech industries show different spatial patterns. The employees of electrical, electronics and appliance industry and those of mechanical and metallurgical industry have a significant concentration between 39 and 64 km and between 0 km and 63 km respectively, while the employees of chemical industry are randomly distributed across space, up to 132 km and then show a geographical dispersion for the rest of the distance. In fact, the random distribution of this latter industry is due to the random distribution of plants with a large size (more than 100 employees). These plants account for 18 % of the total number of this industry, however, they create 72% of the total jobs on this industry, which causes the random distribution of all employees. Therefore, the point pattern of firms with large sizes affects the point pattern of employees.

According to the literature, the textile industry usually displays a strong geographical concentration in other countries: France, the United-Kingdom and Germany (Koh and Riedel, 2014). Our results also show that this industry is also characterized by a geographical concentration in Tunisia for plants between 0 and 46 km and for employees between 0 and 44 km. Three neighboring governorates: Monastir, Sousse and Mahdia contain the highest share in this sector in terms of plants (45 %) and employees (42%). This explain the radius of the significant concentration detected. Furthermore, these three governorates are well known for their specialization in the textile and clothing sector (Karray and Driss, 2014) which is confirmed by our result that this sector shows a strong tendency to agglomerate in this region. In fact, this region provides a high availability of skilled labor, which attracts more employees and therefore leads to the location of other firms. This is a snowball mechanism: as a result of the high spatial concentration of this sector, firms can also benefit from technological externalities derived from skilled rotation and specialized workforce.

The last sector characterized by a geographical concentration is the diverse industry. A significant geographical concentration is detected for this sector at radius of 31 km. In fact, the majority of plants of this sector are located in delegations of the governorates of Sfax, Sousse, and the metropolitan of Grand-Tunis and other neighboring delegations. This radius therefore corresponds to the distance between the coastal delegations mentioned above that contain the largest share of this sector in terms of plants and employees. The diverse industry includes activities that can be classified into the following two subsectors: (i) Pulp, Paper and paperboard et (ii) various branch (Table 1.19 in the appendix 1). The nature of these activities can explain the strong concentration in the urban littoral zones. These types of activities require a localization near the cities and the markets with strong demand.

The majority of manufacturing sectors are characterized by significant geographical concentration. Only two sectors, considered as classic industries: agro-food industry and building materials, ceramics and glass industry present a significant spatial dispersion for plants and employees. The agro-food plants are dispersed in two different spatial scales [0-74km] and [87-137km] and randomly distributed between 74 and 87km. The random spatial distribution between these two spatial scales is detected because of the limited number of plants that are located at this distance. Indeed, three sub-sectors of this industry (of 10 sub-sectors) have the highest share of plants (61%): oils and fats subsector (25%), grain and derivatives subsector (20%) and cold storage subsector (16%). This spatial dispersion can then be explained by the fact that plants favor locating near exploited soils and customers in order to reduce transport costs or also are dispersed to avoid strong competition. Building materials, ceramics and glass plants are also dispersed in two spatial scales [0-42km] and [86-141km]. In fact, only the sub-sector: extraction and transformation of stones and marble for construction, provides the majority of plants (42%) in this industry. Thus, this spatial dispersion can be explained by the fact that these firms prefer to locate near natural sources than other firms in the same sector.

We also compute Diggle and Chetwynd (1991)'s measure D function in order to compare its results with those obtained with Duranton and Overman (2005)'s measure. We find that the k_d absolute and D

topographic functions show some similarity between their results, which was also pointed by Marcon and Puech (2015). The industries that show absolute concentration (or absolute dispersion) are the same ones that show a topographic concentration (or a topographic dispersion). The main difference lies in the distance detected for spatial patterns, the D function shows a geographical concentration over a distance longer than that detected by the function k_d . We explain in detail the results of this function in Box 1 in the appendix 1.

To complete our analysis, we estimate smoothed kernel intensity of point pattern figures that show graphically the density of points pattern objects on an inhomogeneous space (Figure 1.16 and Figure 1.30 in the appendix 1). We are then able to detect the areas that have a high density of plants and employees. The results indicate that the highest densities are in the eastern littoral zone of Tunisia and are close to the economic hot spots (Figure 1.8). Although the Tunisian government is making real efforts to achieve regional economic equilibrium through a balanced installation of hot spots between the interior and the coast, the concentration of industries is still close to the hot spots of the littoral zone. Combining these results with those of the k_d and k_{emp} functions, we conclude that the location of the majority of plants in the eastern littoral zone leads to a strong concentration of industries within a maximum radius of 86 km and that this spatial scale corresponds to a maximum distance between two plants in the delegations of the same governorate or neighboring governorates of Tunisia. The spatial distribution of manufacturing activities in Tunisia confirms the enormous contrast between coastal Tunisia and rural Tunisia.

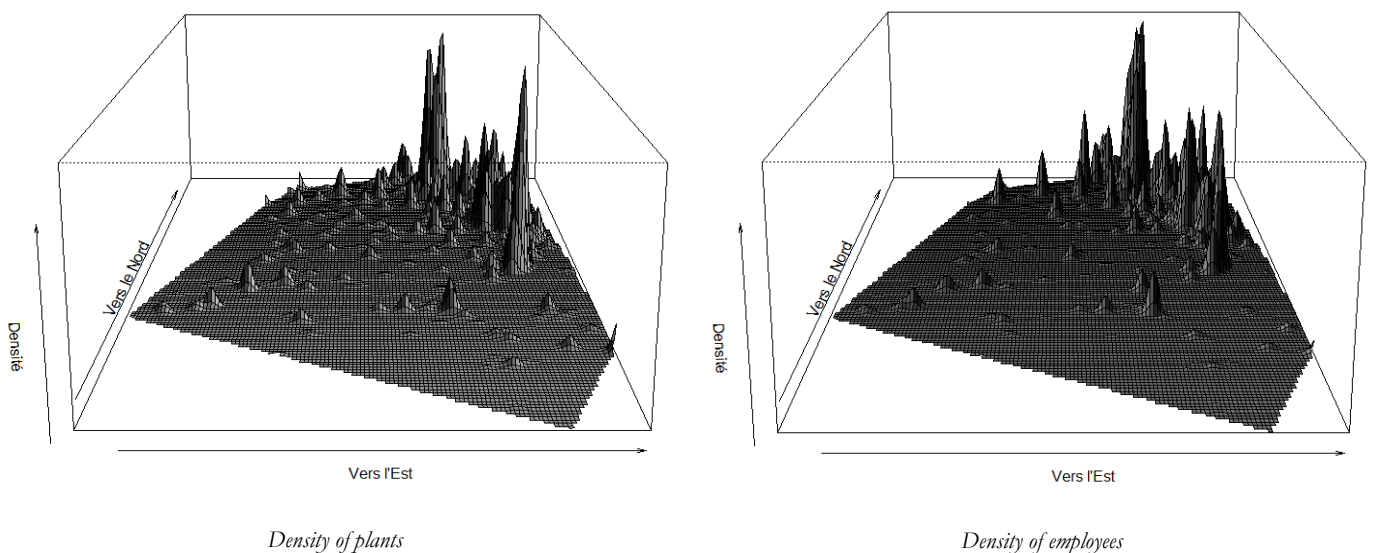


Figure 1.16: Kernel intensity for point patterns in Tunisia

The sustained location in this area may be explained by the fact that some industries tend to localize primarily in governorates with a high population density and an urban environment and benefit from the externalities of the proximity to the capital “Tunis” and to the local markets and to the means of transport for employees.

The important economic weight of the capital generates positive externalities in favor of the governorates around it and the coastline. Conversely, firms avoid locating in the interior and southern regions of Tunisia on account of their structural deficiencies in terms of economic activities, public infrastructures such as health, education as well as public administration. Although all the main advantages of the public policies are still aimed at the interior and southern delegations since independence and the majority of coastal delegations are excluded from the list of benefit zone, the regional manufacturing disparities still exist. Based on results, the delegations that belong to the regional development program are the same ones of the governorates that do not show a geographical concentration. Thus, these policies of fiscal and financial advantages do not have an obvious effect in the Tunisian manufacturing landscape.

However, public agencies establish profound transformations in the manufacturing structure in Tunisia. For instance, the industrial land agency (AFI) orients the decision of the manufacturing location choices, since it has developed several manufacturing zones mainly in the coastal delegations. In addition, the strategy of establishing competitiveness poles in urban areas, mainly in coastal areas, may increase the level of regional disparities and increase the size of the manufacturing agglomeration in coastal areas, and these poles can also be a source of attraction for other firms. Despite the generous financial and tax advantages offered to industrial investments which are placed in regional development zones, the demand for the investment location still seems to be concentrated mainly on industrial areas located near major cities where the workforce, customers and major infrastructure are concentrated.

Linking our results to theory, first, we find some concentrations leading to manufacturing specialization, which may be due to the three Marshall's reasons of manufacturing agglomerations: labor pooling, input sharing and knowledge spillovers. However, we also find heterogeneity in the spatial manufacturing distribution, as plants in different sectors exhibit geographic concentration, creating an overall pattern of manufacturing diversity. As the Tunisian manufacturing fabric mainly consists of small firms, it is more relevant to interpret the results at the micro-firm level than at the industry level. Following Ellison et al. (2010), these concentrations can be explained by the fact that plants in the same sector agglomerate as they share the same inputs, workers, while plants in different sectors also agglomerate because they also share some sources. In addition, agglomeration effects are more important for small firms (Chinitz, 1961; Faggio et al., 2017). We hypothesize that knowledge spillovers are an important factor for agglomerations in Tunisia, since a large economic literature supports the idea that these spillovers have a strong effect on small firms (Howard et al., 2016). Second, the massive concentration in this area can be explained by the second Marshallian source: proximity to suppliers and customers. Third, the large population in this area provides a large and rich labor pool, which attracts firms.

1.5.2. Co-agglomeration of manufacturing industries in Tunisia

In this section, we analyze the industrial co-agglomeration patterns between the manufacturing sectors in Tunisia, using the bivariate function of Duranton and Overman (2005, 2008). The study of co-agglomeration is based on the analysis of clustering for bivariate distributions, which allows identifying the location patterns

(attraction or repulsion) between two different sectors. This method provides more understanding of Tunisian industrial spatial fabric by showing the desire of firms in an industry to locate in close proximity to firms in other industries. The agglomeration between pairs of establishments occurs when the forces that push towards co-location are stronger than those that push towards the grouping of own industry. Otherwise, despite the forces that lead to colocation, if industry-specific concentration forces dominate, the result will be repulsion between establishments of both sectors (Duranton and Overman, 2008). Firms may be attracted to areas with similar characteristics, such as a localized natural advantage, or they can deliberately decide to settle in close proximity to related industries (Duranton and Overman 2008). The question of the drivers of co-location has received a large amount of attention since Ellison et al. (2010) (for instance, Howard et al. 2016; Faggio et al. 2017; Diodato et al. 2018). This focus is due to the fact that the analysis of the agglomeration can hide industrial heterogeneity, which leads to biases in the analysis of cluster policies (Faggio et al. 2017).

Empirically, we use the k_d and k_{emp} bivariate functions, developed by Duranton and Overman's function (2005, 2008) that computes bivariate distributions and determine respectively whether the pairs of plants and employees in two industries are closer than the pairs of manufacturing plants randomly distributed.

These functions are defined as follows:

$$k_d(r) = \frac{1}{n m h} \sum_{i=1}^n \sum_{\substack{j=1 \\ j \neq i}}^m f\left(\frac{d - d_{i,j}}{h}\right)$$

and

$$k_{emp}(r) = \frac{1}{n \sum_{i=1}^n \sum_{\substack{j=1 \\ j \neq i}}^m w(x_i)w(x_j)} \sum_{i=1}^n \sum_{\substack{j=1 \\ j \neq i}}^m w(x_i)w(x_j) f\left(\frac{d - d_{i,j}}{h}\right)$$

where n is the number of plants in the first industrial sector; m is the number of plants in the second industrial sector; $d_{i,j}$ is the distance between pairs of different plants (i and j) with one plant from each sector. In this case, k_d (k_{emp}) is interpreted as an estimate of all neighbor plants (employees) in the second sector around each reference plants (employees) in the first sector. Figures 1.32 and 1.33 in the appendix 1 display the k_d and k_{emp} bivariate functions for all pairs of industries, respectively.

The k_d bivariate function of co-agglomeration detects no spatial random distribution between all manufacturing sectors. Thus, all pairs of these sectors show a spatial interaction between them. In all 36 pairs of industries, we find 26 pairs of industries co-located (72%), 10 co-dispersed (28%). Table 1.13 shows the most co-agglomerated sectors according to the index of localization. The pairs of industries displaying significant dispersion are shown in Table 1.14. However, employees record 10 spatial random co-distributions (28%), 20 pairs are co-agglomerated (56%) and six pairs are co-dispersed (16%). Tables 1.15 and 1.16 display the pairs of different employees displaying significant co-agglomeration and co-dispersion.

The most important attractions are between the leather and footwear industry with all industries for plants and employees. The electrical, electronics and appliance industry is among the first three most co-agglomerated pairs for plants and the first most co-agglomerated for employees. Thus, this industry is characterized by a strong spatial co-agglomeration with various other industries. For plants, this industry displays a geographical co-dispersion with the agro-food industry and building materials, ceramics and glass industry, but for employees, it shows no spatial pattern with these industries.

Table 1.12: The most co-localized manufacturing sectors according to index of localization

Industries	Index of localization
	0-160km
Electrical, electronics and appliance industry - Leather and footwear industry	0.182349
Electrical, electronics and appliance industry - Diverse industry	0.101974
Electrical, electronics and appliance industry - Mechanical and metallurgical industry	0.094831
Leather and footwear industry - Mechanical and metallurgical industry	0.088834
Leather and footwear industry - Diverse industry	0.08512
Electrical, electronics and appliance industry - Chemical industry	0.081898
Leather and footwear industry - Textile and clothing industry	0.079263
Leather and footwear industry - Chemical industry	0.077392
Electrical, electronics and appliance industry - Textile and clothing industry	0.062823
Mechanical and metallurgical industry - Textile and clothing industry	0.050379
Diverse industry - Mechanical and metallurgical industry	0.04973
Chemical industry - Mechanical and metallurgical industry	0.041856
Chemical industry - Textile and clothing industry	0.041396
Wood, cork and furniture industry - Leather and footwear industry	0.038019
Diverse industry - Chemical industry	0.037687
Diverse industry - Textile and clothing industry	0.031695
Wood, cork and furniture industry - Electrical, electronics and appliance industry	0.030906
Wood, cork and furniture industry - Textile and clothing industry	0.024653
Wood, cork and furniture industry - Diverse industry	0.023164
Wood, cork and furniture industry - Mechanical and metallurgical industry	0.021944
Agro-food industry - Textile and clothing industry	0.018283
Leather and footwear industry - Building materials, ceramics and glass industry	0.01517
Wood, cork and furniture industry - Chemical industry	0.014621
Mechanical and metallurgical industry - Building materials, ceramics and glass industry	0.014087
Building materials, ceramics and glass industry - Textile and clothing industry	0.003404
Leather and footwear industry - Agro-food industry	0.000811

Table 1.13: The most co-dispersed manufacturing sectors according to index of dispersion

Industries	Index of dispersion
	0-160km
Building materials, ceramics and glass industry - Agro-food industry	0.079862
Building materials, ceramics and glass industry - Mechanical and metallurgical industry	0.037895
Building materials, ceramics and glass industry - Chemical industry	0.035582
Building materials, ceramics and glass industry - Diverse industry	0.026193
Mechanical and metallurgical industry - Agro-food industry	0.025878
Wood, cork and furniture industry - Building materials, ceramics and glass industry	0.024244
Chemical industry - Agro-food industry	0.023777
Diverse industry - Agro-food industry	0.01613
Wood, cork and furniture industry - Agro-food industry	0.014192
Agro-food industry - Electrical, electronics and appliance industry	0.010643

Table 1.14: The most co-localized employees according to index of localization

Industries	Index of localisation
	0-160km
Leather and footwear industry - Electrical, electronics and appliance industry	0.132137
Leather and footwear industry - Mechanical and metallurgical industry	0.128123
Leather and footwear industry - Diverse industry	0.085264
Leather and footwear industry - Textile and clothing industry	0.0844
Leather and footwear industry - Agro-food industry	0.072885
Leather and footwear industry - Chemical industry	0.067572
Leather and footwear industry - Wood, cork and furniture industry	0.03981
Leather and footwear industry - Building materials, ceramics and glass industry	0.024149
Diverse industry - Electrical, electronics and appliance industry	0.023977
Diverse industry - Mechanical and metallurgical industry	0.022609
Mechanical and metallurgical industry - Electrical, electronics and appliance industry	0.020406
Mechanical and metallurgical industry - Agro-food industry	0.019712
Mechanical and metallurgical industry - Textile and clothing industry	0.018471
Mechanical and metallurgical industry - Chemical industry	0.014232
Diverse industry - Textile and clothing industry	0.011572
Mechanical and metallurgical industry - Wood, cork and furniture industry	0.008449
Agro-food industry - Textile and clothing industry	0.004699
Textile and clothing industry - Wood, cork and furniture industry	0.002153
Electrical, electronics and appliance industry - Chemical industry	0.001198
Electrical, electronics and appliance industry - Agro-food industry	0.001082

Table 1.15: The most co-dispersed employees according to index of dispersion

Industries	Index de dispersion
	0-160km
Agro-food industry - Chemical industry	0.007867
Wood, cork and furniture industry - Chemical industry	0.006581
Agro-food industry - Building materials, ceramics and glass industry	0.005664
Agro-food industry - Diverse industry	0.005457
Building materials, ceramics and glass industry - Textile and clothing industry	0.003902
Agro-food industry - Wood, cork and furniture industry	0.002467

Furthermore, the co-agglomeration that records the highest value of the index of localization is between these two industries: the electrical, electronics and appliance industry and the leather and footwear industry for plants and employees. These two sectors also exhibit the highest agglomeration at the individual level, which leads to this strong co-agglomeration, nevertheless, these two industries represent two totally different manufacturing activities. Moreover, these two industries record a spatial co-agglomeration with all industries. Hence, these attractions show industrial diversity and illustrate the effects of Jacobs' externalities of industrial diversification generating dynamic externalities and industrial agglomerations.

We also find there is an interesting spatial attractions between high-tech industries for plants, a significant attraction between them is observed at intermediate distances (0-48 km). These co-agglomerations confirm Marshall-Arrow-Romer's theoretical expectations of dynamic externalities generated by specialization. Moreover, plants of these industries are mainly located in the governorates (such as Grand-Tunis, Tunisian Sahel and Sfax) where there is also a concentration of universities. This offers diversified profiles of employees and contributes to generate co-agglomeration of these industries. Moreover, Abel and Deitz (2012) show that for US metropolitan areas, universities increase local labor levels in regions where they are located. Therefore, this result provides new evidence of the presence of Marshallian externalities in co-agglomerations which have robust empirical validations in the literature (Faggio et al. 2017).

Interestingly, our results show that the Tunisian manufacturing spatial pattern is mostly characterized by industrial diversification. This is explained by the theory of Jacobs (1969), firms are located in areas that have common advantages for all industries such as infrastructure, means of transport and proximity of the city center, suppliers and customers. But also, there is small specializations which allow to show the co-existence of Jacobs and Marshall externalities. Another explanation could come from network and organizational factors: for UK manufacturing firms during the period 1997–2008, Faggio et al. (2017) show that industrial spatial heterogeneity is more consistent with non-Marshallian factors such as adaptive and organizational factors. This finding of co-agglomeration is also a source of agglomeration (Ellison et al. 2010). Moreover, the role of public policies in infrastructure investments plays a crucial role in determining the type of agglomeration “specialization or diversification”. Hence, agglomeration economies anticipate the organization of the territory (Glaeser et al., 1992). For instance, once the government invests in infrastructure related to manufacturing activities in a specific region and improves the quality of life in this

region, this attracts firms of all specialties. These externalities common to all industries steer this agglomeration towards a diversified manufacturing fabric.

Conversely, the bivariate distributions with traditional industries dominate the classification of spatial co-dispersion for plants and employees. For all the co-dispersed patterns detected, for plants and employees, we find one of the following three traditional sectors in co-dispersed pairs: the agro-food industry, the building materials, ceramics and glass industry and the leather and footwear industry. Plants (or employees) in industry seem to be averse to locate near those of any other industry. This repulsion occurs when the forces that prevent co-localization are strong than those that prevent localization near plants (or employees) of own industry. Indeed, these industries do not show flexibility in their production process to locate near other firms but prefer to locate nearby natural advantages (Ellison et al. 2010), which illustrates this geographic co-dispersion.

1.6. Agglomeration of manufacturing sub-sectors

We finally focus on the location patterns of manufacturing sub-sectors: totally and partially exporting manufacturing firms as well as local, domestic, mixed and foreign manufacturing firms. To document these research questions, we also employ the unweighted function k_d , the smoothing kernel method and the indices of localization and dispersion.

1.6.1. Totally and partially exporting manufacturing firms

The analysis of totally and partially exporting plants leads to identify the type of firms that dominate the manufacturing location pattern in Tunisia and to show where spatial concentrations in Tunisia are open to international trade.

As shown in Figure 1.17, totally exporting plants tend to agglomerate at all distances, while partially exporting plants are significantly concentrated at short distances. The smoothing kernels (Figure 1.18) confirm the geographical concentration of partially exporting plants at short distances, showing that two areas have the highest densities: the governorates of Sfax and Ben Arous. Moreover, this method also shows that the eastern coastal zone hosts the most density of export plants.

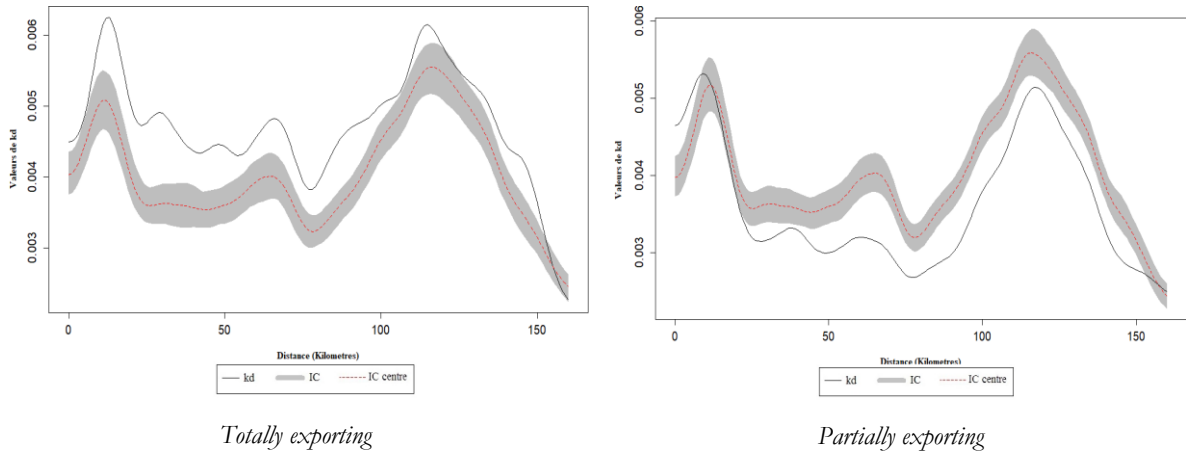


Figure 1.17: Function k_d according to the export regime

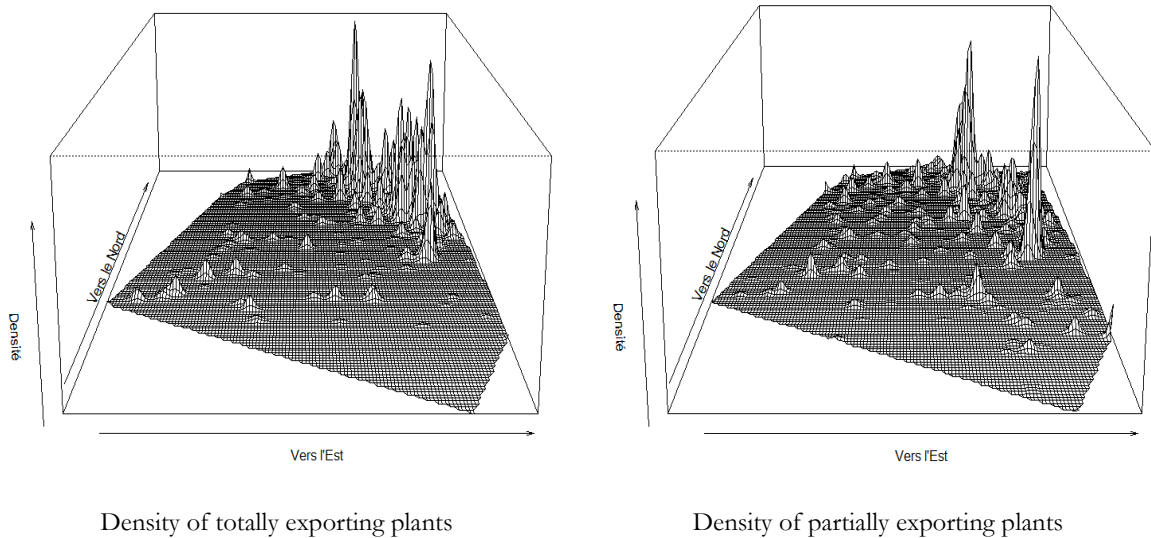


Figure 1.18: Kernel intensity for point patterns according to the export regime in Tunisia

Decomposing the analysis to sectors according to the exporter status provides similar results (Table 1.17 and Figure 1.34 in the appendix 1). Three interesting observations emerge from this analysis:

- When one of these two export regimes contains the largest share of plants, its spatial pattern takes the same form as that of the general case. In other words, the spatial configuration of the sector with the large part of totally or partially exporting plants does not show any significant change from that which unites the two regimes.
- Partially exporting agro-food plants show a significant concentration at a long spatial scale (147 and 160km); this scale corresponds to the distance where 2.4 percent of pairs of this subsector plants are located. Thus, these pairs of plants form a circle with a long radius which can be the distance between two governorates on four sides of country. This long radius can be explained by the fact agro-food

plants locate near natural resources or local markets all over the country, whereas they are dispersed at a short distance in order to avoid strong competition

- Two random spatial distributions are detected: the spatial pattern of totally export plants of ceramic and glass construction materials industry and the spatial pattern of totally export plants of wood, cork and furniture industry. This is due to the limited number of plants for these two sub-sectors, allowing for a wider confidence interval.

The index of localization shows that the most concentrated sub-sector is the totally exporting leather and footwear industry, the spatial scale of this concentration is between 0 and 94 km. The majority of totally exporting plants in this sub-sector are implanted in delegations of the governorate of Nabeul (40%) and also in delegations of neighboring governorates, which explains the strong agglomeration of this sub-sector between 1 and 94 km.

Table 1.16: Results of continuous measures for sub-sectors according to the export regime

Industries	Index of localization
	0-160km
Totally exporting leather and footwear plants	0.2833
Totally exporting electrical, electronics and appliance plants	0.184357
Partially exporting electrical, electronics and appliance plants	0.130836
Partially exporting leather and footwear plants	0.123001
Totally exporting mechanical and metallurgical plants	0.122678
Totally exporting textile and clothing plants	0.098383
Partially exporting diversy plants	0.054847
Totally exporting chemical plants	0.04211
Partially exporting mechanical and metallurgical plants	0.040221
Partially exporting textile and clothing plants	0.038506
Partially exporting chemical plants	0.03043
Partially exporting wood, cork and furniture plants	0.009093
Totally exporting diversy plants	0.006209
Partially exporting agro-food plants	0.005731
Industries	Index of dispersion
	0-160km
Totally exporting agro-food plants	0.059942
Partially exporting building materials, ceramics and glass plants	0.045235

1.6.2. Domestic, mixed and foreign manufacturing industries

Beyond identifying the location pattern of sub-sectors according to export regimes, it is also interesting to determine the effect of foreign direct investment (FDI) on the spatial manufacturing distribution in Tunisia. To document this issue, we follow the same methodology than the previous section.

Figure 1.19 displays the k_d function for mixed and foreign plants and for domestic plants. The mixed and foreign industries display a significant concentration, in contrast to domestic industries. We observe that the spatial pattern of domestic industries exhibits a significant geographical dispersion in Tunisia, which shows that firms either avoid the strong competition at short distances or illustrates the absence of interest of these firms to locate near each other. Besides, plants may prefer to locate far from other domestic ones. Thus, Tunisian manufacturing firms do not seem to be aware of the crucial role of the externalities of neighboring firms in their productivity and regional growth.

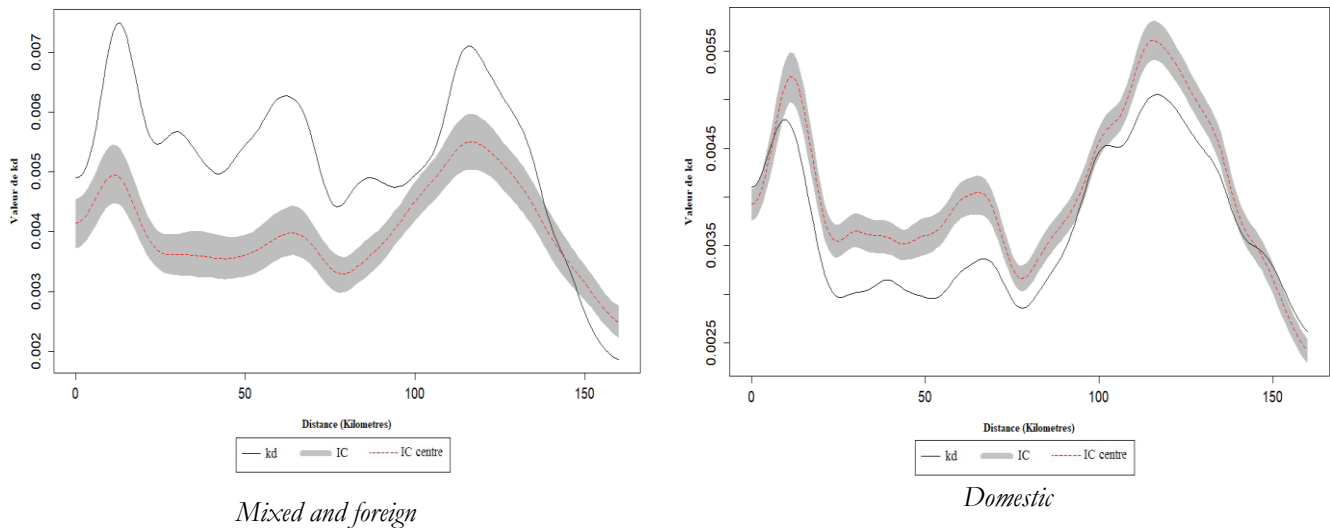


Figure 1.19: Function k_d for plants according to their nationality

The smoothing kernel densities shows a strong density of the foreign and mixed plants in the littoral area (Figure 1.20). Consequently, the geographical concentration of mixed and foreign plants between 0 and 138 km represents the distance between the eastern littoral governorates and between the geographical limits of the coastal zone. Thus, FDI has an impact on spatial distribution of Tunisian manufacturing industries, which makes the littoral zone a center capable of attracting foreign investment, especially the governorates of Tunis, Ben Arous, Bizerte, Nabeul, Sousse and Monastir. These governorates exhibit 71% of the total number of mixed and foreign plants in Tunisia. Hence, the spatial pattern of foreign and mixed plants accentuates regional disparities and does not figure as a solution for this issue.

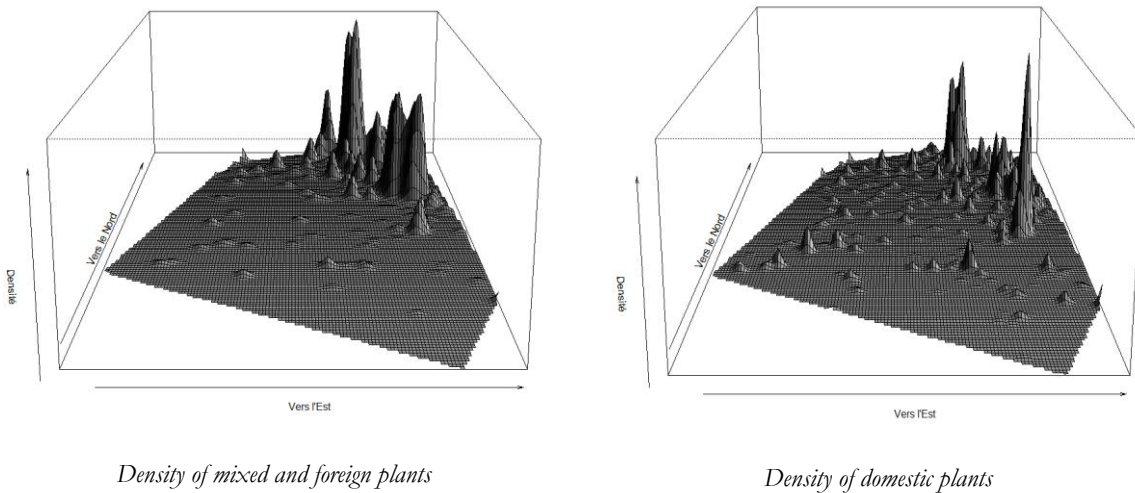


Figure 1.20: Kernel intensity for point patterns according to the nationality of the firms

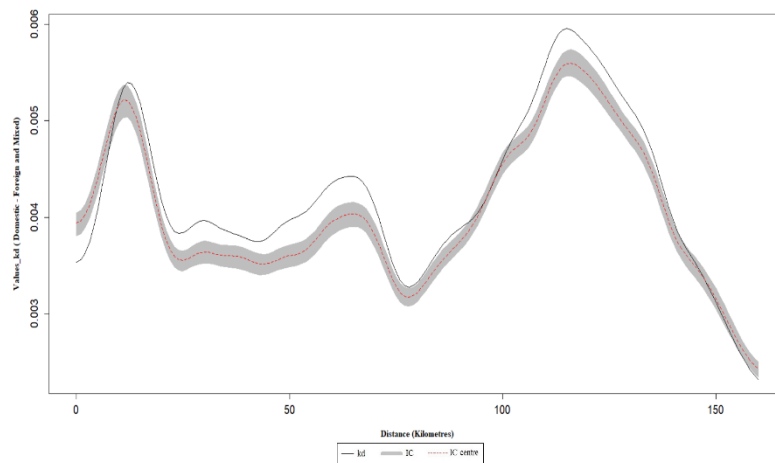


Figure 1.21: Spatial pattern between domestic firms and foreign and mixed firms

We also compute the bivariate function of Duranton and Overman (2008) to assess the spatial pattern between domestic firms and foreign and mixed firms. This function shows that the spatial pattern between these subsectors begins with a significant spatial repulsion at a short distance, up to 7 kilometers and a significant spatial attraction is detected in two spatial scales: 12-91 kilometers and 102-141 kilometers (Figure 1.21). Then, we analyze the location patterns at the sectoral level according to the nationality of firms (Figure 1.35 in the appendix 1). Overall, this analysis provides the same results. The most interesting point in the ranking of the index of localization is that even at the sectoral level, foreign and mixed plants record the highest level of geographical concentration (Table 1.18). FDI then affects not only the spatial distribution at the global level but also at the sectoral level in Tunisia. Domestic traditional industries: agro-food industry and building materials, ceramics and glass industry, exhibit a significant geographical dispersion, while the mixed and foreign agro-food plants show a geographical concentration between 11 and 51 km. This

concentration at this distance is generated by the strong installation of domestic plants in this sector in the delegations of the governorates of Nabeul and those around them (60%).

Table 1.17: Results of continuous measures for sub-sectors according to their nationality

Industries	Index of localization
	0-160km
Mixed and foreign leather and footwear plants	0.256011
Mixed and foreign electrical, electronics and appliance plants	0.200284
Mixed and foreign mechanical and metallurgical plants	0.17493
Mixed and foreign textile and clothing plants	0.120432
Mixed and foreign chemical plants	0.108269
Domestic electrical, electronics and appliance plants	0.107602
Domestic textile and clothing plants	0.066741
Domestic diverse plants	0.045673
Domestic leather and footwear plants	0.045482
Mixed and foreign diverse plants	0.037485
Mixed and foreign agro-food plants	0.032476
Domestic mechanical and metallurgical plants	0.03229
Domestic chemical plants	0.012525
Mixed and foreign wood, cork and furniture plants	0.004423
Domestic wood, cork and furniture plants	0.001036
Industries	Index of dispersion
	0-160km
Domestic agro-food plants	0.0928
Domestic building materials, ceramics and glass plants	0.04962

1.7. Conclusion

In this paper, we have examined the spatial location patterns of manufacturing industries in all Tunisia, using micro-geographic data that includes the addresses of all plants with 10 or more employees. We have followed the methodology proposed by Duranton and Overman (2005) and by Diggle and Chetwynd (1991) in order to detect the spatial pattern of industries. We have also extended the analysis by using a bivariate function developed by Duranton and Overman (2005, 2008) for co-agglomeration. This analysis leads to the following key empirical findings.

First, the spatial distributions of plants do not display similar spatial patterns to the spatial distributions of employees, even though the majority of industries that register a geographical concentration for plants, also show a geographical concentration for employees. The Diggle and Chetwynd (1991)'s function gives almost

the same results of the Duranton and Overman (2005)'s function, showing a geographical concentration or geographical dispersion for the same manufacturing sectors.

Besides, these two functions find that no random spatial distribution is detected for plants in all sectors. Thus, all point patterns show a spatial link between their plants, either a concentration or a dispersion. For employees, only one spatial pattern is characterized by a random spatial distribution: the wood, cork and furniture sector. This random distribution is explained by the small number of employees in this industry. Overall, the significant geographical concentrations of plants and employees are detected at relatively short and intermediate distances. These concentrations are mainly located within a radius of less than 30 km for plants, and less than 70 km for employees.

The electrical, electronics and appliance industry, the mechanical and metallurgical industry and the chemical industry, which are considered among the high-tech industries in Tunisia, show a significant spatial concentration for plants. Interestingly, the spatial patterns of these three industries display a peak of geographical concentration detected at the same distance (11 km). This peak represents the spatial radius where firms in these industries attract and form a high-tech manufacturing cluster. In fact, this radius also corresponds to a maximum distance between two plants in the same delegation or in neighboring delegations in Tunisia. Hence, this result confirms the existence of specialized zones in high-tech industries. We expect that this spatial concentration will generate technological externalities and transfer of information. Moreover, high-tech industries depend on a high-quality workforce. These links have indeed been developed in recent years, for instance, in the Tunisian Sahel (governorates of Sousse, Monastir and Mahdia), there is a significant growth in the number of conventions between universities and firms installed in this region and the valorization of the results of scientific research from the private sector.

The textile industry shows a geographical concentration in Tunisia at intermediate distance. This radius corresponds to a distance between neighboring governorates, indeed, three neighboring governorates: Monastir, Sousse and Mahdia, called Tunisian Sahel, contain the highest share in this sector. Hence, our results confirm the idea that these three neighboring governorates are considered as the center of Tunisia in the production of textile reflecting the snowball mechanism introduced by Fujita (1989), where the textile production specialization attracts qualified workers and therefore leads to localize new firms, which attracts more workers. Moreover, the Tunisian fabric manufacturing is characterized by a spatial dispersion of two manufacturing sectors, considered as classic industries: agro-food industry and building materials, ceramics and glass industry. These spatial dispersions are explained by the fact that the activities of these sectors need to be located near the raw materials, which causes this spatial configuration.

The co-agglomeration analysis shows that the most important spatial attractions are observed between industries classified in completely different fields of manufacturing activities. Indeed, the Tunisian manufacturing fabric is mostly characterized by industrial diversification, this illustrates the effects of externalities explained by the theory of Jacobs (1969). Further, the Tunisian government contributes in defining the type of agglomeration: specialization or diversification by investment in infrastructure, and

implementation of industrial parks in specific regions, therefore these actions improve the attraction sources and advantages in these regions and lead to diversified manufacturing agglomerations.

We also show that the totally exporting regime dominates the spatial manufacturing distribution in Tunisia. The spatial concentration of this subsector is detected mainly all along the eastern coastal governorates. Hence, the Tunisian eastern coast is characterized by an international openness due to the high geographical concentration of firms that are aimed only at exporting abroad. This agglomeration of exporting firms could support Tunisian economic growth, since the massive production in the export manufacturing sector generates economies of scale that reduces production costs and are transmitted throughout the economic system to increase the rate of growth. This international openness helps to attract foreign firms to agglomerate in this region, seeking to exploit this degree of openness and location advantage in terms of low production costs. Another interesting point of our results is that foreign and mixed plants show a strong tendency to agglomerate in Tunisia. Consequently, FDI contributes to the construction of the Tunisian industrial landscape and will be an important path for regional growth, since it serves as a key driver for the transfer of production technologies, skills, innovation capabilities and organizational and management practices to domestic firms.

Overall, we find that almost all the location patterns considered are characterized by a strong agglomeration at short and intermediate distances, while this spatial scale is equivalent to a distance between two neighbor plants in the delegations of the same governorate or two plants in two neighboring governorates. These strong geographical concentrations are caused by the high number of plants located in the Tunisian eastern littoral regions. These agglomerations can be explained by the fact that industries tend to localize primarily in an urban environment to benefit from the externalities of proximity to the local markets, the means of transport and also the city center. In addition, public policies explicitly affect this spatial structuring through the development of several industrial zones in eastern coastal delegations as well as the provision of a suitable infrastructure. Indeed, firms avoid locating in the interior and southern regions on account of its structural deficiencies, despite all the efforts of the government to encourage firms to locate in this region. In contrast, the supply of industrial land in eastern coastal delegations will be saturated in the coming years, therefore, public policies should automatically reinforce the territorial development strategy in favor of the interior and southern areas.

However, while the Tunisian eastern littoral is considered as a manufacturing force, it also suffers from a spatial imbalance between its delegations. The tendency to agglomerate in the same geographical area creates deep disparities between some coastal delegations and all the rest of Tunisia. Interestingly, Amara (2009) also has shown the metropolis of Grand Tunis exhibits a manufacturing imbalance between its delegations. Therefore, Tunisia not only suffers from a structural imbalance between the governorates, but also between the delegations of the same governorate or the same region and even the most developed governorates. Tunisia is then facing a challenge to reduce the imbalance between the governorates. The Investment Code of Tunisia gives priority to the least developed areas for the regional development program. This structural

imbalance also is found among the governments considered as the most developed. To this end, industrial policy and regional development actions should be analyzed at the level of a very small spatial scale in order to correctly show this imbalance and to be able to reduce regional disparities, avoiding the aggregation of the regional specificities. Further analysis can include an econometric analysis at the firm-level on the (co)-location decisions of industrial firms, focusing on tangible factors and on intangible network dimensions (Ellison et al. 2010; Jacobs et al. 2013) to further inform the possible heterogeneity of these determinants at the individual and the sectoral levels, in the spirit of Faggio et al. (2017) and Diodato et al. (2018) and hence to help designing public policies that could be applied to reduce these disparities.

1.8. Appendix 1

Table 1.18: Branches of diverse industry

<p>1. Branch of pulp, paper and paperboard</p> <ul style="list-style-type: none"> • Manufacture of pulp and paperboard and cellulose wadding. • Paper and paperboard processing: packaging items, school and office supplies, sanitary and household items, wallpapers, molded articles and other technical items (filters, dielectric insulators). • Graphic arts and publishing: printing press, work, binding and finishing. 	<p>2. Miscellaneous Branch</p> <ul style="list-style-type: none"> • Chandeliers, watchmaking, eyewear, novelty jewelery. • Brushing, paint brushing, making musical instruments, pencils and abrasive and polishing products. • Reproduction of sound, video and computer recordings. • Recycling and retrieval of non-metallic materials.
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Table 1.19: Size distribution of industry at the sectoral level

Size of plants	IAA		IMCCV		IMM		IEE	
	Number	%	Number	%	Number	%	Number	%
[10-20]	554	50,27	177	42,34	264	40,87	72	20,81
[21-50]	237	21,51	112	26,79	194	30,03	73	21,1
[51-100]	135	12,25	63	15,07	89	13,78	70	20,23
[101-200]	96	8,71	35	8,37	50	7,74	49	14,16
[201-500]	62	5,63	21	5,02	36	5,57	46	13,29
[501-1000]	13	1,18	10	2,39	9	1,39	15	4,34
[1001-5000]	5	0,45	0	0	4	0,62	20	5,78
> 5000	0	0	0	0	0	0	1	0,29
Total	1102	100	418	100	646	100	346	100

IAA: Agro-food industry

IMCCV: Building materials, ceramics and glass industry

IMM: Mechanical and metallurgical industry

IEE: Electrical, electronics and appliance industry

Table 1.20: Size distribution of industry at the sectoral level (continued)

Size of plants	ICH		ITH		IBLA		ICC		ID	
	Number	%	Number	%	Number	%	Number	%	Number	%
[10-20]	195	34,03	251	15,77	85	43,59	45	18,6	109	37,46
[21-50]	193	33,68	476	29,9	71	36,41	91	37,6	94	32,3
[51-100]	86	15,01	428	26,88	23	11,79	51	21,07	43	14,78
[101-200]	48	8,38	275	17,27	7	3,59	30	12,4	26	8,93
[201-500]	39	6,81	136	8,54	7	3,59	13	5,37	14	4,81
[501-1000]	8	1,4	19	1,19	2	1,03	11	4,55	3	1,03
[1001-5000]	3	0,52	7	0,44	0	0	1	0,41	2	0,69
> 5000	1	0,17	0	0	0	0	0	0	0	0
Total	573	100	1592	100	195	100	242	100	291	100

ICH: Chemical industry

ITH: Textile and clothing industry

ICC: Leather and footwear industry

IBLA: Wood, cork and furniture industry

ID: Diverse industr

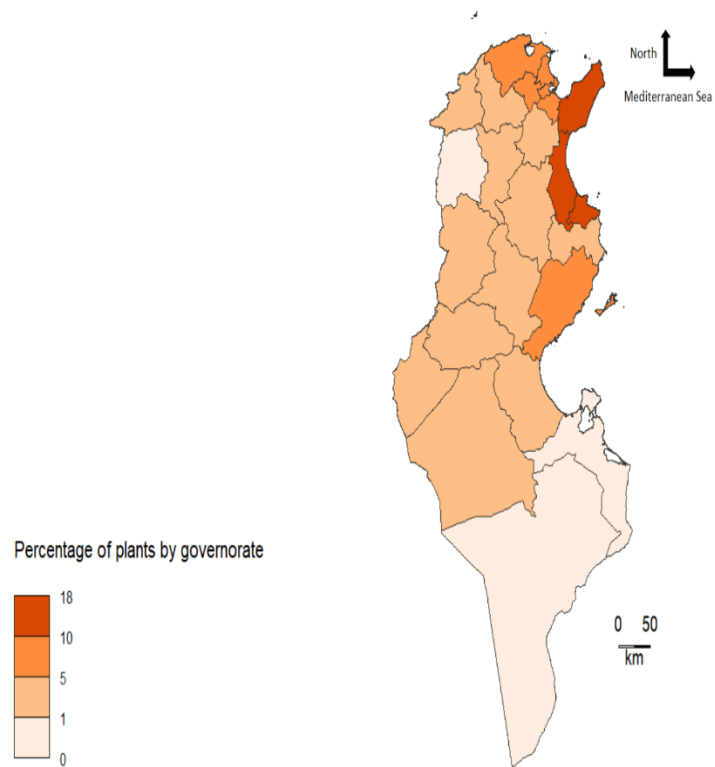


Figure 1.22: Spatial distribution of totally exporting plants by governorate

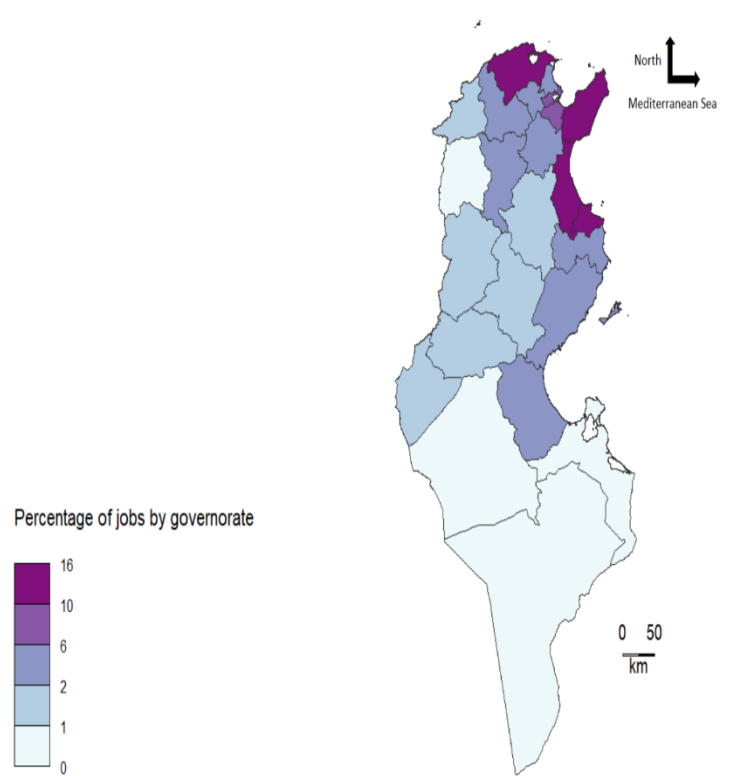


Figure 1.23: Spatial distribution of totally exporting plants jobs by governorate

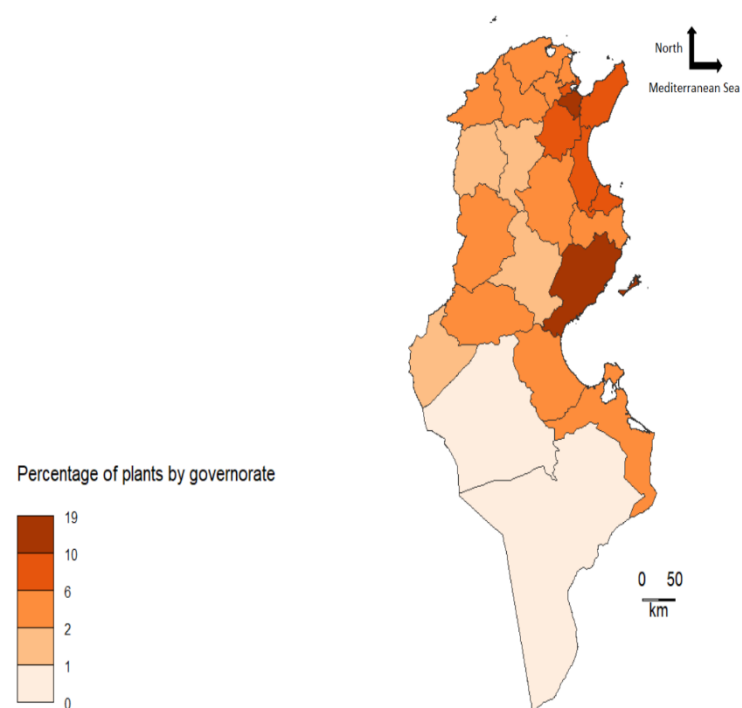


Figure 1.24: Spatial distribution of partially exporting plants by governorate

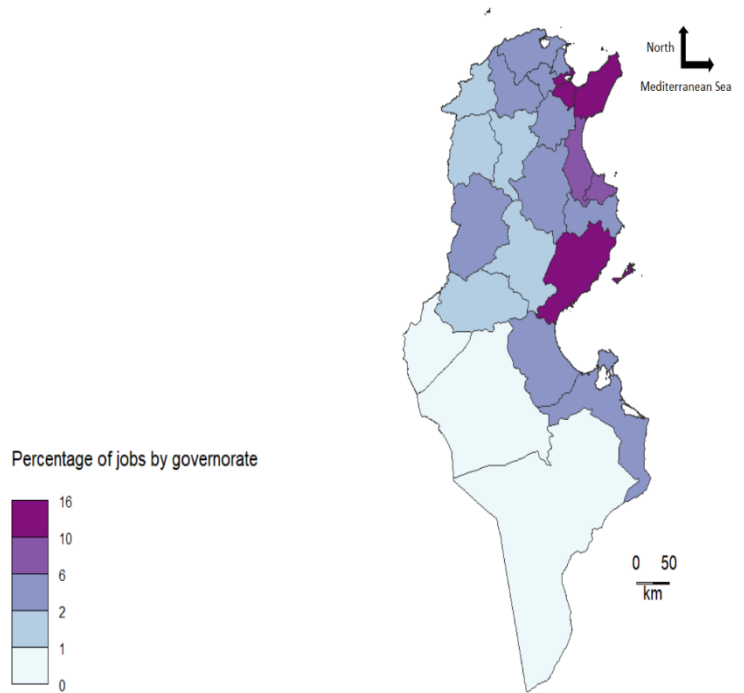


Figure 1.25: Spatial distribution of partially exporting plants jobs by governorate

Source: authors based on data provided by Website of the Agency for the Promotion of Industry and Innovation (2018)

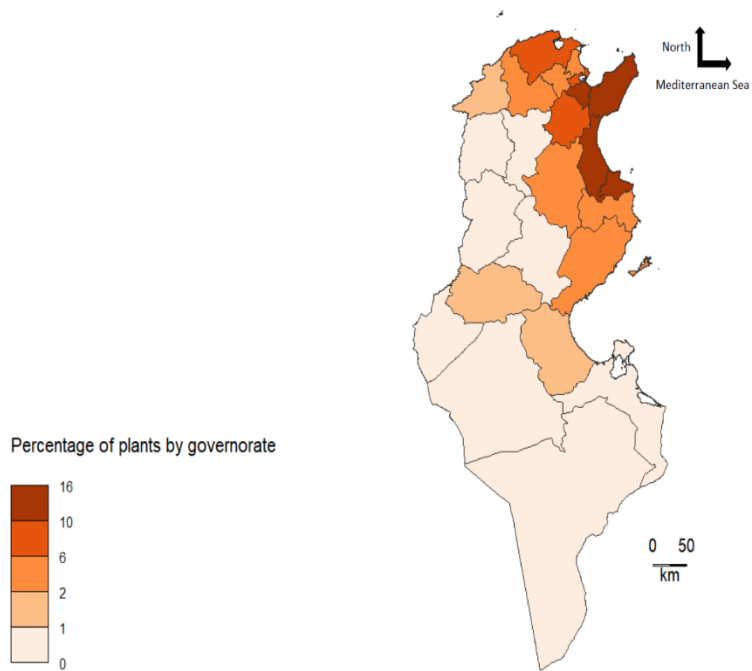


Figure 1.26: Spatial distribution of mixed and foreign plants by governorate

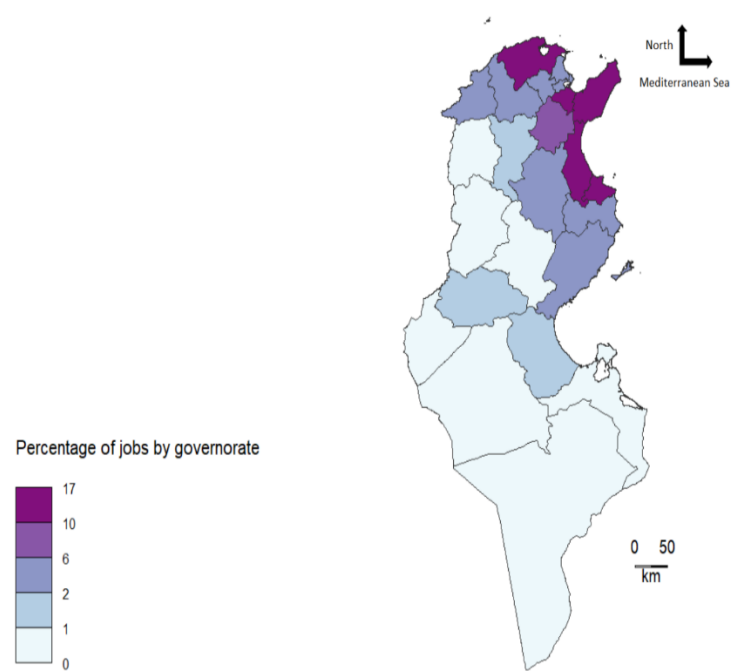


Figure 1.27: Spatial distribution of mixed and foreign plants jobs by governorate

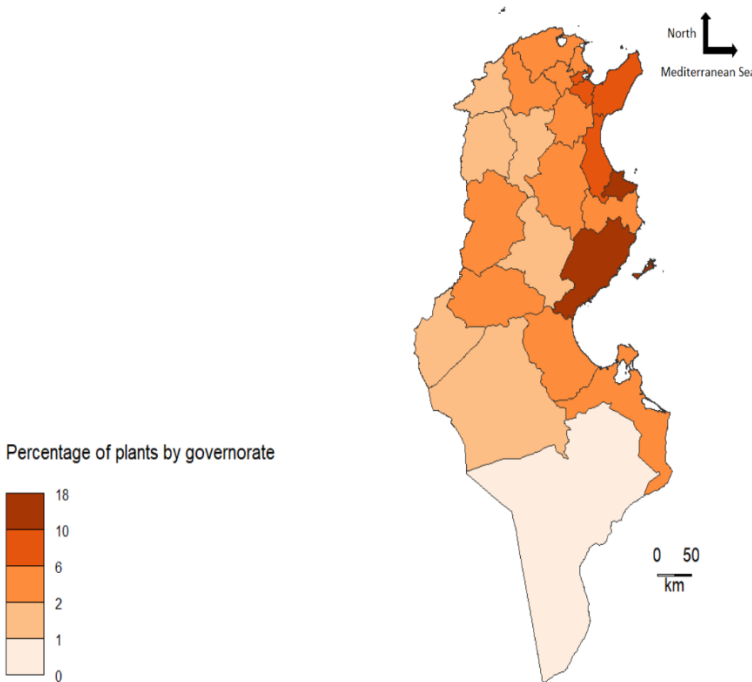


Figure 1.28: Spatial distribution of domestic plants by governorate

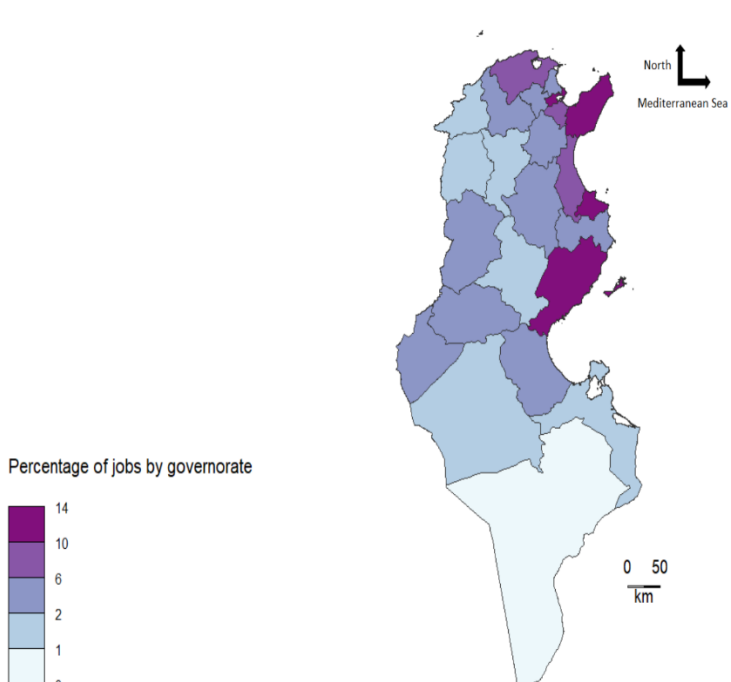
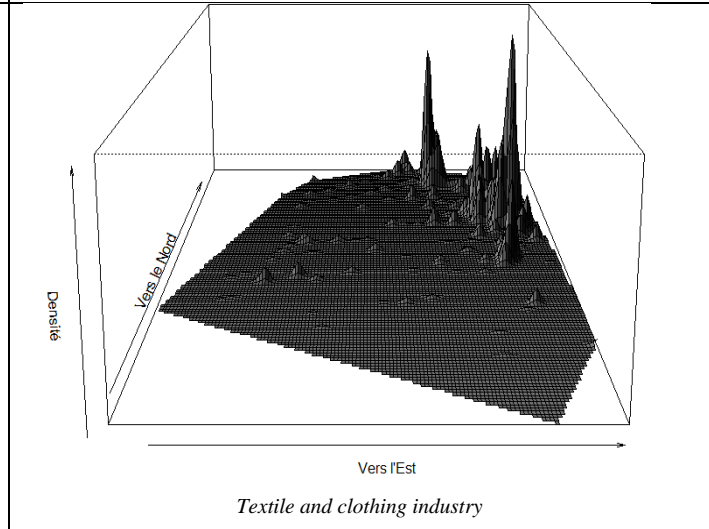
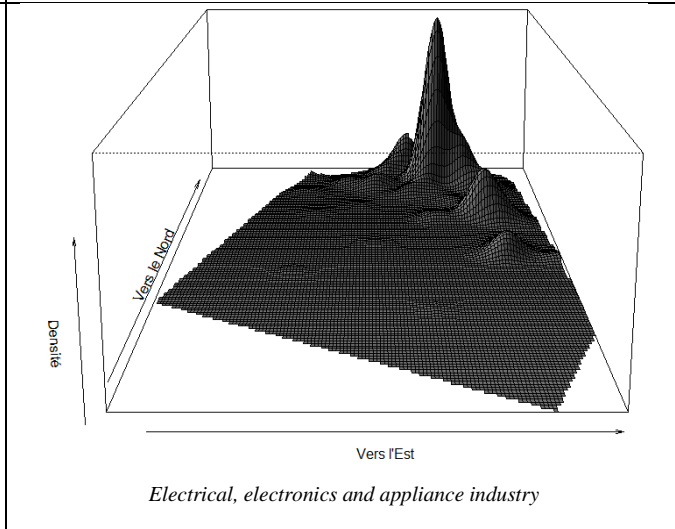
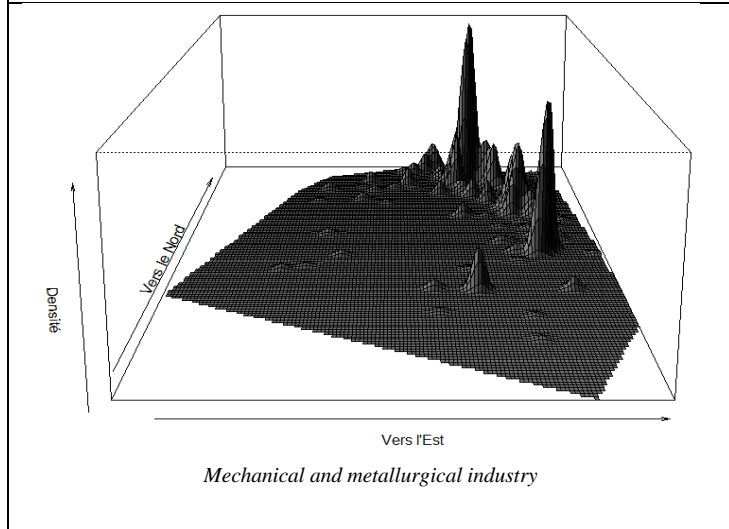
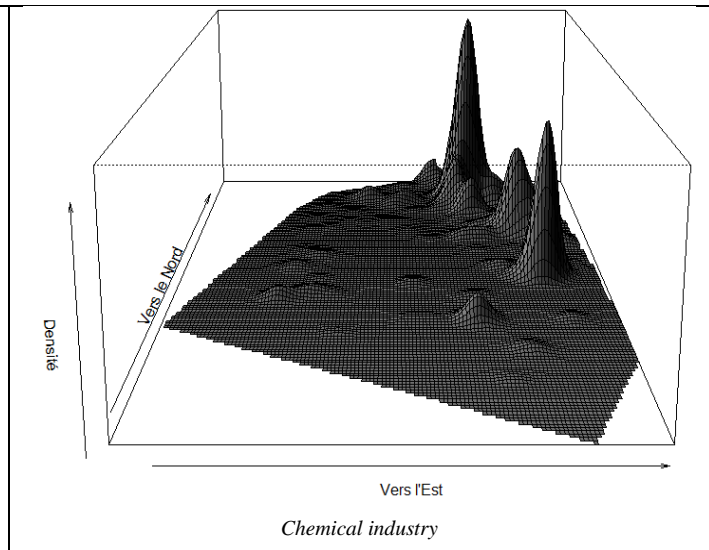
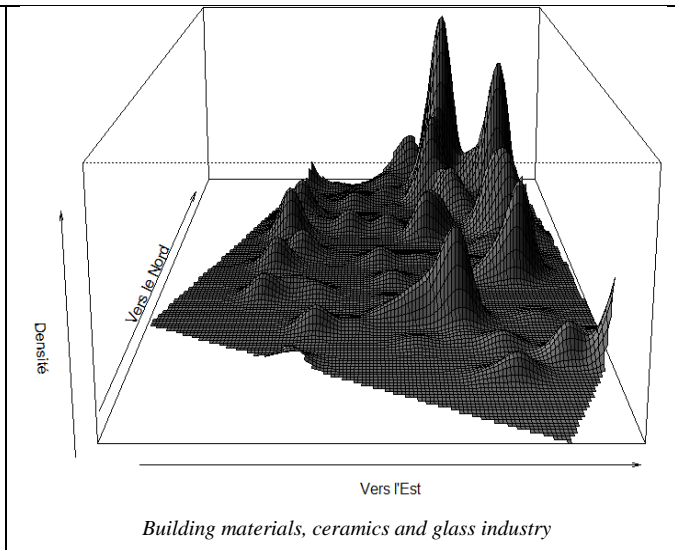
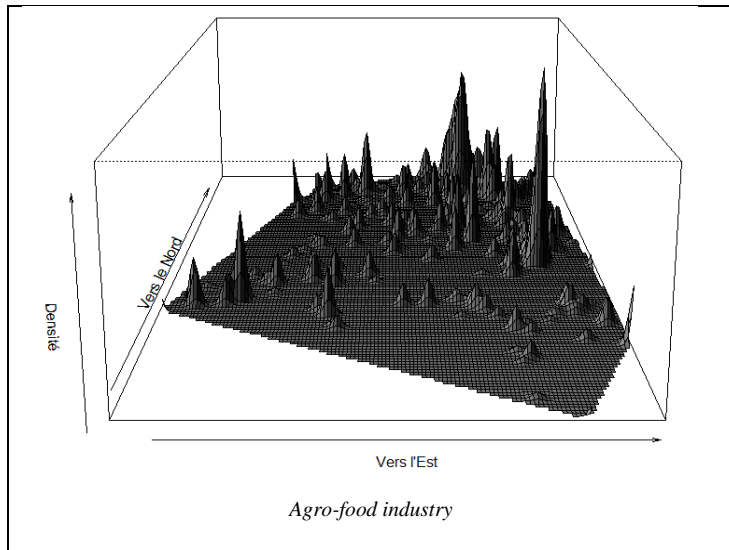


Figure 1.29: Spatial distribution of domestic plants jobs by governorate

Source: authors based on data provided by Website of the Agency for the Promotion of Industry and Innovation (2018)



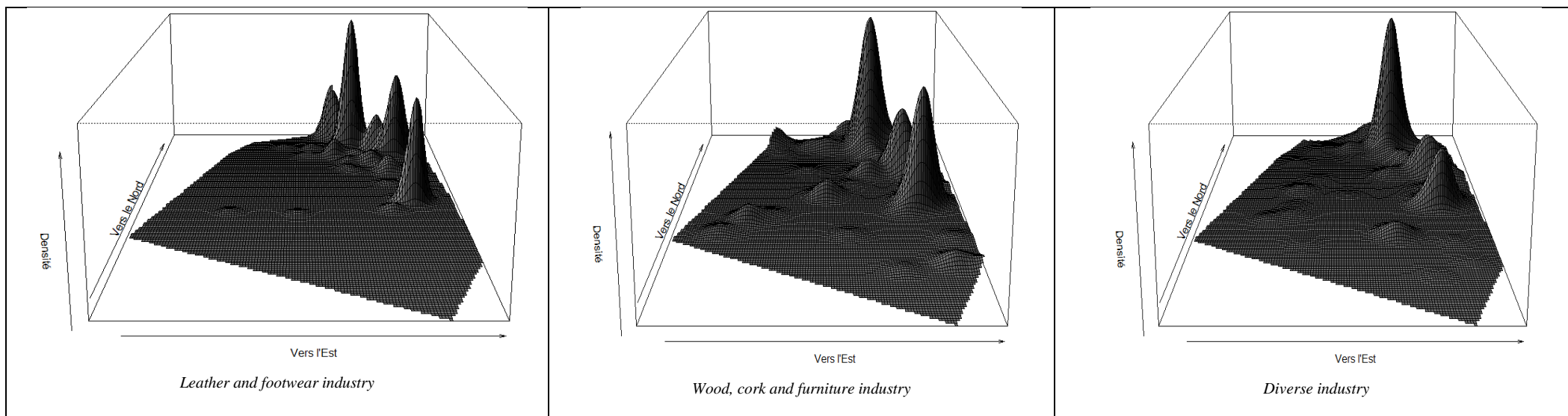


Figure 1.30: Kernel intensity for point patterns at a sectoral level (Figures)

Box 1: Topographic concentration: Diggle and Chetwynd (1991)'s function

We calculate Diggle and Chetwynd (1991)'s measure: D function and compare the results with those obtained with Duranton and Overman (2005)'s measure. Recall that the D function is used to detect the topographic concentration: it indicates whether an industry has a high density related to all industries in heterogeneous space. This function shows the density level of an industry in specific area, whereas the k_d function computes the pairing of neighbors around each point in chosen sector. Diggle and Chetwynd (1991)'s function cannot therefore not be weighted and is generated by point processes, in which each establishment is represented by a point, without weight.

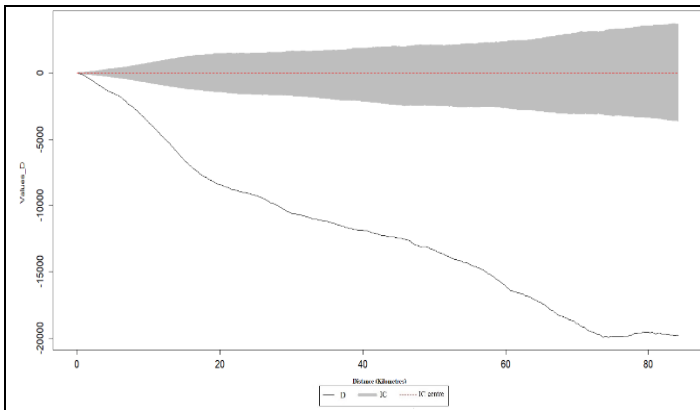
To overcome this disadvantage, we focus only on the distribution of plants in each industry, using the unweighted k_d function and D -function in order to compare between their results and to identify the most localized industries detected by these two functions in Tunisia. Moreover, D -function only detects the concentration or dispersion of a reference sector and its values are not quantifiable (Marcon and Puech, 2003). Therefore, if the result is more than zero, a topographic concentration is detected, otherwise a geographical dispersion is detected, if the result is less than zero. The spatial patterns found by this function are illustrated in the following Figure 1.31.

Since the concentration detected by the D function is not quantifiable and is only detected by comparing the values found with zero, our comparison is based only on the spatial patterns of these two functions.

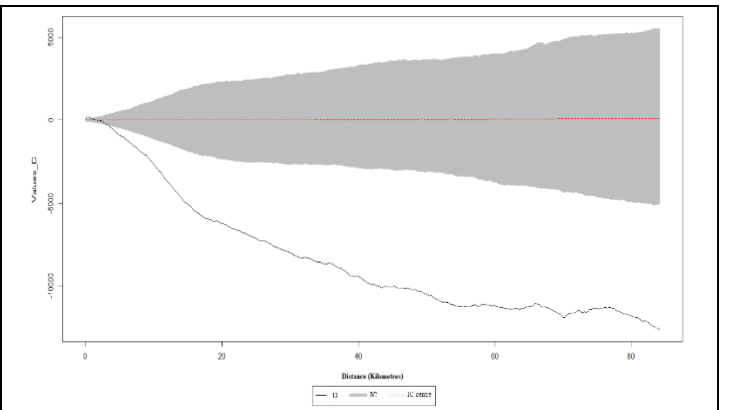
Recall that the absolute concentrations are detected at an intermediate distance (up to 86 km) for leather and footwear industry, chemical industry, mechanical and metallurgical industry and textile and clothing industry. On the contrary, with the D function, the topographic concentration of these sectors is detected all along the distance, in fact, the curve of D function does not move within the confidence interval and all values are more than zero.

Moreover, this functions shows a geographical dispersion throughout distance for the agro-food industry and building materials, ceramics and glass industry. Only the wood, cork and furniture industry displays topographic concentration at a relatively short distance as found by the k_d function, this result confirms that this industry is geographically concentrated at a short distance which is limited to a small number of delegations.

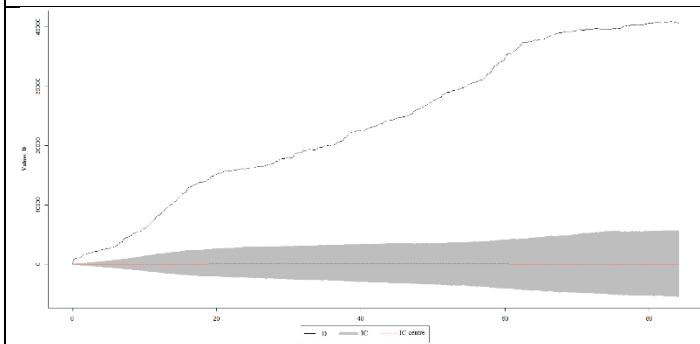
Our study shows that the evaluation by the D function supports the results of the k_d function. Geographical concentrations are detected for the same industries by these two functions, although they show different significant distances.



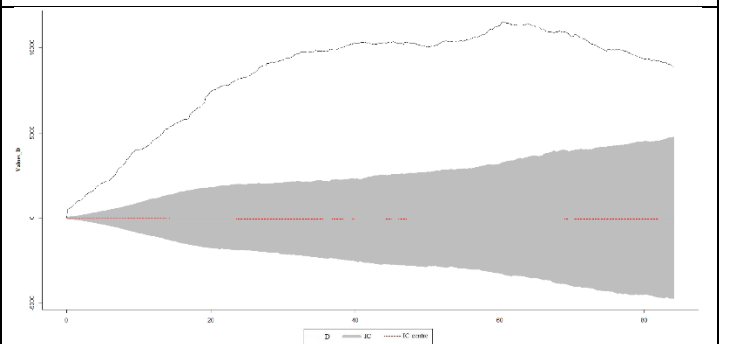
Agro-food industry



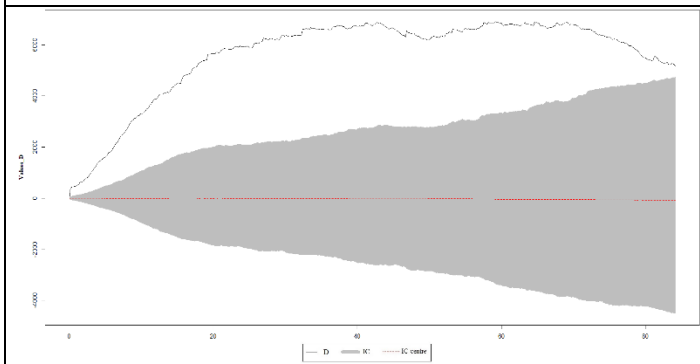
Building materials, ceramics and glass industry



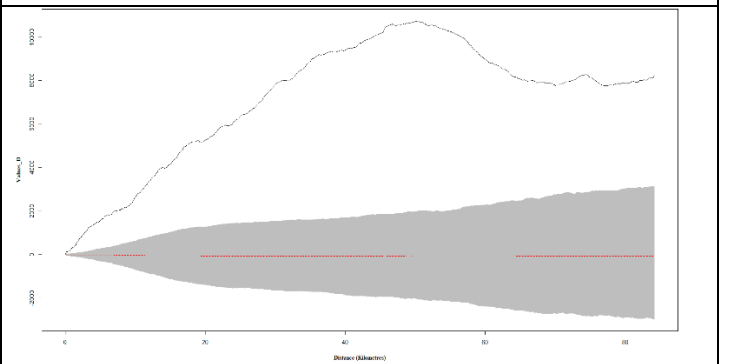
Electrical, electronics and appliance industry



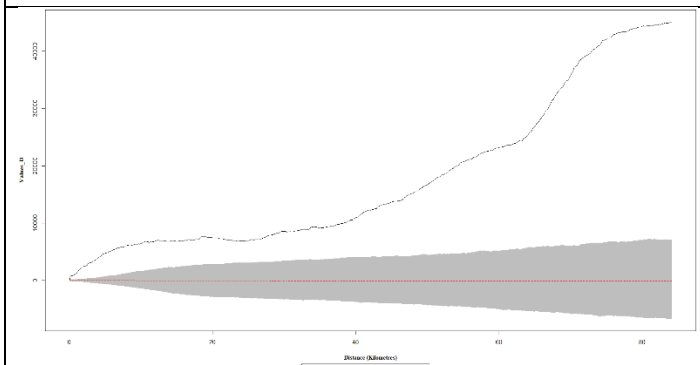
Mechanical and metallurgical industry



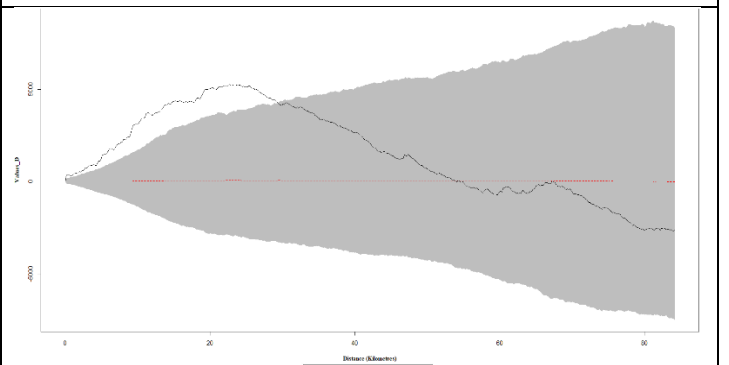
Chemical industry



Textile and clothing industry



Leather and footwear industry



Wood, cork and furniture industry

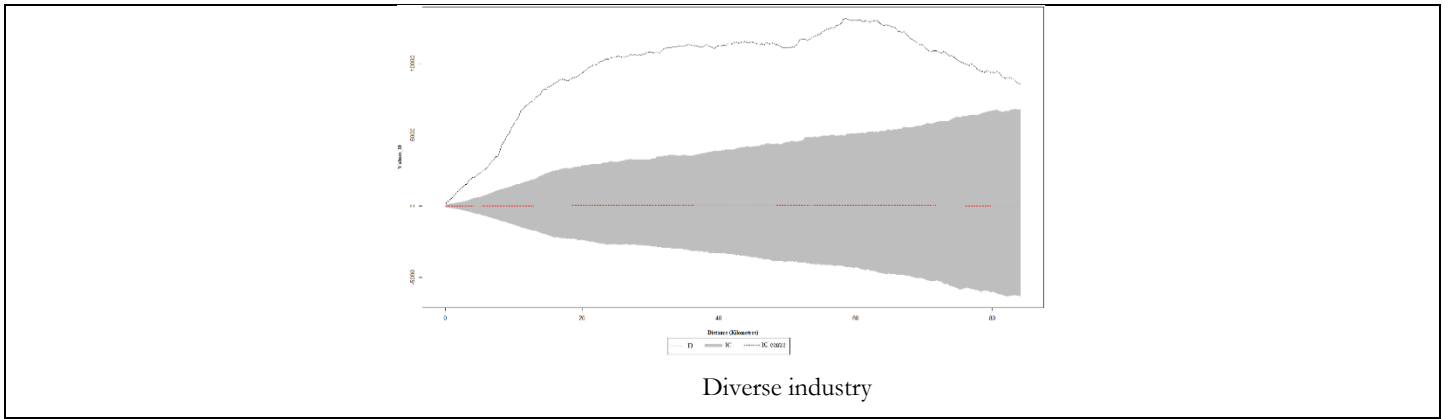
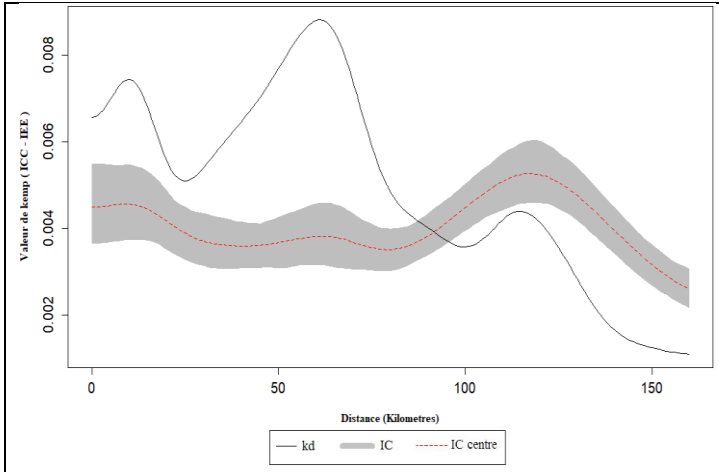
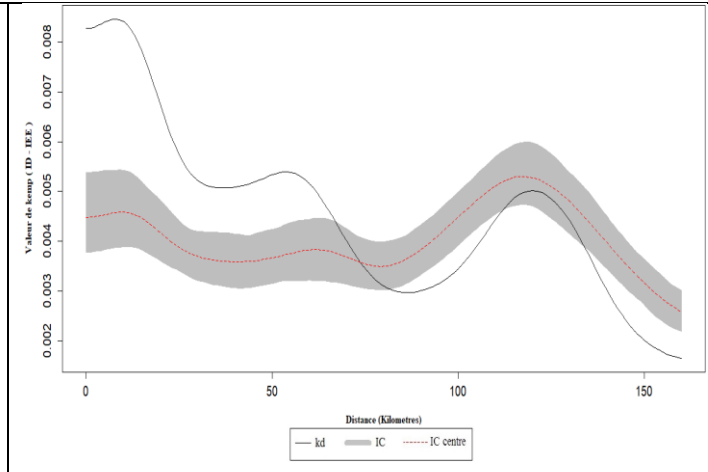


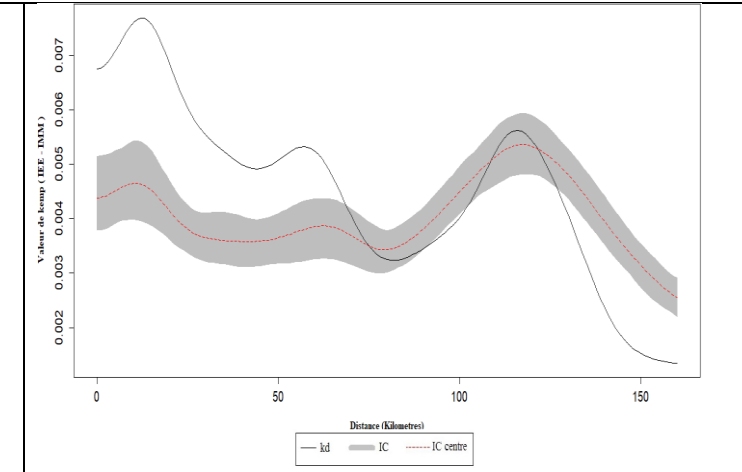
Figure 1.31: Results of topographic concentration (Figures)



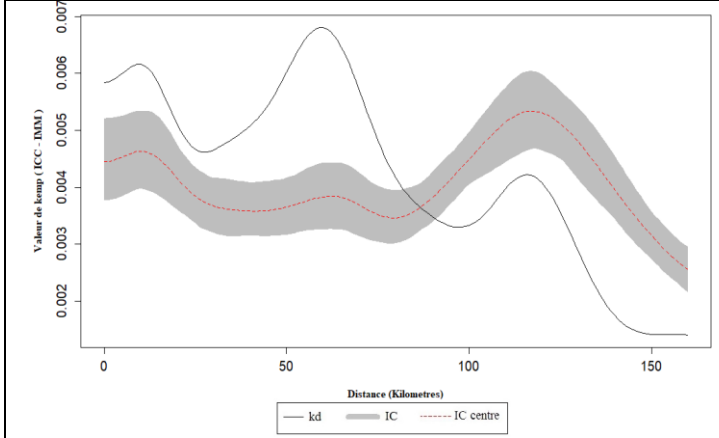
Electrical, electronics and appliance industry - Leather and footwear industry



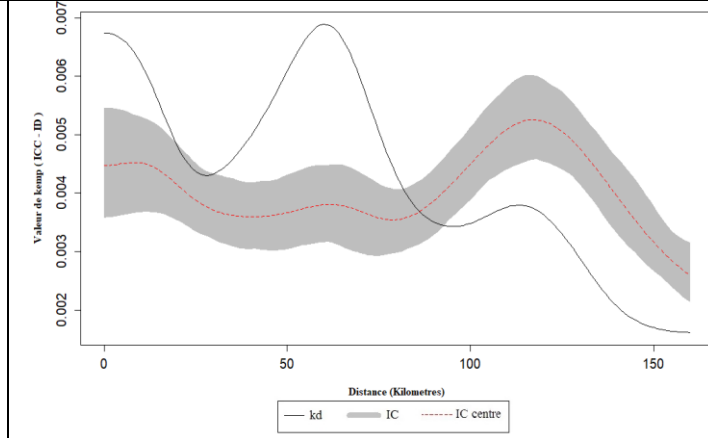
Electrical, electronics and appliance industry - Diverse industry



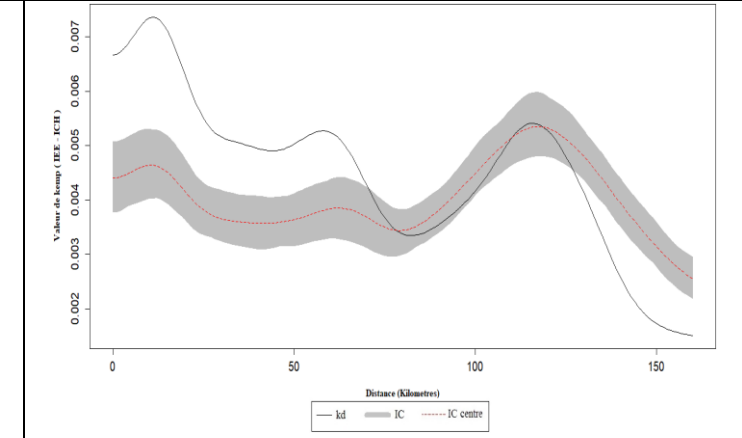
Electrical, electronics and appliance industry - Mechanical and metallurgical industry



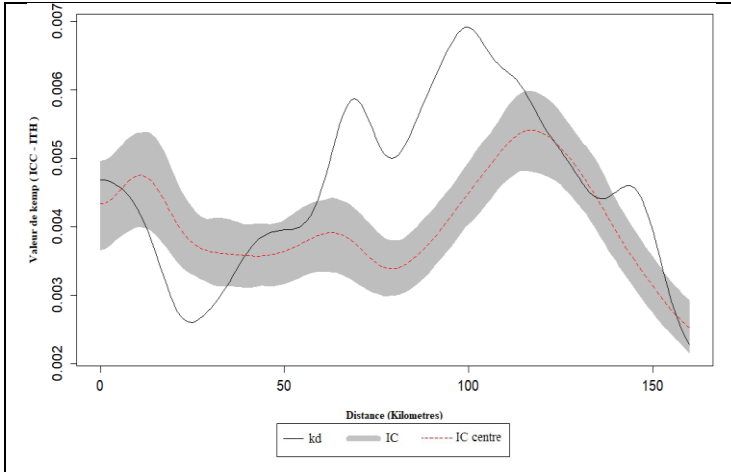
Leather and footwear industry - Mechanical and metallurgical industry



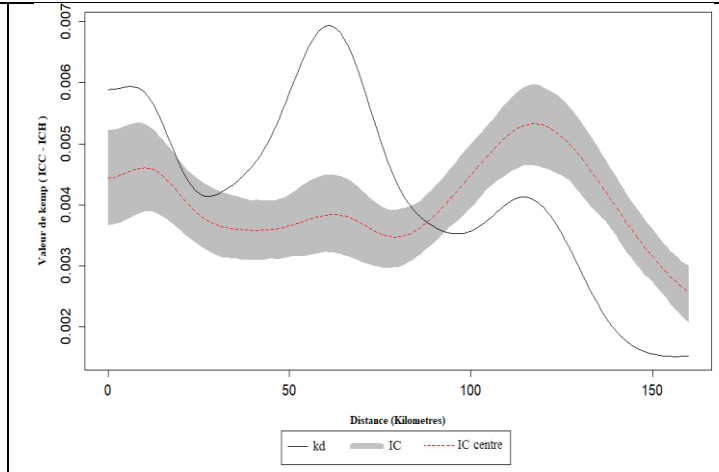
Leather and footwear industry - Diverse industry



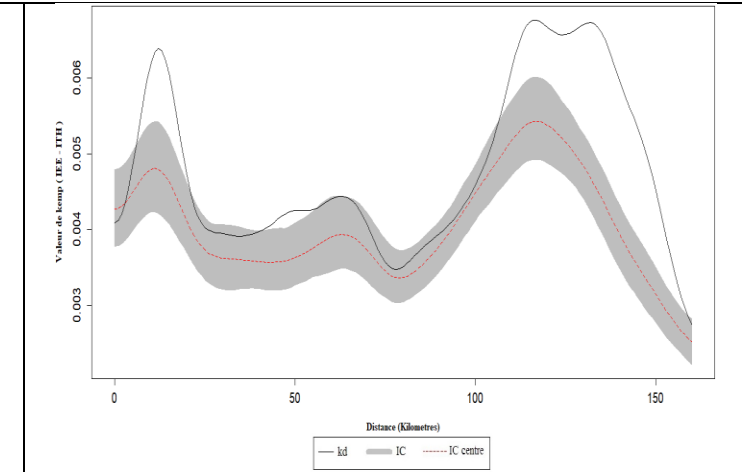
Electrical, electronics and appliance industry - Chemical industry



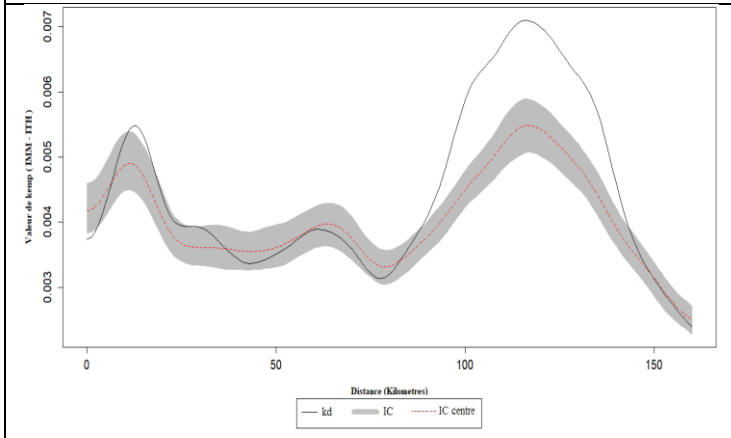
Leather and footwear industry - Textile and clothing industry



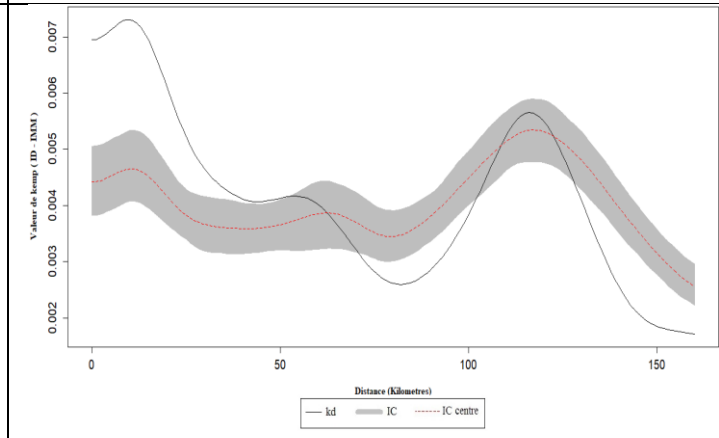
Leather and footwear industry - Chemical industry



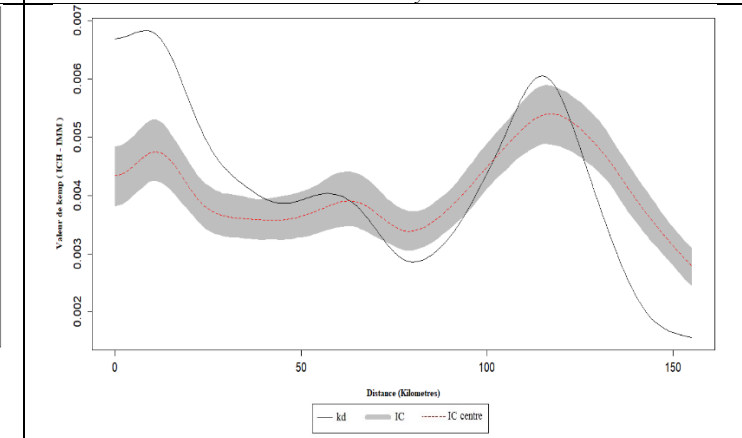
Electrical, electronics and appliance industry - Textile and clothing industry



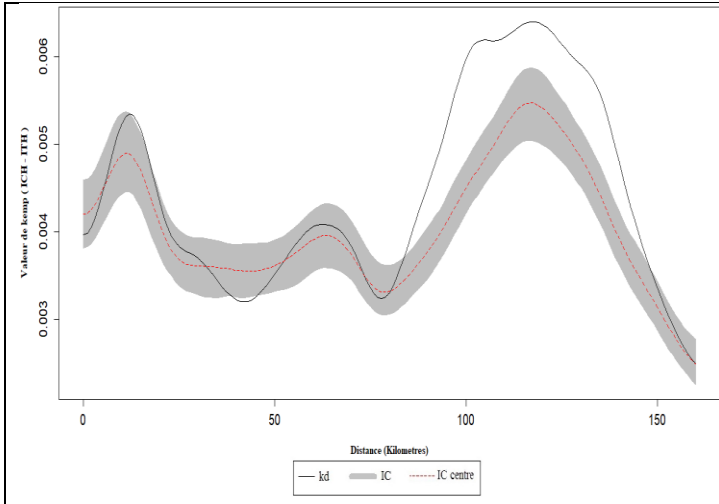
Mechanical and metallurgical industry - Textile and clothing industry



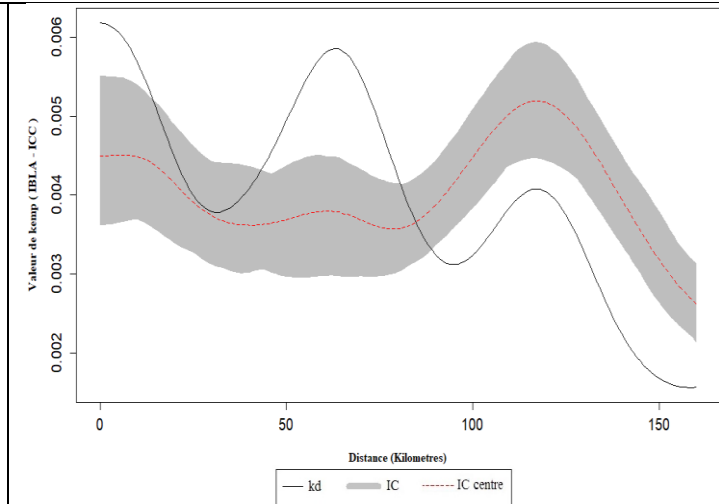
Diverse industry - Mechanical and metallurgical industry



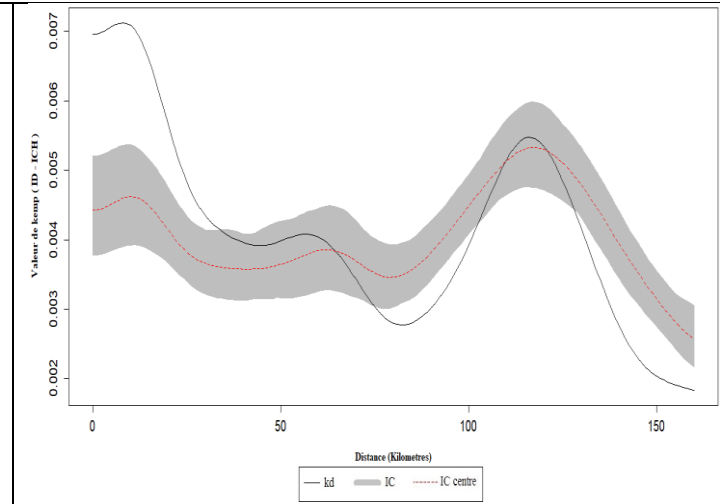
Chemical industry - Mechanical and metallurgical industry



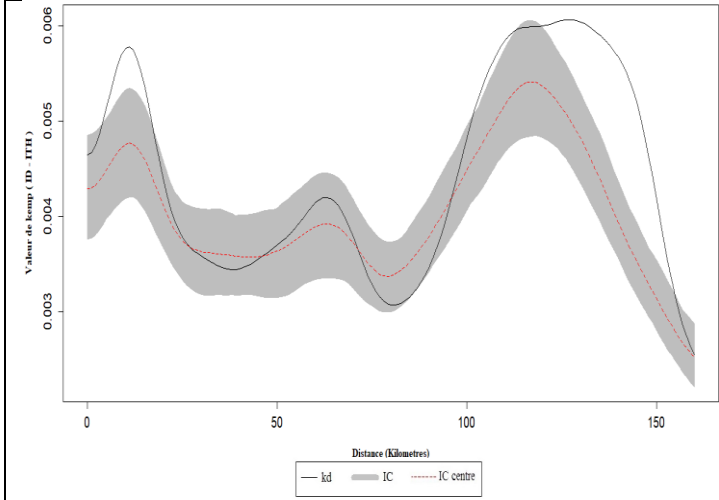
Chemical industry - Textile and clothing industry



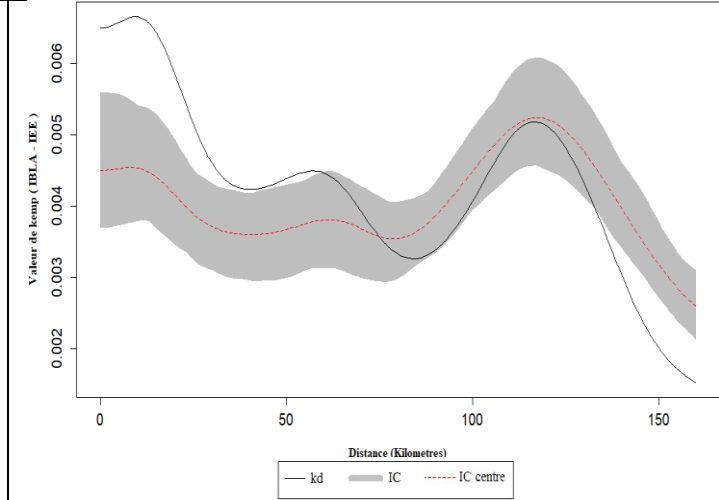
Wood, cork and furniture industry - Leather and footwear industry



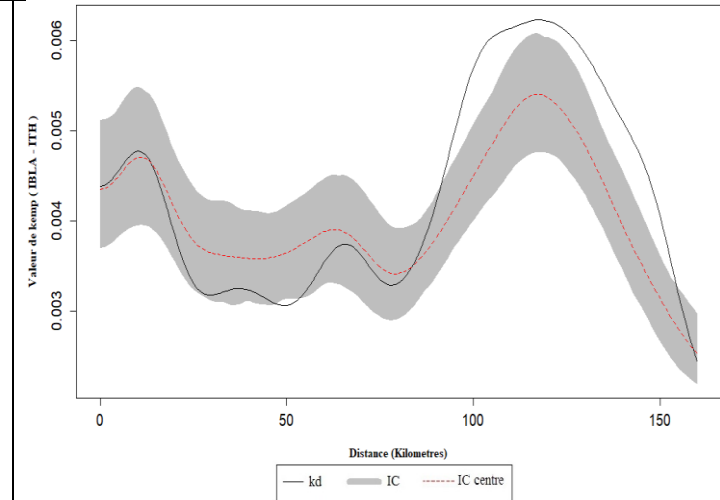
Diverse industry - Chemical industry



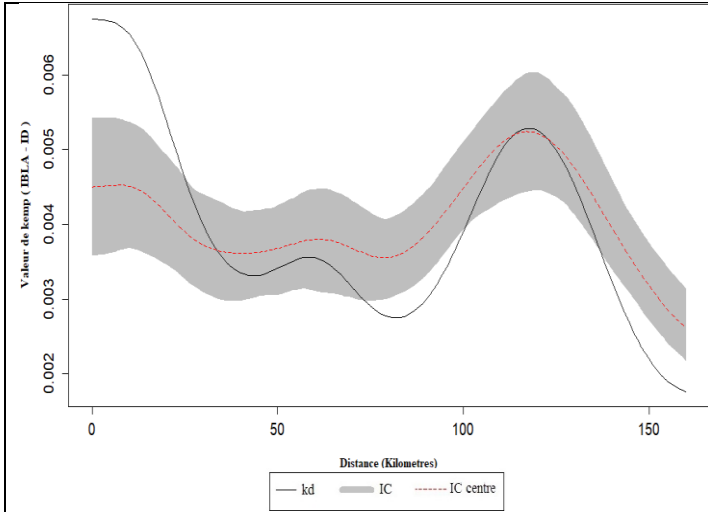
Diverse industry - Textile and clothing industry



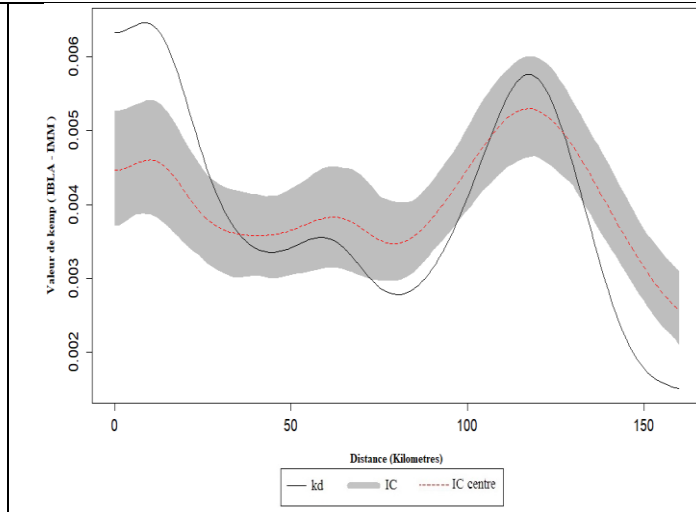
Wood, cork and furniture industry - Electrical, electronics and appliance industry



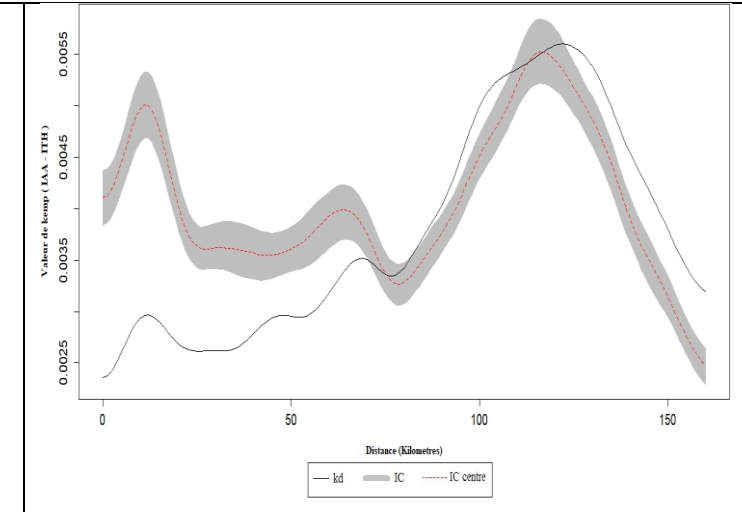
Wood, cork and furniture industry - Textile and clothing industry



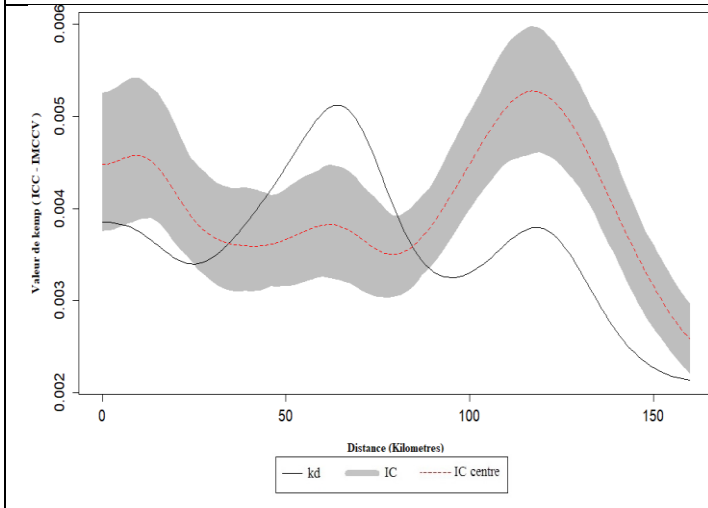
Wood, cork and furniture industry - Diverse industry



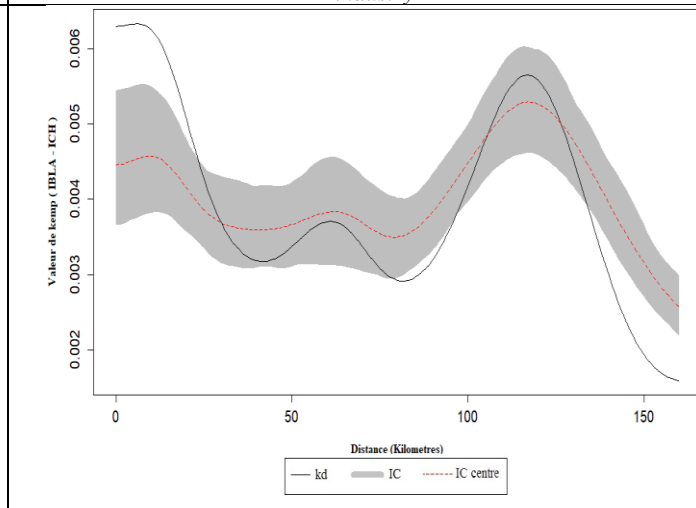
Wood, cork and furniture industry - Mechanical and metallurgical industry



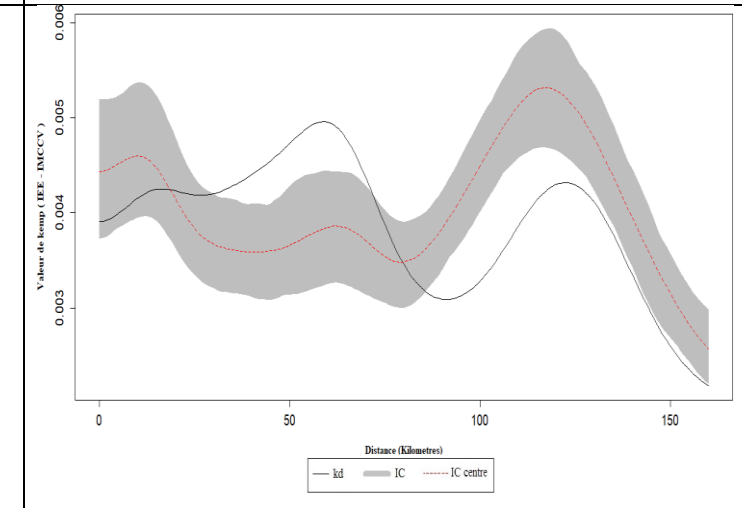
Agro-food industry - Textile and clothing industry



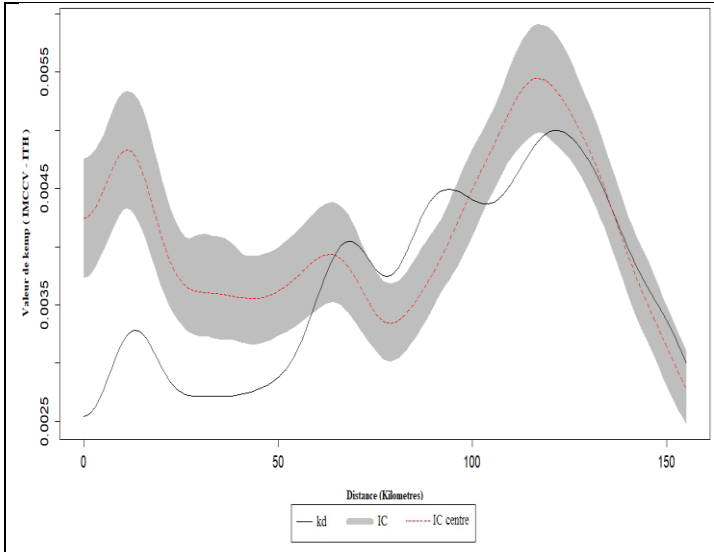
Leather and footwear industry - Building materials, ceramics and glass industry



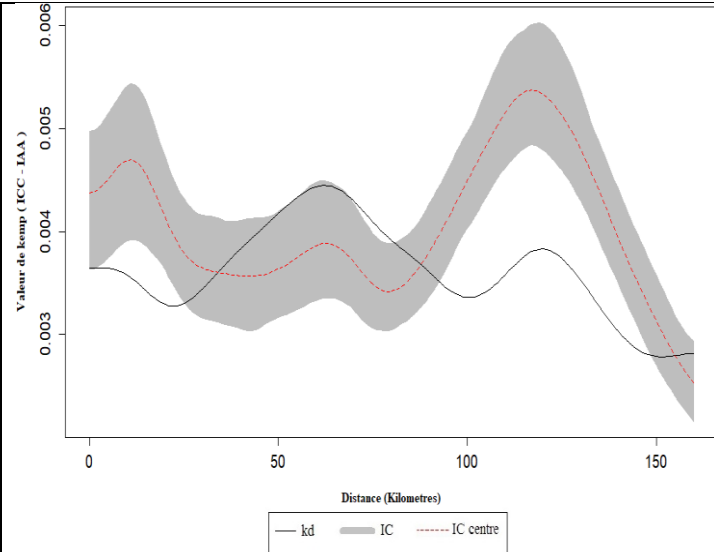
Wood, cork and furniture industry - Chemical industry



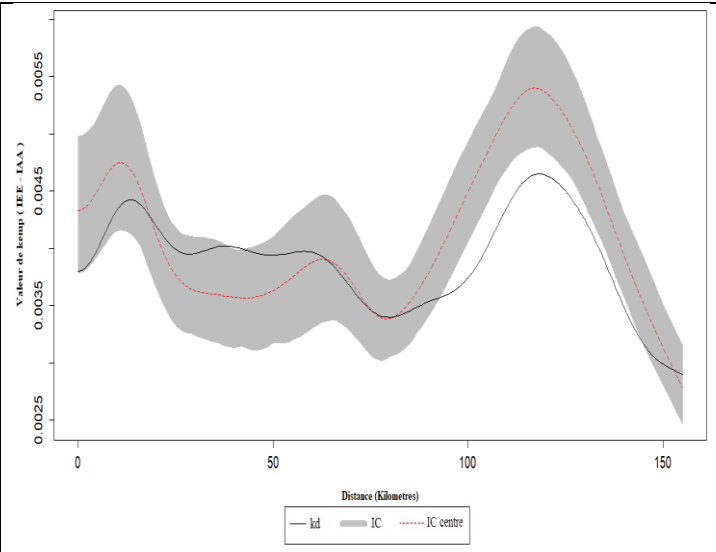
Electrical, electronics and appliance industry - Building materials, ceramics and glass industry



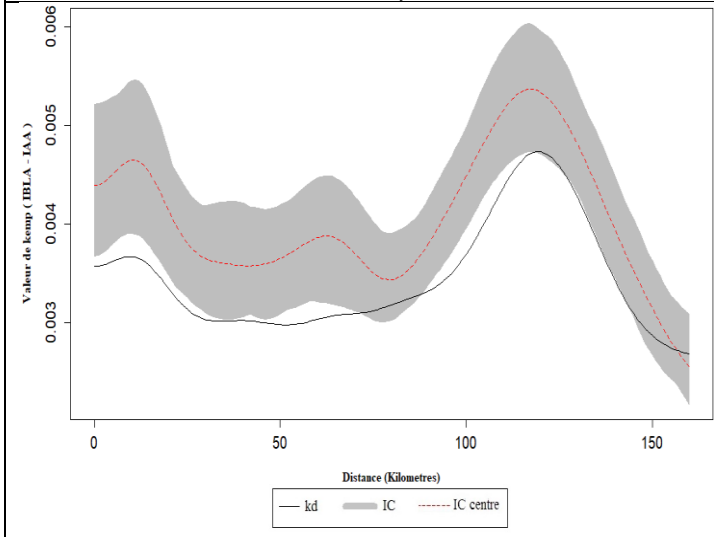
Building materials, ceramics and glass industry - Textile and clothing industry



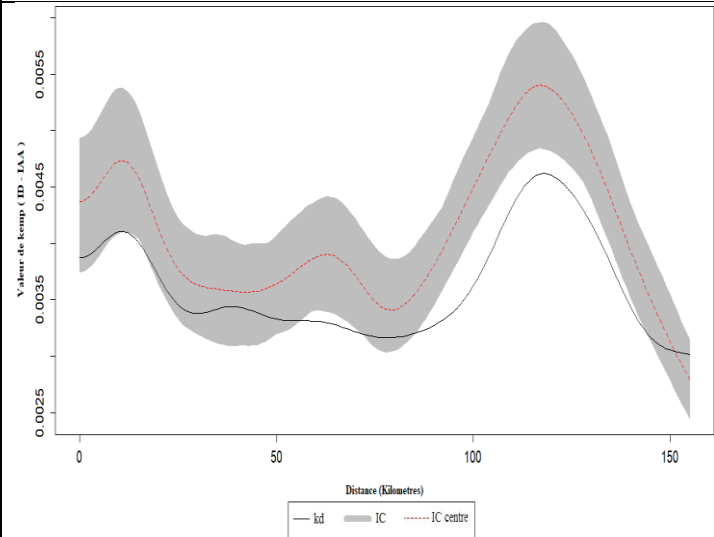
Leather and footwear industry - Agro-food industry



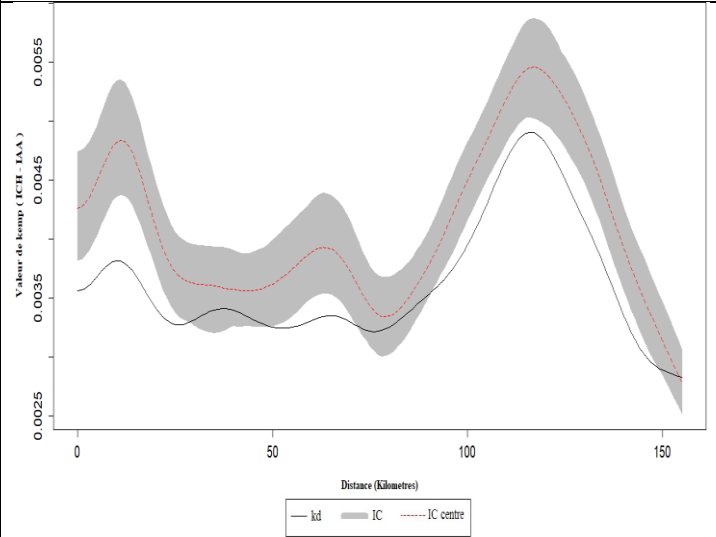
Agro-food industry - Electrical, electronics and appliance industry



Wood, cork and furniture industry - Agro-food industry



Diverse industry - Agro-food industry



Chemical industry - Agro-food industry

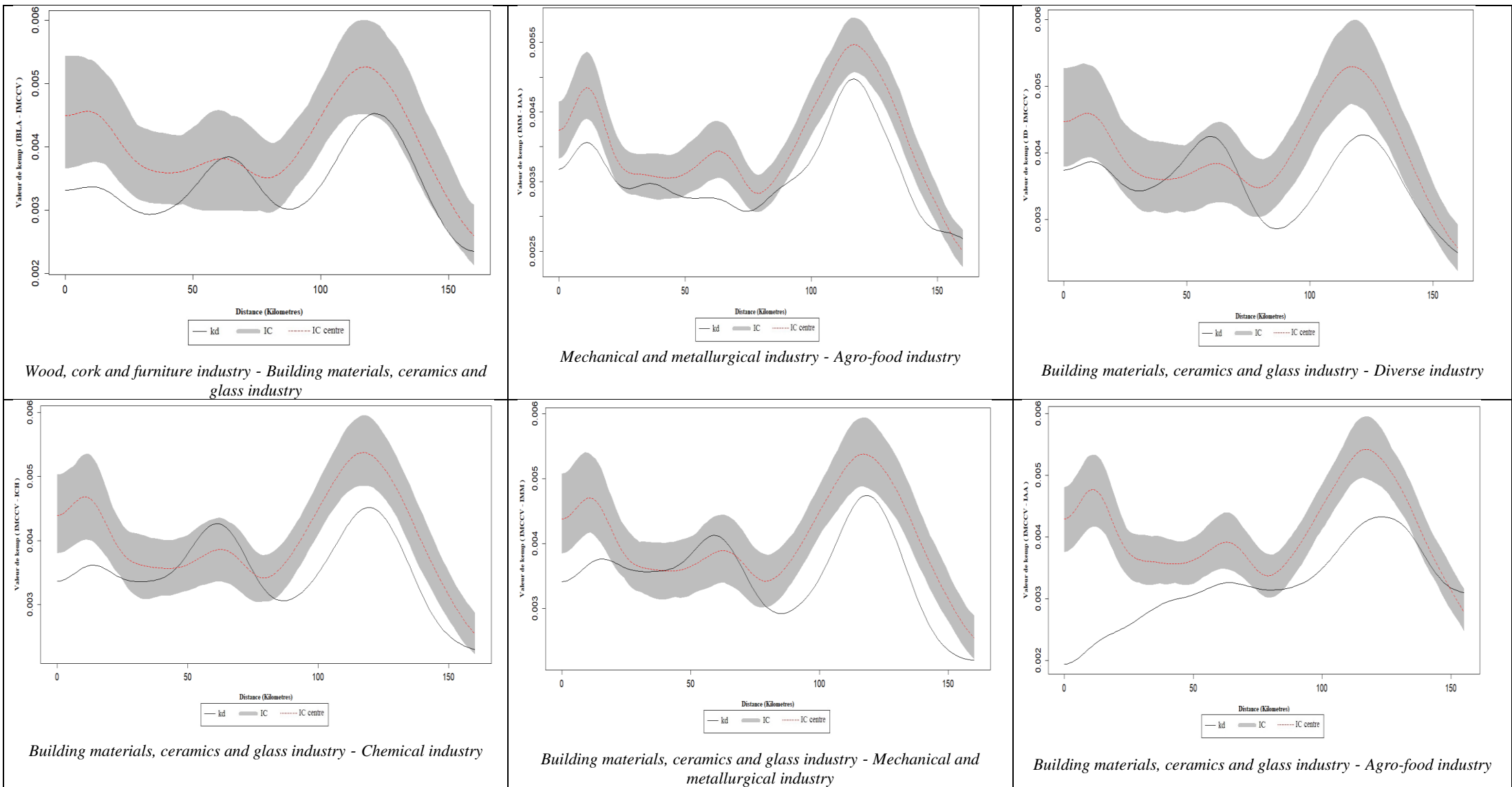
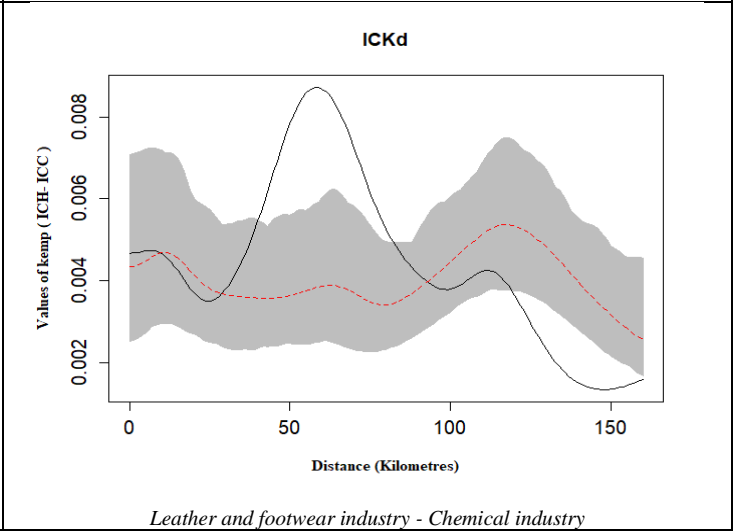
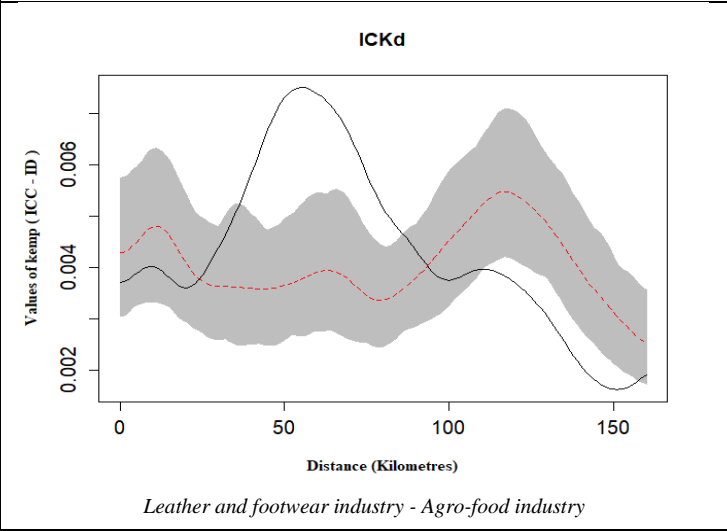
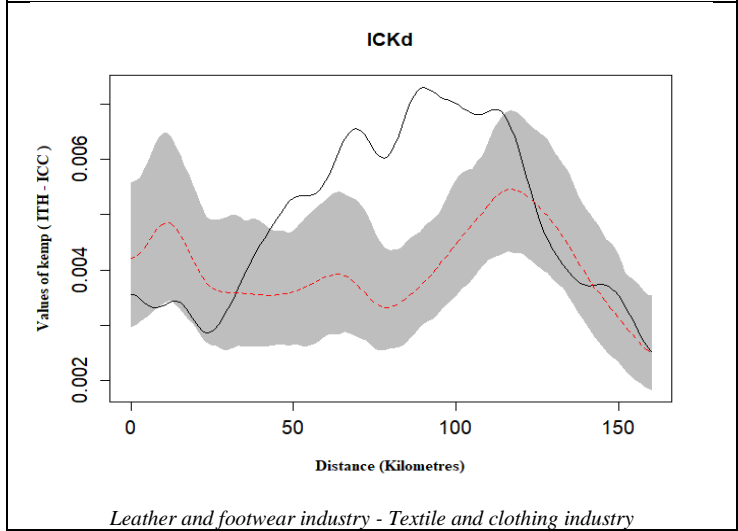
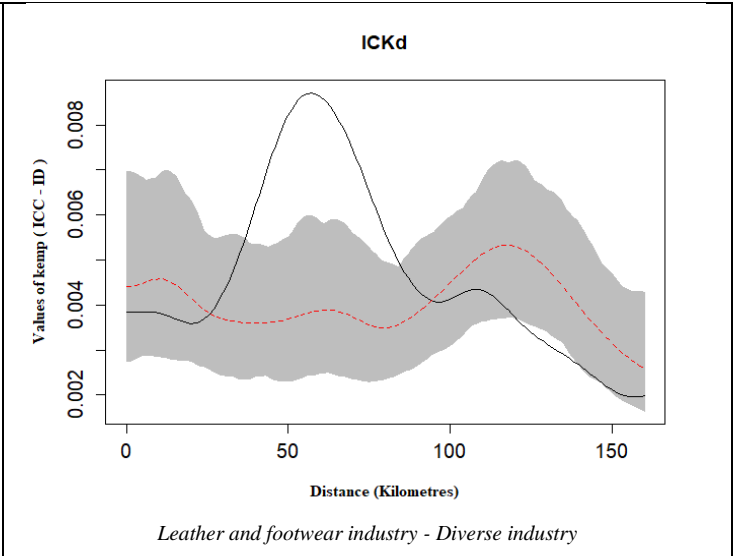
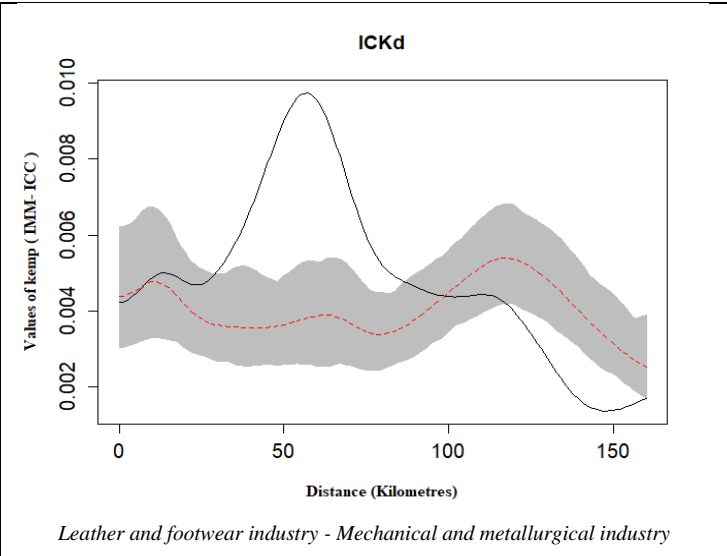
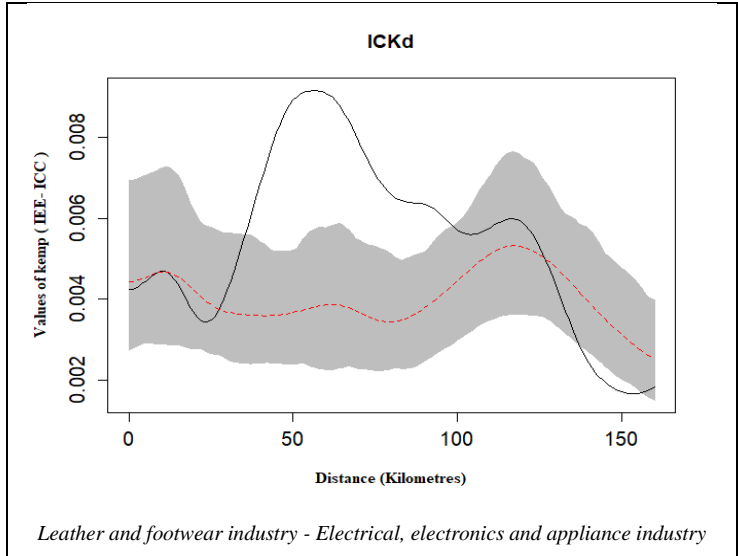
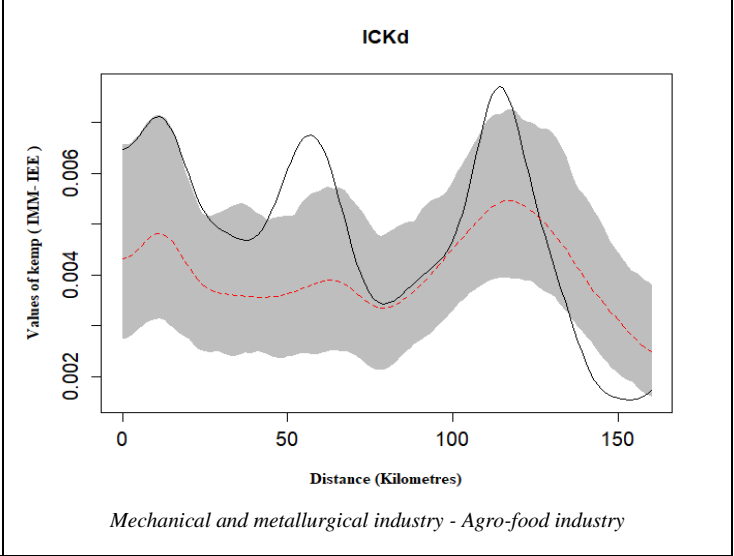
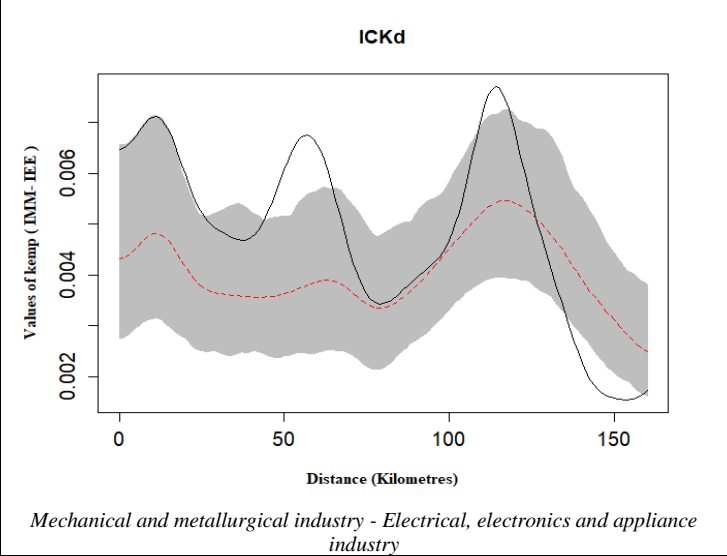
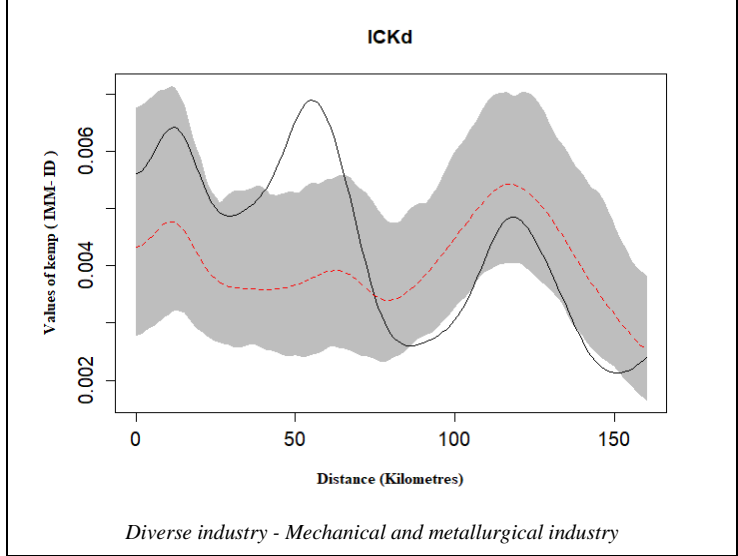
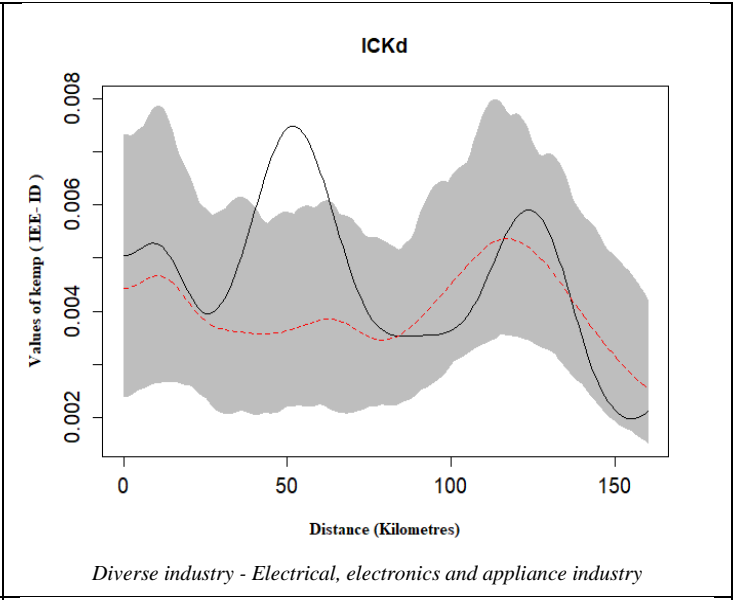
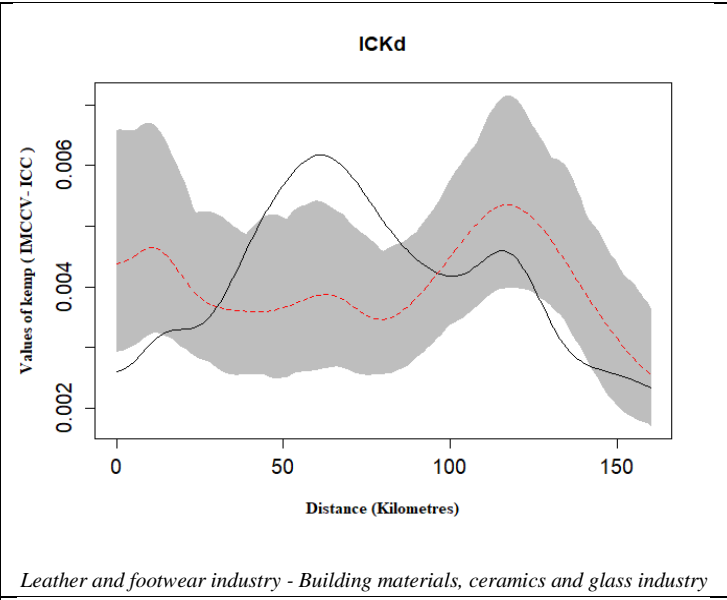
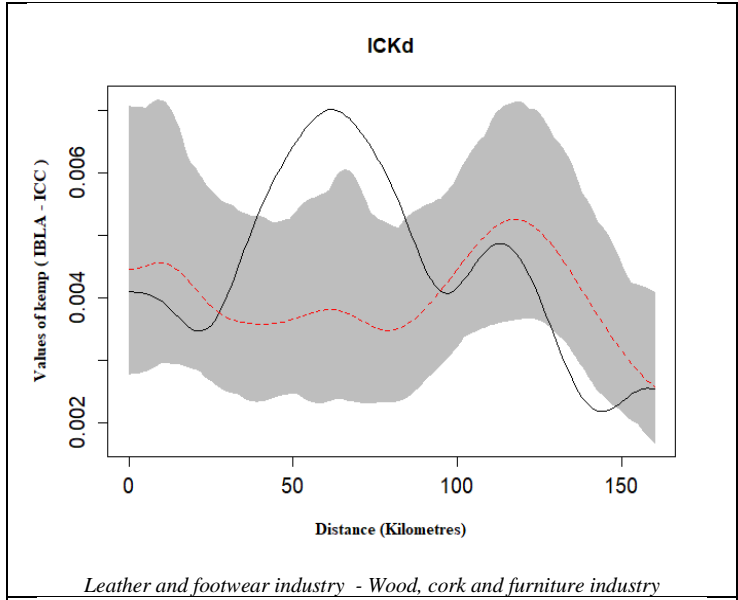
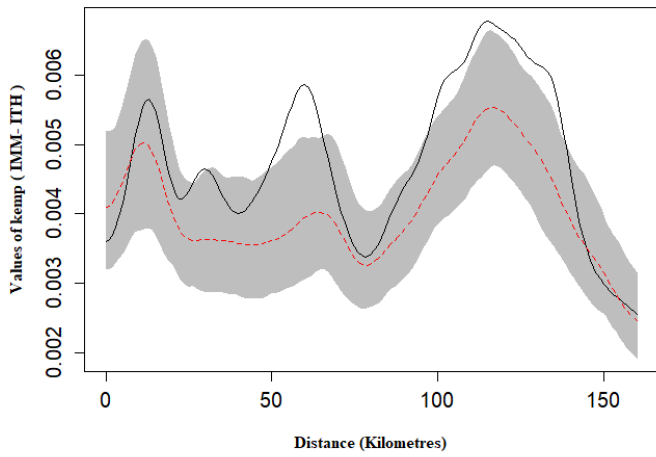


Figure 1.32: Results of the k_d function for co-agglomeration of plants (Figures)



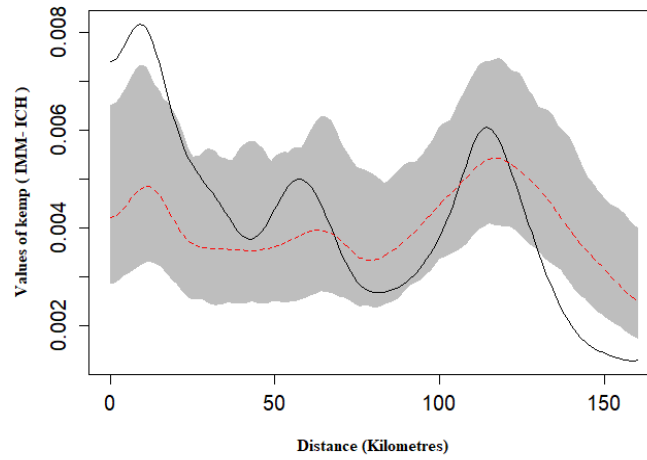


ICKd



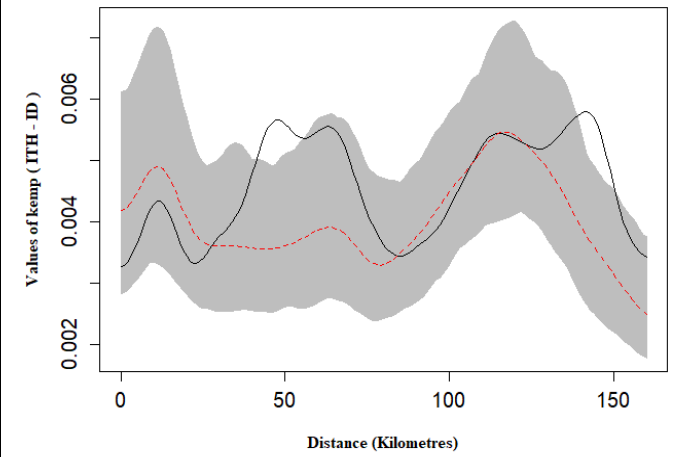
Mechanical and metallurgical industry - Textile and clothing industry

ICKd



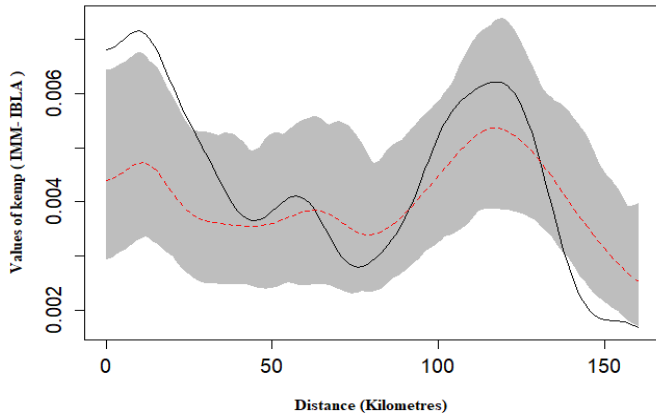
Mechanical and metallurgical industry - Chemical industry

ICKd



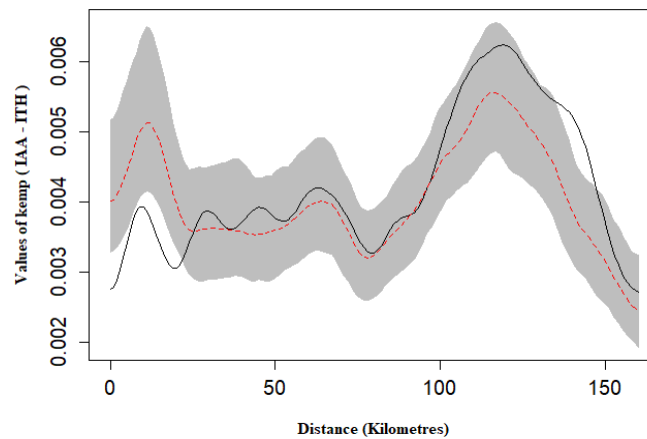
Diverse industry - Textile and clothing industry

ICKd



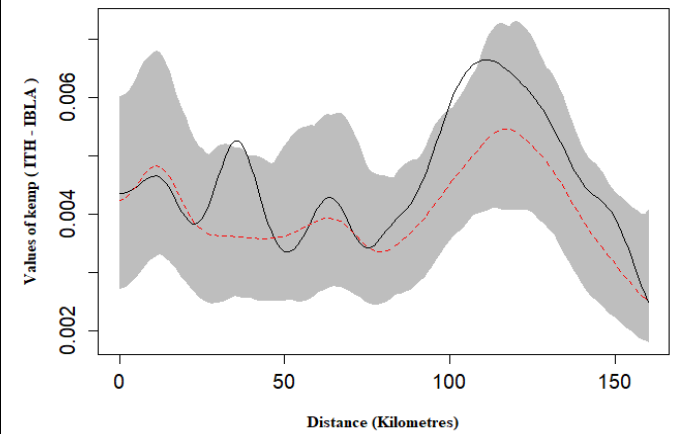
Mechanical and metallurgical industry - Wood, cork and furniture industry

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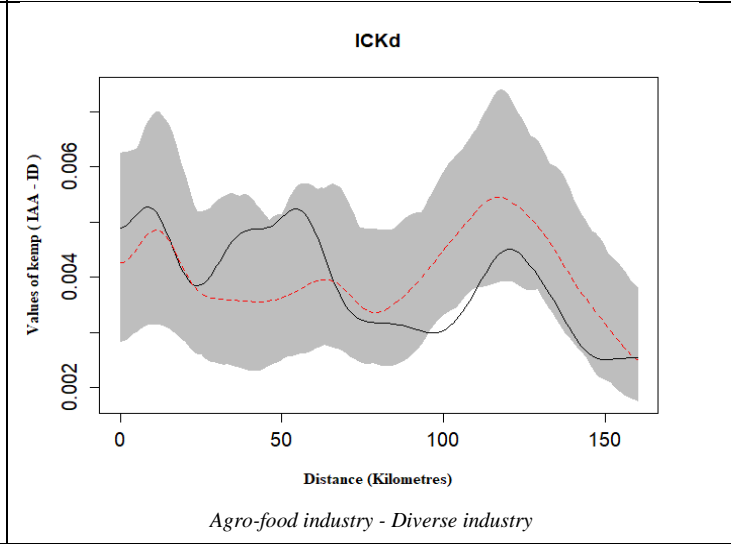
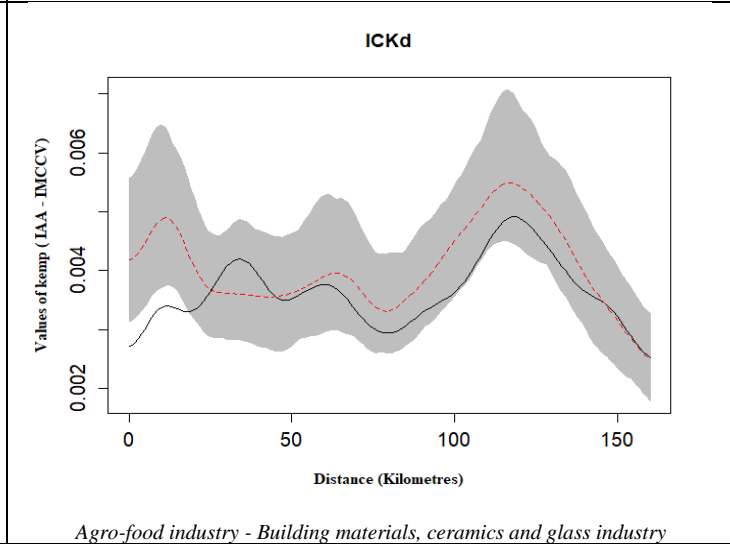
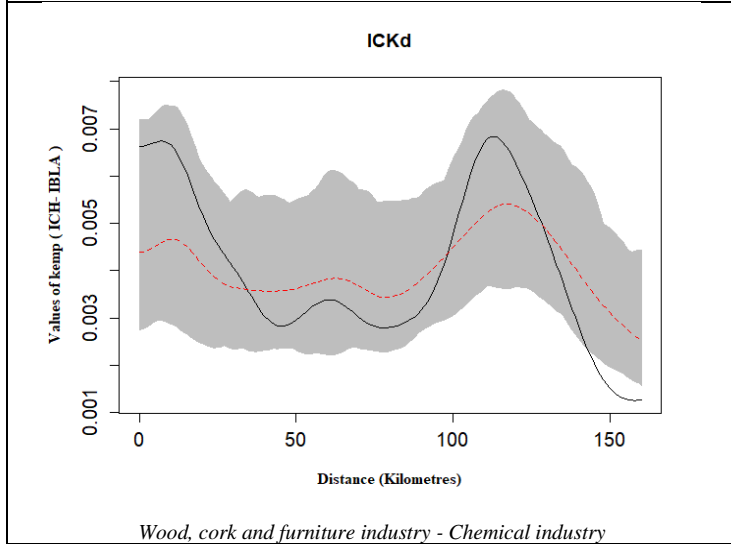
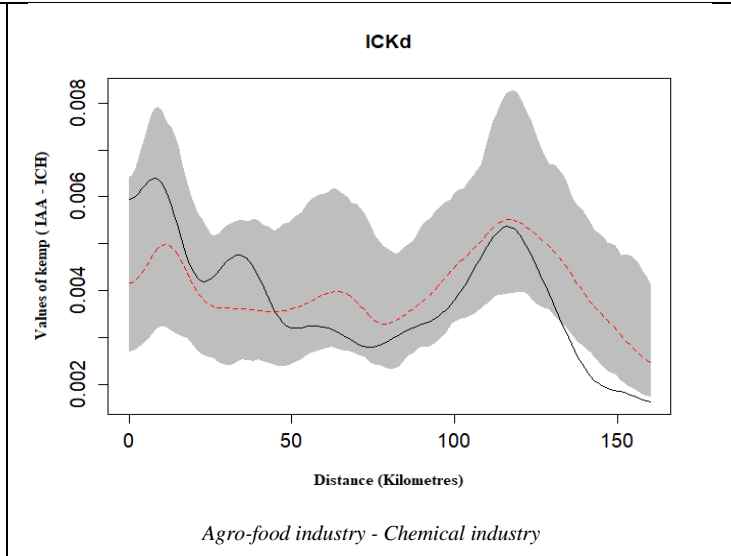
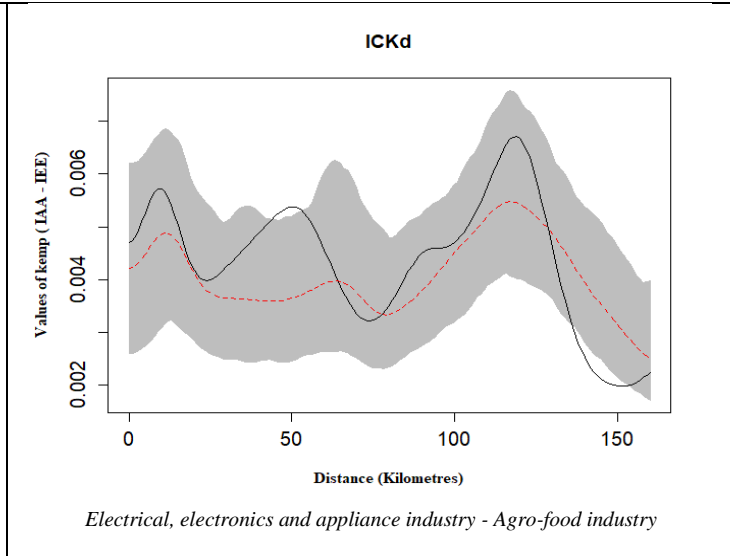
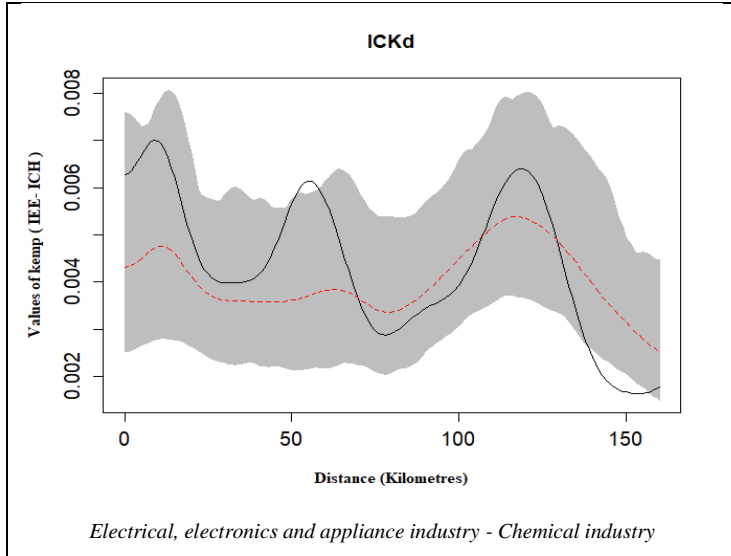


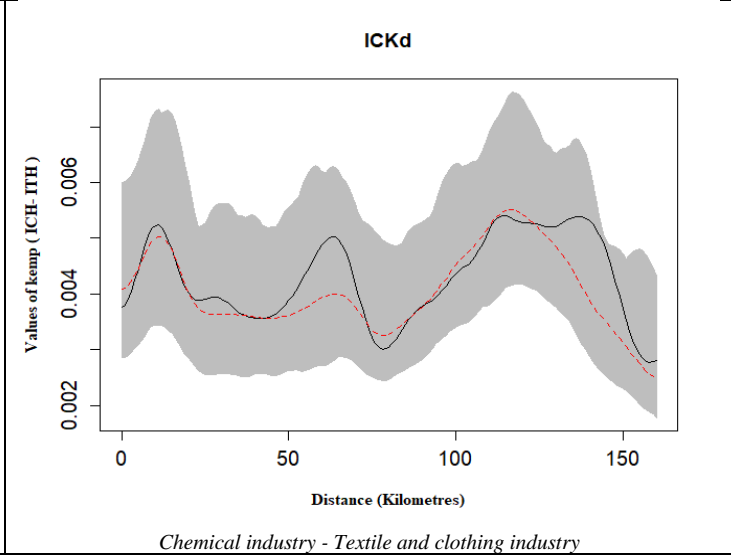
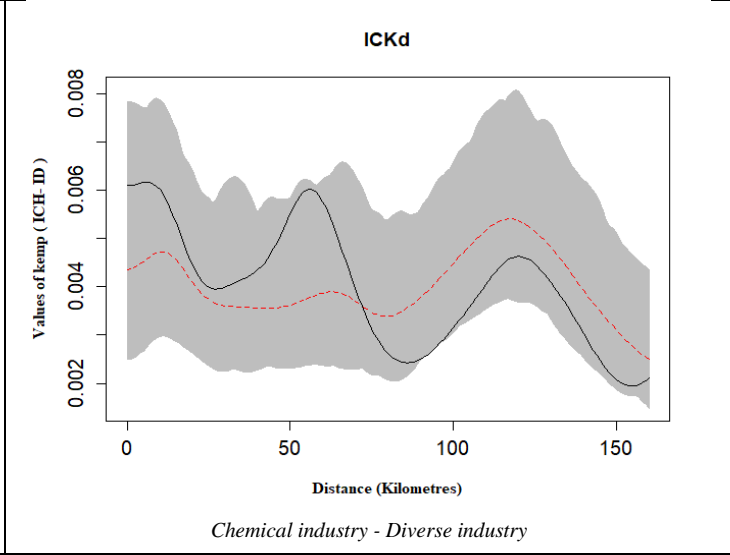
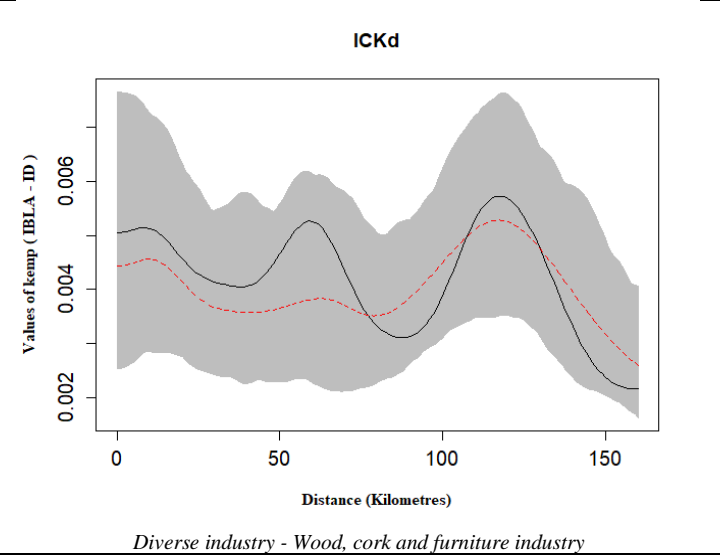
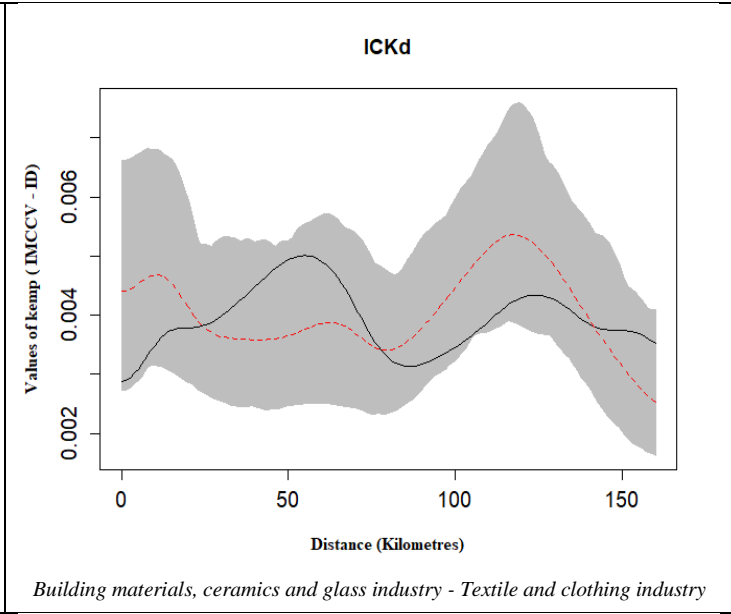
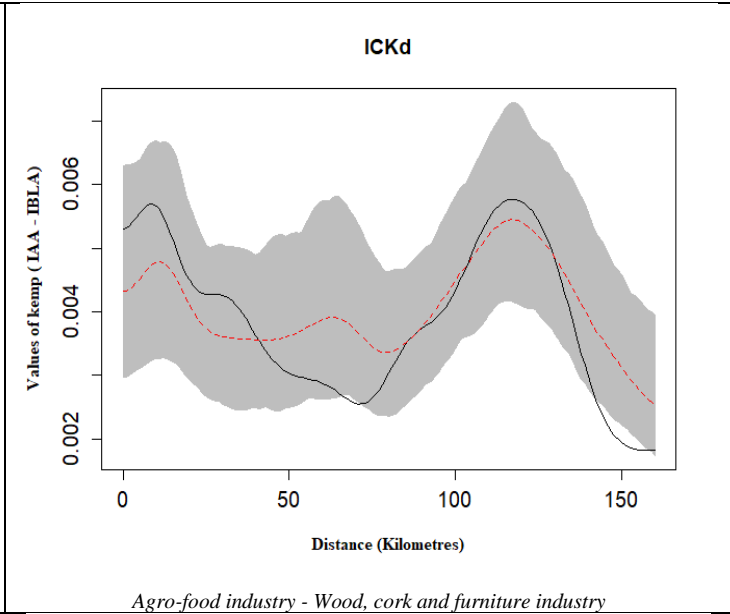
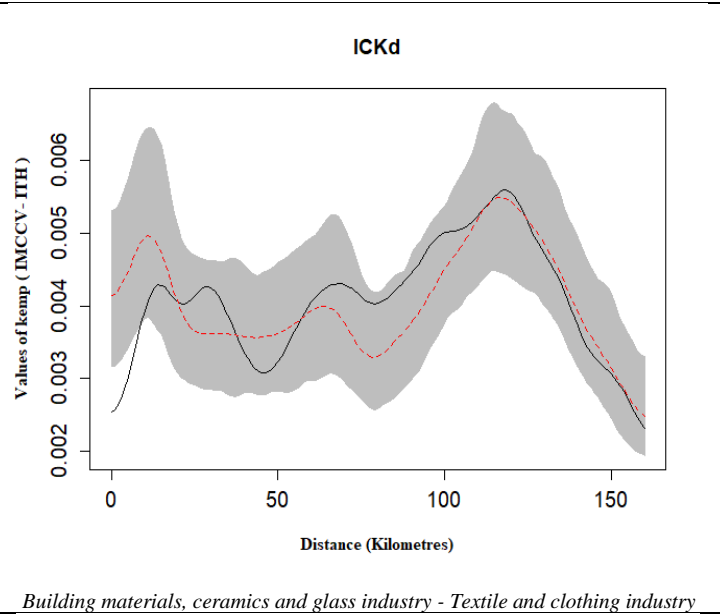
Agro-food industry - Textile and clothing industry

ICKd



Textile and clothing industry - Wood, cork and furniture industry





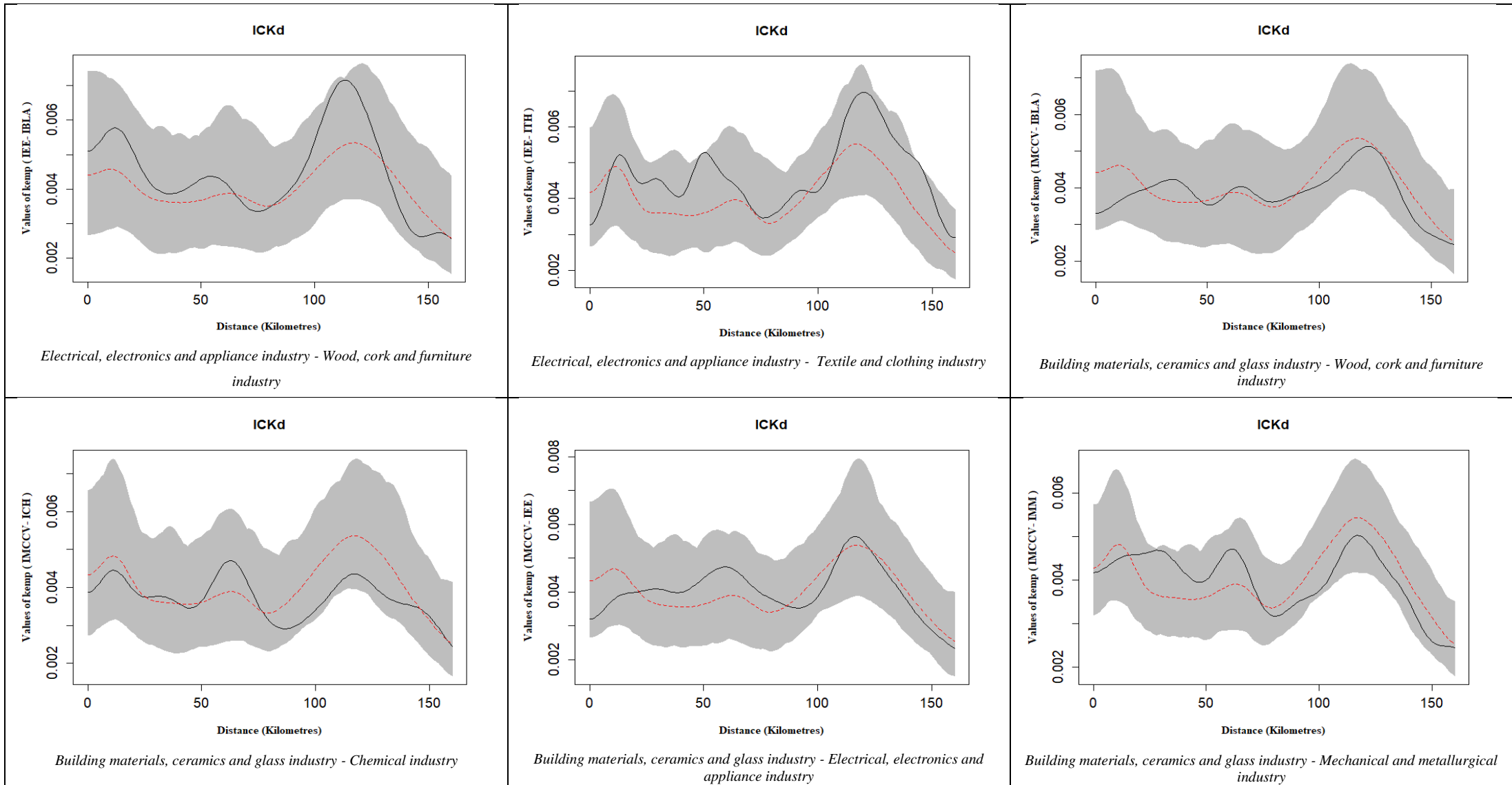
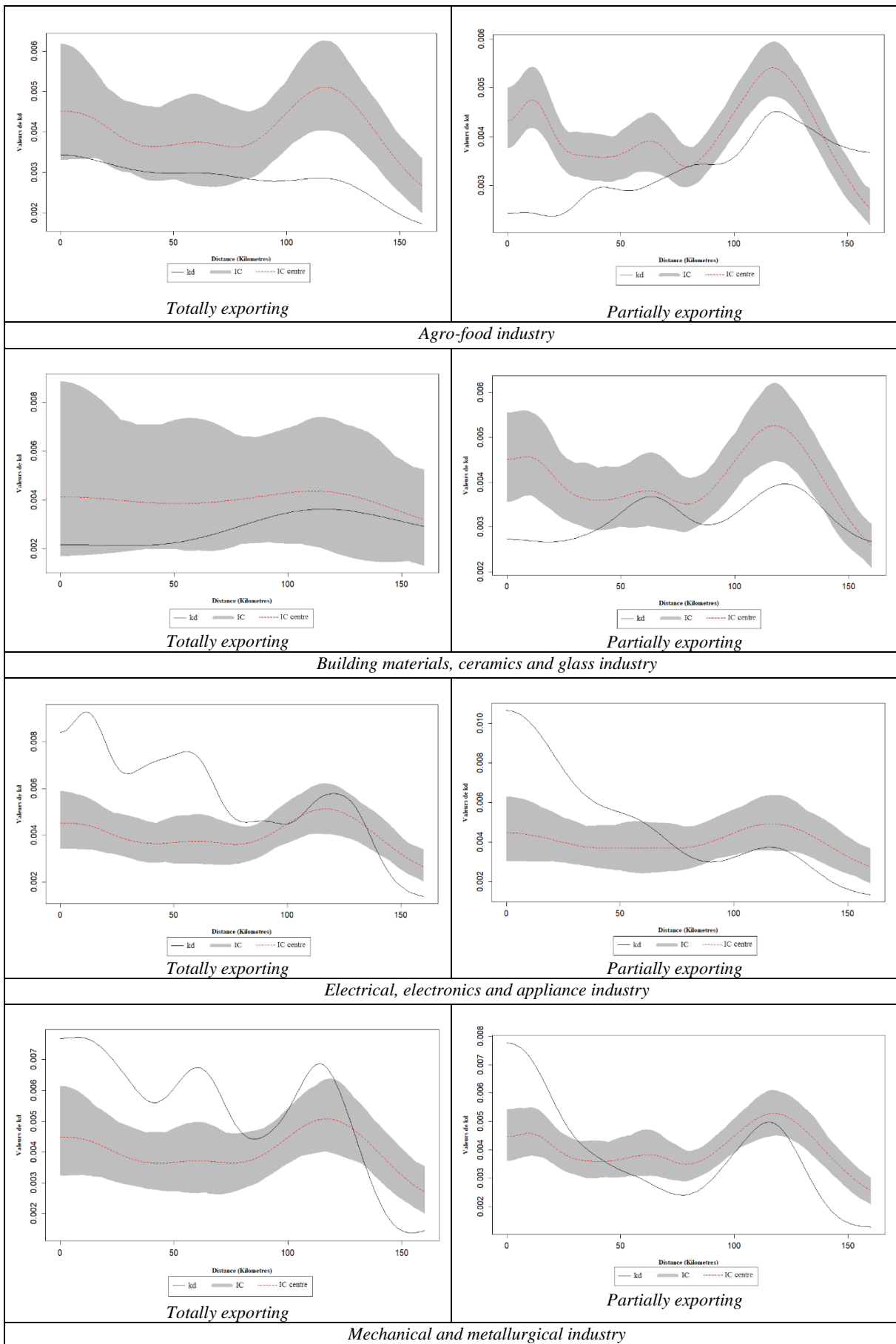
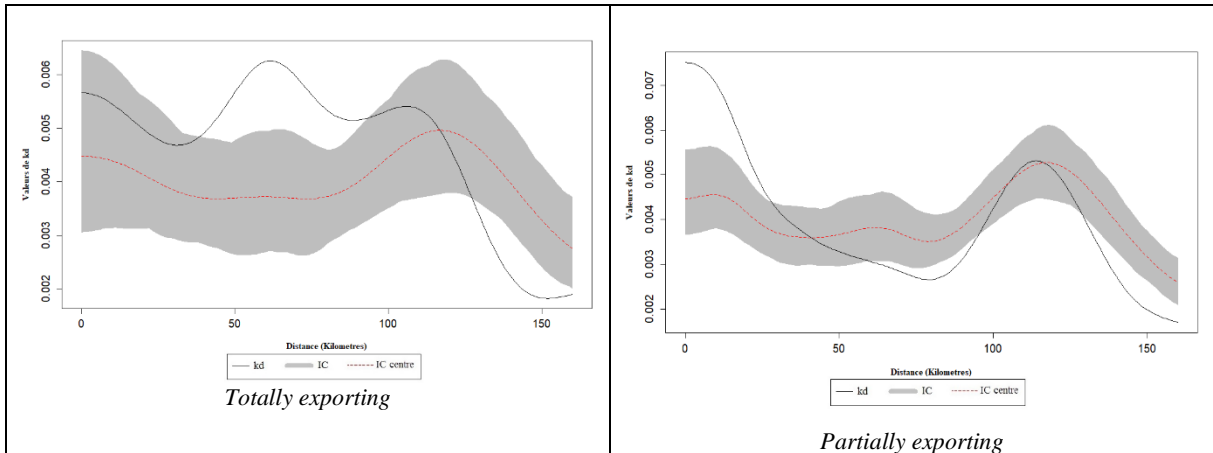
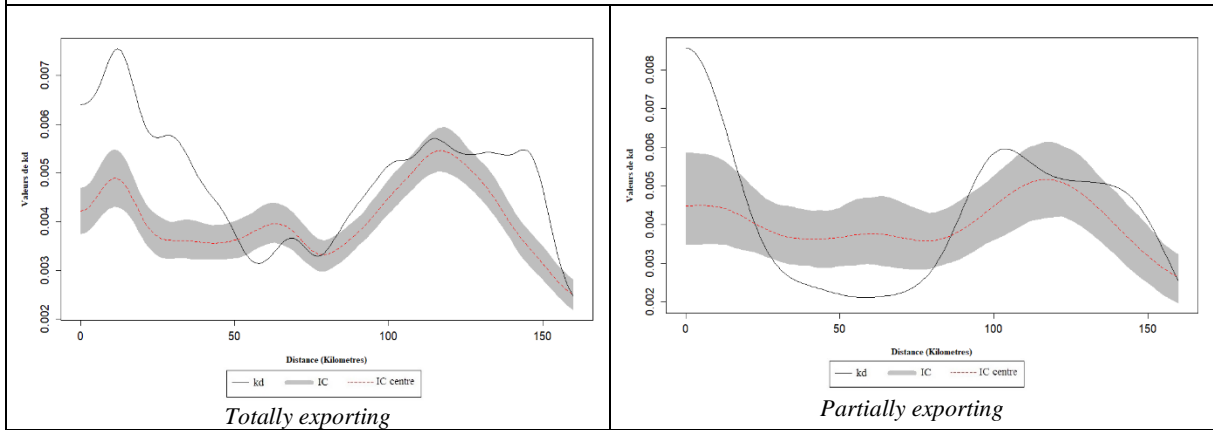


Figure 1.33: Results of the k_{emp} function for co-agglomeration of employees (Figures)

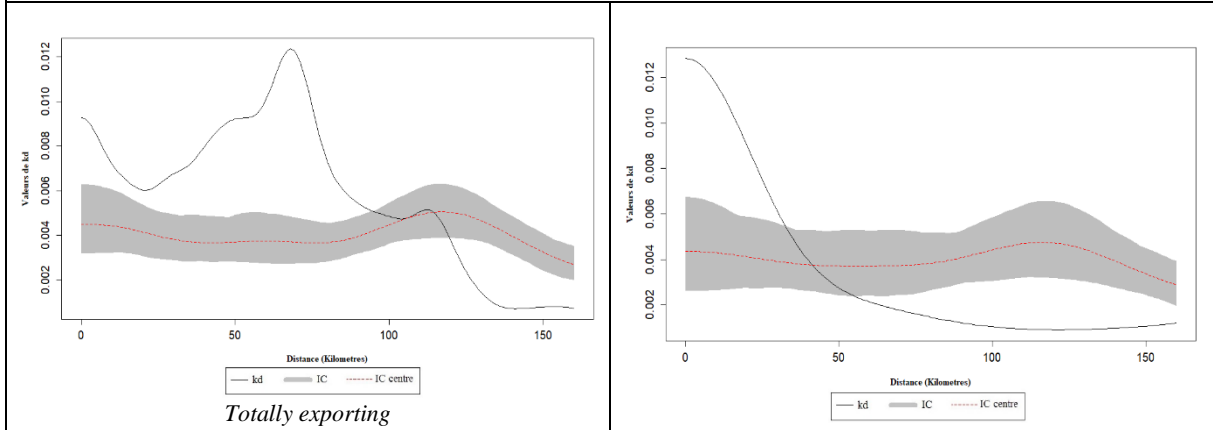




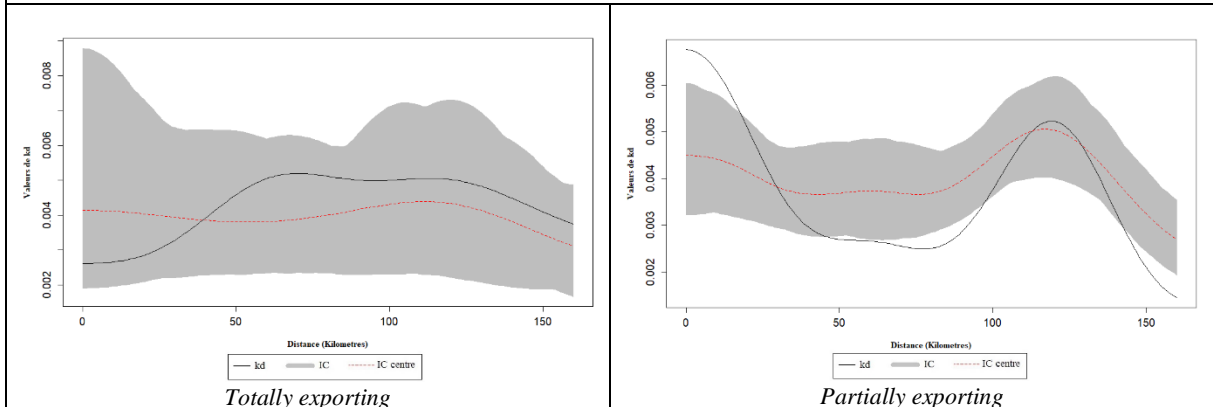
Chemical industry



Textile and clothing industry



Leather and footwear industry



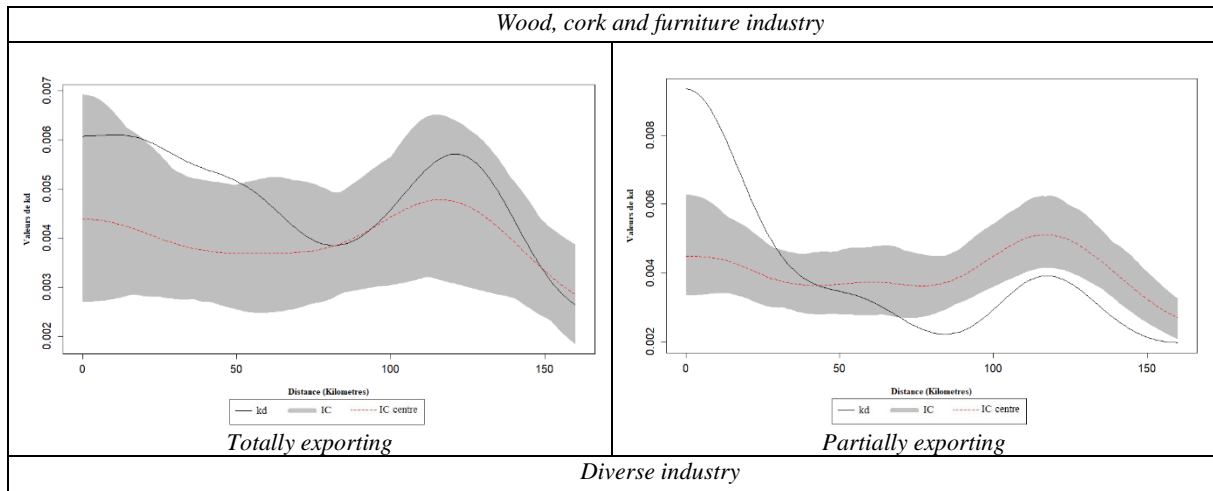
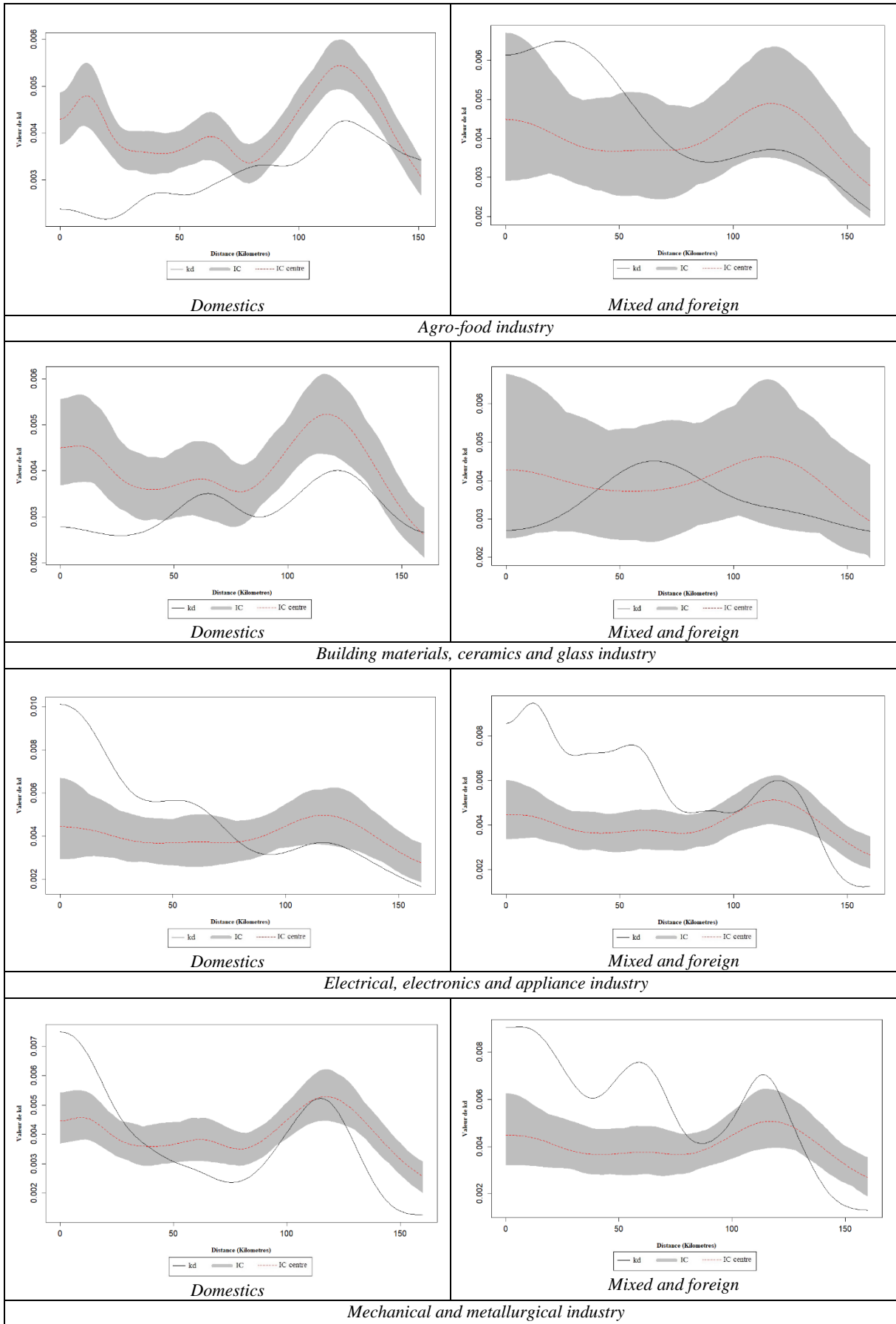
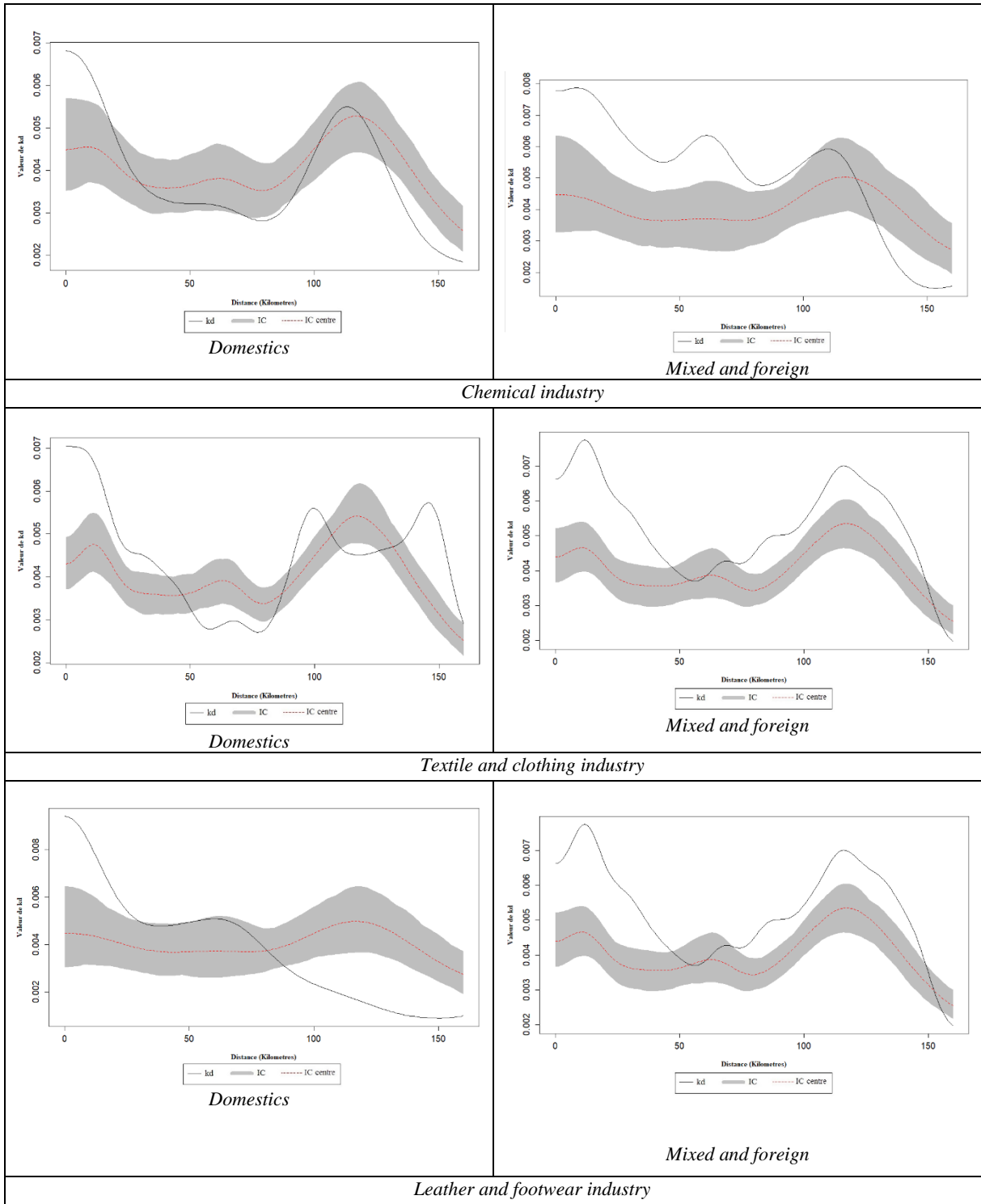


Figure 1.34: Results of the k_d unweighted function at sectoral level according to the export regime





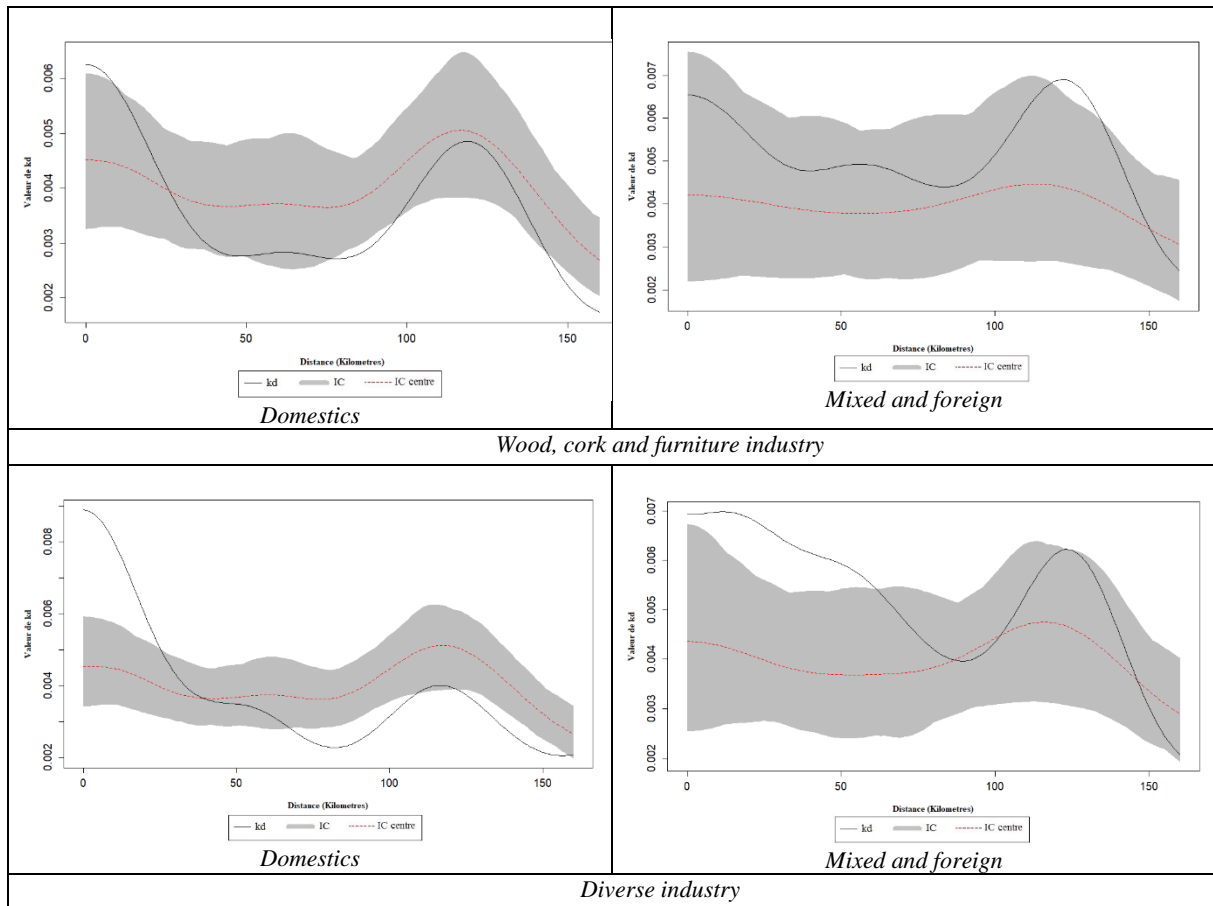


Figure 1.35: Results of the k_d unweighted function at sectoral level according to nationality of firms

2. Spatial tax regime and location choice of manufacturing firms: Firm-evidence in Southern Tunisia

We survey 179 manufacturing firms in southeastern Tunisia to investigate the determinants of manufacturing location choices and the effect of public location-based policies on these choices. Tunisia is spatially divided into four zones, each zone offering a different fiscal regime. The southeast of Tunisia, considered among the least developed regions, contains these four zones, which justifies our choice of this region as the study area. Rich results emerge from the use of various empirical methods. In a nutshell, Multiple Factor Analysis and Hierarchical Cluster Analysis show that manufacturing firms in this region can be divided into different groups depending on their considerations in location choices. These methods confirm the role of fiscal and financial incentives in locations decisions for some manufacturing firms, but also highlight the importance of traditional factors such as workforce, land availability and geographical proximity. Probit models report that the consideration of tax incentives and subsidies in the location choice increases the probability of locating in a tax-advantaged area by 15%.

2.1. Introduction

Regional development policies aimed at correcting imbalances in the spatial distribution of economic activities are numerous and important in Tunisia. For instance, since independence, investment incentive zone programs have been set up with the aim of fostering local economic growth¹⁰. These place-based policies include several tax exemptions and financial subsidies to encourage businesses to locate or relocate in less developed regions of Tunisia. Hence, these positive discriminations are applied through the reform of the *Investment Incentive Code* which puts the most developed regions in competition with the least developed ones.

Tunisia is divided into 264 delegations. Each of them is characterized by a specific spatial regime. The latest version of the *Investment Incentives Code* was established in 2011 and divided the country into four zones with different spatial tax regimes, with delegations as the basic spatial scale unit. The first zone is a spatial area without tax and financial advantages and mostly includes the eastern coastal delegations belonging to the most developed governorates in Tunisia. For the other fiscal spatial zones, the rate of fiscal and financial benefits is implemented in a bottom-up manner. The fourth and last zone concerns the priority delegations for regional development, which are the most disadvantaged areas in Tunisia.

Despite these fiscal advantages allocated to the most lagging areas, Tunisia still suffers from economic imbalances between the governorates of the eastern coast and those of the interior and south. Manufacturing firms' spatial patterns in Tunisia have received an increasing empirical interest, especially after the revolution of January 14, 2011, for example, Amara and Ayadi, 2014; Ayadi and Mattoussi, 2014; Ben Said and Jamoussi, 2015; Ben Said, 2021. Using various methodologies, all these papers uncover strong inequalities in the spatial distribution of manufacturing industries between coastal and interior regions. Therefore, the analysis of the role of these advantages in regional development and in the attraction of manufacturing firms becomes a necessity in the Tunisian context in order to improve the design of further programs.

Understanding the determinants of the location choice of economic activities is a key issue for regional policies (Rathelot and Sillard, 2008). Location choices are far from random (Békés and Harasztosi, 2013), but they are influenced by several factors. The impact of these factors may vary from one plant location decision to another, i.e. not all factors can be considered or have the same influence in location decisions. While manufacturing location was originally linked to the accessibility to raw materials, today, especially with the evolution of manufacturing needs and transport means and the new conditions of labor mobility, the location decision making is complex and multidimensional.

Policy makers at all levels of government implement policies to attract new firms with the aim of improving local economic growth (Liu et al., 2018), especially place-based policies aimed at creating jobs in certain regions (Chaurey, 2017). The pros and cons of place-based policies have long been debated by economists

¹⁰ The evolution of investment incentive zone programs is described in detail in Chapter 1, Section 3.2.

(Chaurey, 2017) and tax policies are one of the most debated (Parchet, 2019). In effect, while tax exemption is the common policy for local authorities to attract new investors (Liu et al., 2018), the economic literature is not conclusive on the link between taxes and business location choices. Some studies confirm the effectiveness of tax policies and show the significant impact of tax exemptions and investment subsidies on location decisions (Harris, 1983; Begg and McDowell, 1987) and others, conversely, express serious doubts about this effectiveness and stress that there is no clear relationship between tax exemptions and location choices. They argue that firms choose to locate in regions with a strong agglomeration of economic activities, despite the high level of taxation (Brülhart et al., 2012, Brülhart and Simpson, 2018).

In this context, this paper investigates the impact of fiscal incentives and financial subsidies on the location decisions of manufacturing firms in southern Tunisia and how positive discrimination affects the manufacturing spatial distribution in this area. For that purpose, we conduct a survey of 179 manufacturing firms in four neighboring southern governorates (Sfax, Gabes, Medenine and Tataouine). We choose this area because, firstly, this area contains delegations with the four different fiscal zones and, secondly, it displays very similar regional characteristics in terms of the regional labor market, infrastructure and proximity to the same natural resources. This survey is based on a questionnaire that consists of five sections and 26 main questions. We exploit the data obtained from this survey using Multiple Factor Analysis (MFA) followed by Hierarchical Cluster Analysis (HCA) and probit models. All methods confirm the strong impact of fiscal incentives and financial subsidies on manufacturing location decisions in southern Tunisia. The MFA findings suggest interesting dimensions. The first dimension, named “Traditional location factors” is correlated with classical factors considered in location decisions such as labor force characteristics, land and buildings availability and strategic geographical position. The second dimension is correlated with factors explaining the role of place-based policies in location decisions and is therefore named “Institutional factor”. The HCA detects three clusters of individuals: the first cluster includes plants in the Tunisian south that choose their production location on the basis of a family decision, the second englobes plants that choose their location in areas with fiscal advantages and the last explains modern firms that need to find in their location, a high quality of life, the availability of high-skilled workers and also prestigious land. Finally, a probit model explaining the probability of locating in tax-advantaged zones shows that the nationality of manufacturing firms does not play a crucial role, while being a partially exporting plant increases the probability of locating in tax-advantaged zones. Furthermore, plants that started production between 2003 and 2009 or have 21 to 50 employees or have “*Affaire personnelle*”¹¹ status are more likely to locate in these zones. However, being a ceramic, mechanical and chemical plant decreases the probability of locating in spatial zones with tax advantages.

The remainder of this chapter is structured as follows: Section 1 briefly evokes the relevant literature. Section 2 provides the survey methodology, including survey design, questionnaire design and sample

¹¹ *Affaire personnelle* is a personal business, which refers to the situation of a natural person who is declared as being self-employed in a business activity, without having created a company.

characteristics. Section 3 presents the survey results of the using Multiple Factor Analysis (MFA) and Hierarchical Cluster Analysis (HCA). Section 5 discusses the results of the econometric analysis based on a probit model. In Section 6, we present our conclusions.

2.2. Location-based policies and location of manufacturing firms: theory and empirics

Taxation can have a strong impact on the discrete choice of business locations (Devereux and Griffith, 2003; Auerbach, 2006), fueling intense debates in both academic and policy circles (Giroud and Rauh, 2019). On the one hand, taxes are seen as a major cost factor for firms and therefore play an essential role in their investment and financing decisions. To reduce the level of taxation, many firms hence engage in various tax exemption activities; such as locating in areas where tax incentives or financial subsidies exist. On the other hand, public authorities have always used tax incentives to influence the relocation and expansion of economic activities (Buss, 2001; Papke, 1991). They set the taxation level on plant activities according to the geographical, economic and social environment (Rathelot and Sillard, 2008).

Theoretically, there is a lack of consensus on whether tax rate cuts and grants attract new firms. Reducing tax rates in specific regions can attract economic activities by increasing the return of firms (Rohlin et al., 2014). When a local jurisdiction reduces its tax rate, it competes with its neighbors to attract economic activities. Thus, neighboring jurisdictions become relatively less attractive for economic activities (Zodrow and Mierkowski, 1986; Wildasin, 1988, 1991; Wilson, 1991; Rathelot and Sillard, 2008). However, this reduction may have a negligible effect when firms prefer to benefit from natural amenities or agglomeration economies. Plants located in industrial agglomerations can handle higher tax burdens than plants that are dispersed or located in more remote spatial areas (Brühlhart and Simpson, 2018). Economic geography emphasizes the link between agglomeration effects and the level of taxation. Plants tend to locate in areas where other plants are already located as they expect to benefit from the positive externalities generated by agglomerations (Guimaraes et al., 2003; Crozet et al., 2004; Cohen and Paul, 2005). These agglomeration economies are prevalent over other factors in location choices (Krugman, 1991a; Venables, 1996). Indeed, when capital and production are mobile and trade costs are sufficiently low, agglomeration economies can lead to spatial concentrations of economic activities that cannot be manipulated by tax differentials (Brühlhart et al., 2012). In fact, predictions on taxation and agglomeration economies can be merged. As a result of industrial agglomerations, some local authorities take advantage of them and increase taxes in these areas (Charlot and Paty, 2006; Rathelot and Sillard, 2008). Hence, agglomeration effects can be proven in location choices when the local jurisdiction related to the setting the tax level explains the behavior of firms (Janeba, 1998; Ludema and Wooton, 2000; Andersson and Forslid, 2003; Baldwin and Krugman, 2004; Borck and Pflüger, 2004).

The empirical literature on the link between location choices and taxation is extensive. We report here only the papers that form the basis of our empirical predictions. Overall, the results are mixed. In the following paragraphs, we first briefly report some papers on developed countries to highlight the mixed results, then we focus on developing countries and end this section with papers on Tunisia.

Empirical studies on firms' location determinants began with personal interviews with business executives in the United States, such as the works of Katona and Morgan (1952) and Mueller and Morgan (1962) (Rathelot and Sillard, 2008). These studies show that labor costs and availability, proximity to markets and materials and taxes are the main factors cited by these executives. The studies by Carlton (1983) and Bartik (1985) are the two first econometric works analyzing the firms' location determinants also in the United States with different conclusions. Carlton (1983) shows that taxes are of limited significance while Bartik (1985) points to a strong effect of taxes on economic activities locations in the United States.

In recent years, the majority of papers study the role of tax incentives, tax exemptions and financial subsidies through programs established by governments. In the United States, Gabe and Bell (2004) reveal a small impact of a tax cut on attracting new firms in the state of Maine between 1993 and 1995. They show that firms prefer to locate in municipalities with important public goods and services, even if their expenses are financed by an increase in local taxes in this state. However, Bhat et al. (2014) exhibit that fiscal conditions and agglomeration economies/diseconomies affect the county demand intensity for new businesses and also the desire of businesses to locate at the county level in the state of Texas for the period 2007-2008. In addition, they find that transportation infrastructure and land development characteristics are attractive factors for new business. Furthermore, in the state of Kansas in the US, Jensen (2017) shows that financial incentives have no discernible impact on relocation or expansion decisions of firms. In Great Britain, Devereux et al. (2007) find that location decisions of new firms are more sensitive to financial incentives in areas with pre-existing industrial activity than in more peripheral areas between 1986 and 1992, while Duranton et al. (2006) show that local taxes have no effect on firm entries in the UK for the years 1984 to 1989. Brühlhart and Simpson (2018) show that government subsidies are more generous in spatial zones with industrial agglomerations in Great Britain from 1985 to 2004. They explain this result by the fact that these policies aim to safeguard existing jobs, avoid the decline of certain sectors and also generate more agglomeration economics in order to attract more firms. In France, Rathelot and Sillard (2008) investigate the impact of local business taxes on firms' decisions to start a new business in France. Their results suggest that local corporate taxes have a strong impact on plant location decisions; a one percentage point increase in the tax rate differential raises the probability that a firm will locate in the least taxed region by about one percentage point. Briant et al. (2015) assess the effectiveness of place-based policies, using the French enterprise zone program "Zones Franches Urbaines" as a case study between 1993 and 2004. Location in French enterprise zones offers several advantages to firms such as exemption from employer's social contributions, exemption from tax on corporate profits, exemptions from business tax, exemption from

property taxes on built lands etc.¹² They show that these place-based policies have a positive but small impact on the creation of manufacturing plants. Mayer et al. (2017) also study the impact of a French enterprise zone program on location decisions and on labor market outcomes in France between 2002 and 2007. Their findings confirm the positive impact of the French enterprise zone program on attracting firms. In contrast, these authors find that these policies mainly attract structurally smaller firms.

All these papers evaluate place-based policies and the role of taxation in developed countries. Therefore, even within the same country, if the time period or area of study changes or if a different research methodology is used, taxation reveals a different impact on location decisions.

In developing countries, there are also several studies on this issue. Wang (2013) analyses the impact of Special Economic Zones (SEZ) in China for the period 1986-1990. He exploits data containing information for 321 Chinese municipalities at the prefecture level to use dynamic panel data models and difference-in-differences methods. In fact, the SEZ program provides more liberal laws and flexible economic policies to specific zones in order to encourage foreign firms to export. This study shows that this program attracts foreign direct investment and generates agglomeration economies and wage increases for workers. However, they also find a small impact of this program for zones created later. Alder et al. (2016) also study the effects of the same program: Special Economic Zones (SEZ) in China. They use data from Chinese cities at the prefectural level for the period 1988-2010. Their difference-in-difference estimations find a positive impact of this program on regional economic growth in China; the implementation of this program leads to an increase in the level of GDP of about 20%. Moreover, this program has a positive impact on physical capital accumulation, factor productivity, investments in human capital, as well as economic growth of neighboring regions through spillover effects. Liu et al. (2018) investigate the effect of location-based tax incentives on the local economy through attracting manufacturing firms in China. They analyze the entry differentials of new private firms across counties containing the Western Regional Development Strategy (WRDS). This strategy aims to establish tax incentives by introducing an 18% reduction in corporate income tax rates for firms in western areas in China after 2000. Using regression discontinuity and data on private manufacturing plants from two surveys conducted in 2002 and 2004, their triple DID estimators indicate that the increase in the number of new entrants eligible for the tax reduction is greater in counties containing this program than in others. Chaurey (2017) analyses the impact of tax incentives on location choices in India. Using a state-industry level aggregate dataset and a firm-level panel dataset, he estimates difference in differences and synthetic control methods. As a result of tax incentives, his results report a strong increase in the number of new firms and employment for both existing new firms. This study confirms the crucial role of location-based policies in correcting regional economic disparities in the context of India. Guimaraes et al. (1998) estimate the effects of industrial incentives on the location of manufacturing plants in Puerto Rico using nested logit models. Actually, 76 municipalities considered as less developed areas in Puerto Rico, receive additional tax exemptions and investment incentives. However, they find that these additional incentives do

¹² Eligibility for these exemptions varies according to the properties of the company.

not have an important effect on location decisions. Parys and James (2010) investigate the role of tax incentives in attracting investment in sub-Saharan Africa for twelve CFA Franc Zone countries¹³ for the period 1994-2006. Using panel data econometrics with country and year fixed effects and difference-in-difference analysis, no robust positive link between tax holidays and investment in the CFA franc zone is found. However, they show that an increase in the number of legal guarantees for FDI and a more flexible tax system contribute to attracting more investments. Sridhar and Wan (2010) examine industrial location in large, medium and small cities in India, China and Brazil. Their study does not focus primarily and directly on the role of taxes; they propose an empirical study to identify the economic geography location determinants and also to understand the role of governmental factors of interest. Using firm-level data from the World Bank, ordered logistic regressions indicate that large capital cities are not attractive for firms. They also show the crucial role of urban governance implications on industrial locations in these countries. Klemm et Parys (2012) provide empirical evidence on the effectiveness of tax incentives in attracting investment using a panel of 40 developing countries in Latin America, the Caribbean and Africa for the period 1985-2004. To test the impact of tax incentives, they specify an ad hoc dynamic panel model and use the within-countries and system GMM as estimators. Results show that lower taxes or tax incentives help attract FDI to Latin America and the Caribbean but not to Africa. They suggest that the strategic interaction in Africa is politically rather than economically motivated.

In Tunisia, several researchers have been interested in identifying the determinants of industrial agglomerations. Métral (2003) analyses the location determinants of manufacturing firms in the Greater Tunis metropolis, which includes the capital Tunis and three surrounding governorates. These governorates are characterized by a spatial regime without fiscal and financial benefits. He shows that the motivations of Tunisian entrepreneurs are likely to explain the geographical concentration of industries across this metropolis and that totally exporting plants do not have the same logic of location decision-making process as partially exporting plants. Karray and Driss (2009) explain regional growth and industrial agglomeration mechanisms for the period 2000-2005. They show that a diversified industrial structure (Jacobian diversification externalities) characterized by a competitive industrial environment (Porter externalities) contributes to increased regional growth. Furthermore, these authors argue that agglomeration forces play a more important role in the growth of coastal regions without tax advantages than in the growth of other regions with tax advantages. Kriaa and Montacer (2009) identify the attractiveness factors of the governorate of Zaghuan through a survey of 35 firms (15 foreign firms and 20 Tunisian firms). This governorate benefits from a spatial regime with fiscal advantages. Thus, their survey shows that the main factors of industrial location in Zaghuan result from a combination of public regional development strategies and the proximity of the capital Tunis.

¹³ The CFA Franc Zone countries include 14 African countries: Benin, Burkina Faso, Guinea-Bissau, Ivory Coast, Mali, Niger, Senegal, Togo, Cameroon, Central African Republic, Chad, Congo-Brazzaville, Equatorial Guinea and Gabon. This name is given to all these countries following French colonization and the use of a single currency (CFA Franc).

Ghazouani (2010) studies the effects of differentials in tax incentives and financial subsidies on the manufacturing location in Tunisia for the year 2008. He notes a significant impact of tax incentive differentials on the attractiveness of the corresponding areas. Kriaa et al. (2011) evaluate spatial disparities across 254 Tunisian delegations in 2005 by constructing a Spatial Composite Index of Welfare (SCIW). Using spatial econometrics models, they show that economic liberalization and public policies for regional development promote development in certain delegations and reduce regional disparities only in coastal delegations considered as the most developed regions. In contrast, interior delegations still suffer from economic inequalities and also the gap between the interior delegations and coastal regions widen even further. The use of the Exploratory Spatial Data Analysis (ESDA) on the SCIW provides that 40 delegations in the most developed governorates (the capital Tunis, Sousse, Monastir and Sfax) have the highest SCIW values and are the most advantaged zones, while 34 delegations in the North West and the Center-West regions have the lowest SCIW values and are the most disadvantaged zones. Amara and Thabet (2012) investigate the impact of agglomeration economies on the productivity of manufacturing firms and the nature of externalities that contribute to local economic growth in different delegations on the Tunisian coast. These authors find that the Greater Tunis, Sousse and Sfax experience a decrease in the number of jobs as a result of the appearance of the negative externalities such as congestion. They also show that the neighboring governorates, and in particular the governorate of Zaghuan, are attractive for industrial firms and workers, due to the geographical proximity of the main industrial agglomerations. Ayadi and Mattoussi (2014) analyze the manufacturing spatial pattern and assess the factors influencing location decisions. Their data cover information from three surveys on Tunisian manufacturing firms from 2004 to 2006. They estimate models measuring the effects of characteristics on the number of firms and on employment growth and a model measuring the effect of agglomerative forces on productivity growth. Results highlight that plants tend to locate more in competitive zones than in specialized ones and that industrial agglomeration with a strong competition experience a lower growth rate as the high initial number of jobs in a spatial zone redcap the growth rate of jobs. They also find that the governorates of the coast and Sfax have positive and significant effects on provincial attractiveness and that exporting plants are mainly concentrated in coastal zones.

Jaouad et al. (2015) study the potential and constraints of manufacturing sectors in six governorates in southern Tunisia. Using exploratory spatial data analysis for a set of regional socioeconomic indicators and principal component analysis, results provide evidence that regions with emerging economic activity have low human development and that the strongest industrial growth belongs to the agro-food sector. Bouzid and Toumi (2020) use data from 24 governorates over the period 2008-2018 and a dynamic panel model in order to emphasize the determinants of the unbalanced regional distribution of foreign direct investments in Tunisia. GMM estimators show that there is a regional interdependence in location decisions of foreign manufacturing plants, in fact, the existence of foreign plants in a specific location attract more foreign plants, which explains the geographical concentration of foreign firms in the coastal areas. Furthermore, they show that a large and developed market, the existence of tax-advantages zones and public infrastructures can be

an attractive source for foreign direct investments. Ben Said (2021) examines the regional location determinants of new industrial firms in 153 Tunisian delegations between 2016 and 2019. Using data on 501 new manufacturing firms and the spatial instrumental Tobit model, they show that the preference for one location over another is influenced by plant location decisions in neighboring areas. In addition, they identify the main location determinants, which are agglomeration economies, land availability and industrial adapted infrastructure. At the sectoral level, their findings show that the textile sector is more geographically concentrated in metropolitan areas considered as the most developed zones in Tunisia and not benefiting from tax advantages, while the agro-food sector tend to be located in interior regions characterized by grants and tax incentives.

In sum, previous studies have investigated the impact of local taxation and tax incentives on promoting regional economic growth through attracting firms and business activities. However, the sign and size of their net effect are not been conclusive in both theoretically and empirically.

2.3. Survey methodology

The objective of our survey is to identify the factors that impact the location choice of manufacturing firms in the four different spatial tax regimes in Tunisia. This section reports the survey design and the questionnaire administration method, the description of the questionnaire and the sample and finally we present some descriptive statistics of the survey data.

2.3.1. Survey design and administration method

The first objective of the survey design is to select a sample of plants that maximizes representativeness in terms of population characteristics. The second objective is to include a sufficient number of plants representing firms located in each of the four zones of spatial tax regimes: one zone without tax advantages and three zones with a different tax regime.

There are two conditions to sample the firms from the parent population. First, the plants surveyed must have the same regional characteristics. This corresponds to plants located in the same region or in neighboring governorates, having the same regional labor market, close to the same natural resources, and also benefiting from the same infrastructure such as access to the airport and port. Second, plants surveyed must be located in the four different spatial tax zones. Table 2.1 in the appendix 2.1 shows the parent-population in all Tunisia in October, 2019. The majority of manufacturing firms (75%) are located in areas without tax advantages, which also contain the largest number of delegations (48%). Only in the governorate of Sfax, plants are located in all spatial tax areas.

The map in Figure 2.1 shows the spatial distribution of the administrative division of delegations and spatial tax regime zones. The map in Figure 2.2 displays the locations of all Tunisian manufacturing firms in 2018.

The eastern south is the most representative region. It contains all four zones and has the same regional characteristics. Hence, we have chosen the eastern south of Tunisia as the study area.

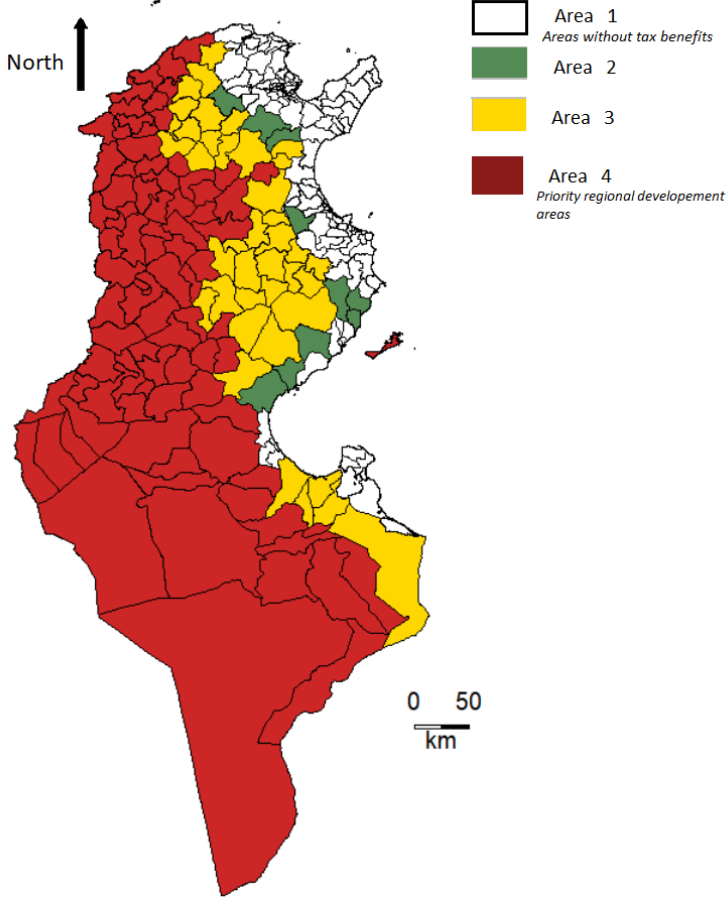


Figure 2.1: Delimitation of investment incentive zones (2011)
Source: made by the authors



Figure 2.2: Location of the 5.405 manufacturing firms in Tunisia (2018)
Source: made by the authors

A third condition would be to construct a sample of plants with similar manufacturing characteristics similar to those of the parent population such as activity sector, size, export regime and nationality. Unfortunately, we could not fully comply with this condition due to the limited number of plants in these areas. Thus, we decide to focus only on regional characteristics. The map in Figure 2.3 shows the different areas surveyed.

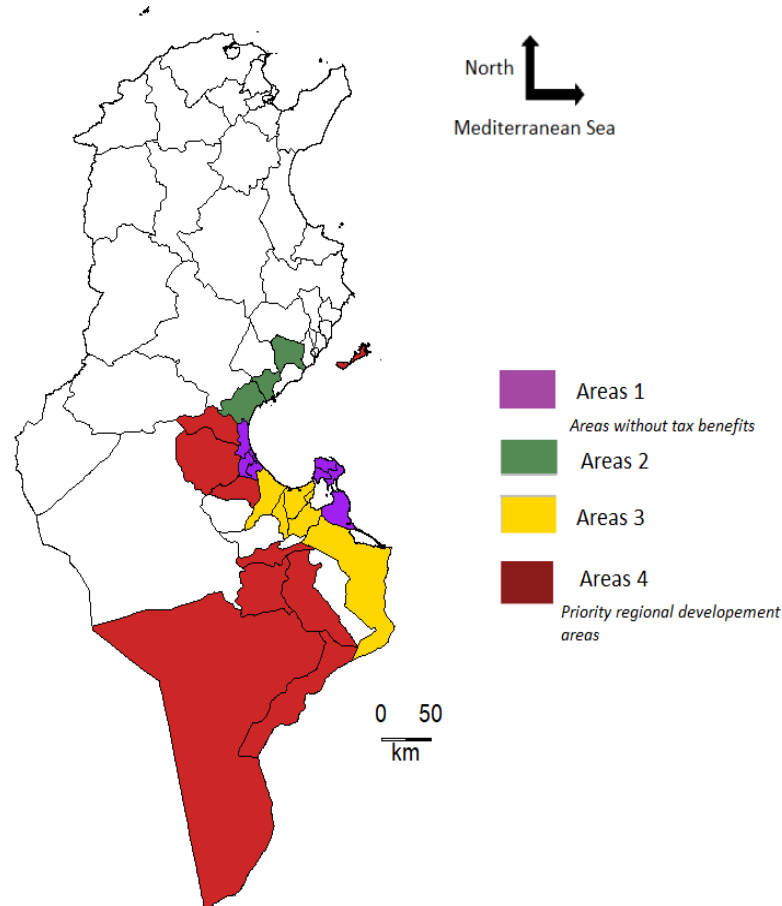


Figure 2.3: The areas surveyed

We delivered the questionnaire in person to plants. Moreover, we used the strategy of indirect administration which consists of leaving the questionnaire at the plant before withdrawing it at the end of the agreed time period. We only investigated plants that started production between 1990 and 2019, due to the inability to respond to the questionnaire when plants started their production before 1990. We started our survey with the priority regional development area, since it contains the smallest number of plants. We surveyed almost the parent-population except three plant in this region. For the other areas, we were not able to survey all plants as previously planned due to some difficulties. For instance, the locations of some plants are not easy to find as they are dispersed and have no visible signs. In addition, some plants refused to answer our questionnaire. Consequently, some manufacturing characteristics such as nationality and export regime could not be controlled to reach an adequate representativeness of the sample relative to the parent population. We present these differences in characteristics in Section 3.3. Finally, for the period from 29 October 2019 to 30 November 2019, 179 plants responded to our questionnaire. The map in Figure 2.4 displays locations of plants surveyed.

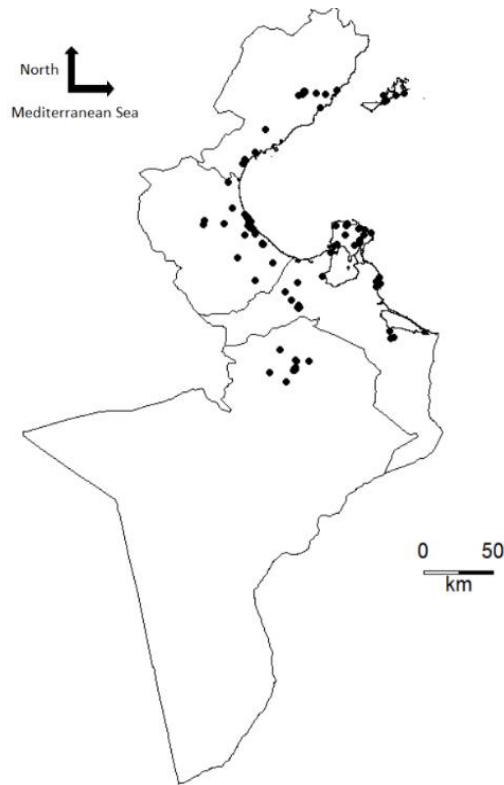


Figure 2.4: Locations of plants surveyed

2.3.2. Questionnaire design

In this study, we have opted for the questionnaire as the survey instrument. We have designed a questionnaire in French with mainly closed-ended questions and few open-ended questions. The closed-ended questions are in several formats: dichotomous questions, a ranking question, single-choice and multi-choice questions and questions with Likert scale to measure the importance of factors in location choices. Our main source of inspiration for our questionnaire was Bertrand Sergot (2004)'s thesis on the determinants of the French firms' location.

Thiétart (1999) and D'Astous (2005), among others, insist that the questionnaire must be pre-tested in order to clarify ambiguous questions, correct errors, verify the degree of understanding and assess the length of time required to complete the questionnaire. We therefore distributed the questionnaire to 12 manufacturing firms located in two eastern coastal governorates of Sousse and Monastir, two weeks before the start of the survey. Following this pre-test, we recorded the time required to complete the questionnaire which varies between 30 and 35 minutes. For the terms used, no comments were received. The only comment was on the length of the questionnaire. In addition, respondents suggested other factors that might influence their choice of location. Hence, we added the suggested factors and organized our questionnaire to make it easier to read and complete. After this process, we rewrote the final version of the questionnaire (in the appendix 2.1).

This survey questions manufacturing firms about their location choice in Tunisian eastern-south through a questionnaire of various sections: four sections for all plants and an additional section only for mixed and foreign plants. There are 26 main questions many of which were divided into sub-questions. These relate to general information about the plant and the respondent (section 1), to characteristics of plants (section 2), to general factors impacting the location choice (section 3), to regional factors impacting the location choice (section 4), to national factors impacting the location choice (section 5). The last section is intended only for mixed and foreign manufacturing firms. Each question comprises multiple items. Table 2.1 describes these different sections.

Table 2.1: Questionnaire design

	Subject of section	Number of questions	Respondents
Section 1	General information about the plant and the respondent		Domestic, mixed and foreign plants
Section 2	Characteristics of plants	8 questions	Domestic, mixed and foreign plants
Section 3	General factors impacting the location choice	5 questions	Domestic, mixed and foreign plants
Section 4	Regional factors impacting the location choice	11 questions	Domestic, mixed and foreign plants
Section 5	National factors impacting the location choice	2 questions	Mixed and foreign plants

2.3.3. Sample characteristics

Tables 2.2 and 2.3 report the distribution of the plants surveyed by area and by sector respectively. As noted earlier, we started to survey plants located in the priority regional development area. Therefore, 38 plants are surveyed, providing 21% of our sample (Area 4). The largest share of our sample (38%) is for the area without tax advantage (Area 1). Note that in Tunisia, the areas without tax advantage are also those with the largest share of plants (Table 2.20 in the appendix 2.2).

Table 2.2: Distribution of the sample by area

Type of areas	Total Number	Delegations	Governorates	Number of plants	% compared to the parent-population in each governorate surveyed	% compared to the parent-population in all governorates surveyed
Area 1	69 plants (38% of the total sample)	Zarzis	Medenine	7	48% of all plants under this spatial regime in Medenine	10% of all plants under this spatial regime in the region surveyed
		Jerba Midoun		5		
		Jerba Houmt Souk		10		
		Jerba Ajim		2		
		Ghannouche	Gabes	2	63% of all plants under this spatial regime in Gabes	
		El Metouia		1		
		Gabes Ouest		3		
		Gabes Sud		8		
Gabes ville		31				
Area 2	32 plants (18% of the total sample)	Agareb	Sfax	27	23% of all plants under this spatial regime in Sfax	23% of all plants under this spatial regime in the region surveyed
		Ghraiba		2		
		Skhira		3		
Area 3	40 plants (22% of the total sample)	Ben Guerdane	Medenine	5	70% of all plants under this spatial regime in Medenine	53% of all plants under this spatial regime in the region surveyed
		Sidi Makhlouf		2		
		Medenine Sud		9		
		Medenine Nord		12		
		Mareth	Gabes	12	86% of all plants under this spatial regime in Gabes	
Area 4	38 plants (21% of the total sample)	Dhehiba	Tataouine	1	88% of all plants under this spatial regime in Tataouine	93% of all plants under this spatial regime in the region surveyed
		Remada		1		
		Tataouine Nord		8		
		Tataouine Sud		3		
		Ghomrassen	Sfax	1	100% of all plants under this spatial regime in Sfax	
		Kerkennah		6		
		Nouvelle Matmata		2		
		Menzel el habib		2		
El hamma	Gabes	14	95% of all plants under this spatial regime in Gabes			

Table 2.3: Distribution of plants surveyed by sector

Sectors	Number	% / Total	% compared to the parent-population of each sector in all governorates surveyed
Agro-food industry	67	37%	30%
Building materials, ceramics and glass industry	44	25%	51%
Mechanical and metallurgical industry	19	11%	12%
Electrical, electronics and appliance industry	3	2%	13%
Chemical industry	15	8%	12%
Textile, clothing and leather industry	15	8%	9%
Wood, cork and furniture industry	5	3%	10%
Diverse industry	11	6%	20%
Total	179	100%	19%

As shown in Table 2.3, the agro-food sector has the largest share of plants surveyed (37%), followed by the building materials, ceramics and glass industry (25%) and the mechanical and metallurgical industry (11%). The least investigated sectors are the electrical, electronics and appliance industry (2%) and the wood, cork and furniture industry (3%). These latter industries as well as “diverse industry” do not contain any plant located in certain tax benefit areas. For this reason, we were unable to select a sample based on manufacturing specifications such as industry sector, plant size, nationality, or export regime. Table 2.4 displays the distribution of plants surveyed by sector and by area of tax benefits. Plants in our sample are not evenly distributed between high-tech and traditional industries. In each area, the number of traditional plants surveyed is higher than that of high-tech plants surveyed. This is related to the nature of the manufacturing fabric in the Tunisian south.

Table 2.4: Distribution of manufacturing sectors by area

Sectors	Area 4	Area 3	Area 2	Area 1
Agro-food industry	15 (39%)	16 (40%)	11 (33%)	25 (36%)
Building materials, ceramics and glass industry	11 (29%)	13 (33%)	4 (13%)	16 (23%)
Mechanical and metallurgical industry	3 (8%)	1 (3%)	5 (16%)	10 (15%)
Electrical, electronics and appliance industry	2 (5%)	0 (0%)	1 (3%)	0 (0%)
Chemical industry	1 (3%)	4 (10%)	2 (6%)	8 (12%)
Textile, clothing and leather industry	4 (10%)	2 (4%)	4 (13%)	5 (7%)
Wood, cork and furniture industry	1 (3%)	4 (10%)	0 (0%)	0 (0%)
Diverse industry	1 (3%)	0 (0%)	5 (16%)	5 (7%)
Total	38	40	32	69

Plants in our sample are not evenly distributed across the different size classes (Table 2.5). The largest share goes to small plants (45%). There is a balance between plants surveyed with a size between 20 and 49 jobs (28%) and those with a size between 50 and 199 jobs (24%). Only four plants with more than 200 jobs are surveyed. Based on plant sizes, plants are evenly distributed between the second and fourth areas (Table 2.6). Moreover, plants with 20-49 jobs are evenly distributed across all areas. Most of the small plants surveyed and those with 50-199 jobs are located in the area without tax advantages.

Table 2.5: Distribution of plants surveyed by size

Plant size	Number	% / Total	% compared to the parent-population in all the governorates surveyed
10 - 19 jobs	81	45%	23%
20 - 49 jobs	51	28%	17%
50 - 199 jobs	43	24%	21%
More than 200 jobs	4	2%	8%
Total	179	100%	19%

Table 2.6: Distribution of plants surveyed by size and area

Plant size	10 - 19 jobs	20 - 49 jobs	50 - 199 jobs	More than 200 jobs	Total
Area 1	40 (49%)	11 (22%)	18 (42%)	0	69
Area 2	9 (11%)	11 (22%)	10 (23%)	2 (50%)	32
Area 3	17 (21%)	15 (29%)	8 (19%)	0	40
Area 4	15 (19%)	14 (27%)	7 (16%)	2 (50%)	38
Total	81	51	43	4	179

The export regime that dominates our sample, is partially exporting (82%) (Table 2.7). These plants surveyed are evenly distributed among areas (Table 2.8). However, 18% of totally export plants are surveyed (Table 2.7) and most of these plants (56%) are located in area without tax advantages (Table 2.8).

Table 2.7: Distribution of plants surveyed by export regime

Export regime	Number	% / Total	% compared to the parent-population in all the governorates surveyed
Totally exporting	32	18%	20%
Partially exporting	147	82%	19%
Total	179	100%	19%

Table 2.8: Distribution of plants surveyed by export regime and area

	Totally exporting	Partially exporting	Total
Area 1	18 (56%)	51 (35%)	69
Area 2	4 (13%)	28 (19%)	32
Area 3	2 (6%)	38 (26%)	40
Area 4	8 (25%)	30 (20%)	38
Total	32	147	179

Most of plants surveyed are domestic (87%), only 23 foreign plants (13%) are surveyed (Table 2.9), which prevents us from deepening the study to analyze the location determinants of foreign plants. The distribution of domestic plants is almost equal between areas (Table 2.10). In contrast, only one foreign plant is surveyed in area 3, otherwise, the other foreign plants display an equitable distribution.

Table 2.9: Distribution of plants surveyed by nationality

Nationality	Number	% / Total
Domestic plant	156	87%
Foreign plant	23	13%
Total	179	100%

Table 2.10: Distribution of plants surveyed by nationality and area

	Foreign plants	Domestic plants	Total
Area 4	8 (35%)	30 (19%)	38
Area 3	1 (4%)	39 (25%)	40
Area 2	5 (22%)	27 (17%)	32
Area 1	9 (39%)	60 (39%)	69
Total	23	156	179

Tables 2.11 and 2.12 show the distribution of plants according to the production period (From the date of the production start until the date of the survey). We surveyed an almost equal number of plants between those with 1 and 10 years of production (43%) and those with 11 and 20 years of production (45%). We focus on plants that started production after 1990 in order to obtain valid answers and to avoid the possibility of not being able to answer to the questionnaire.

Table 2.11: Distribution of plants surveyed by production years

Production years	Number	% / Total
1 - 10 years	79	43%
11 - 20 years	80	45%
21 - 30 years	22	12%

Total	181	100%
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Table 2.12: Distribution of plants surveyed by years in production and area

	1 - 10 years	11 - 20 years	21 - 30 years
Area 1	36 (45%)	22 (28%)	11 (28%)
Area 2	12 (15%)	18 (23%)	3 (23%)
Area 3	10 (13%)	24 (30)	6 (30%)
Area 4	21 (27%)	15 (19%)	3 (19%)
Total	79	79	0

We test the internal consistency of our questionnaire using the Cronbach's alpha test (Nunnally, 1978). This test measures the internal consistency (or reliability) of the questions of a survey. It is used extensively in cases where the questionnaire is intended for a small sample and it is not possible to administer the questionnaire to the entire parent-population. Its value is less than or equal to 1, the questionnaire is considered to provide good reliability when the value of this measure is greater than 0.7. The value of this measure for our study sample is 0.863, indicating fairly good data reliability. Therefore, with this test we guarantee at least the internal reliability of our survey and that this questionnaire can be used by other researchers.

2.4. Results of the survey: Multiple Factor Analysis (MFA)

2.4.1. Methodology of the MFA and description of active groups

In order to analyze the results, we use factorial analysis and more specifically Multiple Factor Analysis (MFA) which is an extended form of Principal Component Analysis (PCA) for quantitative variables (Damiani et al., 2011) and Multiple Correspondence Analysis (MCA) for qualitative variables (Bécue-Bertaut et al., 2008). MFA allows to analyze datasets where variables are structured into groups. While the number and the nature of variables may vary from one group to another, these variables must be of the same nature in a given group. Our data are qualitative and structured in groups of questions related to a source of location determinant. Therefore, we use MFA as it can balance the influence of these different groups and provide information common to the groups and information specific to each group (Escofier and Pagès, 2008; Pagès, 2013).

We identify 11 groups ensuring homogeneity and intra-group consistency between the variables. Table 2.13 presents these different groups. There are eight active groups involved in the construction of the dimensions and three supplementary groups which do not contribute to the construction of the dimensions but will allow to interpret the results.

Table 2.13: Description of MFA groups

Groups	Group description	Number of variables	Group nature
Group 1	Personal and professional relationships or public and private organizations	12 variables	Active group
Group 2	Labor force characteristics	5 variables	Active group
Group 3	Geographical proximity	10 variables	Active group
Group 4	Infrastructures and means of transport	5 variables	Active group
Group 5	Building land and buildings of plants	8 variables	Active group
Group 6	Importance of neighboring plants	4 variables	Active group
Group 7	Local environment and living conditions	8 variables	Active group
Group 8	Tax regimes and local institutions	6 variables	Active group
Group 9	Delegation, governorate, spatial zone of tax regime	3 variables	Supplementary group
Group 10	Plant characteristics	11 variables	Supplementary group
Group 11	Global regional factors	6 variables	Supplementary group

We now present descriptive statistics for the eight active groups. All tables (Tables 2.21 to 2.28). which provide descriptive statistics for these groups, are in the appendix 2.2. The first group concerns the influence of personal and professional relationships or public and private organizations on the location choice of manufacturing firms. This group is composed of 12 variables which includes 12 dichotomous questions. Table 2.21 in the appendix 2.2 shows descriptive statistics of this group. Most of respondents answered no to all of these questions. The firms of our sample choose their location without the intervention of public and private institutes, with the exception of nearly 41% of respondents who consider the family's opinion in their location decisions.

Table 2.22 in the appendix 2.2 displays descriptive statistics for the second group which describes the labor force characteristics. This group consists of five variables that correspond to five Likert-scale questions. In our sample, more than 90% of plants consider the availability of low skilled labor as a very important or important factor in their location choice. Moreover, more than 65% of plants classify the variable “low-skilled at low wages” as a very important or important factor. For the other variables, there is no clear trend.

The third group contains 10 variables describing the geographical proximity to a particular neighborhood. The data collected for this group is obtained by 10 Likert-scale questions (Table 2.23 in the appendix 2.2). More than 62% of plants classify the proximity to suppliers, services required for production and a highway as very important and important factors. For the proximity to sources of raw materials, 35% of respondents consider this factor to be a very important in their location decisions, but 22% of respondents (the second share) consider it to be a very unimportant factor in their location decisions. Proximity to the port is classified as a very unimportant and unimportant factor by more than half of the plants in our sample.

The fourth group concerns the infrastructures and means of transport related to the production. We include five variables to explain this group and collect the data using five Likert-scale questions (Table 2.24 in the

appendix 2.2). More than 75% of plants consider the factors of this group as a very important and important factor except the variable “Availability of means of transport for inputs and outputs”. 42% of plants choose this last factor as a very important and important factor in their location decision.

Table 2.25 in the appendix 2.2 reports the eight variables of the fifth group “Building land and buildings of plants”. Variables in this group are created using Likert-scale questions. More than 78% of plants insist on the importance of the accessibility and visibility of the location which do not always correspond to reality. For the remaining variables, respondents provide mixed responses.

The sixth group is composed of four variables explaining the importance of the proximity to different neighboring plants (Table 2.26 in the appendix 2.2). The data collected for this group are also Likert-scale questions. Most of respondents (86.6%) state that they are neutral to the proximity to plants in the same sector, however, equal percentages are provided for the other variables of this group.

Table 2.27 in the appendix 2.2 reports descriptive statistics for the seventh group “Local environment and living conditions” which contains 7 variables obtained by Likert-scale questions. More than 60% of these plants classify most of the variables in this group (such as proximity to universities, cultural environment) as unimportant and very unimportant factors in their location decisions. This could be interesting; plants in our sample do not seem to be aware of the role of these variables in productivity or in regional growth.

The last group concerns the impact of tax regimes and local institutions on the manufacturing location choice. This group consists of 6 variables collected by Likert-scale questions (Table 2.28 in the appendix 2.2). Over 60% of respondents consider tax variables to be very important and important factors.

2.4.2. Results of the MFA

2.4.2.1. Global analysis of the MFA

We have performed an MFA on the results. We first find that we need 10 dimensions to achieve 50% of the total variance. Figure 2.5 (and Table 2.29 in the appendix 2.2) displays the eigenvalues and the percentages of inertia associated with each dimension. The first dimension recovers 13% of the inertia and the second dimension, 6.7%.

The coordinates of the active groups on the first two dimensions, the corresponding contributions and their representation quality squared cosine are shown in Table 2.14. The same information is provided for the supplementary groups in Table 2.30 in the appendix 2.2. Figures 2.6, 2.7 and 2.8 show the groups representation between the first dimension and the next three dimensions¹⁴. In these figures, the groups with solid triangles are the active groups, and those with empty triangles are the supplementary groups.

¹⁴ Figures 15, 16 and 17 in the appendix 2.2 present the groups representation between the second, third and fourth dimensions.

Figure 2.9 shows the representation of individuals whose contribution is greater than 0.5% and Table 2.31 in the appendix 2.2 reports the coordinates, contributions and cosine squared of individuals.

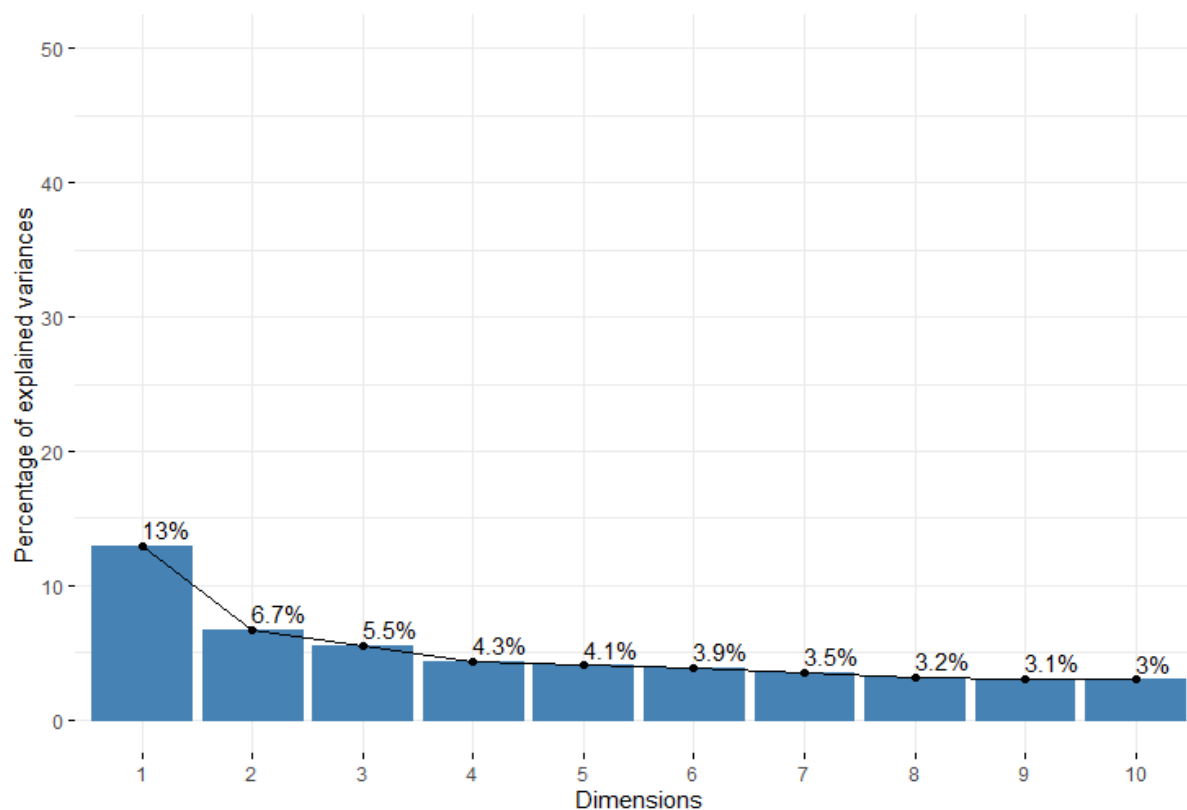


Figure 2.5: Decline of eigenvalues

Table 2.14: Coordinates, contributions and cosine squared of groups

Active groups	Coordinates	Contribution	Cos ²	Coordinates	Contribution	Cos ²
	Dim 1	Dim 1	Dim 1	Dim 2	Dim 2	Dim 2
Personal and professional relationships or public and private organizations	0.363	11.752	0.068	0.255	15.882	0.034
Labor force characteristics	0.535	17.332	0.128	0.115	7.158	0.006
Geographical proximity	0.593	19.212	0.178	0.077	4.785	0.003
Infrastructures and means of transport	0.304	9.851	0.055	0.072	4.455	0.003
Building land and buildings of plants	0.546	17.684	0.167	0.093	5.806	0.005
Importance of neighboring plants	0.322	10.445	0.079	0.065	4.036	0.003
Local environment and living conditions	0.389	12.602	0.087	0.358	22.283	0.073
Tax regimes and local institutions	0.035	1.121	0.001	0.572	35.595	0.219
Supplementary groups	Coordinates	Cos ²	Coordinates	Cos ²		
	Dim 1	Dim 1	Dim 2	Dim 2		
Delegation, governorate, spatial zone of tax regime	0.091	0.001	0.358	0.023		
Plant characteristics	0.501	0.054	0.174	0.007		
Importance of regional factors	0.155	0.002	0.162	0.003		

Table 2.32 in the appendix 2.2 shows the L_g coefficient which measures the connection between groups and is interpreted as an indicator of a group's dimensionality. However, this coefficient is not bounded, therefore, Table 2.33 in the appendix 2.2 reports another statistical indicator, called the RV coefficient, which is a normalized L_g coefficient and varies between 0 and 1. For the L_g coefficient, we are only interested in the diagonal terms. The highest L_g coefficients belong to the three supplementary groups, followed by the active group "Labor force characteristics". Thus, this last active group provides a more multidimensional and richer description. The RV coefficients are close to zero, hence, the groups are globally uncorrelated. The highest RV coefficient (0.217) is between the group "Plant characteristics" and "Geographical proximity", meaning that these two groups are the most related among all groups. The two active groups that show the highest RV coefficient (0.166), are "Building land and buildings of plants" and "Local environment and living conditions". We can also interpret the mean configuration of the MFA (The last line in Table 2.33); the group "Geographical proximity" has the closest configuration to the mean one.

We now interpret the economic significance of the first four dimensions. Three groups: "Geographical proximity to locations related to the production process" (First group), "Labor force characteristics" (Second group) and "Building land and buildings of plants" (Third group) contribute the most to the construction of the first dimension and have the best quality of representation. Therefore, this dimension describes traditional variables of the location choice and we name it "Traditional location factors". According to this dimension, plants focus on the local labor demand in their location decisions. Furthermore, plants in our sample emphasize proximity to a particular neighborhood, which may be proximity to suppliers, customers or city centers etc. Therefore, plants can benefit from their location. The shared labor and proximity to these factors are the foundations of Marshallian externalities, asserting the fundamental role of existing advantages in a region, offered to firms in the same sector. This dimension also shows that plants also consider the availability of land or buildings as a major factor in their location choices. Hence, these plants may support high lands or building prices as a result of the requirement to locate near employment centers, pointing to a necessity to arbitrate between transportation costs and land prices (Alonso, 1964).

Dimension 2 named "Institutional factors" is positively correlated with the group "Tax regimes and local institutions" which presents the best quality of representation. This dimension points to the role of the spatial tax regime in the location choice of manufacturing firms. At the level of the categories in this group, dimension 2 is positively correlated with the categories that mention the unimportance of tax incentives and financial subsidies in the manufacturing location choice. Thus, this dimension expresses the unimportance of institutional factors in location decisions in the Tunisian South.

Dimension 3 is named "Regional infrastructure" since the two groups that contribute the most to the construction of this dimension are "Infrastructures and means of transport" and "Building land and buildings of plants". These two groups have the best quality of representation than the other groups, but the squared cosines are low and less than 10%. As expected, manufacturing firms in southern Tunisia

consider the means of transport and the quality of infrastructure in their location choice in order to facilitate their interactions, in line with Jacobs' externalities. This may shed some light on the role of the government in investing in infrastructure and economic activities parks, which play a crucial role in the regional economic growth.

Dimension 4 is positively correlated with two groups: "Infrastructures and means of transport" and "Importance of neighboring plants". It is also positively related to the group "Local environment and living conditions". These groups also have the best quality of representation, but the squared cosines are low. This dimension illustrates the importance of being located near manufacturing firms and to production-related activities. Hence, we name this axis "Proximity to economic actors". Plants focus the proximity to manufacturing firms on their location choice, they locate in an area agglomerated by manufacturing industries, thus, they can benefit from agglomeration economies.

Dimensions 5 to 9 also give interesting results. Dimension 5 is positively correlated with the group "Labor force characteristics". Specifically, it is highly correlated with the categories: "Not_important_ Availability of low skilled or unskilled labour" and "Important_ Qualified and specialized labour at low wages". Hence, dimension 5 describes plants that seek a location characterized by high-skilled workers at low wages. Dimension 6 is positively related to two groups: "Local environment and living conditions" and "Personal and professional relationships or public and private organizations". This dimension highlights the location determinants of manufacturing activities that are not directly linked to production. Dimension 7 is also correlated with the group "Labor force characteristics" as is dimension 5. However, the difference lies in the categories positively related to this dimension, which are "Important_ Qualified and specialized labor at low wages", "Important_Low-skilled or unskilled labor at low wages" and "Important_Availability of non-unionized workers". Furthermore, Dimension 7 is also related to the two categories of the group "Geographical proximity": "Important_ Proximity to sources of raw materials and/or intermediate inputs" and "Proximity to suppliers and/or subcontractors". According to this dimension, plants choose a location with a low-wage and non-unionized workforce and close to inputs and suppliers. Two groups: "Infrastructures and means of transport" and "Personal and professional relationships or public and private organizations" contribute the most to the construction of the dimension 8 which may express the role of the government in guiding location choices through infrastructure investments and public institutions. Dimension 9 is positively correlated with the group "Tax regimes and local institutions". Unlike the dimension 2, this dimension 9 is related to categories that mention the importance of tax incentives and financial subsidies. Thus, this dimension 9 underlines the importance of institutional determinants in the manufacturing location in the Tunisian South.

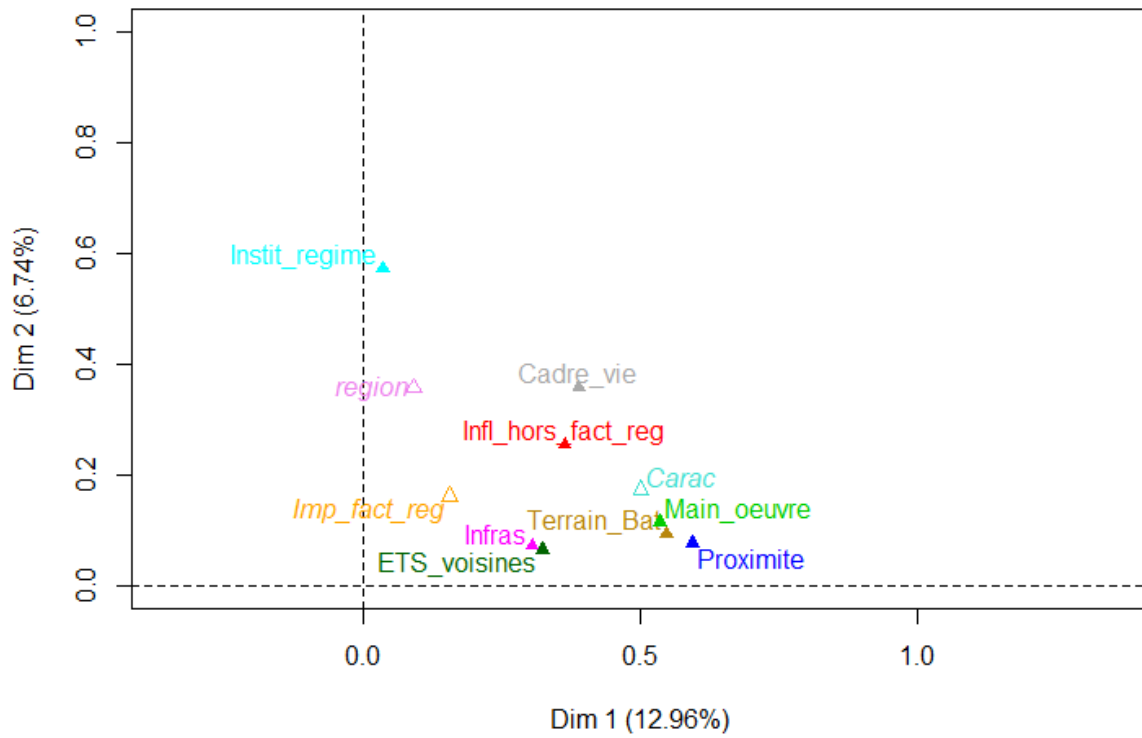


Figure 2.6: Groups representation (Dimension 1 – Dimension 2)

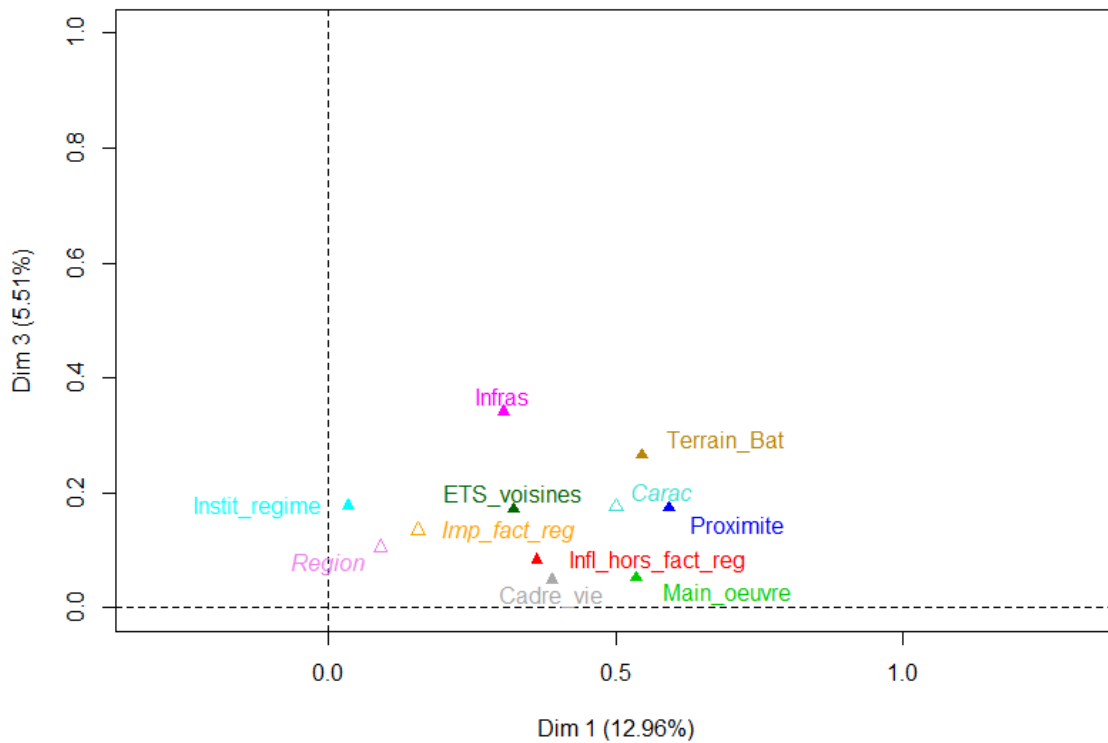


Figure 2.7: Groups representation (Dimension 1 – Dimension 3)

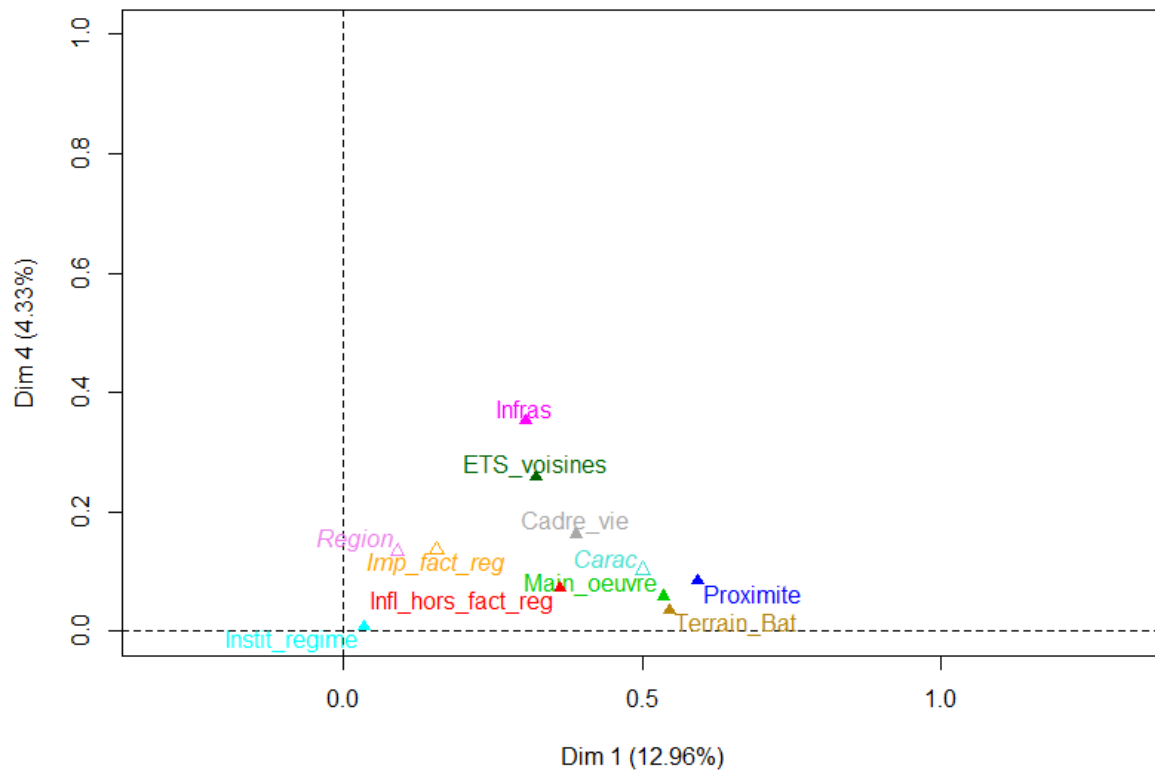


Figure 2.8: Groups representation (Dimension 1 – Dimension 4)

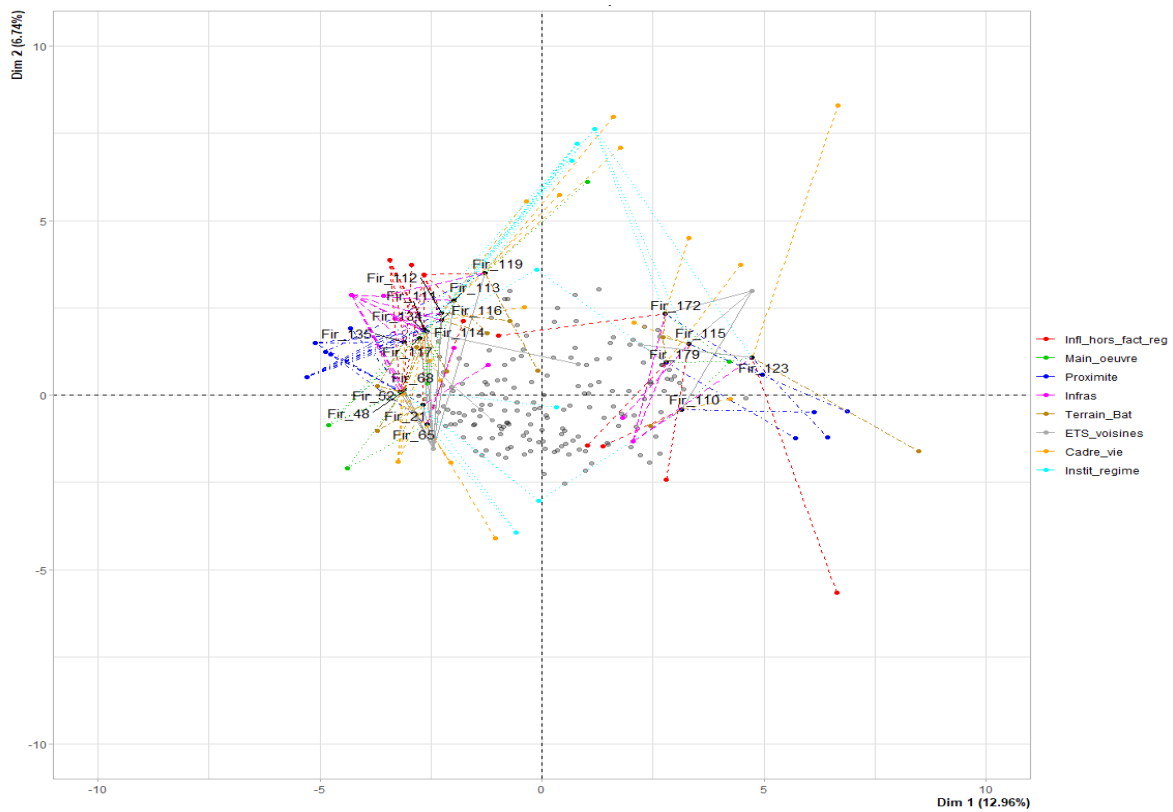


Figure 2.9: Individuals representation

Partial axes show the projection of the principal components of the MCA of each group (individual MCA) into the two dimensions of the MFA. Figures 2.10 and 2.11 display partial axes between the first dimension and the next two dimensions. According to Figure 2.10, the MCA's second dimension of the group "Personal and professional relationships or public and private organizations" coincides with the first dimension of the MFA. This means that this MCA's dimension of this group is highly negatively correlated with the MFA's first dimension. The first two dimensions of the MCA of the groups "Labor force characteristics", "Local environment and living conditions" and "Building land and buildings of plants" are almost as well projected. This shows that these MCAs are close to the MFA's 1st-2nd dimensions but with rotation.

In Figure 2.11, the MCA's first dimension of the group "Labor force characteristics" is highly correlated with the MFA's first dimension and the MCA's second dimension of the group "Tax regimes and local institutions" is highly correlated with the MFA's third dimension. The MCA's 1st-2nd dimensions of the groups "Infrastructures and means of transport" and "Building land and buildings of plants" are almost well-projected. This shows that their MCAs are close to the MFA's 1st-3rd dimensions but with rotation.

Tables 2.34 and 2.35 in the appendix 2.2 report statistical indicators to characterize the first two dimensions by variables and their categories. Table 2.34 in the appendix 2.2 shows correlation ratios between the variables and the first two dimensions and Table 2.35 in the appendix 2.2 displays categories coordinates. We focus only on relationships between active variables and dimensions. Interesting results arise from the variables related to the first dimension. This dimension is related to variables: "Availability of qualified and specialized labor", "Proximity to foreign and mixed plants", "Prestigious land or building" and "Proximity to the airport". In terms of categories, this first dimension contrasts two types of plants: the first considers these variables as important factors in their location choices, and the second considers them as unimportant factors. Hence, we characterize the first type as modern plants and the second as classical plants. Not surprisingly, the second dimension is correlated with the tax variables: "Tax incentives to locate in this region", "Level of taxes on manufacturing firms in this region" and "Funding of public organizations to locate in this region". This dimension is positively correlated with the categories that show the unimportance of these variables in manufacturing location choices. We also find that certain delegations without tax advantages represent coordinates on this dimension close to those of these latter categories. This second dimension is negatively correlated with the categories explaining the importance of these variables and also the position of certain delegations with tax advantages are close to those of these categories on this dimension.

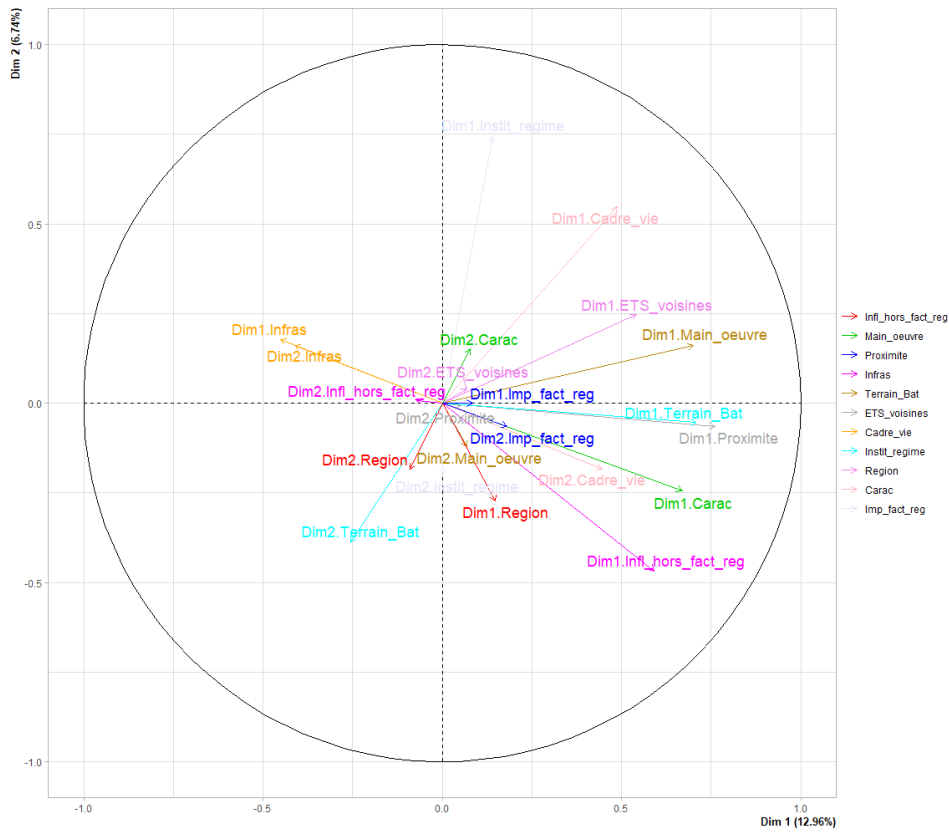


Figure 2.10: Partial axes (Dimension 1 – Dimension 2)

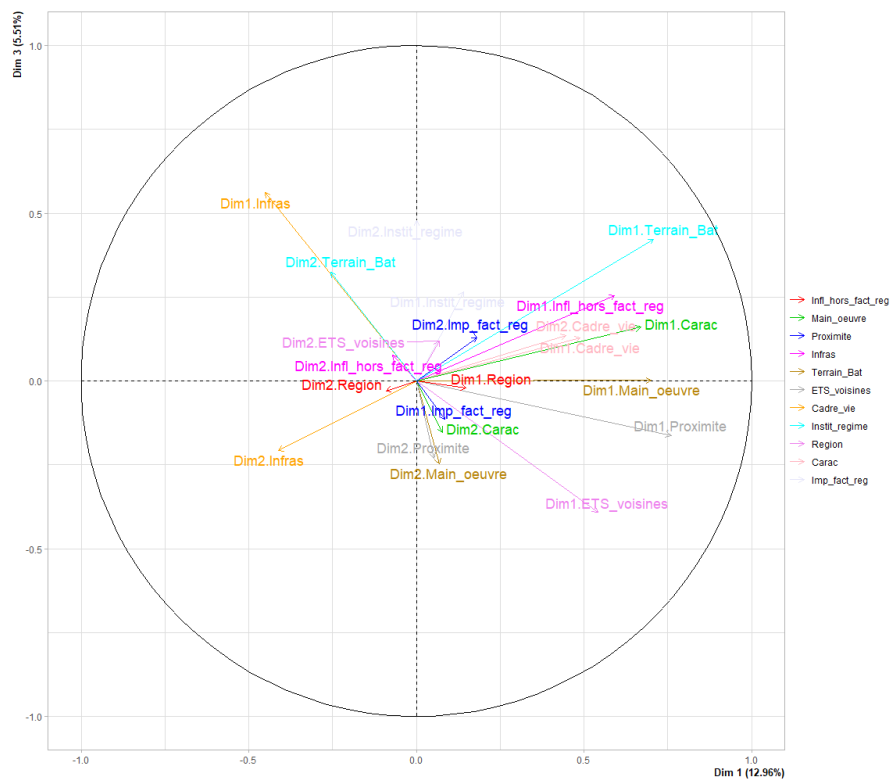


Figure 2.11: Partial axes (Dimension 1 – Dimension 3)

2.4.2.2. Hierarchical clustering

We complement the MFA with a Hierarchical Cluster Analysis (HCA) to define clusters of individuals from our survey data and create a partition. To build these clusters, we retain 25 dimensions that recover 79% of the inertia. Figure 2.12 displays the hierarchical tree. The classification performed on individuals reveals three clusters. This number of clusters maximizes the difference in inertia loss between two successive partitions (Husson et al., 2016).

Each cluster is made of individuals sharing variables whose values do not differ significantly from the mean. The partition in these three clusters is clearer in Figure 2.13, with individuals in each cluster represented by a different color. In fact, the first plan (1-2 dimensions) is the best plan that separates these clusters, more than the other plans. The hierarchical tree is also drawn on the factorial map with the individuals colored according to their clusters in Figure 2.14.

Tables 2.36 and 2.37 in the appendix 2.2 present the clusters description by dimensions. Table 2.36 in the appendix 2.2 only displays the dimensions that significantly characterize the partition and are sorted from those that best describe the partition to those that describe the partition a little less. Hence, dimensions 1, 2, 3 and 9 allow to best characterize the clusters. According to Table 2.37 in the appendix 2.2, individuals in the first cluster have significantly weaker coordinates in dimension 1 since the corresponding v-test is negative and stronger coordinates in dimensions 2 and 3 since the corresponding v-test is positive. In the second cluster, individuals have significantly weaker coordinates on dimensions 2, 3 and 9. For individuals in the third cluster, they have stronger coordinates in dimensions 1 and 2.

Tables 2.38 and 2.39 in the appendix 2.2 display the partition description in three clusters by variables and categories respectively. The clusters' characterization is simplified by keeping only the categories associated with a probability threshold below 0.01. Hence, the present categories characterize at least one cluster at the 0.01 threshold. Two variables that best characterize the partition in three clusters and allow to better separate the clusters are: "Quality of telecommunications infrastructure" and "Availability of qualified and specialized labor" since they provide the lowest probabilities equal to 2.61×10^{-19} et 6.57×10^{-16} . Specifically, each cluster is characterized by a category of these two variables.

In the first cluster, the category "Not_important_Quality of telecommunications infrastructure" is very characteristic: 94.74% of individuals who consider the quality of the telecommunications infrastructure as an unimportant factor in their location choice, are in cluster 1 and 62.07% of individuals in cluster 1 consider that the quality of the infrastructure is not important. Moreover, the first cluster is highly characterized by "Not_important_Quality of road infrastructure", "Not_important_Availability of qualified and specialized labour", "Not_important_Proximity to the highway" and "Yes_ Family of the firm head". Indeed, this cluster includes plants that choose their locations based on a family decision and do not even take into account the traditional variables affecting the manufacturing locations. Indeed, 63% of individuals who rely on the family decision to choose their production locations are in cluster 1 and 79% of individuals in cluster 1 choose their production location according to the family decision.

The category “Important_Quality of telecommunications infrastructure” is very characteristic in the second cluster in third position. The first category is “Imporant_Tax incentives”, followed by “Imporant_Funding of public organizations to locate in this region”: 50.81% (53.21%) of plants that consider tax incentives (public grants) as an important factor, are in the second cluster and 94.03% (86.57%) of plants in this second cluster rely on tax incentives (public grants) to decide their location. These values are important since in all clusters, 69.27% (60.89%) of plants consider tax incentives (public grants) as an important factor in their location decisions. Thus, we can infer from this second cluster the significant role of tax incentives and public grants influencing manufacturing location choices in southern Tunisia.

The third cluster is highly characterized by the category “Important_ Availability of qualified and specialized labour” but in second position after the category “Important_ Prestigious land or building”: 55.06% of individuals who consider prestigious land or buildings as an important factor in their location choice, are in cluster 3 and 90.74% of individuals in cluster 3 state that the prestigious land or building is an important factor. Globally, 49.72% of plants choose this variable as an important factor. For the variable “Availability of qualified and specialized labor”, 52.63% of individuals who consider this variable as an important factor in their location choice are in cluster 3 and 92.54% of individuals in cluster 3 consider it as an essential factor; 53.07% of plants in all clusters choose the availability of qualified and specialized labor as an important factor. Based on these findings, we interpret the individuals in this third cluster as modern plants.

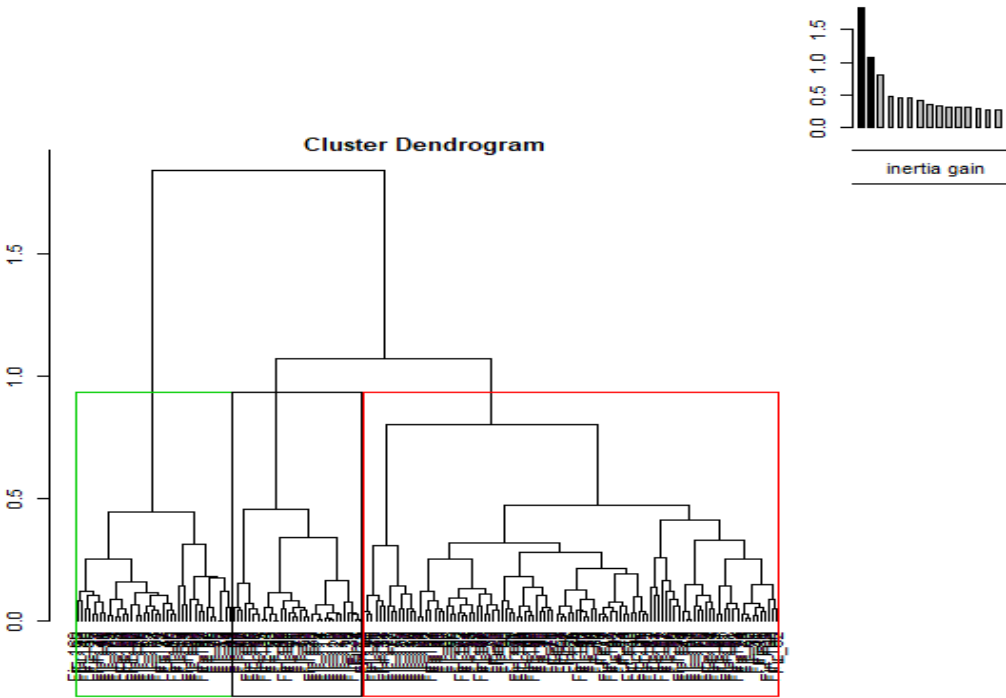


Figure 2.12: Hierarchical tree

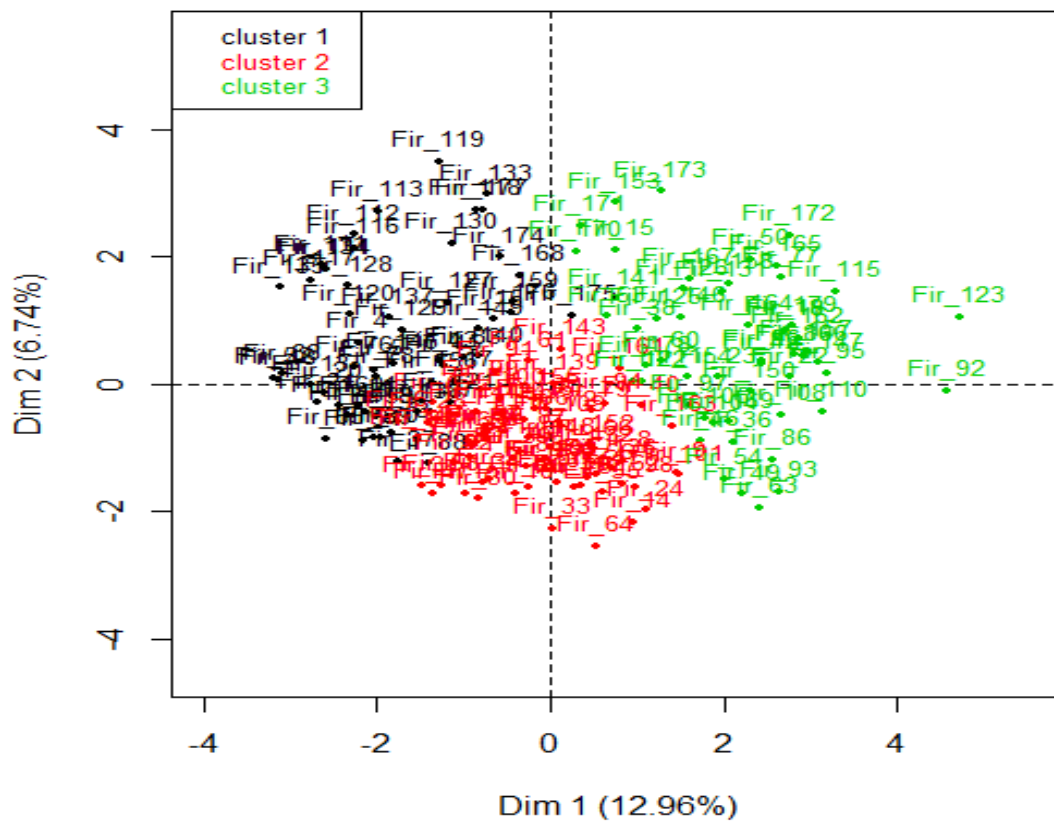


Figure 2.13: Ascending Hierarchical Classification of the individuals

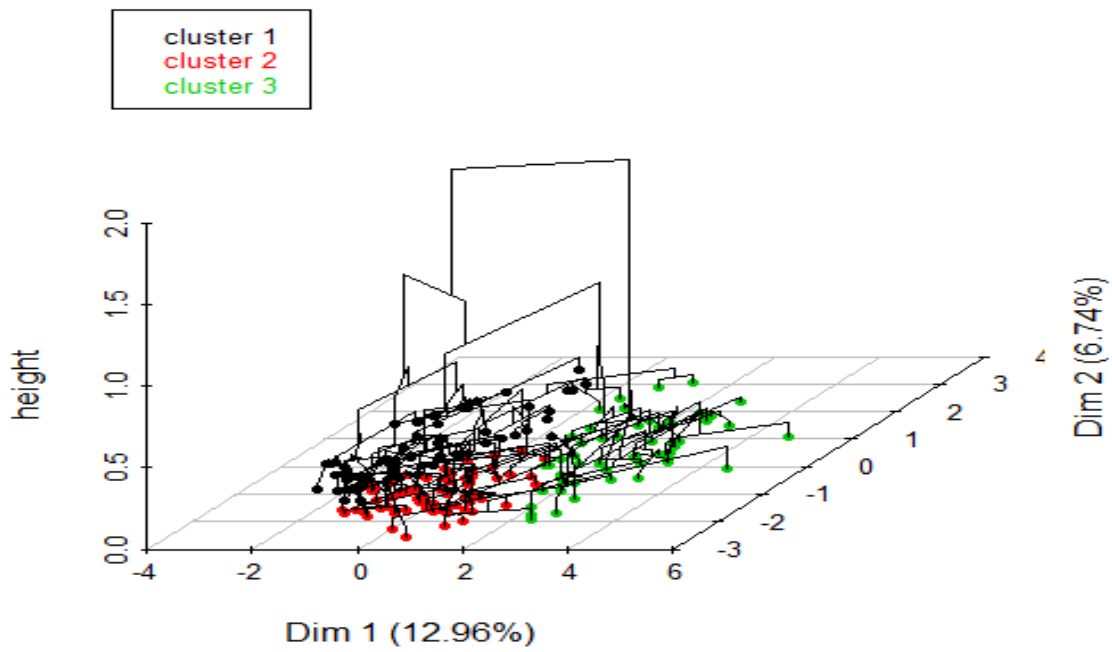


Figure 2.14: Hierarchical tree on the factorial map

2.5. Probit analysis

In this section, we perform an econometric analysis for our study based on a probit model, using dimensions obtained by the MFA as independent (and hence orthogonal) variables. Manufacturing firms choose to locate in a region with or without tax advantages. Hence, our dependent variable is a dummy variable: equal to 1 if plant chooses to locate in a spatial area with tax advantages and equal to 0, otherwise:

$$Y_i^* = \begin{cases} 1 & \text{if } Y_i^* \geq 0 \\ 0 & \text{if } Y_i^* \leq 0 \end{cases} \quad \text{où } Y_i^* = X_i\beta + \varepsilon_i$$

where X_i is a vector of independent variables: $X_i = (1, X_{i1}, \dots, X_{ik})$, β is a vector of parameters: $\beta = (\beta_0, \beta_1, \dots, \beta_k)$, ε_i is a random term and $\varepsilon_i \sim N(0, 1)$. The purpose of the probit model is to estimate the probability that $Y_i^* = 1$ as a function of the independent variables. The model is defined as follows:

$$P = \text{Prob}[Y_i^* | X_i] = \text{Prob}[X_i\beta + \varepsilon \geq 0 | X_i] = \Phi(X_i\beta)$$

where *Prob* denotes probability and Φ is the cumulative distribution function of the standard normal distribution. We estimate this model using maximum likelihood.

Table 2.15 shows the estimates of a specification with the first nine MFA dimensions. We consider this number of dimensions because from the 9th dimension, dimensions recover an inertia of less than 3% in total. Furthermore, we include dimensions up to the ninth dimension, since we find in HCA results that this dimension allows for a better characterization of the clusters. In column 1, we estimate a benchmark model only with these nine dimensions (model 1), while in column 2, we estimate a model with these nine dimensions and the supplementary variables that do not contribute to the construction of the MFA dimensions (model 2). These supplementary variables include plant characteristics: plant size, export regime, nationality, sector, legal status, number of employees and production start date. Table 2.16 shows the average marginal effects.

The coefficient associated with dimension 2 is significantly negative, thus, plants that consider tax incentives and public grants as an insignificant factor in their location choice, are 17% (model 1) less likely to locate in spatial areas with tax advantages. Moreover, the coefficient of dimension 7 is significantly negative; plants looking for low-wage and non-unionized labor, as well as proximity to inputs and suppliers are 8% (model 1) less likely to locate in tax-advantaged spatial areas. Only the coefficient of the dimension 9 is significant and positive, thus, plants that consider tax incentives and public grants as an important factor in their location choice, are 15% (model 1) more likely to locate in spatial areas with tax advantages. Concerning the identifying variables, only the coefficients of two categories of the variable "legal status" are significant. Plants with legal status "*Affaire personnelle*" are 40% more likely to locate in spatial areas with tax advantages, while those with legal status "SURL" are 23% less likely to locate in spatial areas with tax advantages.

To measure the goodness of fit, we calculate three measures: McFadden's Pseudo R², Cox and snell R² and Nagelkerke R² which provide values greater than 50% (Table 2.15). Hence, the goodness of fit for these probit models are satisfactory for all models.

Table 2.15: Benchmark probit models with nine dimensions

	Model 1	Model 2
Dim.1	-0.011 (0.075)	-0.058 (0.154)
Dim.2	-1.028*** (0.147)	-1.383*** (0.236)
Dim.3	0.081 (0.117)	-0.096 (0.174)
Dim.4	-0.010 (0.136)	-0.102 (0.192)
Dim.5	0.215 (0.138)	0.270 (0.176)
Dim.6	-0.189 (0.139)	-0.055 (0.179)
Dim.7	-0.490*** (0.158)	-0.505** (0.240)
Dim.8	-0.141 (0.163)	-0.123 (0.259)
Dim.9	0.873*** (0.179)	1.124*** (0.292)
Production start date: 2003-2009		0.327 (0.530)
Production start date: 2010-2014		-0.140 (0.544)
Production start date: 2015-2019		0.039 (0.548)
Building materials and ceramics industry		-0.333 (0.521)
Mechanical and metallurgical industry		-0.686 (0.605)
Electrical and electronics industry		6.286 (798.562)
Chemical industry		-0.639 (0.700)
Textile industry		1.438 (0.962)
Wood, cork and furniture industry		7.893 (462.351)
Diverse industry		-0.294 (1.019)
Export regime		0.509 (0.574)
Nationality		-0.129 (0.570)
Natural person company		0.036 (2.400)
Public limited company		0.136 (0.491)
<i>Affaire personnelle</i> company		3.468** (1.463)
Single owner limited liability company		-1.967* (1.095)
Number of employees: 12 - 21		-0.662 (0.594)
Number of employees: 22 - 50		0.320 (0.650)
Number of employees: 50 - 475		-0.104 (0.712)
Constant	0.367*** (0.137)	0.098 (0.818)

Observations	179	179
Log Likelihood	-54.107	-36.583
Akaike Inf. Crit.	128.215	131.167
McFadden's Pseudo R ²	0.547	0.693
Cox and snell R ²	0.518	0.603
Nagelkerke R ²	0.703	0.819

Level of significance: *** 1%, ** 5%, * 10%

Table 2.16: Probit model average marginal effects with nine dimensions

	Model 1	Model 2
Dim.1	-0.002	-0.007
Dim.2	-0.170***	-0.158***
Dim.3	0.0135	-0.011
Dim.4	-0.002	-0.012
Dim.5	0.036	0.031
Dim.6	-0.032	-0.006
Dim.7	-0.081***	-0.058**
Dim.8	-0.023	-0.014
Dim.9	0.145***	0.129***
Production start date: 2003-2009		0.038
Production start date: 2010-2014		-0.016
Production start date: 2015-2019		0.005
Building materials and ceramics industry		-0.038
Mechanical and metallurgical industry		-0.078
Electrical and electronics industry		0.719
Chemical industry		-0.073
Textile industry		0.164
Wood, cork and furniture industry		0.903
Diverse industry		-0.034
Export regime		0.058
Nationality		-0.015
Natural person company		0.004
Public limited company		0.016
Affaire personnele company		0.398**
Single owner limited liability company		-0.225*
Number of employees: 12 - 21		-0.076
Number of employees: 22 - 50		0.037
Number of employees: 50 - 475		-0.012
Constant	0.061***	0.011

Level of significance: *** 1%, ** 5%, * 10%

In the first specification with 9 dimensions, most of the identifying variables that characterize plants have an insignificant impact. We re-estimate probit models without dimensions 8 and 9. Tables 2.17 and 2.18 display coefficients' results and average marginal effects respectively. In these two tables, column 1 displays results obtained from the estimation of a baseline specification only with 7 dimensions. Column 2 presents

results from estimations of the specification with seven dimensions and all supplementary variables. In other columns, we gradually introduce the supplementary variables.

Almost all models provide similar results. In this specification, dimensions 2 and 7 have the same significant and negative impact as in the first specification. However, dimension 5 shows a significant and positive impact in all models in this specification. Hence, plants that consider the skilled and specialized labor at low wages as an important factor in their location choices, are 6% (model 5 in Table 2.18) more likely to locate in spatial areas with tax advantages.

Moreover, we find in this specification that all identifying variables have at least one category with a significant impact. The coefficient of the category “Production start date: 2003-2009” has a significant and positive sign in all models. Plants that started production between 2003 and 2009 are 16% (model 8 in Table 2.18) more likely to locate in tax-advantaged spatial areas. The ceramic sector, the mechanical sector and the chemical sector have a significant and negative effect in all models¹⁵, thus, plants in these sectors are 18% (model 9 in Table 2.18) less likely to locate in spatial areas with tax advantages. Unlike the first specification, only one category of the variable “legal status” has a significant impact in this specification. Plants with status “*Affaire personnelle*” are 5% (model 11 in Table 2.18) more likely to locate in tax-advantaged spatial areas. Concerning the variable “Number of employees”, only plants with 21 to 50 employees has a significant and positive impact. Plants with 21 to 50 employees are 17% (model 4 in Table 2.18) more likely to locate in spatial areas with tax advantages. Regarding the two binary variables, the nationality has an insignificant impact on the location choice in the southern Tunisia while the export regime has a positive and significant impact in all models. Partially exporting plants are 17% (models 6 and 7 in Table 2.18) more likely to locate in spatial areas with tax advantages.

To also verify the fit goodness, we present the associated graphs (Figures 2.18, 2.19, 2.20 and 2.21) in the appendix 2.2. The Residuals vs Fitted plot and the Scale-plot show curvilinear trends in all models; actually, we expect to find this shape since the fit of a probit model is curvilinear by nature. The normal QQ plot assesses whether the residuals are roughly normally distributed and whether the points are aligned on the diagonal line. In all models except the first model in the second specification, residuals are close to the diagonal line, pointing to overall adequate specification.

As a robustness check, we estimate logit models using the maximum likelihood method. Table 2.19 reports coefficients’ results and average marginal effects for the first specification with 9 dimensions. Tables 2.42 and 2.41 in the appendix 2.2 report coefficients’ results and average marginal effects for the second specification with 7 dimensions. The signs of the coefficients and marginal effects are generally the same for the logit and probit models. The notable difference is that logit models provide higher coefficient values than those of probit models and standard deviations are very high for certain categories (Electrical and electronics industry, Wood, cork and furniture industry). In the first specification with 9 dimensions,

¹⁵ except in model 2 with all identifying variables for the mechanical and chemical sectors.

contrary to probit models, the coefficient of dimension 5 is significantly positive in logit models. Concerning the second specification with 7 dimensions, dimension 7 and some categories (Production start date: 2003-2009, Chemical industry, Diverse industry) do not show the same stability in logit models as in probit models in terms of significance.

Table 2.17: Probit models with seven dimensions

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Dim.1	-0.007 (0.065)	-0.056 (0.125)	0.063 (0.084)	-0.092 (0.103)	0.014 (0.082)	0.047 (0.080)	-0.008 (0.092)	0.076 (0.083)	0.064 (0.078)	0.015 (0.089)	-0.094 (0.102)
Dim.2	-0.908***	-1.164***	-1.146***	-0.965***	-0.998***	-1.104***	-1.171***	-1.151***	-1.103***	-1.165***	-0.975***
Dim.3	(0.123) 0.024	(0.182) -0.223	(0.169) -0.119	(0.147) -0.105	(0.142) -0.091	(0.155) -0.103	(0.168) -0.207	(0.169) -0.102	(0.154) -0.087	(0.166) -0.183	(0.145) -0.063
Dim.4	(0.104) -0.050	(0.148) -0.123	(0.134) -0.115	(0.117) -0.015	(0.113) -0.021	(0.128) -0.123	(0.138) -0.097	(0.132) -0.115	(0.125) -0.121	(0.134) -0.098	(0.114) -0.010
Dim.5	(0.118) 0.229*	(0.159) 0.312**	(0.146) 0.305**	(0.135) 0.286**	(0.130) 0.328**	(0.138) 0.229*	(0.145) 0.261*	(0.146) 0.318**	(0.137) 0.239*	(0.143) 0.274*	(0.131) 0.262*
Dim.6	(0.121) -0.202	(0.154) -0.045	(0.143) -0.126	(0.140) -0.120	(0.135) -0.203	(0.135) -0.141	(0.144) -0.125	(0.143) -0.122	(0.135) -0.137	(0.144) -0.125	(0.138) -0.098
Dim.7	(0.123) -0.419***	(0.154) -0.432**	(0.144) -0.396**	(0.143) -0.535***	(0.136) -0.488***	(0.138) -0.345**	(0.143) -0.350*	(0.144) -0.361**	(0.138) -0.313**	(0.142) -0.300*	(0.141) -0.525***
	(0.137)	(0.206)	(0.182)	(0.169)	(0.161)	(0.160)	(0.179)	(0.175)	(0.155)	(0.170)	(0.161)
Export regime		1.035** (0.527)	0.883* (0.486)	0.894** (0.446)	0.744* (0.422)	0.933** (0.458)	1.018** (0.481)	0.729* (0.438)	0.732* (0.406)	0.779* (0.431)	
Nationality		-0.535 (0.535)	-0.360 (0.480)	-0.722 (0.488)	-0.522 (0.455)	-0.444 (0.458)	-0.559 (0.483)				-0.293 (0.421)
Production start date: 2003-2009		1.012** (0.465)	0.936** (0.420)	0.893** (0.415)	0.656* (0.390)			0.964** (0.418)			0.804** (0.399)
Production start date: 2010-2014		0.161 (0.460)	-0.054 (0.412)	-0.198 (0.403)	-0.433 (0.380)			-0.066 (0.410)			-0.302 (0.398)
Production start date: 2015-2019		0.401 (0.441)	0.031 (0.403)	0.127 (0.390)	-0.173 (0.367)			0.070 (0.399)			-0.010 (0.375)
Building materials and ceramics industry		-0.767* (0.443)	-0.940** (0.427)			-0.984** (0.401)	-0.873** (0.408)	-0.947** (0.425)	-0.998** (0.400)	-0.897** (0.407)	
Mechanical and metallurgical industry		-0.652 (0.525)	-0.847* (0.476)			-0.969** (0.449)	-0.803* (0.459)	-0.827* (0.472)	-0.971** (0.444)	-0.810* (0.452)	
Electrical and electronics industry		5.855 (519.412)	5.256 (528.371)			5.129 (555.432)	5.779 (533.059)	5.190 (531.567)	5.050 (557.585)	5.641 (539.148)	
Chemical industry		-1.061 (0.665)	-1.047* (0.568)			-0.998* (0.540)	-1.079* (0.599)	-1.050* (0.558)	-1.014* (0.531)	-1.090* (0.579)	
Textile industry		0.365 (0.776)	0.315 (0.709)			0.376 (0.650)	0.619 (0.726)	0.411 (0.689)	0.448 (0.631)	0.725 (0.694)	
Wood, cork and furniture industry		7.493 (293.740)	5.926 (332.075)			5.768 (356.792)	7.370 (304.709)	5.940 (332.481)	5.730 (359.891)	7.333 (304.209)	
Diverse industry		-1.038 (0.823)	-1.092 (0.718)			-0.792 (0.612)	-0.973 (0.710)	-1.092 (0.715)	-0.784 (0.610)	-0.940 (0.698)	

Natural person company		-0.256		-0.240	-0.207		-0.553		-0.606	-0.237	
		(2.035)		(2.003)	(1.646)		(1.631)		(1.631)	(1.822)	
Public limited company		0.388		0.245	0.226		0.372		0.345	0.150	
		(0.471)		(0.396)	(0.376)		(0.425)		(0.418)	(0.378)	
<i>Affaire personnelle</i> company		2.696**		2.482**	2.209**		2.607**		2.506**	2.458**	
		(1.192)		(1.049)	(1.069)		(1.059)		(1.055)	(1.072)	
Single owner limited liability company		-1.260		-0.279	-0.222		-1.297		-1.322	-0.241	
		(0.918)		(0.665)	(0.633)		(0.813)		(0.810)	(0.646)	
Number of employees: 12 - 21		-0.308		0.012						-0.083	
		(0.478)		(0.393)						(0.377)	
Number of employees: 22 - 50		0.478		0.945**						0.777*	
		(0.522)		(0.474)						(0.449)	
Number of employees: 50 - 475		0.352		0.647						0.450	
		(0.612)		(0.520)						(0.499)	
Constant	0.389***	-0.288	0.175	-0.412	0.107	0.417	0.271	-0.017	0.212	0.014	0.164
	(0.123)	(0.729)	(0.559)	(0.594)	(0.484)	(0.447)	(0.486)	(0.492)	(0.385)	(0.420)	(0.516)
Observations	179	179	179	179	179	179	179	179	179	179	179
Log Likelihood	-69.446	-47.876	-53.447	-56.905	-59.604	-56.908	-51.810	-53.737	-57.380	-52.504	-59.035
Akaike Inf. Crit.	154.893	149.752	146.894	153.809	153.208	147.816	145.620	145.473	146.760	145.008	156.070
McFadden's Pseudo R ²	0.418	0.599	0.552	0.523	0.501	0.523	0.569	0.55	0.519	0.56	0.505
Cox and snell R ²	0.427	0.55	0.521	0.502	0.487	0.502	0.53	0.52	0.5	0.526	0.49
Nagelkerke R ²	0.58	0.747	0.708	0.682	0.661	0.682	0.719	0.705	0.678	0.714	0.666

Table 2.18: Probit model average marginal effects with seven dimensions

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Dim.1	-0.002	-0.009	0.011	-0.016	0.003	0.008	-0.001	0.013	0.012	0.002	-0.017
Dim.2	-0.197	-0.176	-0.192	-0.172	-0.186	-0.199	-0.195	-0.194	-0.2	-0.196	-0.18
Dim.3	0.005	-0.034	-0.02	-0.019	-0.017	-0.019	-0.034	-0.017	-0.016	-0.031	-0.012
Dim.4	-0.011	-0.019	-0.019	-0.003	-0.004	-0.022	-0.016	-0.019	-0.022	-0.016	-0.002
Dim.5	0.05	0.047	0.051	0.051	0.061	0.041	0.043	0.054	0.043	0.046	0.048
Dim.6	-0.044	-0.007	-0.021	-0.022	-0.038	-0.025	-0.021	-0.02	-0.025	-0.021	-0.018
Dim.7	-0.091	-0.065	-0.066	-0.096	-0.091	-0.062	-0.058	-0.061	-0.057	-0.05	-0.097
Export regime		0.157	0.148	0.16	0.139	0.168	0.169	0.123	0.133	0.131	
Nationality		-0.081	-0.06	-0.129	-0.097	-0.08	-0.093				-0.054
Production start date: 2003-2009		0.153	0.157	0.159	0.122			0.162			0.148
Production start date: 2010-2014		0.024	-0.009	-0.035	-0.081			-0.011			-0.056
Production start date: 2015-2019		0.061	0.005	0.023	-0.032			0.012			-0.002
Building materials and ceramics industry		-0.116	-0.158			-0.177	-0.145	-0.16	-0.181	-0.151	
Mechanical and metallurgical industry		-0.099	-0.142			-0.175	-0.133	-0.139	-0.176	-0.136	
Electrical and electronics industry		0.886	0.881			0.924	0.96	0.874	0.916	0.948	
Chemical industry		-0.16	-0.175			-0.18	-0.179	-0.177	-0.184	-0.183	
Textile industry		0.055	0.053			0.068	0.103	0.069	0.081	0.122	
Wood, cork and furniture industry		1.133	0.994			1.039	1.225	1.001	1.04	1.232	
Diverse industry		-0.157	-0.183			-0.143	-0.162	-0.184	-0.142	-0.158	
Natural person company		-0.039		-0.043	-0.039		-0.092			-0.102	-0.044
Public limited company		0.059		0.044	0.042		0.062			0.058	0.028
Affaire personelle company		0.408		0.443	0.412		0.433			0.421	0.453
Single owner limited liability company		-0.191		-0.05	-0.041		-0.216			-0.222	-0.044
Number of employees: 12 - 21		-0.047		0.002							-0.015
Number of employees: 22 - 50		0.072		0.169							0.143
Number of employees: 50 - 475		0.053		0.116							0.083
Constant	0.084	-0.044	0.029	-0.074	0.02	0.075	0.045	-0.003	0.039	0.002	0.03

Table 2.19: Benchmark logit models

	Coefficients		Average marginal effects	
	Model 1	Model 2	Model 1	Model 2
Dim.1	-0.017 (0.140)	-0.092 (0.298)	-0.002	-0.006
Dim.2	-1.806*** (0.292)	-2.613*** (0.523)	-0.164***	-0.157***
Dim.3	0.134 (0.210)	-0.111 (0.334)	0.012	-0.007
Dim.4	0.001 (0.252)	-0.197 (0.382)	0.0001	-0.012
Dim.5	0.387 (0.254)	0.599* (0.340)	0.035	0.036*
Dim.6	-0.376 (0.251)	-0.267 (0.345)	-0.034	-0.016
Dim.7	-0.867*** (0.294)	-0.950** (0.476)	-0.079***	-0.057**
Dim.8	-0.213 (0.303)	-0.161 (0.510)	-0.019	-0.01
Dim.9	1.533*** (0.342)	2.127*** (0.602)	0.139***	0.128***
Production start date: 2003-2009		0.521 (1.047)		0.031
Production start date: 2010-2014		-0.378 (1.060)		-0.023
Production start date: 2015-2019		-0.229 (1.081)		-0.014
Building materials and ceramics industry		-0.657 (1.027)		-0.04
Mechanical and metallurgical industry		-1.379 (1.159)		-0.083
Electrical and electronics industry		18.985 (3,382.505)		1.141
Chemical industry		-1.257 (1.359)		-0.076
Textile industry		2.934 (1.953)		0.176
Wood, cork and furniture industry		20.681 (1,991.992)		1.243
Diverse industry		-0.651 (2.160)		-0.039
Export regime		1.344 (1.074)		0.081
Nationality		-0.562 (1.087)		-0.034
Natural person company		-0.381 (6.349)		-0.023
Public limited company		0.399 (0.968)		0.024
Affaire personnelle company		6.353** (3.065)		0.382**
Single owner limited liability company		-3.630* (2.132)		-0.218*
Number of employees: 12 - 21		-1.158 (1.171)		-0.07
Number of employees: 22 - 50		0.743 (1.310)		0.045

Number of employees: 50 - 475		-0.560 (1.392)		-0.034
Constant	0.624** (0.253)	0.304 (1.618)	0.057	0.018
Observations	179	179		
Log Likelihood	-54.325	-35.819		
Akaike Inf. Crit.	128.649	129.637		
McFadden's Pseudo R²	0.545	0.7		
Cox and snell R²	0.516	0.61		
Nagelkerke R²	0.701	0.82		

2.6. Conclusion

This paper examines the impact of tax incentives and financial subsidies on the location decisions of manufacturing firms in southern Tunisia. We have surveyed 179 manufacturing Firms in four spatial areas in this region; each offering a different tax regime. In fact, Tunisia is spatially divided into four zones, the first is a spatial zone that does not benefit from any tax advantages and the last is considered as the most privileged region in terms of fiscal and financial advantages. Following much of the literature on the manufacturing location, we have written a questionnaire based on the factors cited on this literature. Hence, our questionnaire is structured around five parts that include almost all the factors influencing the manufacturing location; we also left open-ended questions to give respondents the option of citing other factors not mentioned in the questionnaire.

Various empirical methods are used to analyze our survey data. Starting with Multiple Factor Analysis, several results stand out. With the first dimension that reflects traditional factors, we show that some plants still choose their location decisions mainly on the basis of traditional factors such as the workforce, the availability of land and buildings and the geographical proximity to locations related to the production process, and which also represent the foundations of Marshallian theory. The second dimension identifies the role of tax incentives and financial subsidies and describes the plants that consider these tax incentives as a minor factor in their location choice.

Hierarchical Cluster Analysis (HCA) identifies three interesting clusters. For the first cluster, the opinions of the family are always important in the decision-making process of the manufacturing locations, and also the usual economic factors are not taken into account in their location choice. In this regard, the idea of the event "I undertake in my region" organized by Tunisia Marketplace (TPM) in 2015 is an initiative that is line with our result: this action encourages Tunisian entrepreneurs to invest in their origin regions in order to develop the regional entrepreneurial culture and thus to improve regional economic growth. The second cluster confirms the impact of tax incentives and financial subsidies on manufacturing location choices as the corresponding plants rely on institutional factors to choose a location. The third cluster groups modern firms looking for high skilled human capital and prestigious land and building in a region to locate their manufacturing unit.

We complete our study with an econometric analysis using the first nine dimensions of the MFA and additional variables that characterize plants as independent variables. Probit models also show the significant impact of tax incentives on location decisions. Dimensions 2 and 9, related to institutional factors, have a significant impact on location decisions of manufacturing firms; the consideration of tax incentives and grants in the location choice increases the probability that a plant will locate in a tax-advantaged area by 15%. As regards the identifying variables, the nationality of manufacturing firm has an insignificant impact on the location choice in the southern Tunisia. The export regime has a significant and positive impact on manufacturing location decisions. Partially exporting plants are more likely to locate in spatial areas with tax advantages than totally exporting plants. For additional categorical variables, at least one category of each variable has a significant impact. Roughly speaking, plants that started production between 2003 and 2009, plants with 21 to 50 employees, plants with “*Affaire personnelle*” status are more likely to locate in tax-advantaged spatial zones in southern Tunisia, while plants in ceramic, mechanical and chemical sectors are less likely to locate in these zones.

In sum, all of these empirical methods endorse the role of tax incentives and financial subsidies in manufacturing location decisions in southern Tunisia. Furthermore, according to our findings, plants in this region do not have the same behavior when choosing the location; some plants are based on traditional location determinants such as workforce characteristics, proximity to customers and/or suppliers and infrastructure and others are based on modern location determinants such as prestigious buildings, highly qualified human capital and a high quality of life.

From a political point of view, this paper contributes to an understanding of the location determinants in order to improve the effectiveness of location-based policies in Tunisia. Thus, these policies should include the heterogeneity of location decisions in their strategies rather than treating all plants as a single entity making similar decisions. Offering tax incentives without improving the quality of life and without providing a high-skilled labor pool is not the right strategy to enhance regional growth and attract new businesses. From a research point of view, this paper contributes to the literature by proposing a new study on the effects of tax policies in developing countries.

The implication of these results is nevertheless restricted by certain limitations related to the methodology of the questionnaire administration and to the sample characteristics. The limited sample characteristics are related to the limited financial resources used in this survey. Hence, more research studies on the differential in tax incentives between Tunisian regions are certainly needed as the reduction of regional disparities is a crucial issue for policy makers in Tunisia. In this chapter, we focus on a specific region in Tunisia, therefore, broadening the sample can also give a wider picture of location choices of manufacturing industries in Tunisia. Moreover, analyzing location factors at the sectoral level can also provide interesting results to understand the needs of firms in each manufacturing sector. An interesting task for future research would be to extend this analysis by using a spatial model to study the spatial interdependence between the location decisions of manufacturing firms.

2.7. Appendix 2

2.7.1. Appendix 2.1

Questionnaire

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Lettre d'accompagnement

Madame, Monsieur,

Nous vous invitons à répondre à ce questionnaire qui s'inscrit dans le cadre d'une thèse, menée par Rawàa LAAJIMI, doctorante en sciences économiques en co-tutelle à l'Université de Sousse, Tunisie et l'Université de Bourgogne Franche-Comté, France.

L'objectif de ce questionnaire est de recueillir des informations sur les facteurs de décision qui conduisent les entreprises manufacturières à localiser leurs unités de production dans les zones franches ou au contraire, de ne pas les y localiser. Ce type de recherche représente un enjeu considérable pour la croissance régionale en Tunisie afin de mieux comprendre les facteurs régionaux qui influencent les choix de localisation des entreprises manufacturières dans un lieu particulier.

Nous vous informons que ce questionnaire concerne uniquement les facteurs de localisation des unités de production (usines). A cette fin, nous vous posons des questions simples et faciles à répondre. Les informations que vous fournirez seront traitées de manière strictement confidentielle et uniquement utilisées dans le cadre de ce projet de recherche.

Le temps estimé pour remplir ce questionnaire est approximativement de 20 minutes.

Vous remerciant énormément par avance de votre collaboration, nous vous prions de croire, Madame, Monsieur, à l'assurance de nos sincères salutations.

Rawàa LAAJIMI

QUESTIONNAIRE N°

Partie 1 : Identification de l'entreprise et du répondant

A. Dénomination

Nom ou raison sociale :

Téléphone :

Email :

Adresse :

B. Année d'entrée en production :

C. Activités de l'entreprise

C.1. Activité principale

Le tableau dans l'annexe (pages 12-13) montre chaque secteur manufacturier en Tunisie avec leurs branches d'activités. Veuillez-vous référer à cette annexe afin de préciser votre activité principale.

.....

C.2. Activité secondaire

Si vous avez une activité secondaire, précisez-là-ci-dessous en se référant également à l'annexe (pages 12-13).

.....

D. Régime d'export de l'entreprise :

Enterprise totalement exportatrice <input type="checkbox"/>	Enterprise partiellement exportatrice <input type="checkbox"/>
---	--

E. Nationalité de l'entreprise

Tunisienne <input type="checkbox"/>	Mixte <input type="checkbox"/> Précisez la nationalité :	Etrangère <input type="checkbox"/> Précisez la nationalité :
-------------------------------------	--	--

F. Statut Juridique

Personne physique <input type="checkbox"/>	Société de fait <input type="checkbox"/>
Société anonyme <input type="checkbox"/>	Coopérative <input type="checkbox"/>
S.A.R.L. <input type="checkbox"/>	Société en nom collectif <input type="checkbox"/>
S.U.R.L. <input type="checkbox"/>	Autre, précisez : <input type="checkbox"/>

G. Caractéristiques du répondant

H.1. Poste occupé du répondant :

Propriétaire de l'entreprise	<input type="checkbox"/>
Directeur de l'entreprise	<input type="checkbox"/>
Responsable dans l'entreprise Quelle fonction exercez-vous ? :	<input type="checkbox"/>
Assistant (e) de direction	<input type="checkbox"/>
Autre, précisez :	<input type="checkbox"/>

H.2. Depuis combien de temps travaillez-vous pour cette entreprise ?

.....

Partie 2 : Questions sur les caractéristiques de l'entreprise

Question 1 : Votre entreprise appartient-elle à un groupe ?

OUI

NON

Question 2 : Votre entreprise est mono ou multi établissements ?

OUI

NON

Combien d'établissements :

Question 3 : Notre questionnaire concerne les facteurs qui influencent le choix de la localisation de l'unité de production. Si cette localisation accueille simultanément d'autres activités, indiquez, s'il vous plait, la nature de celles-ci :

Siège social	<input type="checkbox"/>
Centre de recherche et développement	<input type="checkbox"/>
Entrepôt, logistique et/ou stockage	<input type="checkbox"/>
Activités de services	<input type="checkbox"/>
Lesquelles ?.....	<input type="checkbox"/>
Marketing, fonctions commerciales et/ou de support client	<input type="checkbox"/>
Autre, précisez :	<input type="checkbox"/>

Question 4 : Votre entreprise disposait-elle d'une ou de plusieurs unités de production ?

OUI

NON

Combien d'unités de production :

Si votre réponse est OUI, répondez à la question 4, sinon passez directement à la partie suivante (Partie 3)

Question 5 : Pour quelle raison cette unité de production a-t-elle été effectuée ? *Cochez les cases correspondant à votre situation.*

D'un transfert partiel d'activité(s) depuis l' (les) ancienne (es) unité (s) de production de votre entreprise	<input type="checkbox"/>
D'un transfert total d'activité(s) depuis l' (les) ancienne (es) unité (s) de production de votre entreprise	<input type="checkbox"/>
De la création ex-nihilo d'une nouvelle capacité	<input type="checkbox"/>
Autre, précisez :	<input type="checkbox"/>

Question 6 : Veuillez indiquer la ou les endroit(s) d'autre(s) unité (s) de production :

Délégation (s)	Gouvernorat (s)	Pays (si hors de la Tunisie)

Si vous avez rempli la case Délégation (s) ou Gouvernorat (s), répondez à la question 6, sinon passez directement à la suivante (Partie 3).

Question 7 : Dans quel type de zones, votre (vos) autre (s) unité (s) de production était-elle (étaient-elles) située (s) ? *Cochez les cases correspondant à votre situation.*

Parcs d'activités économiques	<input type="checkbox"/>
Zones de développement régional	<input type="checkbox"/>
Zones aménagées par l'agence foncière industrielle	<input type="checkbox"/>
Zones aménagées par les organismes privés	<input type="checkbox"/>
Autres, précisez :	<input type="checkbox"/>

Question 8 : Pourquoi avez-vous pris la décision de localiser l'unité de production dans l'(es) autre (s) endroit (s) ?

.....

.....

.....

.....

Partie 3 : Questions générales sur les facteurs de localisation de votre entreprise

Question 1 : Avant de choisir cette localisation, avez-vous envisagé d'autres endroits afin de localiser votre unité de production ? Répondez par oui ou non.

OUI <input type="checkbox"/>	NON <input type="checkbox"/>
------------------------------	------------------------------

Si votre réponse est OUI, précisez cet (ces) endroit (s) et expliquez pourquoi vous avez changé d'avis, sinon passez directement à la question 2 :

.....

.....

.....

.....

Question 2 : Avez-vous contacté un acteur spécialisé dans votre processus de recherche d'une localisation pour votre unité de production ?

Cabinet de conseil spécialisé	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Services publics		
Si oui, le (s) quel (s) :	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
.....		
Services privés		
Si oui, le (s) quel (s) :	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
.....		
Autre, précisez :		

Question 3 : Dans le processus de recherche d'une localisation pour votre unité de production, certains acteurs externes de votre entreprise peuvent influencer ou orienter ce choix. Est-ce que ces acteurs externes suivants influencent-ils votre décision de localisation ?

Famille du chef de l'entreprise	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Connaissances et relations personnelles	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Actionnaire (s) de votre entreprise	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Votre (vos) client (s)	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Votre (vos) fournisseur (s)	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Pouvoir politique national	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Pouvoirs politiques locaux	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Autre, précisez :		

Question 4 : Dans le processus de recherche d'une localisation pour votre unité de production, certains acteurs internes de votre entreprise peuvent également influencer ou orienter ce choix. Est-ce que ces acteurs internes suivants influencent-ils votre décision de localisation ?

Cadres,	OU	NO
Si oui, précisez leur (s) fonction (s) :	I <input type="checkbox"/>	N <input type="checkbox"/>
Ouvriers	OU	NO
	I <input type="checkbox"/>	N <input type="checkbox"/>
Autre, s'il y a eu d'autres acteurs internes qui ne sont pas indiqués et ont orienté votre choix de localisation, précisez :	OU	NO
.....	I <input type="checkbox"/>	N <input type="checkbox"/>
.....		

Question 5 : Cette question permet de connaître, en général, les facteurs régionaux que vous avez pris en considération, lorsque vous avez choisi cet endroit afin d'implanter votre unité de production.

Veillez ordonner du plus important (ordre (1)) au moins important (ordre (6)) les facteurs choisis par rapport à la décision de l'implantation de votre unité de production. S'il y a eu un autre facteur, précisez-le, s'il vous plait, dans la case Autre et ordonnez du plus important (ordre (1)) au moins important (ordre (7)).

Main d'œuvre	
Proximité d'un voisinage particulier (exemple : client(s), fournisseur (s), port(s), administration (s) etc.)	
Choix d'un terrain ou d'un bâtiment qui répond à vos besoins	
Moyens de transport / Qualité d'infrastructure	
Qualité de vie de la région	
Proximité des entreprises manufacturières	
Autre, précisez :	
.....	

Partie 4 : Questions sur les facteurs régionaux de localisation de l'entreprise

Cette partie permet de connaître le degré d'importance des facteurs lors de choix de localisation de votre unité de production. Veuillez préciser le degré d'importance que vous avez accordé à chaque facteur lorsque vous avez choisi cet endroit afin d'implanter votre unité de production.

Question 1 : Facteurs liés à la main d'œuvre

Disponibilité d'une main d'œuvre qualifiée et spécialisée				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Main d'œuvre qualifiée et spécialisée à faible salaire				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité d'une main d'œuvre peu ou pas qualifiée				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Main d'œuvre peu ou pas qualifiée à faible salaire				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité des travailleurs non syndiqués				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 2 : Facteurs liés aux marchés de biens et services

Proximité des sources de matières premières et/ou produits intermédiaires				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité des fournisseurs et/ou sous-traitants				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité des activités de services nécessaires pour la production de votre entreprise				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité des locaux de stockage et d'approvisionnement				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 3 : Cette question concerne les entreprises dont leur régime est partiellement exportateur et totalement exportateur après 2 ans de production. *Si cela ne correspond pas à votre situation, passez, s'il vous plait, directement à la question 4.*

Proximité de vos clients potentiels locaux				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 4 : Facteurs liés aux infrastructures de transport et de télécommunication

Proximité du port				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité de l'aéroport				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Proximité de l'autoroute				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité d'infrastructures ferroviaires				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité du centre-ville				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité des moyens de transport				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité des moyens de transport pour les marchandises (matières premières, produits intermédiaires, matériels) et les produits finis				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité des infrastructures routières				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité des infrastructures de télécommunication				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité des réseaux d'eau, énergie et électricité				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 5 : Facteurs liés aux locaux de production

Coûts faibles (coûts de loyers, coûts d'acquisition des terrains, coûts de construction des bâtiments)				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité de terrains à bâtir adaptés à vos besoins (forme du terrain, superficie, accès routier...)				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité de bâtiments adaptés à vos besoins (superficie, architecture...)				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accessibilité et visibilité de votre local				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité des terrains ou des bâtiments disponibles pour étendre votre entreprise				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Terrain ou bâtiment prestigieux				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Si votre siège social est séparé de votre unité de production, précisez le degré d'importance de facteur : **Proximité du siège social de votre entreprise**, *sinon passez directement au facteur suivant.*

Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Si vous avez d'autres locaux à votre entreprise ou au même groupe que votre entreprise, précisez le degré d'importance de facteur : Proximité de ces locaux , <i>sinon passez directement au facteur suivant.</i>				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 6 : Facteurs liés à l'échange avec vos entreprises voisines manufacturières

Ces facteurs permettent de comprendre l'importance que vous accordez aux échanges et relations avec les entreprises manufacturières voisines et votre préférence à être localisé près de ces entreprises. Les entreprises voisines correspondent à ceux dans la même rue, la même avenue ou la même zone industrielle.

Proximité des entreprises du même secteur. Veuillez-vous référer à l'annexe pour la définition de toutes les activités qui appartiennent au même secteur.				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité des entreprises de secteurs différents				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité des entreprises étrangères et mixtes				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité des entreprises tunisiennes				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 7 : Facteurs liés à l'environnement local et au cadre de vie

Proximité du lieu de résidence des travailleurs				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité du lieu de résidence du (es) propriétaire (s) de l'entreprise				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité d'un établissement d'enseignement supérieur				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité de laboratoires de recherche				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Environnement culturel (cinéma, théâtre, bibliothèque..)				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Beauté des paysages				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Facteurs de loisirs (salles de sport, parcs, cafés etc.)				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité de logement pour vos personnels				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 8 : Facteurs liés aux marchés financiers, régimes fiscaux et institutions locales

Proximité des services bancaires nécessaires aux besoins de votre entreprise				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Financement par des organismes privés pour s’implanter dans cette région				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incitations et services par le gouvernement tunisien pour afin de promouvoir le développement industriel régional				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incitations fiscales établies par le gouvernement tunisien afin d’implanter les activités manufacturières dans cette région				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Niveau des taxes et impôts s’exerçant sur les entreprises manufacturières dans cette région				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ce facteur est destiné pour les entreprises <u>non installées dans les parcs d’activités économiques</u> , si cela ne correspond pas à votre situation, passez directement au facteur suivant.				
Proximité des parcs d’activités économiques				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 9 : Cette question est ouverte, répondez, s’il vous plait, librement à cette question. Quelle est la raison principale de votre choix de cet endroit pour localiser votre unité de production et précisez s’il y a eu d’autres facteurs qui ne sont pas cités dans le questionnaire :

.....

.....

.....

.....

.....

Question 10 : Cette question est ouverte, répondez, s’il vous plait, librement à cette question. Quels sont les facteurs régionaux manquants dans cette région qui peuvent être ou sont primordiaux pour votre production ?

.....

.....

.....

.....

.....

Question 11 : Merci de bien vouloir répondre à notre dernière question concernant le degré de satisfaction de votre localisation.

Êtes-vous globalement satisfait de la localisation de votre entreprise ?				
Pas du tout satisfait	Pas satisfait	Neutre	Satisfait	Très satisfait
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

La partie suivante est destinée aux firmes étrangères et mixtes, si cela correspond à votre situation, passez s’il vous plait à répondre aux questions de cette partie, sinon nous vous remercions vivement de votre collaboration et participation à cette recherche.

Partie 5 : Questions destinées uniquement aux entreprises étrangères et

mixtes

Cette partie concerne les entreprises mixtes et étrangères qui se localisent en Tunisie.

Nous souhaitons comprendre les facteurs qui vous ont conduit à transférer vos

Question 1 : Pourriez-vous nous expliquer comment vous avez collecté les informations nécessaires pour s'implanter en Tunisie ?

Cabinet de conseil spécialisé	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Services publics établis par le gouvernement tunisien Si oui, le (s) quel (s) :	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Services privés tunisiens Si oui, le (s) quel (s) :	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Services privés non tunisiens Si oui, le (s) quel (s) :	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Entreprises installées en Tunisie	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Dirigeants tunisiens	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Connaissances et relations personnelles	OUI <input type="checkbox"/>	NON <input type="checkbox"/>
Autre, précisez :	OUI <input type="checkbox"/>	NON <input type="checkbox"/>

Question 2 : Nous citons maintenant plusieurs facteurs qui pourrait influencer votre choix de localisation en Tunisie. *Précisez le degré d'importance pour chaque facteur.*

Disponibilité des sources de matières premières nécessaires à votre production en Tunisie

Pas du tout important	Pas important	Neutre	Important	Très important
-----------------------	---------------	--------	-----------	----------------

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité des fournisseurs importants en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Densité d'entreprises manufacturières				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catégorisation de secteurs manufacturiers trouvés en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité des services destinés aux entreprises en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Est-ce que vous avez exigé la disponibilité des services à fortes valeurs ajoutée en Tunisie, lors du choix de votre localisation ?				
OUI <input type="checkbox"/>		NON <input type="checkbox"/>		
<i>Si votre réponse est OUI, précisez, s'il vous plait, les types de services que vous avez cherché, sinon passez directement au facteur suivant :</i>				
.....				
.....				
.....				
Plusieurs entreprises manufacturières de votre pays d'origine installées en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Souplesse de la législation du travail et de la législation sociale				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Niveau de syndicalisation de la main d'œuvre				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité du système bancaire de la Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disponibilité de financement en capital de la Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attitude du gouvernement tunisien vis-à-vis des investisseurs étrangers				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Niveau de la fiscalité s'exerçant sur les entreprises manufacturières en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incitations fiscales et aides à l'installation fournies par le gouvernement tunisien				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Niveau du risque politique (instabilité politique, insécurité...)				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maitrise de votre langue en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Niveau d'ouverture commerciale de la Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barrières douanières, tarifaires et non tarifaires mises en place par la Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Si vous êtes une entreprise partiellement exportatrice ou totalement exportatrice après 2 ans de production, quel le degré d'importance de facteur « Présence de clients potentiels en Tunisie », <i>si cela ne correspond pas à votre situation, passez directement au facteur suivant.</i>				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité du système éducatif primaire/secondaire de la Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité du système d'enseignement supérieur de la Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité des infrastructures de transport en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qualité des infrastructures de télécommunication en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Niveau de vie en Tunisie				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Proximité géographique avec votre pays d'origine				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proximité culturelle de la Tunisie avec votre pays d'origine				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Un ou plusieurs dirigeants de votre entreprise sont d'origine tunisienne				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Autre, s'il y a eu d'autres facteurs qui permettent de se localiser en Tunisie, précisez-le (s) et indiquez le degré d'importance :				
Pas du tout important	Pas important	Neutre	Important	Très important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Nous vous remercions vivement de votre collaboration et participation à cette recherche

Annexe

<i>Secteur agro-alimentaire</i>	<i>Secteur des matériaux de construction céramique et verre</i>	
Secteur des huiles et corps gras	<input type="checkbox"/>	Ciment, chaux et plâtre <input type="checkbox"/>
Secteur des fruits et légumes	<input type="checkbox"/>	Tuiles et briques en terre cuite <input type="checkbox"/>
Entreposage frigorifique	<input type="checkbox"/>	Ouvrages en béton ou plâtre <input type="checkbox"/>
Secteur du poisson	<input type="checkbox"/>	Carreaux en céramique <input type="checkbox"/>
Secteur des viandes	<input type="checkbox"/>	Extraction et transformation de sable et de granulats <input type="checkbox"/>
Secteur des céréales et dérivés	<input type="checkbox"/>	Extraction et transformation de pierres et de marbre pour la construction <input type="checkbox"/>
Secteur du lait et dérivés	<input type="checkbox"/>	Autres produits en céramique pour la construction <input type="checkbox"/>
Secteur du sucre et dérivés	<input type="checkbox"/>	Travail de la pierre <input type="checkbox"/>
Secteur des boissons	<input type="checkbox"/>	Produits minéraux divers <input type="checkbox"/>
Autre, précisez :.....	<input type="checkbox"/>	Verre et articles en verre <input type="checkbox"/>
	<input type="checkbox"/>	Dérivés de ciment <input type="checkbox"/>
	<input type="checkbox"/>	Autre, précisez :..... <input type="checkbox"/>
<i>Secteur mécanique et métallurgique</i>	<i>Secteur électrique, électronique et de l'électroménager</i>	
Sidérurgie	<input type="checkbox"/>	Fils, câbles isolés et faisceaux de câbles <input type="checkbox"/>
Fabrication de tubes	<input type="checkbox"/>	Electronique grand public <input type="checkbox"/>
Transformation d'acier	<input type="checkbox"/>	Moteurs, génératrices et transformateurs électriques <input type="checkbox"/>
Fonderie	<input type="checkbox"/>	Accumulateurs et piles électriques <input type="checkbox"/>
Chaudronnerie	<input type="checkbox"/>	Lampes, appareils d'éclairage et autres matériels électroniques <input type="checkbox"/>
Métaux non ferreux	<input type="checkbox"/>	Matériel de distribution et commande électrique <input type="checkbox"/>
Forge, emboutissage, estampage, métallurgie des poudres	<input type="checkbox"/>	Composants électroniques <input type="checkbox"/>
Traitement des métaux	<input type="checkbox"/>	Machines de bureau et de matériel informatique <input type="checkbox"/>
Construction métallique et quincaillerie	<input type="checkbox"/>	Appareils d'émission et de transmission <input type="checkbox"/>
Ouvrages en métaux	<input type="checkbox"/>	Equipements de contrôle et des processus industriels <input type="checkbox"/>
Fabrication d'équipements	<input type="checkbox"/>	Appareillage électrique pour moteurs et véhicules <input type="checkbox"/>
Secteur automobile	<input type="checkbox"/>	Electroménager <input type="checkbox"/>
Construction navale	<input type="checkbox"/>	Divers <input type="checkbox"/>
Motocycles et bicyclettes	<input type="checkbox"/>	Autre, précisez :..... <input type="checkbox"/>
Divers	<input type="checkbox"/>	
Autre, précisez :.....	<input type="checkbox"/>	

<i>Secteur chimique</i>		<i>Secteur textile et habillement</i>	
Secteur chimique de base	<input type="checkbox"/>	Filature	<input type="checkbox"/>
Secteur pharmaceutique	<input type="checkbox"/>	Tissage	<input type="checkbox"/>
Peintures, colles, résines et encres	<input type="checkbox"/>	Finissage	<input type="checkbox"/>
Secteur du plastique	<input type="checkbox"/>	Bonneterie	<input type="checkbox"/>
Secteur du caoutchouc et pneumatique	<input type="checkbox"/>	Confection, chaîne, trame et maille	<input type="checkbox"/>
Produits agro-chimiques	<input type="checkbox"/>	Autre, précisez :.....	<input type="checkbox"/>
Savons, détergents, produits d'entretien, parfum et produits cosmétiques	<input type="checkbox"/>		
Raffinage du pétrole	<input type="checkbox"/>		
Autres produits chimiques (huiles essentielles, gaz industriels, explosifs etc.)	<input type="checkbox"/>		
Autre, précisez :.....	<input type="checkbox"/>		
<i>Secteur du bois, du liège et de l'ameublement</i>		<i>Secteur du cuir et des chaussures</i>	
Sciage, rabotage, imprégnation du bois	<input type="checkbox"/>	Apprêt et tannage des cuirs	<input type="checkbox"/>
Menuiserie de bâtiments / charpentes	<input type="checkbox"/>	Chaussures et tiges	<input type="checkbox"/>
Placages et panneaux dérivés de bois	<input type="checkbox"/>	Articles de voyage et de maroquinerie	<input type="checkbox"/>
Emballages en bois et palettes	<input type="checkbox"/>	Habillement en cuir	<input type="checkbox"/>
Objets divers en bois	<input type="checkbox"/>	Autre, précisez :.....	<input type="checkbox"/>
Objets en liège, vannerie ou sparterie	<input type="checkbox"/>		
Meubles et ameublement en tous matériaux	<input type="checkbox"/>		
Autre, précisez :	<input type="checkbox"/>		
<i>Secteur divers</i>			
Pâte à papier, papier et carton	<input type="checkbox"/>		
Articles en papier ou en carton	<input type="checkbox"/>		
Edition	<input type="checkbox"/>		
Imprimerie	<input type="checkbox"/>		
Jeux et jouets	<input type="checkbox"/>		
Autre, Précisez :.....	<input type="checkbox"/>		

2.7.2. Appendix 2.2

Table 2.20: The population-parent

Governorates	Area 3		Area 2		Area 1		Area 0		Total number of delegations	Total number of plants
	Number of delegations	Number of plants	Number of delegations	Number of plants	Number of delegations	Number of plants	Number of delegations	Number of plants		
Tunis	0	0	0	0	0	0	21	336	21	336
Ariana	0	0	0	0	0	0	7	261	7	261
Ben Arous	0	0	0	0	0	0	12	476	12	476
Manouba	0	0	0	0	0	0	8	193	8	193
Nabeul	0	0	0	0	0	0	16	598	16	598
Zaghouan	1	18	3	88	2	144	0	0	6	250
Bizerte	1	2	2	13	0	0	11	239	14	254
Béja	2	10	6	113	1	31	0	0	9	154
Jendouba	9	76	0	0	0	0	0	0	9	76
Le Kef	11	46	0	0	0	0	0	0	11	46
Siliana	7	44	4	22	0	0	0	0	11	66
Sousse	0	0	0	0	1	20	15	483	16	503
Monastir	0	0	0	0	0	0	13	603	13	603
Mahdia	0	0	4	32	0	0	7	120	11	152
Sfax	1	6	2	22	6	142	7	542	16	712
Kairouan	2	8	9	158	0	0	0	0	11	166
Kasserine	13	62	0	0	0	0	0	0	13	62

Sidi bouzid	7	15	5	30	0	0	0	0	12	45
Gabès	4	19	1	14	0	0	5	71	10	104
Médenine	1	0	4	40	0	0	4	49	9	89
Tataouine	7	16	0	0	0	0	0	0	7	16
Gafsa	11	88	0	0	0	0	0	0	11	88
Tozeur	5	53	0	0	0	0	0	0	5	53
Kébili	6	25	0	0	0	0	0	0	6	25
Total	88	488	40	532	10	337	126	3971	264	5328

*Source: Data collected from the website of the Agency for the Promotion of Industry and Innovation in Tunisia in October 2019.
Note that the website is updated every month, consequently, we automatically lose all data for previous months.*

Table 2.21: First group “Personal and professional relationships or public and private organizations”

	NO		YES	
	Number	%	Number	%
Consulting firm specializing in location choice	175	97.77%	4	2.23%
Public services	93	51.96%	86	48.04%
Private services	175	97.77%	4	2.23%
Family of the firm head	106	59.22%	73	40.78%
Personal relationships	127	70.95%	52	29.05%
Shareholders	106	59.22%	73	40.78%
Clients	156	87.15%	23	12.85%
Suppliers	131	73.18%	48	26.82%
National political power	165	92.18%	14	7.82%
Local political power	137	76.54%	42	23.46%
Firm executives	161	89.94%	18	10.06%
Workers	162	90.5%	17	9.5%

Table 2.22: Second group “labor force characteristics”

	Very important	Important	Neutral	Unimportant	Very unimportant
Availability of qualified and specialized labour	59 (32.96%)	36 (20.11%)	3 (1.68%)	49 (27.37%)	32 (17.88%)
Qualified and specialized labour at low wages	18 (10.06%)	56 (31.28%)	1 (0.56%)	67 (37.43%)	37 (20.67%)
Availability of low skilled or unskilled labour	105 (58.66%)	58 (32.4%)	0 (0%)	14 (7.82%)	2 (1.12%)
Low-skilled or unskilled labour at low wages	60 (33.52%)	58 (32.4%)	1 (0.56%)	38 (21.23%)	22 (12.29%)
Availability of non-unionized workers	4 (2.23%)	51 (28.49%)	41 (22.91%)	46 (25.7%)	37 (20.67%)

Table 2.23: Third group “Geographical proximity”

	Very important	Important	Neutral	Unimportant	Very unimportant
Proximity to sources of raw materials and/or intermediate inputs	62 (34.64%)	28 (15.64%)	20 (11.17%)	29 (16.2%)	40 (22.35%)
Proximity to suppliers and/or subcontractors	61 (34.08%)	57 (31.84%)	11 (6.15%)	36 (20.11%)	14 (7.82%)
Proximity to services required for production	55 (30.73%)	61 (34.08%)	23 (12.85%)	33 (18.44%)	7 (3.9%)
Proximity to storage buildings	22 (12.29%)	44 (24.58%)	22 (12.29%)	36 (20.11%)	55 (30.73%)
Proximity to local potential clients	53 (36.05%)	29 (19.73%)	6 (4.08%)	36 (24.49%)	23 (15.65%)
Proximity to the port	30 (16.76%)	33 (18.44%)	12 (6.7%)	58 (32.4%)	46 (25.7%)
Proximity to the airport	19 (10.61%)	50 (27.63%)	10 (5.59%)	49 (27.37%)	51 (28.5%)
Proximity to the highway	59 (32.96%)	53 (29.61%)	10 (5.58%)	40 (22.35%)	17 (9.5%)
Proximity to railway infrastructures	9 (5.03%)	38 (21.23%)	19 (10.61%)	67 (37.43%)	46 (25.7%)
Proximity to the city center	54 (30.17%)	40 (22.35%)	21 (11.73%)	47 (26.25%)	17 (9.5%)

Table 2.24: Fourth group “Infrastructures and means of transport”

	Very important	Important	Neutral	Unimportant	Very unimportant
Availability of means of transport	85 (47.49%)	60 (33.52%)	10 (5.59%)	19 (10.61%)	5 (2.79%)
Availability of means of transport for inputs and outputs	36 (20.11%)	39 (21.79%)	10 (5.59%)	35 (19.55%)	59 (32.96%)
Quality of road infrastructure	68 (37.99%)	45 (25.14%)	25 (13.97%)	29 (16.92%)	12 (6.7%)
Quality of telecommunications infrastructure	81 (45.25%)	60 (33.52%)	12 (6.7%)	15 (8.38%)	11 (6.15%)
Quality of water, energy and electricity supply networks	121 (67.59%)	48 (26.82%)	7 (3.91%)	3 (1.68%)	0 (0%)

Table 2.25: Fifth group “Building land and buildings of plants”

	Very important	Important	Neutral	Unimportant	Very unimportant
Low costs related to production premises	74 (41.34%)	29 (16.2%)	5 (2.79%)	52 (29.05%)	19 (10.62%)
Availability of building land	54 (30.17%)	32 (17.88%)	4 (2.23%)	58 (32.4%)	31 (17.32%)
Availability of building	73 (41.34%)	39 (16.2%)	7 (2.79%)	38 (29.05%)	22 (10.62%)
Accessibility and visibility of the location	56 (31.28%)	85 (47.49%)	15 (8.38%)	21 (11.73%)	2 (1.12%)
Availability of land or buildings to expand the plant	53 (29.61%)	55 (30.72%)	17 (9.5%)	37 (20.67%)	17 (9.5%)
Prestigious land or building	34 (18.99%)	55 (30.73%)	31 (17.32%)	38 (21.23%)	21 (11.73%)
Proximity to the firm's head office	9 (32.14%)	3 (10.71%)	0 (0%)	11 (39.29%)	5 (17.86%)
Proximity to other premises of the firm	6 (25%)	8 (33.33%)	0 (0%)	6 (25%)	4 (16.67%)

Table 2.26: Sixth group “Importance of neighboring plants”

	Very important	Important	Neutral	Unimportant	Very unimportant
Proximity to plants in the same sector	6 (3.35%)	8 (4.47%)	155 (86.6%)	6 (3.35%)	4 (2.23%)
Proximity to plants in the different sector	20 (11.17%)	53 (29.61%)	36 (20.11%)	37 (20.67%)	33 (18.44%)
Proximity to foreign and mixed plants	8 (4.47%)	37 (20.67%)	46 (25.7%)	54 (30.17%)	34 (18.99%)
Proximity to Tunisian plants	14 (7.82%)	50 (27.93%)	33 (18.44%)	48 (26.82%)	34 (18.99%)

Table 2.27: Seventh group “Local environment and living conditions”

	Very important	Important	Neutral	Unimportant	Very unimportant
Proximity to workers' residences	59 (32.96%)	78 (43.58%)	20 (11.17%)	16 (8.94%)	6 (3.35%)
Proximity to the residence of the owners of the firm	50 (27.93%)	39 (21.79%)	21 (11.73%)	25 (13.97%)	44 (24.58%)
Proximity to universities	9 (5.04%)	36 (20.11%)	22 (12.29%)	56 (31.28%)	56 (31.28%)
Proximity to research laboratories	5 (2.79%)	32 (17.88%)	30 (16.76%)	46 (25.7%)	66 (36.87%)
Cultural environment	9 (5.03%)	39 (21.79%)	19 (10.61%)	43 (24.02%)	69 (38.55%)
Natural scenic beauty	7 (3.91%)	41 (22.91%)	27 (15.08%)	53 (29.61%)	51 (28.49%)
Sport and recreation factors	6 (3.35%)	28 (15.64%)	24 (13.41%)	58 (32.4%)	63 (35.2%)
Availability of housing for the staff of the firm	43 (24.02%)	55 (30.72%)	24 (13.41%)	40 (22.35%)	17 (9.5%)

Table 2.28: Eighth group “Tax regimes and local institutions”

	Very important	Important	Neutral	Unimportant	Very unimportant
Proximity to banking services	43 (24.02%)	55 (30.72%)	24 (13.41%)	40 (22.35%)	17 (9.5%)
Funding of private organizations to locate in this region	60 (33.52%)	65 (36.31%)	12 (6.7%)	35 (19.55%)	7 (3.92%)
Funding of public organizations to locate in this region	31 (17.32%)	56 (31.28%)	11 (6.15%)	52 (29.05%)	29 (16.2%)
Tax incentives to locate in this region	69 (38.55%)	55 (30.72%)	6 (3.35%)	38 (21.23%)	11 (6.15%)
Level of taxes on manufacturing firms in this region	66 (36.87%)	49 (27.37%)	8 (4.47%)	45 (25.14%)	11 (6.15%)
Proximity to economic activities parks (these were the free zones)	8 (5.63%)	8 (5.63%)	35 (24.65%)	30 (21.13%)	61 (42.96%)

Table 2.29: Eigenvalues

Dimensions	Eigenvalue	Percentage of variance	Cumulative percentage of variance
Dim 1	3.0865609	12.95893436	12.95893436
Dim 2	1.605793197	6.741927118	19.70086147
Dim 3	1.312404467	5.510133733	25.21099521
Dim 4	1.031768625	4.331883387	29.54287859
Dim 5	0.966088219	4.056124022	33.59900261
Dim 6	0.924336419	3.880828977	37.47983159
Dim 7	0.840668101	3.529547316	41.00937891
Dim 8	0.754035401	3.165819687	44.17519859
Dim 9	0.730441956	3.066762543	47.24196114
Dim 10	0.709650442	2.979469316	50.22143045
Dim 11	0.656861535	2.757834945	52.9792654
Dim 12	0.626092012	2.628649021	55.60791442
Dim 13	0.554210966	2.326856251	57.93477067
Dim 14	0.548348696	2.302243494	60.23701417
Dim 15	0.498264757	2.091965939	62.32898011
Dim 16	0.484559315	2.034423606	64.36340371
Dim 17	0.481157639	2.02014166	66.38354537
Dim 18	0.4388554	1.842535594	68.22608097
Dim 19	0.429947094	1.805134046	70.03121501
Dim 20	0.401911517	1.6874266	71.71864161
Dim 21	0.388955669	1.633031439	73.35167305
Dim 22	0.376551884	1.580954113	74.93262716
Dim 23	0.345736776	1.451576797	76.38420396
Dim 24	0.334334477	1.403704215	77.78790817
Dim 25	0.311392108	1.307380613	79.09528879
Dim 26	0.299575286	1.257767656	80.35305644
Dim 27	0.292534119	1.228205298	81.58126174
Dim 28	0.276798307	1.162138447	82.74340019
Dim 29	0.266726649	1.119852563	83.86325275
Dim 30	0.251145046	1.054433162	84.91768591
Dim 31	0.25060678	1.052173249	85.96985916
Dim 32	0.238049782	0.99945266	86.96931182
Dim 33	0.222615328	0.934651061	87.90396288
Dim 34	0.204107126	0.856944325	88.76090721

Dim 35	0.197371466	0.828664636	89.58957185
Dim 36	0.189459441	0.79544598	90.38501783
Dim 37	0.180091497	0.756114639	91.14113247
Dim 38	0.170556039	0.716079997	91.85721246
Dim 39	0.162667737	0.682960936	92.5401734
Dim 40	0.154534155	0.64881207	93.18898547
Dim 41	0.150652952	0.632516828	93.8215023
Dim 42	0.141981694	0.596110531	94.41761283
Dim 43	0.130934604	0.549729294	94.96734212
Dim 44	0.129862293	0.545227193	95.51256931
Dim 45	0.117964491	0.495274236	96.00784355
Dim 46	0.113626557	0.477061409	96.48490496
Dim 47	0.099676274	0.418491109	96.90339607
Dim 48	0.094779625	0.397932514	97.30132858
Dim 49	0.085643663	0.359575154	97.66090374
Dim 50	0.083092753	0.34886515	98.00976889
Dim 51	0.08217777	0.345023591	98.35479248
Dim 52	0.073228487	0.307450004	98.66224248
Dim 53	0.065660984	0.275677822	98.9379203
Dim 54	0.064426463	0.270494679	99.20841498
Dim 55	0.059905016	0.251511374	99.45992636
Dim 56	0.054507162	0.228848468	99.68877482
Dim 57	0.049294356	0.206962488	99.89573731
Dim 58	0.024833303	0.104262689	100

Table 2.30: Coordinates, contributions and cosine squared of groups (from the third to the tenth dimension)

Active groups	<i>Coordinates</i>							
	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7	Dim 8	Dim 9	Dim 10
Infl_hors_fact_reg	0.083	0.072	0.076	0.187	0.076	0.163	0.06	0.172
Main_oeuvre	0.052	0.059	0.533	0.147	0.389	0.081	0.027	0.179
Proximite	0.174	0.085	0.129	0.053	0.192	0.09	0.153	0.107
Infras	0.342	0.352	0.04	0.106	0.025	0.169	0.06	0.045
Terrain_Bat	0.266	0.035	0.076	0.068	0.024	0.136	0.048	0.123
ETS_voisines	0.171	0.258	0.036	0.07	0.016	0.038	0.076	0.064
Cadre_vie	0.048	0.162	0.031	0.203	0.036	0.051	0.118	0.014
Instit_regime	0.177	0.008	0.045	0.089	0.082	0.027	0.189	0.006
Supplementary groups								
Region	0.105	0.134	0.067	0.089	0.061	0.052	0.173	0.091
Carac	0.176	0.103	0.052	0.097	0.096	0.069	0.097	0.14
Imp_fact_reg	0.135	0.137	0.117	0.086	0.066	0.142	0.175	0.113
Active groups	<i>Cos²</i>							
	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7	Dim 8	Dim 9	Dim 10
Infl_hors_fact_reg	0.004	0.003	0.003	0.018	0.003	0.014	0.002	0.015
Main_oeuvre	0.001	0.002	0.127	0.01	0.068	0.003	0	0.014
Proximite	0.015	0.004	0.008	0.001	0.019	0.004	0.012	0.006
Infras	0.069	0.074	0.001	0.007	0	0.017	0.002	0.001
Terrain_Bat	0.04	0.001	0.003	0.003	0	0.01	0.001	0.008
ETS_voisines	0.022	0.051	0.001	0.004	0	0.001	0.004	0.003
Cadre_vie	0.001	0.015	0.001	0.024	0.001	0.002	0.008	0
Instit_regime	0.021	0	0.001	0.005	0.004	0	0.024	0
Supplementary groups								
Region	0.002	0.003	0.001	0.001	0.001	0.000	0.005	0.001
Carac	0.007	0.002	0.001	0.002	0.002	0.001	0.002	0.004
Imp_fact_reg	0.002	0.002	0.001	0.001	0.000	0.002	0.003	0.001
Active groups	<i>Contribution</i>							
	Dim 3	Dim 4	Dim 5	Dim 6	Dim 7	Dim 8	Dim 9	Dim 10
Infl_hors_fact_reg	6.32	7.02	7.83	20.224	9.032	21.609	8.245	24.177
Main_oeuvre	3.953	5.7	55.195	15.954	46.253	10.693	3.655	25.216
Proximite	13.27	8.242	13.322	5.704	22.879	11.88	20.943	15.026
Infras	26.024	34.159	4.18	11.517	3.008	22.419	8.16	6.397
Terrain_Bat	20.232	3.359	7.85	7.345	2.899	17.987	6.563	17.275
ETS_voisines	13.03	25.042	3.722	7.593	1.929	5.086	10.416	9.037
Cadre_vie	3.663	15.728	3.248	21.987	4.29	6.809	16.206	2.032
Instit_regime	13.508	0.749	4.652	9.677	9.709	3.516	25.812	0.84

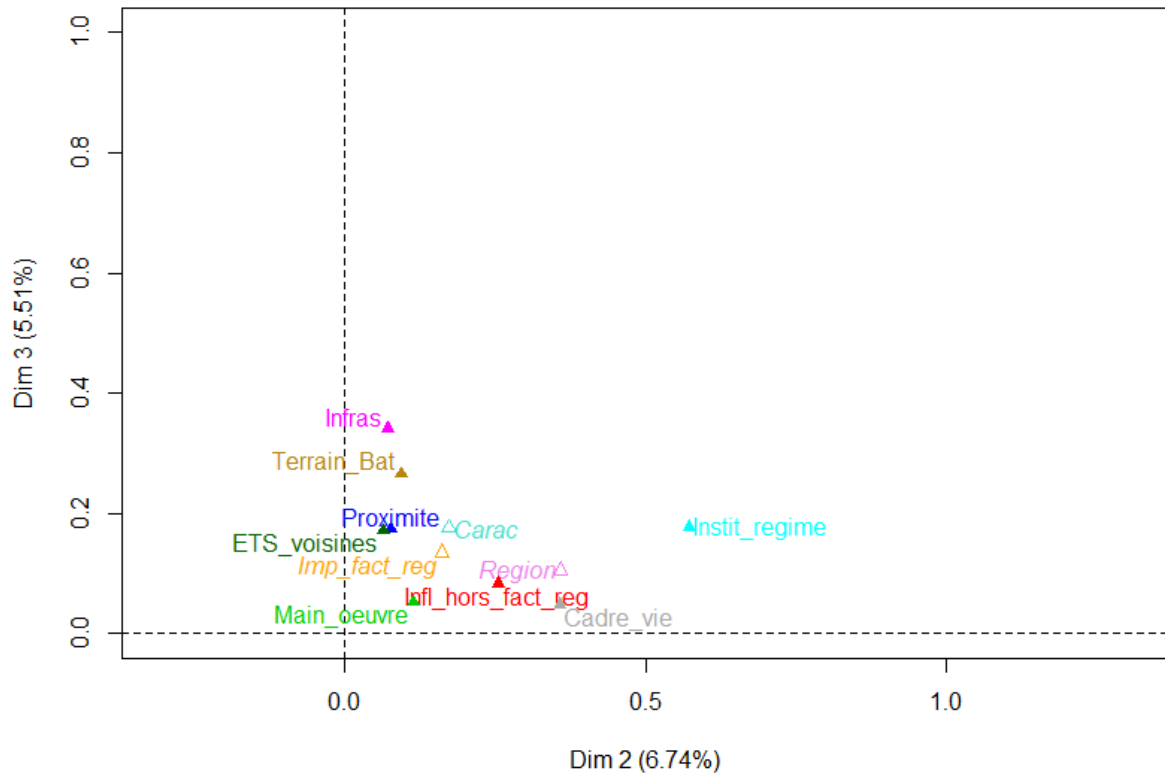


Figure 2.15: Groups representation (Dimension 2 – Dimension 3)

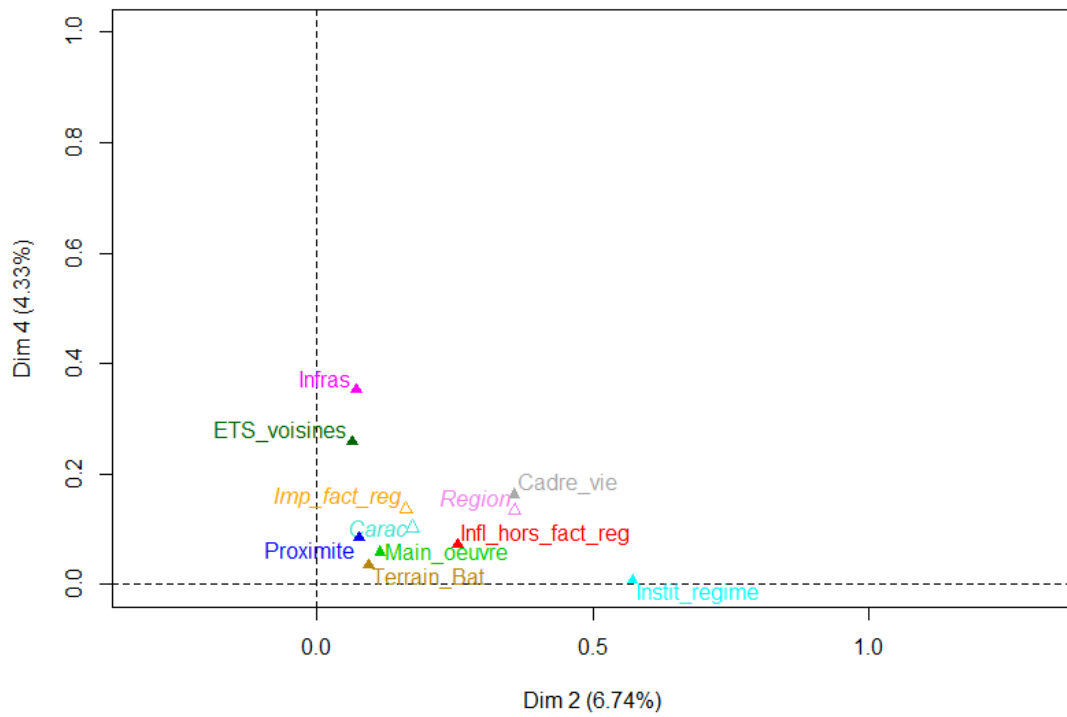


Figure 2.16: Groups representation (Dimension 2 – Dimension 4)

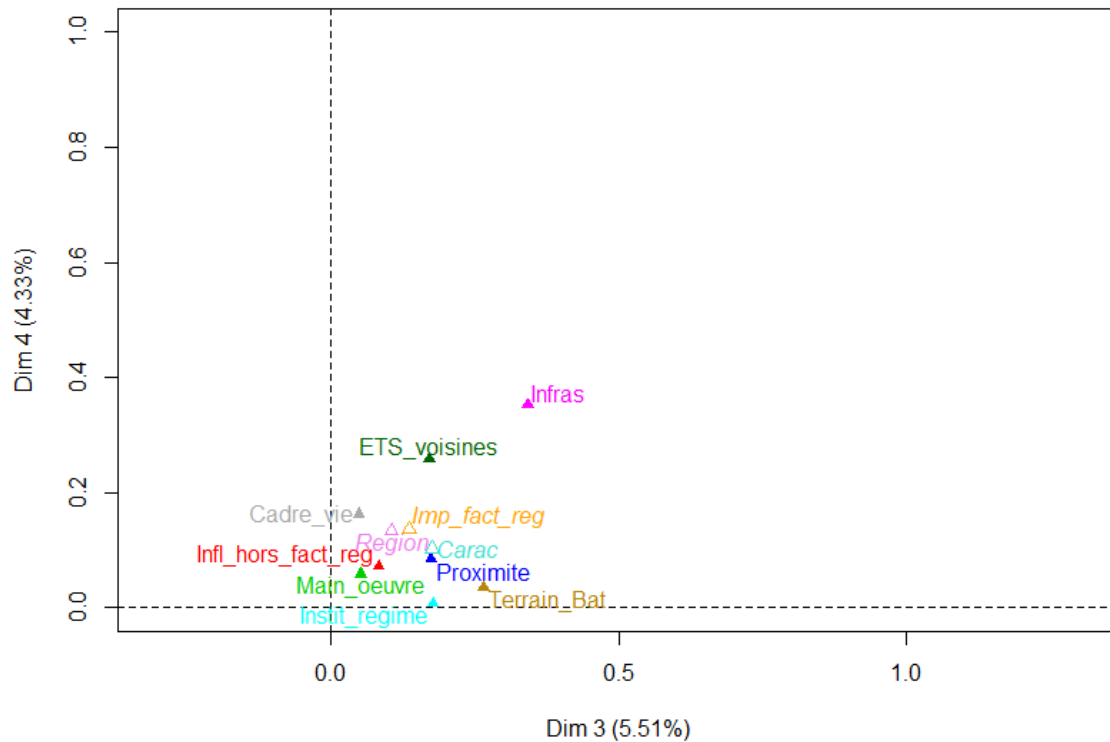


Figure 2.17: Groups representation (Dimension 3 – Dimension 4)

Table 2.31: Coordinates, contributions and cosine squared of individuals

Individuals	Dim 1			Dim 2		
	Coordinates	Contribution	Cos ²	Coordinates	Contribution	Cos ²
Fir_1	-2.126375079	0.818374081	0.280914133	-0.424902066	0.062810903	0.011216866
Fir_2	-0.703541001	0.089588227	0.019873459	-1.483435596	0.765587347	0.088355183
Fir_3	-0.855811584	0.132564867	0.037618406	-0.918611786	0.293576563	0.043341915
Fir_4	-2.217567326	0.890073245	0.213715482	0.659253425	0.151203605	0.018888051
Fir_5	-2.033116893	0.748164016	0.173287356	0.231224222	0.018600474	0.002241346
Fir_6	-1.752000457	0.555572255	0.171893207	-0.578655842	0.11649252	0.018751282
Fir_7	-0.969919028	0.170271937	0.051094354	-1.700428685	1.005944917	0.157043077
Fir_8	0.823866031	0.122852872	0.032025189	-1.199357559	0.500443103	0.067869689
Fir_9	1.465056993	0.388491176	0.122879015	-1.380254417	0.662789542	0.109065394
Fir_10	-0.395605791	0.028326792	0.008393655	-1.700324533	1.005821691	0.155056314
Fir_11	-2.223298619	0.894679971	0.287016999	-0.33594185	0.039263189	0.006553001
Fir_12	0.964646807	0.168425863	0.031450642	0.055600544	0.001075512	0.000104484
Fir_13	-2.776962285	1.395764286	0.374893224	-0.013050624	5.92543E-05	8.28E-06
Fir_14	0.967279954	0.169346605	0.026813281	-2.159656562	1.622657052	0.13366416
Fir_15	0.765235324	0.105989328	0.019452302	2.111034378	1.550415019	0.148037454
Fir_16	-0.165163169	0.004937402	0.001288873	-0.392278288	0.053535997	0.007270635
Fir_17	-1.11745959	0.226014225	0.038670728	0.047056608	0.000770369	6.85741E-05
Fir_18	2.714054376	1.33324268	0.241583487	0.852005388	0.252546898	0.023807557
Fir_19	2.714054376	1.33324268	0.241583487	0.852005388	0.252546898	0.023807557

Fir_20	-2.623604686	1.245859059	0.316394807	-0.121273901	0.005116725	0.000676032
Fir_21	-2.69277575	1.312418954	0.439782418	-0.282182745	0.027702455	0.004829458
Fir_22	2.754827599	1.373602174	0.283170635	0.115837868	0.004668297	0.00050068
Fir_23	1.949096709	0.687604793	0.176947556	0.113467018	0.004479161	0.000599677
Fir_24	1.113455031	0.224397225	0.07277834	-1.96862988	1.34829679	0.227501846
Fir_25	0.286492166	0.014855854	0.004945982	-1.622635212	0.916007749	0.158660504
Fir_26	-0.25217648	0.011510158	0.00271314	-1.600453582	0.89113504	0.109282127
Fir_27	-0.941592703	0.160471639	0.042904758	-1.12339524	0.439058626	0.061072324
Fir_28	-1.399395709	0.354448542	0.075311882	-0.595980525	0.123572403	0.01365987
Fir_29	-0.060058652	0.000652865	0.000192517	-1.347761379	0.631950948	0.096949017
Fir_30	-0.827067632	0.123809557	0.029750024	-1.794385982	1.120183293	0.140035131
Fir_31	-1.490559764	0.402134104	0.101429803	-1.59785093	0.888239075	0.116557256
Fir_32	-0.908366555	0.149346273	0.045168615	-0.967100907	0.325387553	0.0511986
Fir_33	0.036581713	0.000242215	4.66438E-05	-2.25387368	1.767325319	0.177061938
Fir_34	-0.774059804	0.108447901	0.033156202	-1.542285115	0.827535607	0.131627028
Fir_35	-0.740206274	0.09916939	0.030871222	-0.848481307	0.25046204	0.04056326
Fir_36	2.110030085	0.8058411	0.239482431	-0.901805172	0.282932475	0.043744334
Fir_37	-1.771287368	0.567871626	0.098957333	-1.208137254	0.50779674	0.04603652
Fir_38	1.008330395	0.184025428	0.045492955	0.865282346	0.260479195	0.033500718
Fir_39	-0.421176971	0.03210712	0.009438676	-1.161096584	0.469022903	0.071732925
Fir_40	1.062457491	0.204312644	0.05851945	-0.337718488	0.039679576	0.005912713
Fir_41	-0.353705979	0.022644197	0.007557896	-1.068704213	0.39734925	0.068997151
Fir_42	2.447486298	1.084208124	0.224883417	0.327730438	0.037367231	0.004032278
Fir_43	-1.283959554	0.298383501	0.078521177	0.362551773	0.045729602	0.006260719
Fir_44	-2.33157066	0.983941509	0.290910232	-0.478795175	0.07975481	0.01226765
Fir_45	-1.229864219	0.273770376	0.047110638	0.310648479	0.033573438	0.003005683
Fir_46	1.731850522	0.542866358	0.159861036	-0.873428388	0.265406749	0.040660847
Fir_47	-1.346978239	0.328392536	0.113124894	-1.713089035	1.020979979	0.182977165
Fir_48	-3.131295142	1.774680295	0.478749246	0.083553836	0.002428791	0.000340873
Fir_49	2.210529879	0.884432917	0.146863057	-1.722700119	1.032468292	0.089194721
Fir_50	2.315541479	0.970459127	0.192536171	1.966228711	1.345009718	0.138827425
Fir_51	-2.170452345	0.852653596	0.120286425	-0.879390167	0.269042299	0.019746008
Fir_52	-3.195072262	1.847708635	0.587316885	0.100803533	0.003535158	0.000584605
Fir_53	0.652277439	0.077008175	0.016332945	1.074841308	0.401925956	0.044349474
Fir_54	2.014466137	0.734500442	0.125620515	-1.482867993	0.765001589	0.06806841
Fir_55	0.600170185	0.065196	0.022474717	-1.692914763	0.997074341	0.17881979
Fir_56	0.538285617	0.052444225	0.017084146	-1.401036538	0.682898688	0.115735518
Fir_57	-0.788392722	0.112501246	0.043315254	-0.792772613	0.218652593	0.043797864
Fir_58	-1.248854998	0.282290428	0.080612913	-1.577455792	0.865708635	0.128615994
Fir_59	-2.007672707	0.72955485	0.179335641	-0.508926291	0.090108784	0.011523663
Fir_60	1.277817453	0.295535564	0.086201039	0.366006815	0.046605342	0.007072178
Fir_61	-0.244713641	0.010838982	0.002837274	0.369501611	0.047499608	0.006468708
Fir_62	0.828715547	0.124303424	0.026453303	-1.571769388	0.859478481	0.095158282
Fir_63	2.414433206	1.055121589	0.138035448	-1.937776498	1.306365565	0.08891348
Fir_64	0.517822389	0.048532623	0.009292825	-2.535104702	2.235883426	0.222729593
Fir_65	-2.588391628	1.212640564	0.365839188	-0.847970619	0.250160632	0.039263758

Fir_66	0.509237991	0.046936825	0.015614084	-1.018372952	0.36080377	0.062443702
Fir_67	0.064151349	0.000744876	0.000145798	-1.529402203	0.813768319	0.082867477
Fir_68	-3.091870405	1.730273209	0.468032293	0.167120328	0.009716636	0.001367388
Fir_69	-0.960864323	0.167107621	0.030481639	-0.885806669	0.272982776	0.025905505
Fir_70	-1.950965137	0.688923717	0.195706966	-0.830344886	0.239869144	0.035450658
Fir_71	-0.048716063	0.000429553	0.000131741	-0.370168424	0.047671201	0.007606346
Fir_72	0.098235149	0.00174665	0.000552998	-0.581027855	0.117449524	0.019345681
Fir_73	-1.833073465	0.608179616	0.134114479	-0.745232749	0.193215168	0.022166636
Fir_74	0.438724557	0.034838224	0.012274436	-1.471196846	0.753006848	0.138025472
Fir_75	-1.355932499	0.332773136	0.121431258	-0.288870455	0.029031108	0.005511383
Fir_76	-2.250348222	0.916582523	0.178701852	0.280481814	0.027369494	0.002776125
Fir_77	2.667461598	1.287859454	0.250391816	1.68205917	0.984328123	0.099564912
Fir_78	-2.01466775	0.734647471	0.201630121	0.113596752	0.004489409	0.000641033
Fir_79	0.48467065	0.042517289	0.011062574	-0.411446217	0.058895688	0.007972396
Fir_80	2.810106017	1.429280697	0.331826148	0.471394756	0.077308429	0.009337588
Fir_81	-1.536554331	0.427334505	0.09976862	-0.872941932	0.265111194	0.032200961
Fir_82	-1.109182377	0.222678373	0.066252602	-1.242328186	0.536945284	0.083113142
Fir_83	-1.013336212	0.185857138	0.036661227	0.419218589	0.061141828	0.006274526
Fir_84	-1.865649784	0.629988125	0.180468784	-0.510695074	0.090736222	0.013522755
Fir_85	-0.28204989	0.014398723	0.003381923	-1.274272535	0.564913561	0.069029787
Fir_86	2.574333377	1.199503981	0.202219262	-1.181361798	0.485537973	0.04258521
Fir_87	-0.260535348	0.012285856	0.001914776	-0.839166895	0.244993206	0.019864666
Fir_88	-1.408239924	0.358942947	0.064110923	-1.244020657	0.538409283	0.050030392
Fir_89	-2.041520792	0.754361879	0.204511408	-0.840873422	0.245990654	0.034695342
Fir_90	-0.763844163	0.105604311	0.039081213	-0.796353962	0.220632581	0.042478658
Fir_91	-0.631765914	0.072241125	0.022322773	0.203979294	0.014475365	0.002327062
Fir_92	4.584187265	3.803617346	0.362837577	-0.097951949	0.003337978	0.000165658
Fir_93	2.651588599	1.272577982	0.186477484	-1.675147926	0.976255927	0.074425274
Fir_94	0.622262748	0.070084136	0.016773496	-0.2986942	0.03103923	0.003864823
Fir_95	3.1990542	1.852317011	0.384913306	0.171913151	0.010281952	0.001111573
Fir_96	2.434602386	1.072823321	0.269379764	0.384298255	0.05138001	0.006711904
Fir_97	1.599159231	0.462866274	0.06756957	-0.327792624	0.037381413	0.002839005
Fir_98	0.988516083	0.176864063	0.038581582	-1.608074952	0.899642429	0.102099855
Fir_99	-0.812291277	0.119425123	0.029935448	-0.081382571	0.0023042	0.000300487
Fir_100	-0.570715427	0.058953737	0.018275342	-0.218679219	0.016636899	0.002683128
Fir_101	1.496470283	0.405329593	0.078952299	-1.416828104	0.698379818	0.070772235
Fir_102	0.359221892	0.023355959	0.007891928	-1.584513091	0.873472062	0.153549767
Fir_103	0.028554594	0.000147579	2.79747E-05	-1.339313279	0.62405333	0.06154281
Fir_104	1.874619342	0.636060324	0.168733449	-0.609384269	0.129193253	0.017830252
Fir_105	1.798155234	0.585229867	0.196054742	-0.523956833	0.095509896	0.016646158
Fir_106	-0.300506683	0.016344829	0.004876356	-0.554311298	0.106896827	0.016591843
Fir_107	-1.380386907	0.344884583	0.087582045	-0.421424821	0.061787067	0.008163072
Fir_108	2.675104907	1.295250459	0.314198687	-0.47702754	0.079167013	0.009991016
Fir_109	0.124502535	0.002805618	0.000645301	-0.649578131	0.146798003	0.017565841
Fir_110	3.144044175	1.789160895	0.455178143	-0.421357885	0.06176744	0.00817535
Fir_111	-2.647850276	1.268992242	0.369670077	1.8786362	1.227842689	0.186085624

Fir_112	-2.25555846	0.920831769	0.227022703	2.351084031	1.92306365	0.246659257
Fir_113	-1.993460099	0.71926216	0.171110264	2.713291152	2.561239273	0.316995986
Fir_114	-2.585722326	1.210140761	0.296212975	1.815998318	1.147329709	0.146107056
Fir_115	3.302852907	1.974470203	0.397273591	1.464059597	0.745718413	0.078060035
Fir_116	-2.26637381	0.929683674	0.247528929	2.142003386	1.596238059	0.221107351
Fir_117	-2.760565952	1.379330607	0.372497215	1.633259198	0.928041891	0.130387813
Fir_118	-0.849177077	0.130517469	0.025356382	2.739702912	2.611345271	0.263935433
Fir_119	-1.275611741	0.294516164	0.050310711	3.500533249	4.263102448	0.378871427
Fir_120	-2.315194104	0.970167975	0.219438725	1.099127337	0.420294178	0.049457764
Fir_121	-1.1552021	0.241539442	0.047871756	-0.290095678	0.029277897	0.003018881
Fir_122	1.049840376	0.199488866	0.022833198	0.058242768	0.001180161	7.02755E-05
Fir_123	4.739938031	4.066468817	0.420109769	1.065137643	0.394701541	0.02121431
Fir_124	-0.559048996	0.056568135	0.012631575	-0.444459466	0.068726096	0.007984029
Fir_125	1.230744512	0.274162426	0.075114983	1.036574092	0.373816145	0.053283342
Fir_126	1.539551361	0.429003152	0.072846335	1.493933527	0.776461458	0.068593331
Fir_127	-1.190739704	0.256629034	0.062392579	1.285911139	0.575279995	0.072764774
Fir_128	-2.329580682	0.982262652	0.262067646	1.546260889	0.831807626	0.115457842
Fir_129	-1.710855598	0.529783989	0.109756677	0.854094788	0.253787074	0.027353719
Fir_130	-1.136987293	0.23398248	0.061861428	2.212392044	1.702870145	0.234224809
Fir_131	1.976319992	0.70694666	0.137210807	1.456919667	0.738462706	0.074566714
Fir_132	0.444165361	0.035707668	0.010775173	-1.118861535	0.435521944	0.06837346
Fir_133	-0.732023912	0.096989039	0.02079652	2.98276258	3.095242837	0.345284838
Fir_134	-2.624797722	1.24699238	0.339504476	1.828866764	1.163647633	0.164823055
Fir_135	-3.111479088	1.752289633	0.469408498	1.524077224	0.808111526	0.112624045
Fir_136	0.703275948	0.089520737	0.021292709	-1.313714678	0.600425959	0.074298747
Fir_137	-1.859907609	0.626116085	0.171326365	1.043063376	0.378511212	0.053884375
Fir_138	-1.537264891	0.427729827	0.130263181	-0.439882615	0.067317961	0.010665909
Fir_139	0.038697062	0.000271037	8.96943E-05	-0.000379428	5.0086E-08	8.62318E-09
Fir_140	-0.838906692	0.12737947	0.028598435	0.446047265	0.069218011	0.008084938
Fir_141	0.742847587	0.099878394	0.029612695	1.349740738	0.633808512	0.097764056
Fir_142	-1.524628256	0.420726674	0.139673015	-0.835834175	0.243051107	0.041978298
Fir_143	0.116647062	0.002462747	0.000663543	0.556293894	0.107662867	0.015091417
Fir_144	-0.843811573	0.128873337	0.045752879	-0.433065589	0.065247625	0.012051326
Fir_145	-1.800437117	0.586716138	0.2047116	0.336314222	0.039350279	0.00714294
Fir_146	1.517646738	0.416882346	0.098181607	1.057708089	0.389214496	0.04768924
Fir_147	3.096462201	1.735416349	0.308496185	0.339759619	0.040160663	0.00371417
Fir_148	-0.00400697	2.90606E-06	9.60025E-07	-0.990524429	0.341340435	0.058665255
Fir_149	-0.838444285	0.127239085	0.038626629	0.868979728	0.262710025	0.041491361
Fir_150	2.303535965	0.96042203	0.188338683	-0.112018029	0.004365492	0.000445375
Fir_151	-0.64247947	0.074712046	0.022938302	1.016648679	0.359583004	0.057436048
Fir_152	0.453359135	0.037201192	0.004567773	-0.949610633	0.313724542	0.020040611
Fir_153	0.754921227	0.103151463	0.018938944	2.856319668	2.838382863	0.271122843
Fir_154	1.580578611	0.452172681	0.146155977	0.113386302	0.00447279	0.000752152
Fir_155	-0.181949158	0.005992006	0.001944664	-0.217535209	0.016463284	0.002779736
Fir_156	-1.349631625	0.329687599	0.104344408	0.032146758	0.000359527	5.91988E-05
Fir_157	2.976823051	1.603903218	0.358455068	0.529384437	0.097498895	0.011336292

Fir_158	2.05797203	0.766568651	0.183278408	1.5929711	0.882822003	0.109811586
Fir_159	-0.428198148	0.033186518	0.008263133	1.300010451	0.587964415	0.076163843
Fir_160	-2.450092912	1.086518753	0.206410882	-0.336200677	0.039323713	0.003886553
Fir_161	0.814008981	0.11993074	0.027064922	0.259206303	0.023374831	0.00274435
Fir_162	2.876767261	1.4978957	0.249232072	0.732267024	0.186550454	0.016148546
Fir_163	1.408955638	0.359307893	0.094030098	-0.646357946	0.145346153	0.019788753
Fir_164	2.288891539	0.948249334	0.217674915	0.930311193	0.301102144	0.035959567
Fir_165	2.612571829	1.235402847	0.224133142	1.864463238	1.209386189	0.114150351
Fir_166	2.916483675	1.539540855	0.244900919	0.45386772	0.071666459	0.005931027
Fir_167	1.611467696	0.470018905	0.131827539	1.65956469	0.958176968	0.139814209
Fir_168	-0.361661676	0.023674297	0.004503035	1.711146302	1.018665602	0.100803277
Fir_169	2.07313995	0.77791001	0.159462649	-0.584842835	0.118996915	0.012690539
Fir_170	0.290123034	0.015234792	0.003571567	2.093507144	1.524776711	0.185970147
Fir_171	0.355905478	0.022926696	0.00411755	2.486549004	2.151054433	0.200984977
Fir_172	2.777602837	1.396408273	0.350335992	2.333647089	1.894644417	0.247294708
Fir_173	1.288865637	0.300668138	0.048414281	3.031011685	3.196189913	0.267752429
Fir_174	-0.566618741	0.058110416	0.015968372	2.002229607	1.394713849	0.19939145
Fir_175	0.260714476	0.012302756	0.003273044	1.081392752	0.406840579	0.056310374
Fir_176	-0.464613976	0.039071192	0.009698251	1.117089047	0.43414314	0.056064053
Fir_177	-0.766752968	0.106410149	0.022732206	2.750146128	2.631291097	0.292443642
Fir_178	1.095826244	0.217347932	0.049089919	0.289220323	0.029101473	0.003419531
Fir_179	2.793396373	1.412333462	0.361009975	0.923375437	0.296629261	0.039446703

Table 2.32: The L_g coefficient

Lg	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	MFA
Group 1	1.937											
Group 2	0.185	2.232										
Group 3	0.292	0.249	1.98									
Group 4	0.14	0.156	0.27	1.682								
Group 5	0.276	0.289	0.233	0.151	1.782							
Group 7	0.048	0.153	0.252	0.068	0.12	1.314						
Group 8	0.142	0.21	0.225	0.116	0.292	0.114	1.748					
Group 9	0.077	0.061	0.084	0.04	0.11	0.062	0.126	1.492				
Group 10	0.316	0.18	0.311	0.215	0.228	0.192	0.278	0.614	5.53			
Group 11	0.634	0.36	0.659	0.351	0.61	0.188	0.333	0.19	0.928	4.647		
Group 12	0.455	0.345	0.464	0.319	0.302	0.231	0.369	0.214	1.038	0.994	10.071	
MFA	1.003	1.145	1.162	0.85	1.054	0.691	0.963	0.665	0.756	1.077	0.874	2.44

Table 2.33: The RV coefficient

RV	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	MFA
Group 1	1											
Group 2	0.089	1										
Group 3	0.149	0.118	1									
Group 4	0.078	0.08	0.148	1								
Group 5	0.148	0.145	0.124	0.087	1							
Group 6	0.03	0.089	0.156	0.045	0.078	1						
Group 7	0.077	0.106	0.121	0.068	0.166	0.075	1					
Group 8	0.045	0.033	0.049	0.025	0.067	0.045	0.078	1				
Group 9	0.096	0.051	0.094	0.07	0.073	0.071	0.09	0.214	1			
Group 10	0.211	0.112	0.217	0.125	0.212	0.076	0.117	0.072	0.183	1		
Group 11	0.103	0.073	0.104	0.077	0.071	0.064	0.088	0.055	0.139	0.145	1	
MFA	0.461	0.491	0.528	0.419	0.505	0.386	0.466	0.349	0.206	0.32	0.176	1

Table 2.34: Correlation ratios between the variables and the first two dimensions

Dimension 1			Dimension 2		
	R2	p.value		R2	p.value
fr_MO_F1	0.466695869	5.99E-26	s_Délégation	0.563794148	3.47E-17
s_Nbre_Salariés.2	0.397203456	3.92E-19	fr_RF_F4	0.534869064	3.10E-31
fr_ETS_F3	0.355202039	1.35E-18	fr_RF_F5	0.482632546	4.02E-27
fr_LP_F6	0.342419535	7.83E-18	s_Zones	0.392916939	7.25E-19
fr_ITT_F2	0.333891543	2.48E-17	fr_RF_F3	0.372454819	1.20E-19
fr_MBS_F5	0.302429228	1.55E-15	fr_CV_F5	0.273601723	5.84E-14
fg_Famille	0.302397889	1.55E-15	fr_CV_F3	0.187017213	1.49E-09
fr_ITT_F9	0.290822903	6.79E-15	fr_CV_F6	0.17771554	4.18E-09
fr_ITT_F3	0.280743137	2.41E-14	fg_Famille	0.171725547	8.08E-09
fr_ITT_F1	0.275405703	4.67E-14	fg_Servi_pub	0.154872676	5.04E-08
fr_LP_F2	0.273375833	6.01E-14	fg_Actionnaire	0.13090653	6.48E-07
fr_MO_F4	0.269577302	9.59E-14	fr_CV_F7	0.130144199	7.02E-07
fr_CV_F4	0.241787227	2.75E-12	fg_Qualite_vie	0.126945043	2.49E-04
fr_CV_F2	0.237872818	4.38E-12	fr_MO_F3	0.122059356	1.64E-06
fr_CV_F3	0.236595179	5.09E-12	fg_Frs	0.119481065	2.15E-06
fr_ITT_F8	0.22615996	1.73E-11	c_Autres_Act_Loca	0.10569686	3.49E-03
c_Mono_Multi_établ	0.207911042	1.42E-10	fg_Pouv_Locaux	0.103536727	1.12E-05
fr_LP_F8	0.197418929	4.65E-10	s_Activité.principale	0.095243639	1.52E-02
fr_ITT_F4	0.187073998	1.48E-09	s_Gouvernorat	0.090134635	2.39E-03
fr_LP_F5	0.183614928	2.18E-09	fr_LP_F3	0.076693121	1.75E-04
fr_LP_F7	0.180732098	3.00E-09	fr_ITT_F3	0.069577347	3.60E-04
fg_Actionnaire	0.176390085	4.84E-09	fr_CV_F4	0.066550918	4.89E-04
fr_ETS_F4	0.167195166	1.33E-08	s_Statut.Juridique	0.065417267	1.86E-02
s_Statut.Juridique	0.152877078	7.70E-06	fr_ITT_F9	0.063753598	6.50E-04
c_Appartient_groupe	0.139903687	2.50E-07	fg_Proximite.entreprises	0.063571809	4.30E-02
fr_MO_F5	0.136819635	3.47E-07	fr_CV_F2	0.06163353	8.06E-04
c_Autres_Act_Loca	0.133073129	0.000365107	fr_ETS_F4	0.059953165	9.55E-04
fg_Servi_pub	0.129371466	7.61E-07	c_Autres_Unités	0.059209718	1.03E-03
fg_Pouv_Locaux	0.126325393	1.05E-06	s_Nbre_Salariés.2	0.054685801	1.97E-02
fr_LP_F4	0.119241847	2.20E-06	fr_ITT_F8	0.051353643	2.29E-03
fr_ITT_F5	0.11872607	2.32E-06	fr_ITT_F5	0.051176214	2.33E-03
c_Autres_Unités	0.115554527	3.23E-06	fr_LP_F1	0.049230316	2.84E-03
fr_CV_F8	0.113570764	3.97E-06	fr_ETS_F3	0.046006359	3.94E-03
fg_Pouv_Nat	0.110171005	5.65E-06	c_Appartient_groupe	0.042131533	5.84E-03
s_Activité.principale	0.103052533	0.00861806	fr_RF_F2	0.034280578	1.31E-02
s_Régime.d.export	0.089063276	4.96E-05	fg_Pouv_Nat	0.03319965	1.46E-02
fr_ETS_F1	0.08859073	5.20E-05	fr_LP_F2	0.031193614	1.80E-02
fg_Main_œuvre	0.088265165	0.00650064	fg_Cab_spé	0.030659665	1.91E-02
s_Nationalité	0.085392654	7.21E-05	fr_CV_F1	0.028241973	2.45E-02
fg_Cadr	0.081243518	0.000110051	fr_MO_F2	0.025119548	3.41E-02
fg_Proximite	0.08039189	0.023780815	fr_LP_F4	0.024870865	3.50E-02
fg_Proximite.entreprises	0.079504333	0.012964354	fr_MBS_F1	0.024573394	3.61E-02

fr_CV_F7	0.074332181	0.000222229	fr_LP_F6	0.022807743	4.36E-02
fr_LP_F1	0.06147159	0.000818965	c_Mono_Multi_établ	0.022216098	4.64E-02
fr_CV_F6	0.058148334	0.001146978			
fg_Connai.rela	0.056476169	0.001358888			
s_Gouvernorat	0.055892769	0.039350539			
fg_Cab_spé	0.052175996	0.002102113			
fr_ETS_F2	0.052006909	0.002138511			
fg_Frs	0.047170055	0.003496459			
fr_RF_F3	0.045608012	0.004099326			
fr_ITT_F7	0.042864964	0.005422911			
fr_MBS_F2	0.042767475	0.005477177			
fr_ITT_F10	0.032584117	0.015604077			
fr_CV_F5	0.03078763	0.018805769			
fr_LP_F3	0.027858913	0.025539285			
fr_MBS_F3	0.023660327	0.039802466			

Table 2.35: Categories coordinates in two first dimensions

Dimension 1			Dimension 2		
	Estimate	p.value		Estimate	p.value
s_Nbre_Salariés.2=(50.470]	1.728535894	4.18E-16	s_Délégation=Jerba Midoun	2.319851108	5.29E-05
s_Statut.Juridique=Société anonyme	1.444505133	2.70E-06	s_Délégation=Jerba Houmt Souk	2.306651244	3.28E-09
c_Autres_Act_Loca=Entrepôt. logistique et/ou stockage	1.400770974	0.000103779	s_Zones=Zone 0	1.223077794	7.04E-21
fg_Cab_spé=fg_Cab_spé_OUI	1.357521811	0.002102113	fr_RF_F4=fr_RF_F4_Pas important	1.004383095	3.10E-31
fr_LP_F8=fr_LP_F8_Pas important	1.297793712	4.65E-10	fr_RF_F5=fr_RF_F5_Pas important	0.91841134	4.02E-27
fr_LP_F7=fr_LP_F7_Pas important	1.212387121	3.00E-09	fg_Qualite_vie=fg_Qualite_vie_3	0.847899423	1.77E-05
fr_MO_F1=fr_MO_F1_Important	1.202474827	5.99E-26	s_Délégation=Gabes ville	0.823004047	0.000390931
fr_ITT_F9=fr_ITT_F9_Important	1.158439636	6.79E-15	fr_RF_F3=fr_RF_F3_Pas important	0.792396178	1.20E-19
fr_ETS_F3=fr_ETS_F3_Important	1.092343626	1.35E-18	fr_MO_F3=fr_MO_F3_Pas important	0.775888985	1.64E-06
fg_Main_œuvre=fg_Main_œuvre_1	1.092147783	0.000794636	c_Autres_Act_Loca=NA	0.753646352	0.000307231
fg_Pouv_Nat=fg_Pouv_Nat_OUI	1.08589573	5.65E-06	fg_Cab_spé=fg_Cab_spé_NON	0.750589568	0.019058005
fr_CV_F4=fr_CV_F4_Important	1.066674967	2.75E-12	fr_CV_F5=fr_CV_F5_Important	0.748119525	5.84E-14
fr_ITT_F2=fr_ITT_F2_Important	1.042899074	2.48E-17	fg_Main_œuvre=fg_Main_œuvre_5	0.699040184	0.004611694
fr_LP_F6=fr_LP_F6_Important	1.028071854	7.83E-18	fr_CV_F3=fr_CV_F3_Important	0.631611425	1.49E-09
c_Mono_Multi_établ=c_Mono_Multi_établ_OUI	0.989131889	1.42E-10	fr_CV_F6=fr_CV_F6_Important	0.602940253	4.18E-09
fr_CV_F3=fr_CV_F3_Important	0.984928604	5.09E-12	fr_CV_F7=fr_CV_F7_Important	0.582715796	7.02E-07
fg_Famille=fg_Famille_NON	0.982959163	1.55E-15	fg_Famille=fg_Famille_OUI	0.534282481	8.08E-09
fr_MBS_F5=fr_MBS_F5_Pas important	0.969570845	1.55E-15	s_Gouvernorat=Medenine	0.517598863	0.00332093
fr_ITT_F1=fr_ITT_F1_Important	0.965267436	4.67E-14	fg_Servi_pub=fg_Servi_pub_NON	0.499073539	5.04E-08
fr_MO_F4=fr_MO_F4_Pas important	0.962268347	9.59E-14	fg_Frs=fg_Frs_NON	0.494380255	2.15E-06

fr_ITT_F3=fr_ITT_F3_Important	0.961764233	2.41E-14	fg_Pouv_Locaux=fg_Pouv_Locaux_NON	0.481094208	1.12E-05
fr_LP_F2=fr_LP_F2_Important	0.919284252	6.01E-14	fg_Actionnaire=fg_Actionnaire_NON	0.466481188	6.48E-07
c_Appartient_groupe=c_Appartient_groupe_OUI	0.89172391	2.50E-07	fg_Pouv_Nat=fg_Pouv_Nat_NON	0.429960544	0.014639951
fr_ITT_F8=fr_ITT_F8_Important	0.865878847	1.73E-11	fg_Proximite.entreprises=fg_Proximite.entreprises_6	0.424917619	0.001984046
fr_ITT_F4=fr_ITT_F4_Important	0.863438243	1.48E-09	fr_CV_F4=fr_CV_F4_Important	0.403645239	0.000489407
fr_CV_F2=fr_CV_F2_Pas important	0.856873301	4.38E-12	fr_ITT_F9=fr_ITT_F9_Pas important	0.391218009	0.000649858
s_Gouvernorat=Sfax	0.855637162	0.023555369	s_Nbre_Salariés.2=(0.12.5]	0.387882996	0.016979832
fg_Cadr=fg_Cadr_OUI	0.832540998	0.000110051	c_Autres_Unités=c_Autres_Unités_NON	0.373480575	0.00102998
fr_LP_F5=fr_LP_F5_Important	0.769437594	2.18E-09	fr_LP_F3=fr_LP_F3_Important	0.362576485	0.000174834
s_Nationalité=Mixte	0.767086779	7.21E-05	c_Appartient_groupe=c_Appartient_groupe_NON	0.3529611	0.005844875
fr_ETS_F4=fr_ETS_F4_Important	0.764109659	1.33E-08	fr_ITT_F3=fr_ITT_F3_Pas important	0.345346741	0.000360067
fg_Actionnaire=fg_Actionnaire_OUI	0.750728982	4.84E-09	fr_ETS_F4=fr_ETS_F4_Important	0.330032928	0.000955218
s_Activité.principale=Secteur chimique	0.749805946	0.016491039	fr_CV_F2=fr_CV_F2_Important	0.314601005	0.000805633
fr_LP_F4=fr_LP_F4_Important	0.741777153	2.20E-06	fr_ITT_F8=fr_ITT_F8_Pas important	0.297606411	0.002285179
fg_Pouv_Locaux=fg_Pouv_Locaux_OUI	0.736751214	1.05E-06	fr_ITT_F5=fr_ITT_F5_Important	0.287030819	0.00232673
c_Autres_Unités=c_Autres_Unités_OUI	0.723365216	3.23E-06	fr_LP_F1=fr_LP_F1_Pas important	0.28441909	0.002835407
fr_MO_F5=fr_MO_F5_Pas important	0.704275347	3.47E-07	fr_ETS_F3=fr_ETS_F3_Important	0.283555364	0.003936295
fr_ITT_F10=fr_ITT_F10_Important	0.690430687	0.015604077	fr_CV_F1=fr_CV_F1_Important	0.251264095	0.024533654
s_Régime.d.export=Totalement exportatrice	0.684189076	4.96E-05	fr_LP_F4=fr_LP_F4_Important	0.244349769	0.034998216
fg_Servi_pub=fg_Servi_pub_OUI	0.632395849	7.61E-07	fr_RF_F2=fr_RF_F2_Pas important	0.234713661	0.013091243
fr_CV_F7=fr_CV_F7_Important	0.610555909	0.000222229	c_Mono_Multi_établ=c_Mono_Multi_établ_NON	0.233215119	0.046444747
fr_ITT_F5=fr_ITT_F5_Pas important	0.606122098	2.32E-06	fr_LP_F2=fr_LP_F2_Pas important	0.223980385	0.018027893
s_Zones=Zone 1	0.598192787	0.030680371	fr_MO_F2=fr_MO_F2_Pas important	0.203921608	0.034088079

fr_CV_F8=fr_CV_F8_Important	0.594755116	3.97E-06	fr_MBS_F1=fr_MBS_F1_Pas important	0.198647982	0.036120073
fg_Proximite.entreprises=fg_Proximite.entreprises_4	0.578463695	0.023797341	fr_LP_F6=fr_LP_F6_Important	0.19137832	0.043593884
fg_Proximite=fg_Proximite_6	0.558225274	0.009487591	s_Activité.principale=Secteur agro-alimentaire	0.103760562	0.046660082
fr_ETS_F1=fr_ETS_F1_Important	0.532035042	5.20E-05	fr_LP_F6=fr_LP_F6_Pas important	-0.19137832	0.043593884
fr_CV_F6=fr_CV_F6_Important	0.478159549	0.001146978	fr_MBS_F1=fr_MBS_F1_Important	-0.198647982	0.036120073
fr_ETS_F2=fr_ETS_F2_Important	0.461777032	0.002138511	fr_MO_F2=fr_MO_F2_Important	-0.203921608	0.034088079
fg_Connai.rela=fg_Connai.rela_NON	0.459821787	0.001358888	fr_LP_F2=fr_LP_F2_Important	-0.223980385	0.018027893
fr_LP_F1=fr_LP_F1_Pas important	0.440628187	0.000818965	c_Mono_Multi_établ=c_Mono_Multi_établ_OUI	-0.233215119	0.046444747
fg_Frs=fg_Frs_OUI	0.430662827	0.003496459	fr_RF_F2=fr_RF_F2_Important	-0.234713661	0.013091243
fr_RF_F3=fr_RF_F3_Pas important	0.38443132	0.004099326	fg_Proximite=fg_Proximite_3	-0.243164364	0.034535002
fr_MBS_F2=fr_MBS_F2_Pas important	0.383275751	0.005477177	fr_LP_F4=fr_LP_F4_Pas important	-0.244349769	0.034998216
fr_ITT_F7=fr_ITT_F7_Pas important	0.368607692	0.005422911	fr_CV_F1=fr_CV_F1_Pas important	-0.251264095	0.024533654
fr_CV_F5=fr_CV_F5_Important	0.347930355	0.018805769	fr_ETS_F3=fr_ETS_F3_Pas important	-0.283555364	0.003936295
fr_LP_F3=fr_LP_F3_Pas important	0.302967564	0.025539285	fr_LP_F1=fr_LP_F1_Important	-0.28441909	0.002835407
fr_MBS_F3=fr_MBS_F3_Important	0.282925153	0.039802466	fr_ITT_F5=fr_ITT_F5_Pas important	-0.287030819	0.00232673
s_Statut.Juridique=S.A.R.L.	0.129831355	0.002137211	fr_ITT_F8=fr_ITT_F8_Important	-0.297606411	0.002285179
fr_MBS_F3=fr_MBS_F3_Pas important	-0.282925153	0.039802466	fr_CV_F2=fr_CV_F2_Pas important	-0.314601005	0.000805633
fr_LP_F3=fr_LP_F3_Important	-0.302967564	0.025539285	fr_ETS_F4=fr_ETS_F4_Pas important	-0.330032928	0.000955218
fr_CV_F5=fr_CV_F5_Pas important	-0.347930355	0.018805769	fr_ITT_F3=fr_ITT_F3_Important	-0.345346741	0.000360067
fr_ITT_F7=fr_ITT_F7_Important	-0.368607692	0.005422911	s_Gouvernorat=Sfax	-0.349535485	0.017071979
fr_MBS_F2=fr_MBS_F2_Important	-0.383275751	0.005477177	c_Appartient_groupe=c_Appartient_groupe_OUI	-0.3529611	0.005844875
fr_RF_F3=fr_RF_F3_Important	-0.38443132	0.004099326	s_Zones=Zone 2	-0.356236872	0.000974044
fg_Frs=fg_Frs_NON	-0.430662827	0.003496459	fr_LP_F3=fr_LP_F3_Pas important	-0.362576485	0.000174834
fr_LP_F1=fr_LP_F1_Important	-0.440628187	0.000818965	c_Autres_Unités=c_Autres_Unités_OUI	-0.373480575	0.00102998

fg_Connai.rela=fg_Connai.rela_OUI	-0.459821787	0.001358888	fr_ITT_F9=fr_ITT_F9_Important	-0.391218009	0.000649858
fr_ETS_F2=fr_ETS_F2_Pas important	-0.461777032	0.002138511	s_Zones=Zone 1	-0.39964383	0.002084637
fr_CV_F6=fr_CV_F6_Pas important	-0.478159549	0.001146978	fr_CV_F4=fr_CV_F4_Pas important	-0.403645239	0.000489407
fr_ETS_F1=fr_ETS_F1_Pas important	-0.532035042	5.20E-05	s_Délégation=Agareb	-0.422877192	0.020652573
fg_Proximite.entreprises=fg_Proximite.entreprises_6	-0.544488319	0.000794698	s_Nbre_Salariés.2=(21.50]	-0.429861205	0.007689243
fr_CV_F8=fr_CV_F8_Pas important	-0.594755116	3.97E-06	fg_Pouv_Nat=fg_Pouv_Nat_OUI	-0.429960544	0.014639951
fr_ITT_F5=fr_ITT_F5_Important	-0.606122098	2.32E-06	fg_Actionnaire=fg_Actionnaire_OUI	-0.466481188	6.48E-07
fr_CV_F7=fr_CV_F7_Pas important	-0.610555909	0.000222229	s_Zones=Zone 3	-0.467197092	0.000130863
fg_Servi_pub=fg_Servi_pub_NON	-0.632395849	7.61E-07	fg_Pouv_Locaux=fg_Pouv_Locaux_OUI	-0.481094208	1.12E-05
s_Régime.d.export=Partiellement exportatrice	-0.684189076	4.96E-05	fg_Frs=fg_Frs_OUI	-0.494380255	2.15E-06
fr_ITT_F10=fr_ITT_F10_Pas important	-0.690430687	0.015604077	fg_Qualite_vie=fg_Qualite_vie_6	-0.496850869	0.006953961
fr_MO_F5=fr_MO_F5_Important	-0.704275347	3.47E-07	fg_Servi_pub=fg_Servi_pub_OUI	-0.499073539	5.04E-08
c_Autres_Unités=c_Autres_Unités_NON	-0.723365216	3.23E-06	fg_Famille=fg_Famille_NON	-0.534282481	8.08E-09
s_Nbre_Salariés.2=(12.5.21]	-0.728345685	0.001598784	fr_CV_F7=fr_CV_F7_Pas important	-0.582715796	7.02E-07
fg_Pouv_Locaux=fg_Pouv_Locaux_NON	-0.736751214	1.05E-06	fr_CV_F6=fr_CV_F6_Pas important	-0.602940253	4.18E-09
fr_LP_F4=fr_LP_F4_Pas important	-0.741777153	2.20E-06	c_Autres_Act_Loca=Entrepôt. logistique et/ou stockage	-0.618569389	0.012153653
fg_Actionnaire=fg_Actionnaire_NON	-0.750728982	4.84E-09	fr_CV_F3=fr_CV_F3_Pas important	-0.631611425	1.49E-09
fr_ETS_F4=fr_ETS_F4_Pas important	-0.764109659	1.33E-08	s_Gouvernorat=Tataouine	-0.696849789	0.016044887
s_Nationalité=Tunisienne	-0.767086779	7.21E-05	fr_CV_F5=fr_CV_F5_Pas important	-0.748119525	5.84E-14
fr_LP_F5=fr_LP_F5_Pas important	-0.769437594	2.18E-09	fg_Cab_spé=fg_Cab_spé_OUI	-0.750589568	0.019058005
fg_Main_œuvre=fg_Main_œuvre_5	-0.795440574	0.021875553	fr_MO_F3=fr_MO_F3_Important	-0.775888985	1.64E-06
s_Activité.principale=Secteur agro-alimentaire	-0.797743797	0.002641778	fr_RF_F3=fr_RF_F3_Important	-0.792396178	1.20E-19

c_Autres_Act_Loca=NA	-0.814673849	0.007413802	s_Activité.principale=Secteur des matériaux de construction céramique et verre	-0.807272266	4.36E-05
fg_Cadr=fg_Cadr_NON	-0.832540998	0.000110051	s_Statut.Juridique=Société anonyme	-0.836337404	0.014418875
fr_CV_F2=fr_CV_F2_Important	-0.856873301	4.38E-12	s_Délégation=Tataouine Nord	-0.872820875	0.026805378
fr_ITT_F4=fr_ITT_F4_Pas important	-0.863438243	1.48E-09	s_Délégation=El hamma	-0.90393518	0.001947219
fr_ITT_F8=fr_ITT_F8_Pas important	-0.865878847	1.73E-11	fr_RF_F5=fr_RF_F5_Important	-0.91841134	4.02E-27
c_Appartient_groupe=c_Appartient_groupe_NON	-0.89172391	2.50E-07	fr_RF_F4=fr_RF_F4_Important	-1.004383095	3.10E-31
fr_LP_F2=fr_LP_F2_Pas important	-0.919284252	6.01E-14	s_Délégation=Skhira	-1.469757769	0.030879966
fr_ITT_F3=fr_ITT_F3_Pas important	-0.961764233	2.41E-14			
fr_MO_F4=fr_MO_F4_Important	-0.962268347	9.59E-14			
fr_ITT_F1=fr_ITT_F1_Pas important	-0.965267436	4.67E-14			
fr_MBS_F5=fr_MBS_F5_Important	-0.969570845	1.55E-15			
fg_Famille=fg_Famille_OUI	-0.982959163	1.55E-15			
fr_CV_F3=fr_CV_F3_Pas important	-0.984928604	5.09E-12			
c_Mono_Multi_établ=c_Mono_Multi_établ_NON	-0.989131889	1.42E-10			
fr_LP_F6=fr_LP_F6_Pas important	-1.028071854	7.83E-18			
fr_ITT_F2=fr_ITT_F2_Pas important	-1.042899074	2.48E-17			
fr_CV_F4=fr_CV_F4_Pas important	-1.066674967	2.75E-12			
fg_Pouv_Nat=fg_Pouv_Nat_NON	-1.08589573	5.65E-06			
fr_ETS_F3=fr_ETS_F3_Pas important	-1.092343626	1.35E-18			
fr_ITT_F9=fr_ITT_F9_Pas important	-1.158439636	6.79E-15			
fr_MO_F1=fr_MO_F1_Pas important	-1.202474827	5.99E-26			
s_Nbre_Salariés.2=(0.12.5]	-1.204152776	6.15E-08			
fr_LP_F7=fr_LP_F7_Important	-1.212387121	3.00E-09			

fr_LP_F8=fr_LP_F8_Important	-1.297793712	4.65E-10
fg_Cab_spé=fg_Cab_spé_NON	-1.357521811	0.002102113
s_Délégation=Jerba Midoun	-1.580409965	0.014376311
s_Statut.Juridique=Personne physique	-1.628875059	0.018142653

Table 2.36: Dimensions best characterized the partition

	Eta2	P-value
Dim.1	0.76892686	1.023181e-56
Dim.2	0.37937762	5.872375e-19
Dim.3	0.06102697	3.921699e-03
Dim.9	0.06099347	3.934032e-03

Table 2.37: Description of each cluster by dimensions

Cluster 1						
	v.test	Mean in category	Overall mean	Sd in category	Overall sd	p.value
Dim.2	4.754313	0.6522308	1.615619e-16	1.1632629	1.267199	1.991223e-06
Dim.3	2.790341	0.3460667	-1.718733e-16	1.0795098	1.145602	5.265261e-03
Dim.1	-9.332944	-1.7751079	-4.094335e-16	0.8030038	1.756861	1.029704e-20
Cluster 2						
	v.test	Mean in category	Overall mean	Sd in category	Overall sd	p.value
Dim.3	-2.975590	-0.3303457	-1.718733e-16	0.9821815	1.145602	2.924251e-03
Dim.9	-3.294928	-0.2728980	-3.356641e-16	0.7480681	0.854659	9.844701e-04
Dim.2	-8.206566	-1.0077849	1.615619e-16	0.6476520	1.267199	2.276051e-16
Cluster 3						
	v.test	Mean in category	Overall mean	Sd in category	Overall sd	p.value
Dim.1	10.52872	2.1094106	-4.094335e-16	0.9301237	1.756861	6.369484e-26
Dim.2	3.80501	0.5498557	1.615619e-16	1.1531117	1.267199	1.417985e-04

Table 2.38: Link with partition described by variables

Variables	p-value
fr_ITT_F9	2.61e-19
fr_MO_F1	6.57e-16
fr_ITT_F8	5.33e-14
fr_LP_F6	4.47e-14
fr_MO_F4	6.38e-12
fr_ITT_F3	1.77e-12
fg_Famille	3.27e-12
s_Nbre_Salariés.2	1.41e-12
fr_CV_F4	7.98e-11
fr_CV_F3	3.79e-11
fr_ETS_F3	1.69e-11
fr_LP_F2	2.55e-10
fr_ITT_F1	1.98e-10
fr_ITT_F2	1.64e-9
fr_MBS_F5	6.69e-8
fr_CV_F2	1.95e-7

fr_LP_F5	1.92e-7
fr_RF_F4	1.63e-7
fr_RF_F3	1.39e-7
fg_Autr_End	0.0096
fr_RF_F2	0.00847
fg_Qualite_vie	0.00803
fg_Cadr	0.00803
s_Régime.d.export	0.00691
fr_ETS_F2	0.00667
fg_Frs	0.0055
fr_MO_F3	0.00485
fg_Pouv_Nat	0.00453
fr_ITT_F10	0.00325
fr_MO_F2	0.00323
s_Activité.principale	0.00279
s_Statut.Juridique	0.00277
s_Nationalité	0.00272
c_Autres_Act_Loca	0.00108
s_Zones	0.000827
fr_CV_F5	0.00068
fr_LP_F1	0.000337
fr_CV_F7	0.000273
fg_Pouv_Locaux	0.000267
fr_CV_F6	0.000228
c_Autres_Unités	0.00021
fr_ETS_F1	0.0000956
c_Appartient_groupe	0.000079
fr_ITT_F4	0.0000756
fr_MO_F5	0.000034
fr_LP_F7	0.0000285
fr_CV_F8	0.0000285
fr_LP_F4	0.0000249
fg_Actionnaire	0.0000103
fr_RF_F5	0.00000886
fr_ETS_F4	0.00000468
fg_Servi_pub	0.00000242
c_Mono_Multi_établ	0.0000023
fr_LP_F8	0.00000105

Table 2.39: Link with partition described by categories

	Cluster 1				
	Cla/Mod	Mod/Cla	Global	p.value	v.test
fr_ITT_F9=fr_ITT_F9_Pas important	94.736842	62.068966	21.229050	3.702705e-20	9.196363
fr_ITT_F8=fr_ITT_F8_Pas important	68.181818	77.586207	36.871508	6.550266e-15	7.792873
fr_MO_F1=fr_MO_F1_Pas important	59.523810	86.206897	46.927374	8.623359e-14	7.460441
fr_ITT_F3=fr_ITT_F3_Pas important	65.671642	75.862069	37.430168	2.508483e-13	7.318452
fg_Famille=fg_Famille_OUI	63.013699	79.310345	40.782123	3.231765e-13	7.284370
fr_LP_F2=fr_LP_F2_Pas important	52.688172	84.482759	51.955307	6.851532e-10	6.169479
fr_LP_F6=fr_LP_F6_Pas important	53.333333	82.758621	50.279330	9.122247e-10	6.124057
fr_ITT_F1=fr_ITT_F1_Pas important	45.689655	91.379310	64.804469	5.820834e-08	5.424219
fr_ITT_F2=fr_ITT_F2_Pas important	46.363636	87.931034	61.452514	1.738491e-07	5.225325
fr_CV_F2=fr_CV_F2_Important	50.561798	77.586207	49.720670	1.991148e-07	5.200162
fg_Servi_pub=fg_Servi_pub_NON	49.462366	79.310345	51.955307	2.903231e-07	5.129623
s_Nbre_Salariés.2=(0,12.5]	64.444444	50.000000	25.139665	3.063239e-07	5.119514
fg_Actionnaire=fg_Actionnaire_NON	46.226415	84.482759	59.217877	1.048735e-06	4.882266
c_Mono_Multi_étab=c_Mono_Multi_établ_NON	40.140845	98.275862	79.329609	1.607065e-06	4.797440
c_Appartient_groupe=c_Appartient_groupe_NON	38.666667	100.000000	83.798883	3.331261e-06	4.649261
fr_MBS_F5=fr_MBS_F5_Important	50.000000	70.689655	45.810056	4.098883e-06	4.606304
fr_MO_F4=fr_MO_F4_Important	43.220339	87.931034	65.921788	8.478771e-06	4.452724
fg_Pouv_Locaux=fg_Pouv_Locaux_NON	40.145985	94.827586	76.536313	2.008034e-05	4.263996
fr_LP_F5=fr_LP_F5_Pas important	50.704225	62.068966	39.664804	2.942626e-05	4.177862
c_Autres_Unités=c_Autres_Unités_NON	39.285714	94.827586	78.212291	7.423126e-05	3.962300
fr_ETS_F3=fr_ETS_F3_Pas important	41.739130	82.758621	64.245810	2.710531e-04	3.641501
fr_LP_F7=fr_LP_F7_Important	36.250000	100.000000	89.385475	3.556406e-04	3.570985
c_Autres_Act_Loca=NA	56.410256	37.931034	21.787709	5.023560e-04	3.479497
fr_ITT_F4=fr_ITT_F4_Pas important	39.393939	89.655172	73.743017	5.371989e-04	3.461488
fr_LP_F8=fr_LP_F8_Important	36.024845	100.000000	89.944134	5.559042e-04	3.452264
fg_Proximite.entreprises=fg_Proximite.entreprises_6	47.826087	56.896552	38.547486	6.035779e-04	3.430002
fr_RF_F4=fr_RF_F4_Pas important	50.909091	48.275862	30.726257	6.083034e-04	3.427885
s_Activité.principale=Secteur agro-alimentaire	47.761194	55.172414	37.430168	8.654026e-04	3.330982
fg_Frs=fg_Frs_NON	38.931298	87.931034	73.184358	1.570254e-03	3.161377
fr_CV_F8=fr_CV_F8_Pas important	44.444444	62.068966	45.251397	1.967159e-03	3.095146
fg_Qualite_vie=fg_Qualite_vie_3	59.259259	27.586207	15.083799	2.100879e-03	3.075588
fr_ITT_F10=fr_ITT_F10_Pas important	80.000000	13.793103	5.586592	2.303751e-03	3.047993
s_Délégation=Jerba Midoun	100.000000	8.620690	2.793296	3.165558e-03	2.951186
fg_Pouv_Nat=fg_Pouv_Nat_NON	35.151515	100.000000	92.178771	3.207141e-03	2.947153
fr_CV_F3=fr_CV_F3_Pas important	38.059701	87.931034	74.860335	4.368243e-03	2.850268
s_Zones=Zone 0	44.927536	53.448276	38.547486	5.353597e-03	2.784950
fr_ETS_F4=fr_ETS_F4_Pas important	39.166667	81.034483	67.039106	5.373835e-03	2.783726
fr_MO_F5=fr_MO_F5_Important	47.272727	44.827586	30.726257	5.806550e-03	2.758510
fg_Main_œuvre=fg_Main_œuvre_5	59.090909	22.413793	12.290503	6.893773e-03	2.701933
fr_RF_F5=fr_RF_F5_Pas important	45.312500	50.000000	35.754190	7.000973e-03	2.696798
fr_MO_F2=fr_MO_F2_Pas important	40.000000	72.413793	58.659218	9.759805e-03	2.584225
fr_MO_F2=fr_MO_F2_Important	21.621622	27.586207	41.340782	9.759805e-03	-2.584225
fr_RF_F5=fr_RF_F5_Important	25.217391	50.000000	64.245810	7.000973e-03	-2.696798

fr_MO_F5=fr_MO_F5_Pas important	25.806452	55.172414	69.273743	5.806550e-03	-2.758510
fr_ETS_F4=fr_ETS_F4_Important	18.644068	18.965517	32.960894	5.373835e-03	-2.783726
fg_Qualite_vie=fg_Qualite_vie_6	17.307692	15.517241	29.050279	5.089774e-03	-2.801296
fr_CV_F3=fr_CV_F3_Important	15.555556	12.068966	25.139665	4.368243e-03	-2.850268
fg_Pouv_Nat=fg_Pouv_Nat_OUI	0.000000	0.000000	7.821229	3.207141e-03	-2.947153
fr_ITT_F10=fr_ITT_F10_Important	29.585799	86.206897	94.413408	2.303751e-03	-3.047993
fr_CV_F8=fr_CV_F8_Important	22.448980	37.931034	54.748603	1.967159e-03	-3.095146
fg_Frs=fg_Frs_OUI	14.583333	12.068966	26.815642	1.570254e-03	-3.161377
fg_Proximite.entreprises=fg_Proximite.entreprises_5	10.810811	6.896552	20.670391	1.014189e-03	-3.286561
c_Autres_Act_Loca=Entrepôt, logistique et/ou stockage	0.000000	0.000000	9.497207	8.659278e-04	-3.330813
fr_RF_F4=fr_RF_F4_Important	24.193548	51.724138	69.273743	6.083034e-04	-3.427885
fr_LP_F8=fr_LP_F8_Pas important	0.000000	0.000000	10.055866	5.559042e-04	-3.452264
fr_ITT_F4=fr_ITT_F4_Important	12.765957	10.344828	26.256983	5.371989e-04	-3.461488
fr_LP_F7=fr_LP_F7_Pas important	0.000000	0.000000	10.614525	3.556406e-04	-3.570985
fr_ETS_F3=fr_ETS_F3_Important	15.625000	17.241379	35.754190	2.710531e-04	-3.641501
s_Statut.Juridique=Société anonyme	10.869565	8.620690	25.698324	1.595538e-04	-3.775708
c_Autres_Unités=c_Autres_Unités_OUI	7.692308	5.172414	21.787709	7.423126e-05	-3.962300
fr_LP_F5=fr_LP_F5_Important	20.370370	37.931034	60.335196	2.942626e-05	-4.177862
fg_Pouv_Locaux=fg_Pouv_Locaux_OUI	7.142857	5.172414	23.463687	2.008034e-05	-4.263996
fr_MO_F4=fr_MO_F4_Pas important	11.475410	12.068966	34.078212	8.478771e-06	-4.452724
fr_MBS_F5=fr_MBS_F5_Pas important	17.525773	29.310345	54.189944	4.098883e-06	-4.606304
c_Appartient_groupe=c_Appartient_groupe_OUI	0.000000	0.000000	16.201117	3.331261e-06	-4.649261
c_Mono_Multi_établ=c_Mono_Multi_établ_OUI	2.702703	1.724138	20.670391	1.607065e-06	-4.797440
s_Nbre_Salariés.2=(50,470]	4.651163	3.448276	24.022346	1.259550e-06	-4.846032
fg_Actionnaire=fg_Actionnaire_OUI	12.328767	15.517241	40.782123	1.048735e-06	-4.882266
fg_Servi_pub=fg_Servi_pub_OUI	13.953488	20.689655	48.044693	2.903231e-07	-5.129623
fr_CV_F2=fr_CV_F2_Pas important	14.444444	22.413793	50.279330	1.991148e-07	-5.200162
fr_ITT_F2=fr_ITT_F2_Important	10.144928	12.068966	38.547486	1.738491e-07	-5.225325
fr_ITT_F1=fr_ITT_F1_Important	7.936508	8.620690	35.195531	5.820834e-08	-5.424219
fr_LP_F6=fr_LP_F6_Important	11.235955	17.241379	49.720670	9.122247e-10	-6.124057
fr_LP_F2=fr_LP_F2_Important	10.465116	15.517241	48.044693	6.851532e-10	-6.169479
fg_Famille=fg_Famille_NON	11.320755	20.689655	59.217877	3.231765e-13	-7.284370
fr_ITT_F3=fr_ITT_F3_Important	12.500000	24.137931	62.569832	2.508483e-13	-7.318452
fr_MO_F1=fr_MO_F1_Important	8.421053	13.793103	53.072626	8.623359e-14	-7.460441
fr_ITT_F8=fr_ITT_F8_Important	11.504425	22.413793	63.128492	6.550266e-15	-7.792873
fr_ITT_F9=fr_ITT_F9_Important	15.602837	37.931034	78.770950	3.702705e-20	-9.196363

Cluster 2

	Cla/Mod	Mod/Cla	Global	p.value	v.test
fr_RF_F4=fr_RF_F4_Important	50.806452	94.029851	69.273743	3.802521e-09	5.892563
fr_RF_F3=fr_RF_F3_Important	53.211009	86.567164	60.893855	2.127023e-08	5.601339
fr_ITT_F9=fr_ITT_F9_Important	46.808511	98.507463	78.770950	3.649194e-08	5.507039
fr_RF_F5=fr_RF_F5_Important	50.434783	86.567164	64.245810	7.399201e-07	4.950582
fr_CV_F4=fr_CV_F4_Pas important	45.070423	95.522388	79.329609	1.146795e-05	4.387465
fr_ITT_F8=fr_ITT_F8_Important	48.672566	82.089552	63.128492	3.700365e-05	4.125434
s_Activité.principale=Secteur des matériaux de construction céramique et verre	63.636364	41.791045	24.581006	5.530969e-05	4.031977

fr_CV_F3=fr_CV_F3_Pas important	45.522388	91.044776	74.860335	6.499766e-05	3.993891
fr_ITT_F3=fr_ITT_F3_Important	48.214286	80.597015	62.569832	9.720422e-05	3.897467
fg_Qualite_vie=fg_Qualite_vie_6	59.615385	46.268657	29.050279	1.231352e-04	3.839799
fg_Famille=fg_Famille_NON	48.113208	76.119403	59.217877	3.519662e-04	3.573704
fr_CV_F5=fr_CV_F5_Pas important	45.038168	88.059701	73.184358	3.826399e-04	3.551776
fr_LP_F1=fr_LP_F1_Important	47.572816	73.134328	57.541899	1.093887e-03	3.265195
fr_ETS_F3=fr_ETS_F3_Pas important	46.086957	79.104478	64.245810	1.247667e-03	3.227753
fr_MO_F2=fr_MO_F2_Important	51.351351	56.716418	41.340782	1.420281e-03	3.190497
fr_CV_F6=fr_CV_F6_Pas important	44.274809	86.567164	73.184358	1.497979e-03	3.175075
fg_Proximite.entreprises=fg_Proximite.entreprises_5	59.459459	32.835821	20.670391	2.543063e-03	3.018170
fg_Servi_pub=fg_Servi_pub_OUI	48.837209	62.686567	48.044693	2.632776e-03	3.007648
fr_RF_F2=fr_RF_F2_Important	48.275862	62.686567	48.603352	3.829995e-03	2.891835
fg_Autr_End=fg_Autr_End_OUI	64.000000	23.880597	13.966480	4.376651e-03	2.849656
fr_MO_F3=fr_MO_F3_Important	40.490798	98.507463	91.061453	4.666978e-03	2.829164
s_Délégation=Jerba Houmt Souk	0.000000	0.000000	5.586592	7.855387e-03	-2.658223
fr_MO_F3=fr_MO_F3_Pas important	6.250000	1.492537	8.938547	4.666978e-03	-2.829164
fg_Autr_End=fg_Autr_End_NON	33.116883	76.119403	86.033520	4.376651e-03	-2.849656
fr_RF_F2=fr_RF_F2_Pas important	27.173913	37.313433	51.396648	3.829995e-03	-2.891835
c_Autres_Act_Loca=NA	17.948718	10.447761	21.787709	3.829133e-03	-2.891905
fg_Servi_pub=fg_Servi_pub_NON	26.881720	37.313433	51.955307	2.632776e-03	-3.007648
fr_CV_F6=fr_CV_F6_Important	18.750000	13.432836	26.815642	1.497979e-03	-3.175075
fr_MO_F2=fr_MO_F2_Pas important	27.619048	43.283582	58.659218	1.420281e-03	-3.190497
fr_ETS_F3=fr_ETS_F3_Important	21.875000	20.895522	35.754190	1.247667e-03	-3.227753
fr_LP_F1=fr_LP_F1_Pas important	23.684211	26.865672	42.458101	1.093887e-03	-3.265195
fr_CV_F5=fr_CV_F5_Important	16.666667	11.940299	26.815642	3.826399e-04	-3.551776
fg_Famille=fg_Famille_OUI	21.917808	23.880597	40.782123	3.519662e-04	-3.573704
fr_ITT_F3=fr_ITT_F3_Pas important	19.402985	19.402985	37.430168	9.720422e-05	-3.897467
fr_CV_F3=fr_CV_F3_Important	13.333333	8.955224	25.139665	6.499766e-05	-3.993891
fr_ITT_F8=fr_ITT_F8_Pas important	18.181818	17.910448	36.871508	3.700365e-05	-4.125434
fr_CV_F4=fr_CV_F4_Important	8.108108	4.477612	20.670391	1.146795e-05	-4.387465
s_Zones=Zone 0	17.391304	17.910448	38.547486	8.353817e-06	-4.455910
fr_RF_F5=fr_RF_F5_Pas important	14.062500	13.432836	35.754190	7.399201e-07	-4.950582
fr_ITT_F9=fr_ITT_F9_Pas important	2.631579	1.492537	21.229050	3.649194e-08	-5.507039
fr_RF_F3=fr_RF_F3_Pas important	12.857143	13.432836	39.106145	2.127023e-08	-5.601339
fr_RF_F4=fr_RF_F4_Pas important	7.272727	5.970149	30.726257	3.802521e-09	-5.892563

Cluster 3

	Cla/Mod	Mod/Cla	Global	p.value	v.test
fr_LP_F6=fr_LP_F6_Important	55.056180	90.740741	49.720670	6.240936e-14	7.502925
fr_MO_F1=fr_MO_F1_Important	52.631579	92.592593	53.072626	2.325081e-13	7.328635
fr_MO_F4=fr_MO_F4_Pas important	63.934426	72.222222	34.078212	3.649175e-12	6.950142
fr_ETS_F3=fr_ETS_F3_Important	62.500000	74.074074	35.754190	4.073566e-12	6.934605
fr_CV_F3=fr_CV_F3_Important	71.111111	59.259259	25.139665	2.971348e-11	6.647984
fr_CV_F4=fr_CV_F4_Important	75.675676	51.851852	20.670391	1.093574e-10	6.453415
s_Nbre_Salariés.2=(50,470]	69.767442	55.555556	24.022346	5.073050e-10	6.216828
fr_ITT_F1=fr_ITT_F1_Important	58.730159	68.518519	35.195531	1.789196e-09	6.015873
fr_ITT_F2=fr_ITT_F2_Important	55.072464	70.370370	38.547486	1.408977e-08	5.672294
fr_LP_F5=fr_LP_F5_Important	44.444444	88.888889	60.335196	8.893989e-08	5.347983

fr_LP_F2=fr_LP_F2_Important	48.837209	77.777778	48.044693	1.413197e-07	5.263524
fr_MBS_F5=fr_MBS_F5_Pas important	46.391753	83.333333	54.189944	1.490485e-07	5.253731
fr_LP_F4=fr_LP_F4_Important	38.297872	100.00000	78.770950	1.519097e-07	5.250230
fr_LP_F8=fr_LP_F8_Pas important	83.333333	27.777778	10.055866	1.345003e-06	4.832986
fr_ETS_F4=fr_ETS_F4_Important	54.237288	59.259259	32.960894	1.703319e-06	4.785771
fr_MO_F5=fr_MO_F5_Pas important	40.322581	92.592593	69.273743	2.469105e-06	4.710664
fr_ITT_F9=fr_ITT_F9_Important	37.588652	98.148148	78.770950	3.846077e-06	4.619531
fr_CV_F8=fr_CV_F8_Important	43.877551	79.629630	54.748603	8.484249e-06	4.452585
fr_ETS_F1=fr_ETS_F1_Important	47.945205	64.814815	40.782123	2.257068e-05	4.237814
fr_CV_F2=fr_CV_F2_Pas important	44.444444	74.074074	50.279330	2.768053e-05	4.191755
c_Mono_Multi_établ=c_Mono_Multi_établ_OUI	59.459459	40.740741	20.670391	3.401151e-05	4.144797
fr_LP_F7=fr_LP_F7_Pas important	73.684211	25.925926	10.614525	4.846023e-05	4.062932
fr_RF_F3=fr_RF_F3_Pas important	47.142857	61.111111	39.106145	9.870047e-05	3.893765
fr_ITT_F4=fr_ITT_F4_Important	53.191489	46.296296	26.256983	1.173595e-04	3.851577
fr_CV_F7=fr_CV_F7_Important	58.823529	37.037037	18.994413	1.245650e-04	3.836963
fr_ITT_F8=fr_ITT_F8_Important	39.823009	83.333333	63.128492	1.695092e-04	3.760596
fr_CV_F6=fr_CV_F6_Important	52.083333	46.296296	26.815642	1.961364e-04	3.723941
fg_Famille=fg_Famille_NON	40.566038	79.629630	59.217877	2.162698e-04	3.699212
fr_LP_F1=fr_LP_F1_Pas important	44.736842	62.962963	42.458101	3.209811e-04	3.597751
fr_ITT_F3=fr_ITT_F3_Important	39.285714	81.481481	62.569832	4.807999e-04	3.491231
s_Nationalité=Mixte	60.869565	25.925926	12.849162	1.277758e-03	3.220929
c_Autres_Unités=c_Autres_Unités_OUI	51.282051	37.037037	21.787709	1.875683e-03	3.109241
fr_ETS_F2=fr_ETS_F2_Important	48.888889	40.740741	25.139665	2.326547e-03	3.045033
c_Appartient_groupe=c_Appartient_groupe_OUI	55.172414	29.629630	16.201117	2.411182e-03	3.034270
fr_CV_F5=fr_CV_F5_Important	47.916667	42.592593	26.815642	2.497984e-03	3.023585
s_Régime.d.export=Totallement exportatrice	53.125000	31.481481	17.877095	2.991866e-03	2.968572
fr_MBS_F2=fr_MBS_F2_Pas important	44.262295	50.000000	34.078212	3.960889e-03	2.881260
fg_Cadr=fg_Cadr_OUI	61.111111	20.370370	10.055866	4.981117e-03	2.808252
fr_MBS_F3=fr_MBS_F3_Important	37.068966	79.629630	64.804469	5.897368e-03	2.753434
fr_MO_F3=fr_MO_F3_Pas important	62.500000	18.518519	8.938547	6.183253e-03	2.737902
fr_ITT_F5=fr_ITT_F5_Pas important	40.000000	62.962963	47.486034	6.993056e-03	2.697175
fg_Pouv_Nat=fg_Pouv_Nat_OUI	64.285714	16.666667	7.821229	7.530624e-03	2.672420
fg_Actionnaire=fg_Actionnaire_OUI	41.095890	55.555556	40.782123	9.365583e-03	2.598413
fg_Actionnaire=fg_Actionnaire_NON	22.641509	44.444444	59.217877	9.365583e-03	-2.598413
fg_Pouv_Nat=fg_Pouv_Nat_NON	27.272727	83.333333	92.178771	7.530624e-03	-2.672420
fr_ITT_F5=fr_ITT_F5_Important	21.276596	37.037037	52.513966	6.993056e-03	-2.697175
fr_MO_F3=fr_MO_F3_Important	26.993865	81.481481	91.061453	6.183253e-03	-2.737902
fr_MBS_F3=fr_MBS_F3_Pas important	17.460317	20.370370	35.195531	5.897368e-03	-2.753434
fg_Cadr=fg_Cadr_NON	26.708075	79.629630	89.944134	4.981117e-03	-2.808252
fr_MBS_F2=fr_MBS_F2_Important	22.881356	50.000000	65.921788	3.960889e-03	-2.881260
s_Nbre_Salariés.2=(12.5,21]	13.333333	11.111111	25.139665	3.478040e-03	-2.921989
s_Régime.d.export=Partiellement exportatrice	25.170068	68.518519	82.122905	2.991866e-03	-2.968572
fr_CV_F5=fr_CV_F5_Pas important	23.664122	57.407407	73.184358	2.497984e-03	-3.023585
c_Appartient_groupe=c_Appartient_groupe_NON	25.333333	70.370370	83.798883	2.411182e-03	-3.034270
fr_ETS_F2=fr_ETS_F2_Pas important	23.880597	59.259259	74.860335	2.326547e-03	-3.045033
c_Autres_Unités=c_Autres_Unités_NON	24.285714	62.962963	78.212291	1.875683e-03	-3.109241
s_Nationalité=Tunisienne	25.641026	74.074074	87.150838	1.277758e-03	-3.220929
fr_ITT_F3=fr_ITT_F3_Pas important	14.925373	18.518519	37.430168	4.807999e-04	-3.491231

fr_LP_F1=fr_LP_F1_Important	19.417476	37.037037	57.541899	3.209811e-04	-3.597751
fg_Famille=fg_Famille_OUI	15.068493	20.370370	40.782123	2.162698e-04	-3.699212
fr_CV_F6=fr_CV_F6_Pas important	22.137405	53.703704	73.184358	1.961364e-04	-3.723941
fr_ITT_F8=fr_ITT_F8_Pas important	13.636364	16.666667	36.871508	1.695092e-04	-3.760596
fr_CV_F7=fr_CV_F7_Pas important	23.448276	62.962963	81.005587	1.245650e-04	-3.836963
fr_ITT_F4=fr_ITT_F4_Pas important	21.969697	53.703704	73.743017	1.173595e-04	-3.851577
fr_RF_F3=fr_RF_F3_Important	19.266055	38.888889	60.893855	9.870047e-05	-3.893765
fr_LP_F7=fr_LP_F7_Important	25.000000	74.074074	89.385475	4.846023e-05	-4.062932
c_Mono_Multi_établ=c_Mono_Multi_établ_NON	22.535211	59.259259	79.329609	3.401151e-05	-4.144797
fr_CV_F2=fr_CV_F2_Important	15.730337	25.925926	49.720670	2.768053e-05	-4.191755
fr_ETS_F1=fr_ETS_F1_Pas important	17.924528	35.185185	59.217877	2.257068e-05	-4.237814
s_Nbre_Salariés.2=(0,12.5]	6.666667	5.555556	25.139665	2.229257e-05	-4.240597
fr_CV_F8=fr_CV_F8_Pas important	13.580247	20.370370	45.251397	8.484249e-06	-4.452585
fr_ITT_F9=fr_ITT_F9_Pas important	2.631579	1.851852	21.229050	3.846077e-06	-4.619531
fr_MO_F5=fr_MO_F5_Important	7.272727	7.407407	30.726257	2.469105e-06	-4.710664
fr_ETS_F4=fr_ETS_F4_Pas important	18.333333	40.740741	67.039106	1.703319e-06	-4.785771
fr_LP_F8=fr_LP_F8_Important	24.223602	72.222222	89.944134	1.345003e-06	-4.832986
fr_LP_F4=fr_LP_F4_Pas important	0.000000	0.000000	21.229050	1.519097e-07	-5.250230
fr_MBS_F5=fr_MBS_F5_Important	10.975610	16.666667	45.810056	1.490485e-07	-5.253731
fr_LP_F2=fr_LP_F2_Pas important	12.903226	22.222222	51.955307	1.413197e-07	-5.263524
fr_LP_F5=fr_LP_F5_Pas important	8.450704	11.111111	39.664804	8.893989e-08	-5.347983
fr_ITT_F2=fr_ITT_F2_Pas important	14.655172	29.629630	61.452514	1.408977e-08	-5.672294
fr_ITT_F1=fr_ITT_F1_Pas important	31.481481	14.545455	64.804469	1.789196e-09	-6.015873
fr_CV_F4=fr_CV_F4_Pas important	18.309859	48.148148	79.329609	1.093574e-10	-6.453415
fr_CV_F3=fr_CV_F3_Pas important	16.417910	40.740741	74.860335	2.971348e-11	-6.647984
fr_ETS_F3=fr_ETS_F3_Pas important	12.173913	25.925926	64.245810	4.073566e-12	-6.934605
fr_MO_F4=fr_MO_F4_Important	12.711864	27.777778	65.921788	3.649175e-12	-6.950142
fr_MO_F1=fr_MO_F1_Pas important	4.761905	7.407407	46.927374	2.325081e-13	-7.328635
fr_LP_F6=fr_LP_F6_Pas important	5.555556	9.259259	50.279330	6.240936e-14	-7.502925

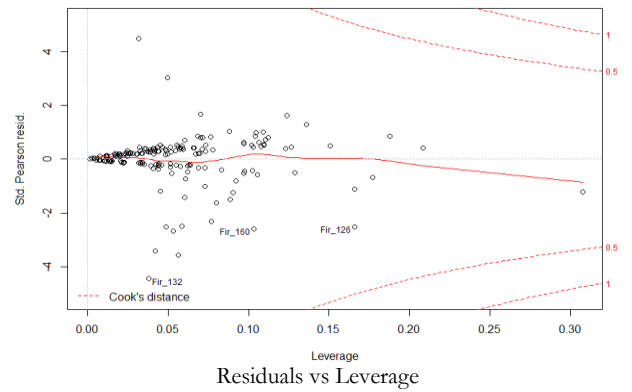
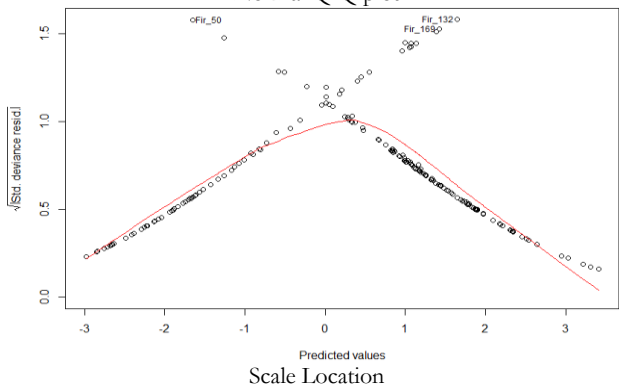
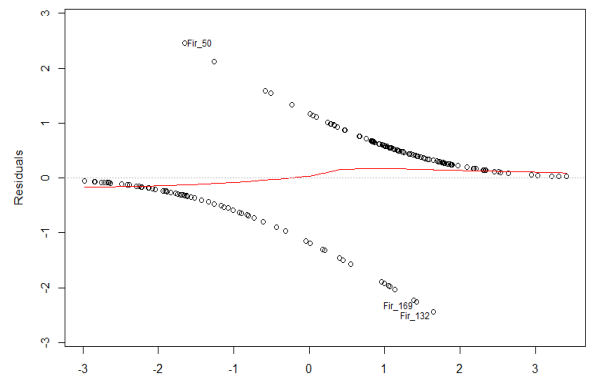
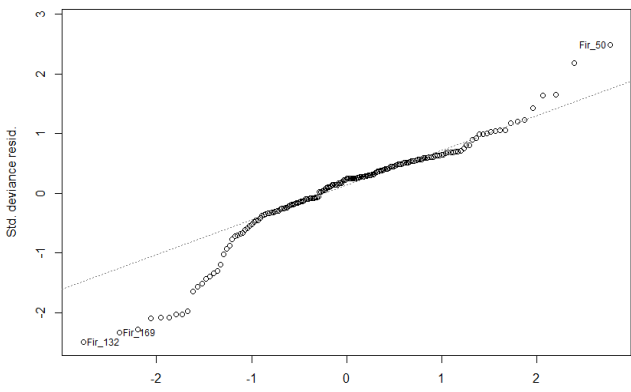


Figure 2.18: Plots of probit model 1 - Specification 1

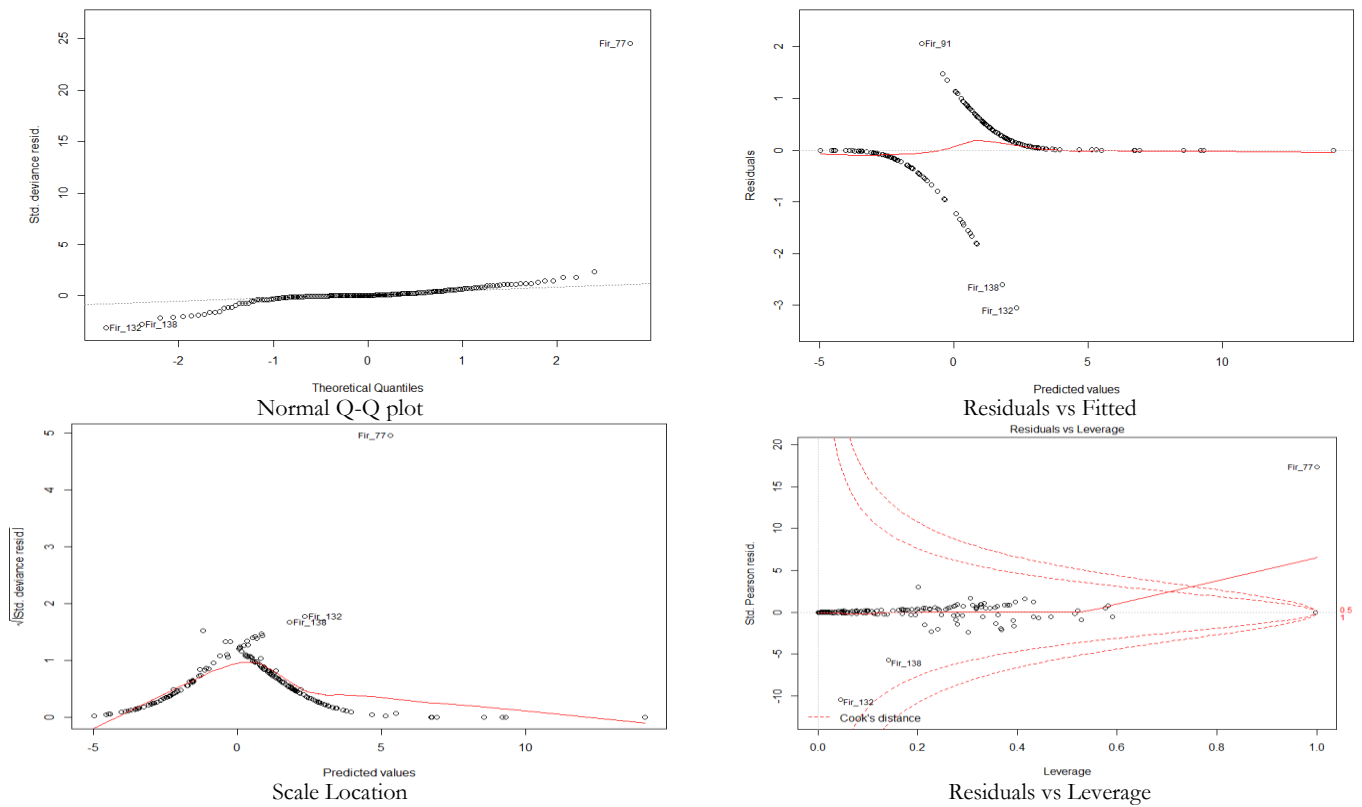


Figure 2.19: Plots of probit model 2 - Specification 1

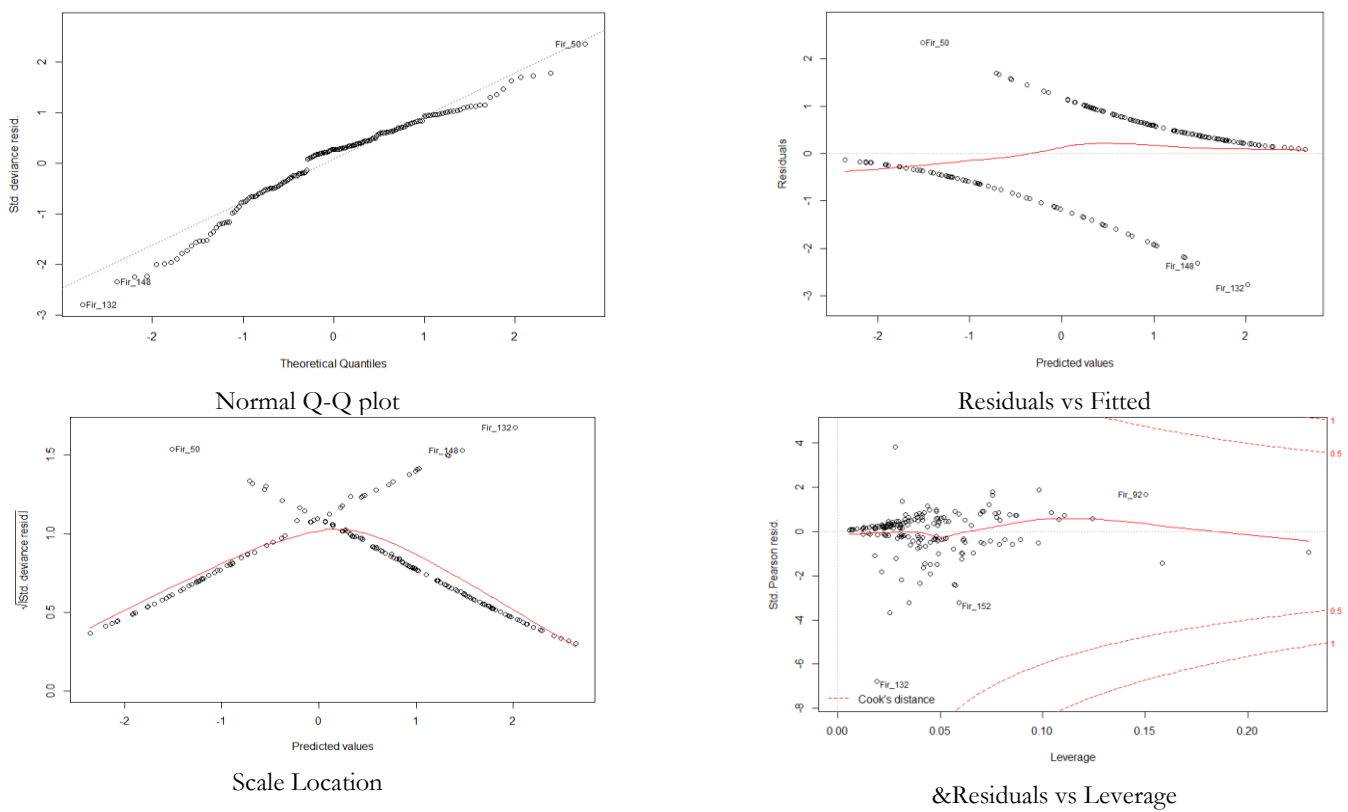
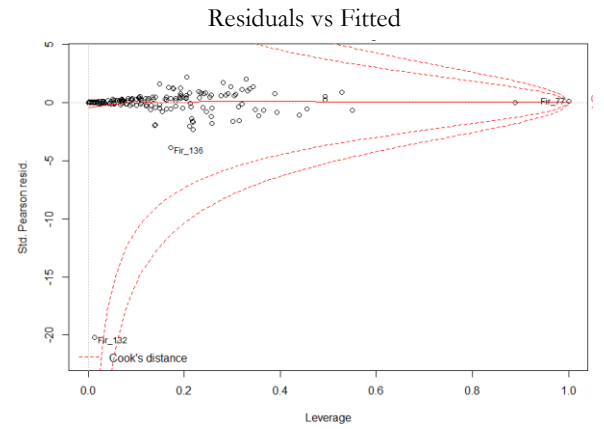
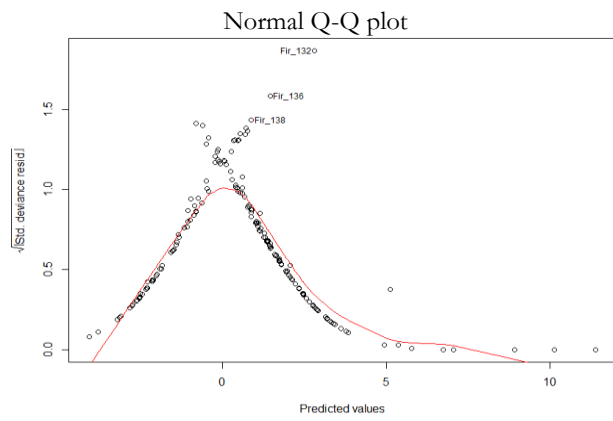
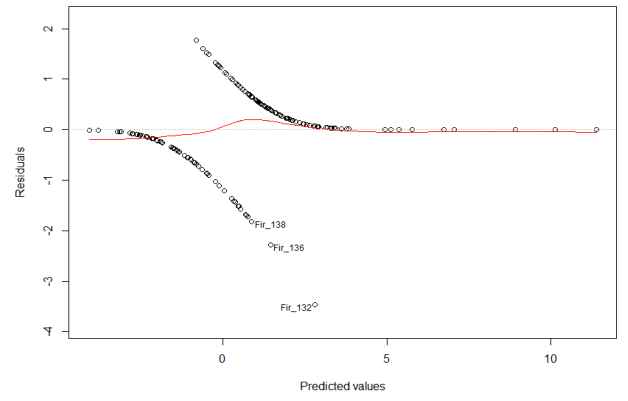
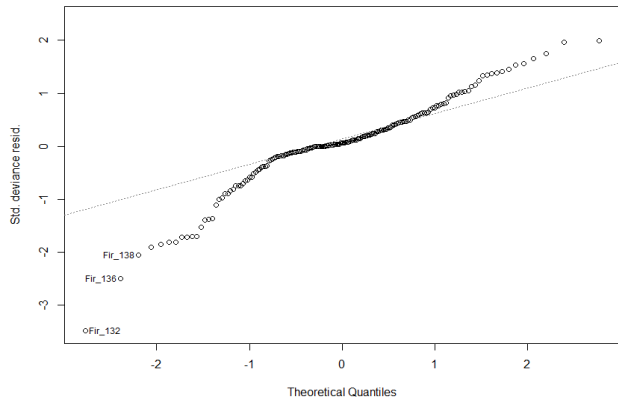


Figure 2.20: Plots of probit model 1 - Specification 2



Scale Location

Residuals vs Leverage

Figure 2.21: Plots of probit model 2 - Specification 2

Table 2.40: Logit models with seven dimensions

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Dim.1	-0.009 (0.116)	-0.075 (0.237)	0.156 (0.151)	-0.159 (0.187)	0.026 (0.147)	0.115 (0.146)	-0.023 (0.175)	0.181 (0.148)	0.149 (0.141)	0.028 (0.169)	-0.159 (0.184)
Dim.2	-1.588*** (0.243)	-2.211*** (0.388)	-2.140*** (0.360)	-1.725*** (0.289)	-1.760*** (0.280)	-2.069*** (0.334)	-2.259*** (0.374)	-2.147*** (0.359)	-2.065*** (0.331)	-2.237*** (0.366)	-1.731*** (0.284)
Dim.3	0.044 (0.182)	-0.461* (0.276)	-0.222 (0.243)	-0.152 (0.211)	-0.156 (0.204)	-0.218 (0.230)	-0.453* (0.256)	-0.189 (0.238)	-0.179 (0.225)	-0.387 (0.246)	-0.077 (0.203)
Dim.4	-0.101 (0.209)	-0.267 (0.303)	-0.287 (0.272)	-0.054 (0.250)	-0.051 (0.241)	-0.298 (0.257)	-0.249 (0.278)	-0.289 (0.271)	-0.293 (0.254)	-0.255 (0.273)	-0.035 (0.239)
Dim.5	0.388* (0.217)	0.650** (0.298)	0.596** (0.263)	0.552** (0.257)	0.622** (0.246)	0.460* (0.249)	0.574** (0.280)	0.619** (0.264)	0.479* (0.250)	0.598** (0.281)	0.460* (0.249)
Dim.6	-0.399* (0.219)	-0.208 (0.283)	-0.367 (0.262)	-0.284 (0.258)	-0.442* (0.250)	-0.388 (0.254)	-0.349 (0.271)	-0.364 (0.262)	-0.386 (0.254)	-0.363 (0.268)	-0.225 (0.253)
Dim.7	-0.724*** (0.252)	-0.827** (0.415)	-0.655* (0.340)	-0.971*** (0.325)	-0.868*** (0.305)	-0.558* (0.293)	-0.628* (0.349)	-0.592* (0.326)	-0.494* (0.282)	-0.508 (0.327)	-0.907*** (0.306)
Export regime		2.190** (0.981)	1.847** (0.903)	1.760** (0.818)	1.452* (0.769)	1.909** (0.855)	2.195** (0.910)	1.603* (0.837)	1.583** (0.779)	1.786** (0.838)	
Nationality		-1.046 (0.963)	-0.620 (0.847)	-1.429 (0.877)	-0.985 (0.816)	-0.767 (0.805)	-1.033 (0.862)				-0.533 (0.764)
Production start date: 2003-2009		1.589* (0.869)	1.504* (0.770)	1.450* (0.766)	1.088 (0.721)			1.542** (0.762)			1.202* (0.725)
Production start date: 2010-2014		0.060 (0.872)	-0.250 (0.755)	-0.581 (0.731)	-0.950 (0.691)			-0.263 (0.751)			-0.733 (0.724)
Production start date: 2015-2019		0.400 (0.840)	-0.047 (0.746)	0.009 (0.708)	-0.428 (0.658)			0.027 (0.740)			-0.212 (0.679)
Building materials and ceramics industry		-1.747** (0.857)	-2.033** (0.832)			-2.137*** (0.789)	-2.020** (0.805)	-2.057** (0.831)	-2.150*** (0.788)	-2.045** (0.805)	
Mechanical and metallurgical industry		-1.479 (1.003)	-1.719** (0.865)			-1.964** (0.823)	-1.738** (0.864)	-1.689** (0.861)	-1.965** (0.818)	-1.715** (0.851)	
Electrical and electronics industry		18.450 (3,631.424)	16.408 (2,199.844)			16.495 (2,259.516)	18.675 (3,622.462)	16.285 (2,214.769)	16.354 (2,262.289)	18.378 (3,661.175)	
Chemical industry		-2.612**	-2.128**			-2.107**	-2.693**	-2.128**	-2.133**	-2.635**	

		(1.278)	(1.063)			(0.999)	(1.151)	(1.041)	(0.978)	(1.112)	
Textile industry		0.559	0.573			0.525	0.941	0.737	0.660	1.165	
		(1.466)	(1.311)			(1.209)	(1.373)	(1.258)	(1.159)	(1.280)	
Wood, cork and furniture industry		20.200	16.952			16.889	20.449	16.988	16.853	20.358	
		(2,041.715)	(1,419.905)			(1,506.244)	(2,079.764)	(1,422.638)	(1,517.240)	(2,083.909)	
Diverse industry		-2.507	-2.219			-1.766	-2.437*	-2.233*	-1.791	-2.392*	
		(1.614)	(1.355)			(1.166)	(1.432)	(1.354)	(1.159)	(1.387)	
Natural person company		-0.946		-0.768	-0.623		-1.389			-1.508	-0.708
		(5.300)		(4.629)	(3.636)		(4.251)			(4.201)	(3.984)
Public limited company		1.297		0.699	0.566		1.220			1.117	0.467
		(0.954)		(0.758)	(0.718)		(0.873)			(0.850)	(0.707)
Affaire personnelle company		4.929**		4.326**	3.861*		4.941**			4.690**	4.339**
		(2.386)		(1.896)	(2.015)		(1.961)			(1.963)	(1.946)
Single owner limited liability company		-2.246		-0.550	-0.427		-2.389			-2.423	-0.468
		(1.794)		(1.168)	(1.084)		(1.523)			(1.512)	(1.123)
Number of employees: 12 - 21		-0.458		0.140							-0.088
		(0.920)		(0.708)							(0.672)
Number of employees: 22 - 50		0.837		1.858**							1.478*
		(1.016)		(0.899)							(0.836)
Number of employees: 50 - 475		0.335		1.027							0.696
		(1.176)		(0.964)							(0.911)
Constant	0.704***	-0.329	0.360	-0.636	0.243	0.748	0.427	0.014	0.384	-0.073	0.449
		(0.222)	(1.402)	(1.025)	(1.094)	(0.876)	(0.805)	(0.889)	(0.893)	(0.697)	(0.774)
Observations	179	179	179	179	179	179	179	179	179	179	179
Log Likelihood	-69.282	-46.531	-52.755	-56.260	-59.199	-55.814	-49.805	-53.026	-56.274	-50.540	-58.697
Akaike Inf. Crit.	154.564	147.062	145.509	152.519	152.398	145.629	141.610	144.052	144.549	141.081	155.395
McFadden's Pseudo R²	0.419	0.610	0.558	0.529	0.504	0.532	0.583	0.556	0.528	0.577	0.508
Cox and snell R²	0.428	0.557	0.525	0.506	0.489	0.508	0.540	0.523	0.506	0.536	0.492
Nagelkerke R²	0.582	0.756	0.713	0.687	0.664	0.690	0.734	0.711	0.687	0.728	0.668

Table 2.41: Logit model average marginal effects with seven dimensions

	Model 1	Model 2	Model 10	Model 11	Model 8	Model 5	Model 7	Model 6	Model 3	Model 4	Model 9
Dim.1	-0.001	-0.006	0.014	-0.016	0.003	0.011	-0.002	0.017	0.015	0.002	-0.016
Dim.2	-0.193	-0.177	-0.197	-0.169	-0.181	-0.202	-0.195	-0.198	-0.203	-0.195	-0.176
Dim.3	0.005	-0.037	-0.02	-0.015	-0.016	-0.021	-0.039	-0.017	-0.018	-0.034	-0.008
Dim.4	-0.012	-0.021	-0.026	-0.005	-0.005	-0.029	-0.021	-0.027	-0.029	-0.022	-0.004
Dim.5	0.047	0.052	0.055	0.054	0.064	0.045	0.05	0.057	0.047	0.052	0.047
Dim.6	-0.049	-0.017	-0.034	-0.028	-0.045	-0.038	-0.03	-0.034	-0.038	-0.032	-0.023
Dim.7	-0.088	-0.066	-0.06	-0.095	-0.089	-0.054	-0.054	-0.055	-0.048	-0.044	-0.092
Export regime		0.175	0.17	0.172	0.149	0.186	0.189	0.148	0.155	0.156	
Nationality		-0.084	-0.057	-0.14	-0.101	-0.075	-0.089				-0.054
Production start date: 2003-2009		0.127	0.138	0.142	0.112			0.142			0.122
Production start date: 2010-2014		0.005	-0.023	-0.057	-0.098			-0.024			-0.075
Production start date: 2015-2019		0.032	-0.004	0.001	-0.044			0.002			-0.022
Building materials and ceramics industry		-0.14	-0.187			-0.208	-0.174	-0.19	-0.211	-0.178	
Mechanical and metallurgical industry		-0.118	-0.158			-0.191	-0.15	-0.156	-0.193	-0.15	
Electrical and electronics industry		1.475	1.509			1.607	1.611	1.505	1.605	1.604	
Chemical industry		-0.209	-0.196			-0.205	-0.232	-0.197	-0.209	-0.23	
Textile industry		0.045	0.053			0.051	0.081	0.068	0.065	0.102	
Wood. cork and furniture industry		1.615	1.559			1.645	1.764	1.57	1.654	1.777	
Diverse industry		-0.2	-0.204			-0.172	-0.21	-0.206	-0.176	-0.209	
Natural person company		-0.076		-0.075	-0.064		-0.12			-0.132	-0.072
Public limited company		0.104		0.068	0.058		0.105			0.097	0.048
Affaire personnelle company		0.394		0.424	0.397		0.426			0.409	0.442
Single owner limited liability company		-0.18		-0.054	-0.044		-0.206			-0.211	-0.048
Number of employees: 12 - 21		-0.037		0.014							-0.009
Number of employees: 22 - 50		0.067		0.182							0.15
Number of employees: 50 - 475		0.027		0.101							0.071
Constant	0.085	-0.026	0.033	-0.062	0.025	0.073	0.037	0.001	0.038	-0.006	0.046

3. Push and pull factors in Tunisian internal migration: The role of human capital

This chapter examines the pull and push factors on interregional flows in Tunisia, focusing on the role of differences in human capital. Using data from the 2004 and 2014 Tunisian censuses, we estimate a gravity model augmented with proxies capturing high- and low-skilled level human capital and, among other controls, an original nighttime light proxy for regional GDP. We consider both unemployment rate differential and spatial distance as multilateral resistance variables and we add cultural and quality of life variables. We find that the macroeconomic variables are the main determinants of interregional flows. As for human capital, high skilled level acts as a pull factor and low skilled level as a restraining factor in the destination regions. Furthermore, non-economic variables have a significant impact on migration flows: Tunisians leave their origin regions not only in search of jobs but also in search of better living conditions.

Note: A short version of this chapter was the subject of a presentation in Workshop n Inequality and Polarization, University of Trier, Germany (Online, 2019)

3.1. Introduction

Since the Tunisian independence in 1956, massive internal migration in the form of rural exodus from the North-West and Center-West to the metropolis of Grand Tunis and the eastern coastal centers has occurred, triggered by attraction to urbanization (Belhedi, 1997; Bilgili and Marchand, 2016; Bounouch and Gsir, 2017). As a result, Tunisia suffers not only from an economic imbalance between coastal and southern-interior regions, but also from a blatant imbalance in terms of population growth rates (Lamine, 2008). In the 1990s, Tunisia experienced rapid economic growth after the implementation of new free trade economic reforms, which led to rapid and strong urbanization, driven by massive rural-urban migration flows (Amara et al., 2018). During this period, urban regions had twice as many inhabitants as rural regions, whereas in 1975 the population was almost evenly distributed between rural and urban regions (Jelili and Mzali, 1998). In fact, the share of the population in rural areas fell from 60% in 1966 to 33% in 2014 (Amara et al., 2018). Almost 90.2% of households in rural areas report in 2012 that at least one member of their small family has migrated to urban areas (Drissi, 2014). The 2014 national census data show that 339,803 persons (79% of migrants) moved to eastern coastal areas between 2009 and 2014, while 90,738 persons (21% of migrants) moved to interior and southern areas. As a result, in the Tunisian interior regions, cities are losing their populations due to economic recession, lack of economic solutions, lack of jobs and regional disparities in living standards (Amara et al., 2018).

Tunisia also experiences agricultural labor migration from the Center-West to eastern littoral governorates (olive harvest) and from the North-West to the North-East (Belhedi, 1997). Moreover, a specific type of migration is generated by the supply of jobs in the tourism sector during the summer (Jelili and Mzali, 1998), contributing to the creation of spontaneous settlements in the periphery of the eastern littoral cities near tourist centers. Globally, compared to other countries, Bell et al. (2015) find that Tunisia has an average propensity of people to migrate between its regions. They develop an indicator to measure the overall intensity of internal migration within countries that encompasses both migration rates and migration probabilities.

Focusing on the qualification of the migrants, it appears that Tunisian interregional flows also involve a large number of migrants with secondary and university education. The Tunisian National Institute of Statistics (INS) registers about 65% of migrants with secondary and university education in 2004 and 74% of these migrants in 2014. Migration is therefore increasingly selective in Tunisia, and even points to a brain drain in internal flows. This reflects the evolution of qualification, since the new generation of young Tunisians is globally more skilled and qualified, with less experience in agricultural activities and more interested in the quality of life in the big cities (Amara et al., 2018). Moreover, according to the same source (INS), almost 70% of migrants moved to the same eight governorates¹⁶ for both periods 2004 and 2014,

¹⁶ These governorates are Tunis, BenArous, Ariana, Nabeul, Bizerte, Zaghuan, Sousse, Monastir and Sfax.

these governorates being characterized by the largest number of residents with secondary and university education. This rural-to-urban direction of migration is responsible for most of the change in the labor force distribution in Tunisia (Radwan et al. 1991). The resulting regional imbalance is a longstanding, major concern in Tunisia. Since independence in 1956, Tunisian governments have attempted to reduce inequalities between different Tunisian governorates and have consequently introduced various policies of positive discrimination with the aim of reducing the regional imbalance in favor of interior and southern regions and encouraging firms to locate in these regions. For instance, the Investment Incentives Code is a political program distinguishing the less developed zones from the more developed ones and encouraging investment based on a territorial delimitation. This program offers additional tax and financial advantages such as exemption from certain taxes and investment premiums for investors and young entrepreneurs who decide to invest in the least developed areas.

One of the major underlying issues of these migration features is that of the spatial distribution and spatial mobility of human capital, defined as the skills, experiences and knowledge that enable the individual to earn an income. Goldin (2016) defines human capital as “*the stock of productive skills, talents, health, and expertise of the labor force*”. It is considered one of the most important sources of sustained economic growth (Abel and Deitz, 2012). Increasing levels of human capital leads to accelerated reinvention and long-term economic growth (Glaeser and Saiz, 2004; Glaeser, 2005), while its concentration in a specific region contributes to knowledge spillovers which in turn improve regional productivity and foster regional growth (Marshall, 1920; Jacobs, 1969; Lucas, 1988; Romer, 1990; Rauch, 1993; Moretti, 2004). This mechanism attracts more firms and also more workers (Glaeser et al., 1992; Fujita and Thisse; 2002) and therefore links the stock of regional human capital to human mobility, with retroaction effects (Bernard and Bell, 2018). In the specific case of Tunisia, due to the lack of sufficient natural resources, human resources are the main capital of the country. Hence, the acquisition of qualified capital is a primary concern and a strong political will to continuously improve the level of human capital is expressed through various strategies and programs in Tunisia such as, among other things, the reform of the education system introduced free education at all levels and compulsory education from the age of 6 to 16. Since independence, the Tunisian government has consolidated investment in knowledge and adaptation of the education and training system. In particular, after the implementation of the Structural Adjustment Program in 1986 and the engagement in the process of opening borders and global integration, Tunisia devoted more resources to education. In addition, the Tunisian government has promoted university education with a large public network throughout the country.

The regional structure of skills cannot therefore be ignored when analyzing the determinants of internal migration in Tunisia and our aim is to explicitly link the analysis of the determinants of interregional flows in Tunisia to human capital. From a theoretical point of view, migration is traditionally treated as a by-product of job search (Biagi et al., 2011) with two different mechanisms and implications. On the one hand, neoclassical theory states that people migrate from low-income areas to high-income areas, ultimately leading to regional equilibrium and wage equalization. On the other hand, new economic geography shows

how a circular and cumulative mechanism can lead to a center-periphery configuration where people and economic activities tend to migrate to regions with geographical concentrations of employment, causing a regional disparity in wages and the number of jobs. Moreover, in the urban growth literature, a widely discussed hypothesis states that the rapid growth of urban areas is primarily due to rapid population growth rates that put pressure on limited agricultural land, causing labor migration to cities, and economic forces that attract migrants to urban areas (Jelili and Mzali, 1998). Hence, migration becomes the main process shaping demographic patterns within countries, replacing fertility and mortality in demographic changes (Bell et al., 2015). Moreover, migration has been the subject of many policy concerns, both in developed and developing countries. These concerns may be aimed at encouraging migration in the case of low migration rates or mitigating it in the case of high migration rates (Greenwood, 1997). Therefore, an understanding of migration patterns is an important foundation for resolving disparities-related issues in Tunisia and can also help the government to understand the main reasons for the flows of people from specific regions and the effect of differences in human capital on interregional flows.

The literature on internal migration is scarce in developing countries and in Tunisia in particular. In general, most studies focus on international migration issues, which differ from the internal migration analysis (Basile et al., 2018). The barriers to international migration, such as language acquisition, administrative procedures, immigration policy, institutional barriers and cultural differences between countries (Belot and Ederveen 2012; Caragliu et al., 2013) often do not exist in internal migration. We fill this void in the empirical literature of developing countries by focusing on Tunisia and on the effects of differences in human capital on interregional flows. In our study, Human capital is measured as the educational level of individuals. To address this issue, we extend the gravity model of migration developed by Piras (2017) for two periods: 1999-2004 and 2009-2014. To the best of our knowledge, only two studies: Kriaa and Mouaddeb (2014) and Amara and Jemmali (2018) used gravity models in the Tunisian context. Kriaa and Mouaddeb (2014) employ the gravity model to analyze the spatial mobility of young university graduates between 2004 and 2008. Their empirical analysis is based on data collected from a one-time survey conducted by the Ministry of Vocational Training and Employment in collaboration with the World Bank. This study shows that young graduates migrate mainly because of structural deficiencies in their regions of origin. Amara and Jemmali (2018) use various gravity models, as well as a Poisson pseudo-maximum-likelihood specification to characterize internal migration and to assess the relative importance of distance, job market characteristics and economic variables. They exploit data from the general population and housing census for 2004, which describes the movements of individuals from 1999 to 2004 in Tunisia. Their results show that the strongest migration flows are from low-income and disadvantaged regions to economically advantaged regions and that there is a strong impact of low unemployment and high per capita expenditure in destination areas on migration decisions of Tunisians. We differ from these two papers in various respects. While Kriaa and Mouaddeb (2014) also use a gravity model as we do, their focus is on the spatial movements of young graduates while we investigate all internal migration. These two concepts do not have the same definitions. With respect to Amara and Jemmali (2018), we focus on the role of human capital differences in

interregional flows in Tunisia and propose a different methodology to construct human capital proxies. Moreover, we include various multilateral resistance variables in our gravity model and we also introduce different explanatory variables such as cultural and living condition variables using different estimation methods. Finally, the study period of Amara and Jemmali (2018) only covers one year (2004 census) while our study period includes two years (2004 and 2014 census).

With respect to our identification strategy, while the gravity equation proposed by Piras (2017) includes one variable for human capital at origin and destination, we further disaggregate the variable by distinguishing low skilled level and high skilled level of human capital. This allows us to consider that each region contains both levels of human capital. Such a disaggregation is important as we expect that regions with a high proportion of high-skilled people to attract more migrants and especially high skilled migrants, which are highly mobile across space (Faggian, 2007; Faggian et al., 2017; Whistler et al., 2008, Wozniak, 2010; Abel and Deitz, 2012; Malamud and Wozniak, 2012). The second level is the low skilled level, which is expected to be a factor preventing migration; the less educated people are, the less they tend to migrate (Borjas, 1991). With this disaggregation, we are also able to detect whether the effects of migration determinants are symmetric or asymmetric in source and destination regions.

In our specification of the gravity model, an economic variable such as regional GDP is essential. Due to the unavailability of data for this variable in Tunisia at the regional level, we use an original proxy: the nighttime lights satellite imagery developed by the Earth Observations Group (EOG). This proxy is increasingly taken as a proxy for GDP in empirical economic studies (Ghosh et al., 2010) as the electric night light captured by the satellite can provide an approximation of the level of economic activities across the country. We then base our identification strategy on three specifications varying with the definition of the multilateral resistance variable, which is negatively correlated with interregional flows: unemployment rate differential, road distance and both variables. Together with the usual gravity variables (population, proxy for regional GDP, unemployment rate differential and road distance) and human capital proxies, we also add cultural and quality of life variables that may affect the migration decisions of Tunisians. Moreover, we estimate pooled regressions for 2004 and 2014 and include interaction with year dummies to capture potential differentiated time effects of variables on interregional flows separately.

Our findings show that macroeconomic variables have a significant impact on interregional migration, especially that population size acting as a factor that encourages migration in the origin governorates and that attracts migrants in the destination governorates. With respect to human capital, we find that in the destination governorates, interregional flows are positively related to the high skilled level of persons and negatively to the low skilled level of persons. In the origin governorates, these two levels of human capital show mixed results. Moreover, we find that non-economic variables have a significant influence on migration decisions in Tunisia: people inflows are positively correlated with almost all cultural and quality of life variables, pointing that Tunisians leave their origin governorates not only in search of jobs but also in search of better living conditions in the governorates of destination.

The rest of this chapter is structured as follows. Section 2 provides the literature review. In Section 3, we present the specification of our model while Section 4 presents the data and descriptive statistics. Section 5 contains the empirical results and Section 6 concludes.

3.2. The theory and empirics of internal migration

3.2.1. Neoclassical theories vs New economic geography

The reasons for migration have evolved over time. The first ancestors emigrated to respond to their basic survival instincts, while today's migration, triggered by globalization and the advancement of transport means, generally aims to improve the standard of living¹⁷ (Faggian et al., 2017). Over the years, migration decisions have become a complex and multidimensional process (Amara et al., 2018), involving both economic and non-economic factors that affect migration, with different weights in the migration decision (Biagi et al., 2011). These differences are related to both individual characteristics and economic and social structures between countries or between regions within the same country. Thus, factors that influence migration include characteristics of people and places (Greenwood, 1997). Specifically, the decisions to migrate are typically modelled as a function of push and pull factors: push factors are the reasons that forcefully push people into migration from their origin regions, while pull factors are the ones that forcefully attract them to destination regions. Roughly speaking, push and pull factors are linked to the same migration determinant, which may have a different impact in the region of origin and that of destination.

The first attempts to theorize factors of human migration are related to the works of Ernst Georg Ravenstein (1889), which form the basis for modern migration theories. The economic literature on labor migration can now roughly be divided into two main theories with opposite predictions: neoclassical theory and new economic geography (Piras, 2017). On the one hand, neoclassical theory highlights that differences in the level of amenities explain differences in wages and rents, thus, migration restores the spatial utility differentials after changes in amenities (Graves and Linneman, 1979; Graves and Mueser, 1993). The second approach states that the different levels of amenities do not sufficiently explain the migration mechanism, which is explained by levels of opportunities provided from different regions (Greenwood, 1985; Greenwood and Hunt, 1989; Evans, 1990). For Greenwood (1993), different types of jobs offered in regions have a different attraction power that may vary over time, in a cyclical or secular manner.

According to the traditional neoclassical approach, migration is a rational action based on utility maximizing (Maza, 2006). Before taking decisions to migrate, actors compare their satisfaction with their current location with the satisfaction expected from another location (Rossi, 1955; Pissarides and McMaster, 1990). Therefore, migration appears as a reaction of an individual against dissatisfaction (Leslie and Richardson, 1961) and in response to regional utility differentials (Greenwood, 1993). In contrast, this traditional

¹⁷ Except for migrants who move for survival reasons such as climate, war or ecological disaster.

hypothesis has been challenged by proponents of the equilibrium hypothesis, who assume that observed differentials do not reflect opportunities for real utility gains, but are offset by adjustments in wages and rents (Greenwood, 1993).

Hence, the central property of neoclassical models stresses that migration is a mechanism for balancing geographic differences; migrants move from low-wage areas to high-wage areas and as result, they modify labor supply and demand functions (Piguet, 2013). Regions with above average unemployment rates will experience a decline in relative wages and an increase in levels of migration to other regions. Therefore, an equilibrium with compensating differentials will result, at least in the long term (Pissarides and McMaster, 1990). Hence, migration from low-income to high-income regions leads to the convergence of wages and the disappearance of unemployment (Pissarides and McMaster, 1990; Basile et al., 2018). This process ends when marginal labor productivity becomes equal between regions, in which case migration will be theoretically impossible from a neoclassical point of view. Harris and Todaro (1970) argue that it is not only the difference in wages between two regions that explains migration, but the wage expected by the migrant in the destination region, given the monetary and non-monetary costs of moving. A previous related model was developed by Simon (1955, 1957), based on the concept of bounded rationality which explains that the search for a destination would end once an acceptable destination is found, without necessarily considering all possible destinations. In sum, in neoclassical theories, households consider migration as an investment decision and finally migrate to places where wages are higher and the migration returns exceed the costs generated by the move (Mitze and Reinkowski, 2011).

The second approach involves the new economic geography models pioneered by Krugman (1991a) and deepened by Fujita and Thiess (2002). In these models, workers tend to gather in regions with high geographical concentrations of employment, which further causes a center-periphery pattern characterized by a difference in wages and prices and thus causes imbalance between the center and the periphery (Blanchard and Katz, 1992; Decressin and Fatas, 1995). The new economic geography then reverses Borjas's (1991) predictions (Piras, 2017): regional human capital functions act as a magnet; they attract more workers, and especially those with high skills who seek higher wages in order to ensure their satisfaction and in response to their skills and experiences. Agglomeration forces trigger a snowball process: firms and workers are concentrated where labor demand and supply are high in order to benefit from scale economies and, as a consequence, this mechanism attracts more and more firms and workers. These concentrations not only attract individuals from other regions but also prevent resident individuals from moving to other regions.

Regarding internal migration of human capital, these two theories indicate that persons with a high level of education are attracted to regions with high wages, low unemployment rates, a large labor pool and attractive amenities. Several authors have contributed to understanding the relationship between human capital levels and migration. Greenwood (1997) affirms that "*interregional migration is a major mechanism through which labor resources are redistributed geographically in response to changing economic and demographic forces*". The real start was with George Borjas (1991), who assumes that the higher the average level of education in the origin country, the

higher the migration; and the higher the average level of education in the destination country, the lower the migration (Piras, 2017). Hence, human capital doesn't have the same role in origin and destination regions (Piras, 2021). Borjas (1991) explains these movements by the fact that the skills and experience of migrants are rewarded in the destination countries more than in the origin countries. Hence, the level and characteristics of human capital influence the propensity to migrate. The reactions of high skilled and low skilled persons are affected by the different economic and social situations. Actually, finding a job is not equitable between workers with high skills and those with low skills (Fratesi and Percoco, 2014). Highly skilled persons are often more likely to migrate than others; the more qualified people are, the more likely they are to take risks and therefore to migrate (Lee, 1966).

3.2.2. Empirical literature on internal migration

From an empirical point of view, internal migration has been extensively studied in developed countries¹⁸, but less so in North African countries. Table 3.1¹⁹ presents a selection of various articles that form the basis of this chapter's methodology. It provides the objective, time period, study area, dependent and independent variables, human capital variables, model, estimation methods and main results of these papers. In the following paragraphs, we describe these papers focusing on the introduction of variables that affect internal migration in their models. First, we present the role of the variables traditionally used in migration issues, then the human capital variables, and lastly the additional variables. We end this section with articles that address the internal spatial mobility of individuals in Tunisia.

Most of these studies find that traditional variables such as GDP, income and unemployment rate are the main determinants of internal migration, but other factors might matter. Maza (2006) investigates the factors that affect regional migration firstly, based on a semiparametric model proposed by Maza and Villaverde (2004a), across 17 Spanish regions during the period 1995-2002. He finds that migrants between Spanish regions tend to move to regions with high per capita income. Biagi et al. (2011) determine the variables that affect labor mobility at short and long distances in Italy for the years 2001 and 2002, using a negative binomial model, where short-distance migration is human mobility between Italian provinces. To analyze long-distance migration mobility, they group these provinces into three regions (north, center and south). They incorporate a variety of variables - economic, social and cultural and location-specific amenities - and find that the variables affecting migration at a short distance differ from those at a long distance; only spatial distance has a significant impact at short and long distances. Economic variables such as high GDP per capita and low unemployment rates play an important role at long distance, while natural amenities play a

¹⁸ For instance, Coen-Pirani (2010), Molloy et al. (2011), Arzaghi and Rupasingha (2013), Faggian and Franklin (2014) in the United States, Franco and Maza (2010), Maza, et al. (2018), Hierro et al. (2018) in Spain, Hunt (2006), Schündeln (2014) in Germany, Baccaini (2001), Baccaini and Dutreuilh (2007) in France, Biagi et al. (2011), Etzo et al. (2011), Piras (2012a, 2012b, 2017) in Italy, Newbold (2001), Coulombe (2006) in Canada, Dennett (2018) in Australia, Faggian and McCann (2009), Abreu et al. (2014) in the United Kingdom etc.

¹⁹ Some papers mentioned in this table investigate issues other than the internal migration determinants. In this table, we only present the analysis specific to the determinants of internal migration.

dominant role in interprovincial flows at short distance. Mitze and Reinkowski (2011) base their analysis on the neoclassical migration model to describe aggregate and age-group-specific internal migration trends for a sample of 97 German regions in the decade 1996-2006. Using dynamic panel data estimators and instrumental variable methods, they find that real income differences and unemployment rates are the main factors of interregional flows in Germany. Piras (2017) estimates a gravity model to analyze internal migration, focusing on the impact of human capital across 20 Italian regions. His hypotheses are based on the theoretical work of Borjas (1991). He then extends the gravity model of migration proposed by Karemera et al. (2000), who study international migration to the North America. Using different estimators (Table 3.1), classical results are found; macroeconomic variables such as per capita GDP and unemployment are the main drivers of migration flows. Higa et al. (2019) investigate the determinants of Japanese municipal-level migration using a modified gravity model in 2014. A rich database exploited in this study contains various variables from different categories and 3,592,920 pairs of municipalities for 2014. They mainly find that the greater the distance between two municipalities, the greater the barrier to migration; and the greater the population in the origin municipality, the more its residents tend to emigrate. Piras (2021) studies bilateral migration flows disaggregated by educational level of migrants from South to Center-North in Italy using a gravity model estimated by two-ways (2-FE) fixed effects and Ortega–Peri (2013b)’s approaches. Focusing on the results important for our purpose, the paper shows that the traditional variables explaining migration have a different impact on interregional flows for each educational level. For instance, per capita GDP acts as push factor at origin for migration graduates and as restraining factor for migration of other educational levels. At destination, this variable has a positive role as a pull factor for migration flows of all educational levels, except for no schooling migration flows which acts as a factor preventing inflows.

Empirical studies that analyze the role of human capital in internal migration remain scarce and existing studies show mixed results (Piras, 2017). Maza (2006) measures the impact of human capital by the fraction of the university-educated working population in the total working population. He finds that regional human capital is unrelated to the net migration rate in Spain between 1995 and 2002. Mitze and Reinkowski (2011) measure human capital as the share of employees with university degrees relative to total employees. Its impact on flows is not significant in the case of Germany for the decade 1996-2006. In contrast, Biage et al. (2011) find that human capital, measured as the number of residents with a secondary school education, has a slightly significant impact on the level of migration flows at long distance but no impact between Italian provinces for the years 2001-2002. Fratesi and Percoco (2014) aim to analyze the consequences rather than the causes of migration. However, they start their empirical study with an econometric analysis on the determinants of the net migration rate in Italian regions over the period 1983–2001. These authors estimate a model with the net human capital gain from migration as dependent variable. The results show that the human capital stock has an important positive impact on the net human capital gain from migration. They conclude that the Italian Centre-Northern regions benefit from this human capital gain because they had a large human capital stock in the first place, contrary to Southern Italian regions.

To measure human capital, Piras (2017) constructs a proxy defined as the average years of schooling of the resident population. He finds that human capital has no effect in destination regions but a negative effect in origin regions. This negative effect is mainly observed when the direction of migration is from the most developed to the least developed regions. In this case, human capital is interpreted as a restraining factor that prevents people from moving to another location. Two explanations are put forward to justify this restraining effect. The first is related to the existence of agglomeration economies in the origin regions that incite people to stay in their regions. The second explanation is that the expectations of people in terms of the rewards for skills are found in origin regions; therefore, it is not necessary to migrate. Moreover, he concludes that persons with high levels of human capital are more willing to migrate. Overall, these results are interpreted in terms of agglomeration economies where the most developed regions (Centre-Northern regions) are represented as the core and the least developed regions (Southern regions) as the periphery of Italy. Higa et al. (2019) mainly focus on the effect of human capital on internal migration in Japan by testing the variation in human capital stock and human capital-related variables among municipalities. Human capital is measured by two variables: the share of university graduates in the municipal population and the shortage of nursery school capacity and educational support from a municipal government. The results show that in Japan, people move from municipalities with low human capital to those with high human capital. In estimates by age groups, they find that the differences in human capital stock most affect the flows of migrants aged 20-30 years. As Piras (2017)'s paper, Piras (2021) uses also the average years of schooling of the resident population as human capital proxy. The results found are mixed for the impact of human capital on migration flows by education level. For no schooling and primary migrants, human capital acts as a pull and push factor, however, for graduates' migration flows, this variable has a limiting role for migration inflows and outflows.

Beyond these traditional variables, various papers introduce other variables to control for the factors that additionally affect migration. Maza (2006) introduces housing costs and climatic conditions, which explain net migration rates in Spain between 1995 and 2002. The cost of housing in the destination region discourages migratory flows to it, while Spanish people tend to migrate to regions where the climatic conditions are better than in their origin region. Biage et al. (2011) add into their model various variables to control for social and environmental characteristics. They show that Italian people give more weight to differences in quality of life and amenities between Italian provinces in their migration decision. For short-distance migration, people tend to migrate to relatively smaller provinces with a better quality of life, especially areas close to the coast. Mitze and Reinkowski (2011) extend their model by including variables of regional competitiveness and environmental conditions to determine the migration factors in German regions for the decade 1996-2006. Their results show that an increasing level of international competitiveness attracts additional in-migration flows. Higa et al. (2019) also include various additional variables in their modified gravity model to analyze Japanese migration drivers in 2014. Public services are found to be an attraction factor in migration, along with economic conditions. In addition, high land prices discourage people from moving and crime rates have a negative impact on the influx of people in Japan.

We end this section with papers that deal with the spatial mobility of individuals in Tunisia. Jelili and Mzali (1998) attempt to model individual rural-urban migration decisions in Tunisia, focusing on human capital investment incentives and individual characteristics. They also test the migration selectivity hypothesis, which assumes that individuals who choose to migrate earn more in cities than in rural areas. Their model, inspired by Nakosteen and Zimmer (1980), presents an equation describing the dichotomous decision to migrate, where the dependent variable is the binomial observation of being in an urban area or not. Using micro level data developed by the Office of Tunisians Abroad in 1987, and Ordinary Least Squares (OLS) and maximum likelihood probit methods, they find that the probability of migration decreases with age and that the maximum probability of migration occurs at age 36. Moreover, their findings indicate that non-migrants choose to stay in their origin governorates because they do not perceive more favorable returns elsewhere and that those who stay in their origin governorates earn more than those who leave if they had decided to stay. Kriàa and Mouaddeb (2014) aim to analyze the mobility of young university graduates between 2004 and 2008. Based on different specifications, these authors show the importance of structural conditions in origin governorates on the migration decision-making process of young people after their graduation. In fact, these young graduates leave their regions because of the deterioration of the quality of life and the shortage of jobs. The structural conditions of the destination governorates show a small effect on spatial mobility of young university graduates. In detail, Kriàa and Mouaddeb (2014) find that the metropolis of Grand-Tunis (the capital and the governorates around it) has a strong attraction effect for young graduates, since this region offers the largest pool in the service sector in Tunisia. Moreover, the larger the population size in a governorate, the greater the inflows. Thus, young graduates' mobility seems to be concentrated around large cities. These authors also show that origin governorates are characterized by repulsion effects resulting from the negative impact of unemployment rate, per capita expenditure and number of jobs in all sectors in origin governorates. In sum, the repulsion effects of origin governorates have more effect on the spatial mobility of these young graduates than the attraction effects of destination governorates. Amara and Jemmali (2018) study the determinants of inter-governorate migration in Tunisia during the period 1999-2004 using basic and extended gravity models and various independent variables: demographic, geographic and socio-economic variables. They also analyze the role of human capital in internal migration by including in their model the percentages of people with higher education and without education. Poisson pseudo maximum likelihood estimations mainly show the strong and positive impact of population size in origin and destination governorates on internal migration in Tunisia. The estimations also exhibit that inter-governorate flows are negatively correlated in origin governorates with most variables - unemployment rate, per capita expenditure, job vacancies, urbanization rate- acting as incentives for migration. They also re-estimate their models using differential variables and find that Tunisians are more attracted to governorates with high income and low unemployment rate. For human capital variables, their results show that the percentage of people with higher education and the percentage of people without education have no significant impact in destination governorates, while in origin governorates, these variables encourage people to migrate. In the estimations with differential variables, human capital differentials have no impact on migration flows.

All these empirical studies, except Amara and Jemmali (2018), analyze the effect of human capital (of migrants or residents) on internal migration. In fact, they usually divide the study area into two types of regions, those with high human capital and those with low human capital, and then study the determinants of bilateral migration between these two types of regions. Because migration patterns might be different for high-skilled and low-skilled human capital, we contribute to the literature by dividing human capital into two categories: high and low-skilled. Consequently, we analyze the potential for differentiated impacts of two levels of human capital in origin and destination regions in order to show the effect of each level of human capital on interregional flows. Beyond the macroeconomic variables and human capital variables and in connection with this empirical literature, we also include various socio-economic variables.

Table 3.1: Empirical papers on internal migration and human capital

Authors	Objective	Time period and study area	Dependent variable	Independent variables	Human capital	Model and estimation methods	Results
Jelili and Mzali (1998)	Model and test individual rural-urban migration decisions and migration selectivity	4,000 persons aged between 15 and 55 in 1974 Different urban and rural areas in Tunisia	Dummy variable: 1 if moved from rural to urban areas during 1974-1987, 0 otherwise	Real annual earnings Variables related to migrants' personal characteristics Variables related to education and labor force of migrants Professional situation Residence of migrants at the time of migration decisions	Variables related to education and labor force of migrants: Years of schooling Dummy variable: 1 if migrants had vocational training of migrants at the time of migration decisions, 0 otherwise Dummy variable: 1 for migrants with an occupational skill not transferable to the urban economy, 0 otherwise	Individual rural-urban migration Ordinary Least Squares regression Maximum likelihood probit methods	Anticipated monetary gains from rural-urban migration have a significant but small impact.
Maza (2006)	Analyze the determinants of migrations	1995–2002 17 Spanish regions	Gross interregional migration rate	Size of population Per capita GDP Unemployment rate Human capital Housing price Climate changes	Regional human capital reported on national human capital Human capital measure: $K_{it} = \frac{\text{working age population with university studies}}{\text{working age population}}$	Semiparametric model Weighted least squares	No effect of human capital on internal migration in Spanish regions Emigrants tend to move to regions with high per capita income
Biage et al. (2011)	Model the effects of various factors on the labour mobility at short distance and long distance	2001-2002 103 Italian provinces	Gross migration flows	Linear distance in kilometers Per capita GDP Unemployment rate Population Human capital Several variables of social capital Several variables of amenities and disamenities	The number of residents with a secondary school diploma per 10,000 inhabitants	Negative binomial model, augmented with instruments Nonlinear instrumental variable techniques Generalized Method of Moments	Significant role of natural amenities at short distance Significant role of economic variables at long distance. A small significant effect of human capital at long distance and no effect at short distance
Mitze and Reinkowski (2011)	Test the theoretical neoclassical model of migration	1996-2006 97 German regions	Net migration rates	Population Per capita GDP Unemployment Rate Human Capital level Net Commuting level Proxy for International Competitiveness Binary dummies for types of settlement structure Different geographical binary dummies	The share of employees with university degree relative to total employees	Neoclassical inspired Harris–Todaro model Static and dynamic migration functions Dynamic panel data estimators and instrumental variable methods	Real income differences and unemployment rate are statistically significant and correlated with the net migration rate and provide opposite signs No effect of human capital on migration flows

Fratesi and Percoco (2014)	Analyze the link between regional disparities and migration flows Study the determinants of selective migration	1983–2001 20 Italian regions	Net migration rate Net human capital gain (ratio between net human capital gain and total population)	Per capita GDP Unemployment rate house price index Human capital Manufacturing location quotient Service location quotient	Human capital stock per capita in the receiving region	Fixed-effect estimates with a full set of time dummies	Per capita GDP has a significant positive impact on the net migration rate Unemployment rate and service location quotient have a significant negative impact The internal migration flows are selective and oriented towards the most qualified people who emigrate from the least developed regions to the most developed in Italy
Kriàa and Mouaddeb (2014)	Study the determinants of interregional mobility of university graduates	2004-2008 24 Tunisian governorates	Ratio between the flows between training governorate and governorate of first job and the number of graduates in the origin governorate Gross migration flows of young graduates	Per capita expenditures Population Unemployment rate Number of jobs Number of jobs in different sectors Number of university graduates Different geographical variables	Number of university graduates Proportion of people with higher education, aged 19 to 24	Gravity model Log-normal distribution Negative binomial distribution Poisson distribution	Strong impact of structural conditions in origin regions on internal migration of young graduates Importance of the Grand-Tunis metropolis of as an attraction pole for young graduates Unemployment rate, per capita expenditure, number of jobs in all sectors have a repulsive impact in origin governorates
Piras (2017)	Analyze the pull and push migratory factors Study the role of human capital on migration flows	1970-2005 20 Italian regions	Bilateral Migration flows from origin to destination	Population Per capita GDP Unemployment rate Average Years of schooling (Human capital)	Average years of schooling of resident population: $ayspop_t = \frac{\sum_{s=1}^4 a_s P_{st}}{P_t}$ a_s is the number of years of schooling for schooling level s ; P_{st} is the number of individuals with schooling level s and P_t is total population	Gravity model augmented with human capital Common correlated effects mean group estimator Augmented mean group estimator Mean group estimator	Per capita GDP and unemployment are the main factors on migration flows Human capital has no role at destination region, it presents as a restraining factor at origin region

Amara and Jemmali (2018)	Determine the factors of inter-governorates migration	One year 2014 24 Tunisian governorates	Migration volume from origin governorate to destination governorate	Population Distance Contiguous borders Wage Unemployment rate Job vacancies Educational level Per capita expenditure Urbanization rate	Percentage of people with higher education Percentage of people without education	Gravity models Poisson pseudo maximum likelihood method Ordinary least squares method	Significant impact of population size at origin and destination on migration flows Significant migration flows from governorates with and high unemployment rate to regions governorates with low unemployment rate and high per capita expenditure
Higa et al. (2019)	Examine the drivers of domestic municipal-level migration.	One year 2014 1896 Japanese municipalities	Population flows from origin to destination Population flows by age group from origin to destination	Population /Population by age group Share of university graduates in the municipal population Shortage rate of nursery school capacity Distance between municipalities Different geographical dummy variables Several economic variables Indicators of quality of life Variables related to access to public services Dummy variables for municipal government support	Two variables: Human capital stock of municipalities measured by the share of university graduates in the municipal population Human capital related variable measured by the shortage rate of nursery school capacity	Modified gravity model Ordinary least squares estimation	People migrate from municipalities with low human capital stock to those with high human capital stock The increase in the share of university graduates at the municipalities of destination as well as of origin generates an increase in inter-municipal flows
Piras (2021)	Analyze the migration factors from South to Center-North in Italy for five different educational groups	1980-2013 8 southern Italian regions 12 Italian regions of the Center and North	Migration flows by educational level of education	Population Per capita GDP Unemployment rate Average Years of schooling Migration networks	Proxy for the human capital stock measured as average years of schooling of resident population	Gravity model 2-FE model Ortega-Peri(b) model	Migration flows is depending on the migrant educational level Independent variables show a different role in migration flows for each level of education

3.3. Model

We base our empirical analysis on the extended version gravity model developed by Piras (2017), which we further extend to allow for differentiated levels of human capital. We use the gravity model as it provides a good fit to migration flows in many empirical cases (Fan, 2005) and allows to precisely analyze the respective impacts of pull and push factor. As reviewed in the last section, the differences in demographics, economics and quality of life conditions and government support between regions also affect migration (Greenwood, 1997; Higa et al., 2019). Hence, the gravity model can control for these differences and can estimate the effect of each regional characteristic at origin as well as at destination on interregional migration.

Formally, the model in Piras (2017) is based on the idea that the gravity model explains migration flows according to the system of demand and supply factors in the regions/countries. This is expressed by the following function:

$$F_{ijt} = A_{ij}^{a_0} \frac{S_{it}^{a_1} D_{jt}^{a_2}}{R_{ijt}^{a_3}} \quad i = 1 \dots N; \quad j = 1 \dots M \text{ and } t = \text{time} \quad (1)$$

where F_{ijt} is gross migration flows from the origin region i to the destination region j at time t . N and M are the total number of origin and destination regions respectively. A_{ij} captures all time-invariant region-pair effects linked with bilateral migration flows from i to j . S_{it} contains the supply-push factors at home, these factors push migrants to leave the origin regions and move to another region. D_{jt} contains the demand-pull factors at destination, which are the attraction factors in the receiving regions. The variable R_{ijt} represents multilateral resistance factors which restrict migration flows from i to j . a_0, a_1, a_2 and a_3 are structural elasticities linking migration flows to pull and push factors.

One key variable is then that of multilateral resistance, which represents all the barriers to migration and is therefore negatively correlated with interregional flows. Classically, this model is based on a function of the distance between origin and destination regions as well as explanatory variables related to the characteristics of the two regions (LeSage and Pace, 2009). Migration flows are inversely correlated with geographical distance and directly correlated with population size and income in origin and destination areas. Geographical distance is the usual variable of resistance in the gravity models as it encompasses more than a question of spatial length: it includes all the costs related to migration as transportation costs, housing costs, costs of searching information and even psychological costs (Higa et al., 2019). However, alternative approaches have been proposed for multilateral resistance variables defined as barriers to migration and negatively correlated with interregional flows. Several authors support the idea of including financial and transport costs inversely correlated with migration flows rather than geographic distance. In general, choosing the most appropriate control variable for multilateral resistance is still a challenge in the empirical literature (Yotov et al., 2016) and ignoring this term is characterized as the Gold Medal Mistake by Baldwin and Taglioni (2006). Alternative approaches have been proposed. Bertoli and Fernández-Huertas Moraga

(2013) argue that the impact exerted by the attractiveness of other destinations can be qualified as a multilateral resistance to migration to a given destination. Following these authors, Piras (2017) introduces the unemployment rate as multilateral resistance instead of geographical distance. In our empirical study, we consider all these options. Using unemployment rate as multilateral resistance is particularly relevant in the case of internal migration in a small country like Tunisia. Indeed, geographical distance represents physical distance between regions while unemployment level represents economic distance between regions. The higher the unemployment rate, the more it reduces the chances of finding a job in the destination region and indeed, the more it reduces migration. In the case of Tunisia, characterized by a high unemployment rate in almost all regions, this variable can curb migration flows. We can therefore consider unemployment rate differential measured as the difference between the unemployment rate at destination and the unemployment rate at origin as a good proxy for resistance to migration, since the geographical distance between Tunisian governorates is not very large and public transport costs are not high in Tunisia. In addition, we focus on the unemployment rate as it explains employment opportunities, which, according to the economic literature, are a dominant factor in migration decisions of individuals, particularly of working age (Scott, 2010).

Piras (2017) extends the model of Karemera et al. (2000) by introducing human capital into the supply S_{it} and demand D_{jt} functions. For Karemera et al. (2000), demand and supply functions in regions depend on income and population at origin and destination. For Piras (2017), this model is a reduced form of the equation of pull and push factors and he therefore extends this model by introducing human capital into the supply and demand functions of migrants. Thus, the supply S_{it} and demand D_{jt} functions of migrants are defined as follows:

$$S_{it} = b_i y_{it}^{b_1} n_{it}^{b_2} h_{it}^{b_3} \quad (2)$$

$$D_{jt} = c_j y_{jt}^{c_1} n_{jt}^{c_2} h_{jt}^{c_3} \quad (3)$$

where y_{it} and y_{jt} are expected income in origin and destination regions respectively. n_{it} and n_{jt} are the stock of population at origin and destination respectively. Finally, we denote the average level of human capital at origin h_{it} and at destination h_{jt} .

We further extend this formulation by distinguishing between the two levels of human capital: high skilled and low skilled. Hence, we propose the following reformulation of demand and supply functions of migrants:

$$S_{it} = b_i y_{it}^{b_1} n_{it}^{b_2} h h_{it}^{b_3} h l_{it}^{b_4} \quad (4)$$

$$D_{jt} = c_j y_{jt}^{c_1} n_{jt}^{c_2} h h_{jt}^{c_3} h l_{jt}^{c_4} \quad (5)$$

$h h_{it}$ and $h h_{jt}$ are the averages of high skilled persons at origin and destination respectively, and $h l_{it}$ and $h l_{jt}$ are the averages of low skilled persons respectively at origin and destination respectively.

Placing equations (4) and (5) into (1) yields the new version of gravity:

$$F_{ijt} = A_{ijt}^{a_0} \frac{(b_1 y_{it}^{b_1} n_{it}^{b_2} h_{it}^{b_3} h_{it}^{b_4})^{a_1} (c_j y_{jt}^{c_1} n_{jt}^{c_2} h_{jt}^{c_3} h_{jt}^{c_4})^{a_2}}{R_{ijt}^{a_3}} \quad i = 1 \dots N; \quad j = 1 \dots M \quad \text{and } t = \text{time} \quad (6)$$

This formulation states that bilateral migration flows from origin i to destination j are driven by the mass of the two regions: the greater their mass, the greater the bilateral flows. In addition, the income level can be a push factor when it is low or a pull factor when it is high: the higher the income in the origin region, the lower the migration flows. However, for multilateral resistance variables, the higher they are, the lower they lead to migration flows from i to j . We expect the two variables of human capital to affect interregional flows differently: the higher the high skilled level at destination, the higher the interregional flows, while the higher the low skilled level at destination, the lower the interregional flows.

Various authors such as Hunt (2006), Mayda (2010) or Piras (2017) point out that pull and push factors might operate asymmetrically, i.e. they do not have the same impact on interregional flows in origin and destination regions. Symmetric models assume that economic conditions in the origin and destination regions have the same sign on interregional mobility, i.e. there is a homogeneity of the elasticities of characteristics in origin and destination regions (Kriaa and Mouaddeb, 2014). Conversely, asymmetric models allow for heterogeneity of these elasticities: economic conditions in the origin region may have a different or even greater effect on mobility than that in the destination region. We estimate the unconstrained asymmetric models and test whether the origin and destination elasticities for each variable are significantly different. Furthermore, when the variable has a positive impact in the origin and destination regions, it acts as a push factor at origin and as a pull factor at destination. However, when the variable has a negative impact at origin (at destination), it is interpreted as a restraining factor of migration outflows (migration inflows).

3.4. Interregional migration in Tunisia: Descriptive statistics

3.4.1. Descriptive statistics

This section provides descriptive statistics for the database which we collected from the Tunisian National Institute of Statistics (INS).

The migration data are derived from the General Population and Housing Census (RGPH) covering two periods of Tunisian movements: 1999-2004, 2009-2014. This census is an exhaustive survey conducted by the INS every 10 years to collect statistical data on the entire population, households and dwellings in the country. According to this source, migration is defined as movements of individuals who change governorates (or their delegations) within the same governorate or between two different governorates at two given times (between the time of survey and before five years). We only collected migration flows

among 24 Tunisian governorates because the 2004 census only provides these data to the public at the governorate level and, moreover, only the censuses carried out by the INS collect data on migrations in Tunisia. This feature is the major constraint for the modeling and quantitative analysis of internal migration issues in Tunisia and explains the limited number of papers on migration issues. Internal migration in Tunisia mainly occurs from the southern and interior regions to the eastern coastal regions. Figure 3.1 displays the different regions in Tunisia. Our data show that 134,649 persons (76%) moved from the south and interior to the eastern coastal regions between the years 2009 and 2014, and 43,661 persons (24%) moved in the opposite direction. Between 1999 and 2004, 153,399 persons (79%) emigrated from the south and interior to the eastern coast, against 40,903 persons (21%) emigrating in the opposite direction. A slight increase was observed in south-interior emigration towards the eastern coast for the period 2009-2014 compared to the period 1999-2004.

Table 3.2 displays the regional movements of migrants among the Tunisian governorates. The movements of incoming and outgoing migrants in eastern coastal regions were very active compared to those in interior and southern regions. The eastern coastal regions received a large number of migrants in these two periods, more than 3 times that of migrants to the interior and south. Moreover, this number almost doubled in the period 2009-2014 compared to the period 1999-2004. At the regional level, the metropolis of Grand-Tunis, followed by the east central, are always the same regions exposed to the largest number of incoming migrants over time.

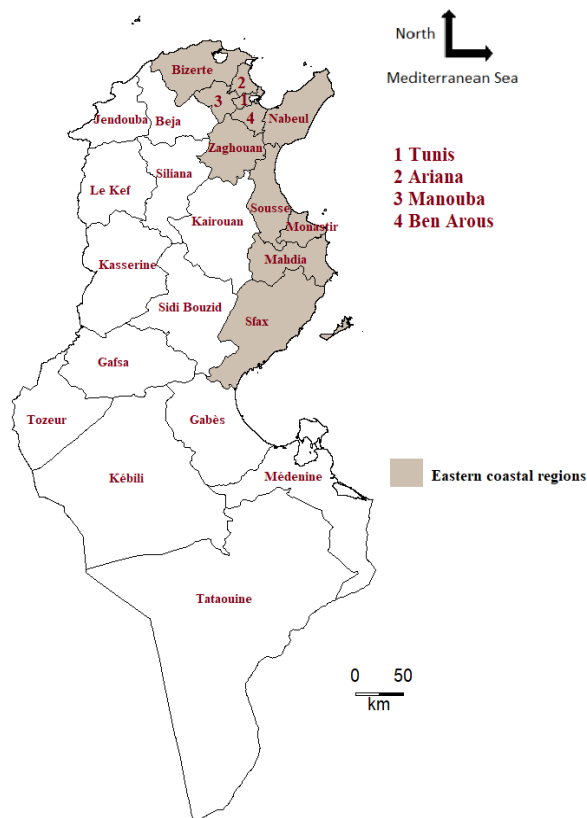


Figure 3.1: Administrative division of Tunisia
Source: made by the authors

Table 3.2: Regional movements of migrants in Tunisia

Governorats	Incoming migrants		Outgoing migrants		Net migration rate (%)	
	1999-2004	2009-2014	1999-2004	2009-2014	1999-2004	2009-2014
Tunis	63127	65877	93702	93269	-3,11	-2,59
Ariana	55722	59956	15671	19869	9,49	6,96
BenArous	56786	48403	19278	21778	7,42	4,21
Manouba	24673	22706	13185	14234	3,42	2,23
Metropolis of Grand-Tunis	200308	196942	141836	149150	2,6	1,81
Nabeul	24166	29026	15966	16259	1,18	1,62
Zaghouan	4760	5462	6113	6135	-0,84	-0,38
Bizerte	12554	8698	14886	15084	-0,44	-1,12
Northeast	41480	43186	36965	37478	0,33	0,37
Sousse	35704	36498	13655	17341	4,05	2,84
Monastir	28485	24829	11608	12976	3,7	2,16
Mahdia	10325	9204	12572	12332	-0,59	-0,76
Sfax	32042	29144	19212	19538	1,5	1,01
East central	106556	99675	57047	62187	2,22	1,45
<i>Eastern coastal governorats</i>	348344	339803	235848	248815	1,92	1,34
Beja	5923	5477	15934	13438	-3,29	-2,63
Jendouba	7336	5156	18706	17876	-2,73	-3,17
LeKef	6284	6055	18131	13955	-4,58	-3,25
Siliana	5683	4535	17686	14067	-5,13	-4,27
Northwest	25226	21223	70457	59336	-3,73	-3,26
Kairouan	8842	7031	32667	29448	-0,46	-3,93
Kasserine	7301	5773	21368	18598	0,12	-2,92
Sidibouazid	5998	7384	20525	16517	-2,38	-2,12
West central	22141	20188	74560	64563	-3,87	-3,08
Gabès	12566	12406	14156	14579	-0,46	-0,58
Médenine	15558	16778	15033	14081	0,12	0,56
Tataouine	4601	4609	8013	7092	-2,38	-1,66
Southeast	32725	33793	37202	35752	-0,49	-0,2
Gafsa	8277	7479	15895	13229	-2,35	-1,7
Tozeur	3615	3847	4734	4174	-1,15	-0,3
Kébili	4259	4208	5891	4672	-1,14	-0,3
Southwest	16151	15534	26520	22075	-1,84	-1,09
<i>Interior and South governorats</i>	96243	90738	208739	181726	-2,78	-2,16
Total	444587	430541	444587	430541		

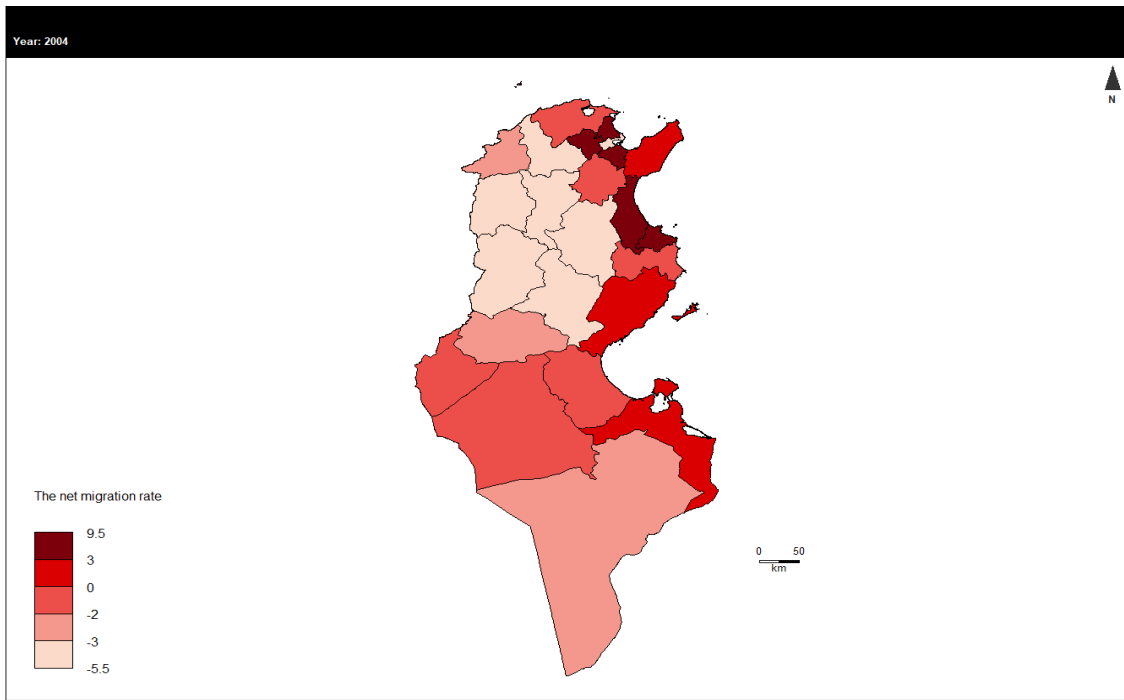
Source: authors based on data provided by the censuses of Tunisian National Institute of Statistics

Figure 3.2 shows the net migration rate map using a quintile classification in all the Tunisian governorates for our two periods. The net migration rate is the ratio of net migration to the population of each governorate. As we see in the last two columns in Table 3.2, the net migration rates are quite diverse between the Tunisian governorates. The northwest and west central regions show the highest negative net migration;

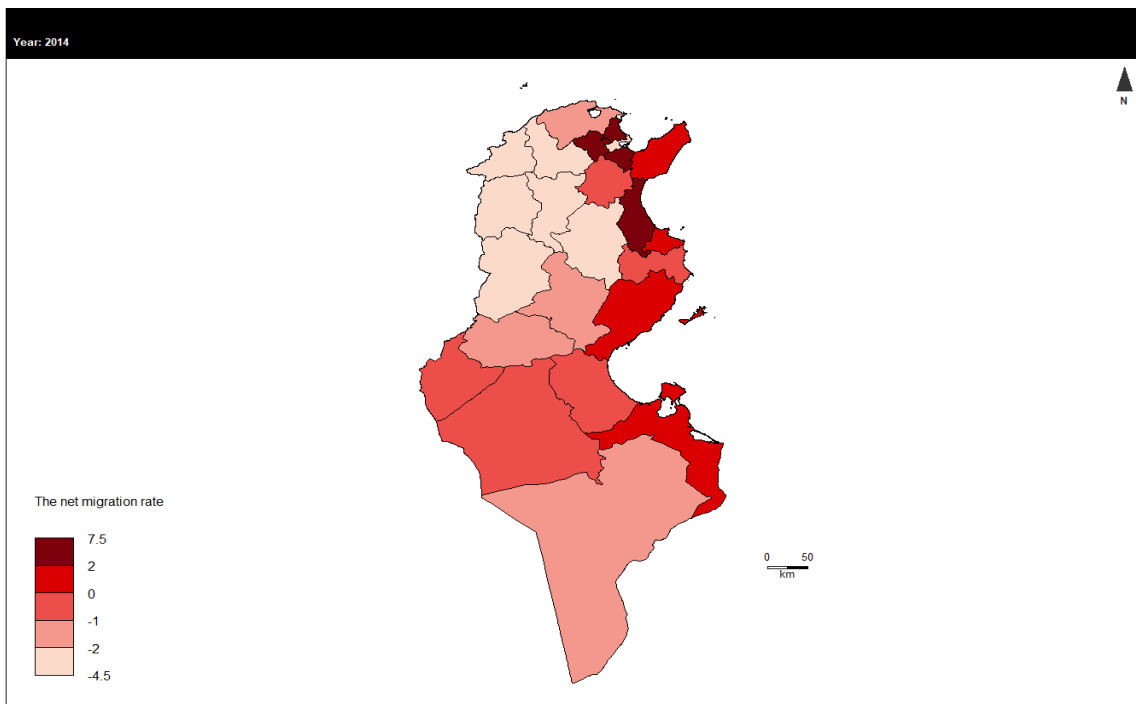
these regions record a large number of outgoing migrants. This rate is negative²⁰ for all the governorates of the interior and south except one: Medenine, which is among the least developed regions, displays a positive rate. This governorate is located on the southern coast and contains two very popular cities: Djerba is a popular tourist destination in Tunisia and the other is Ben Gardane, considered as a commercial center in the South because of its important market for products imported from Libya, since they share the same spatial border. Interestingly, the capital Tunis records a negative net migration. Although the capital records the largest number of incoming migrants in comparison with other governorates, it also displays a larger number of outgoing migrants. This can be explained by overpopulation leading to an expansion of neighboring governorates and governorates of the Tunisian Sahel²¹ (Lamine, 2009). In fact, the capital is not the only one among the most developed regions to display a negative migration rate, three other governorates do too: Bizerte, Zaghuan and Mahdia. The number of outgoing migrants from the eastern coastal regions is high, more than doubling between 2004 and 2014.

²⁰ The negative rate shows that the number of outgoing migrants is higher than the number of incoming migrants.

²¹ The Tunisian Sahel includes the governorates of Sousse, Monastir and Mahdia.



1999- 2004



2009- 2014

Figure 3.2: Net migration rate by governorate
Source: authors based on data provided by the censuses of Tunisian National Institute of Statistics

Figure 3.3 shows the share of each governorate in migration flows to eastern coastal regions and Figure 3.4 displays the share of each governorate in migration flows to southern and interior regions. The migrants from the northeast and west central mainly emigrate to the eastern coastal region over time. Three southern

governorates (Tozeur, Siliana and Tataouine) show the lowest share of migration to the eastern coast. Moreover, for two periods the capital Tunis shows a very high number of outgoing migrants to southern and interior governorates.

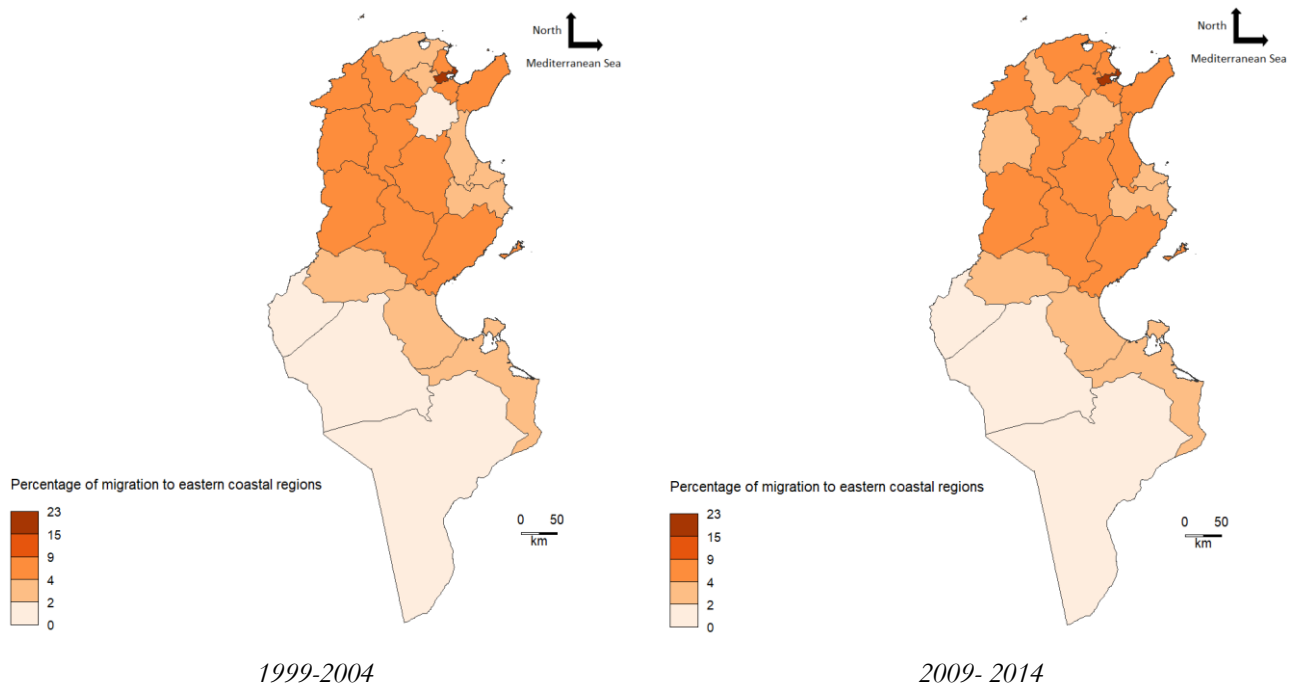


Figure 3.3: Departing migrants to eastern coastal regions

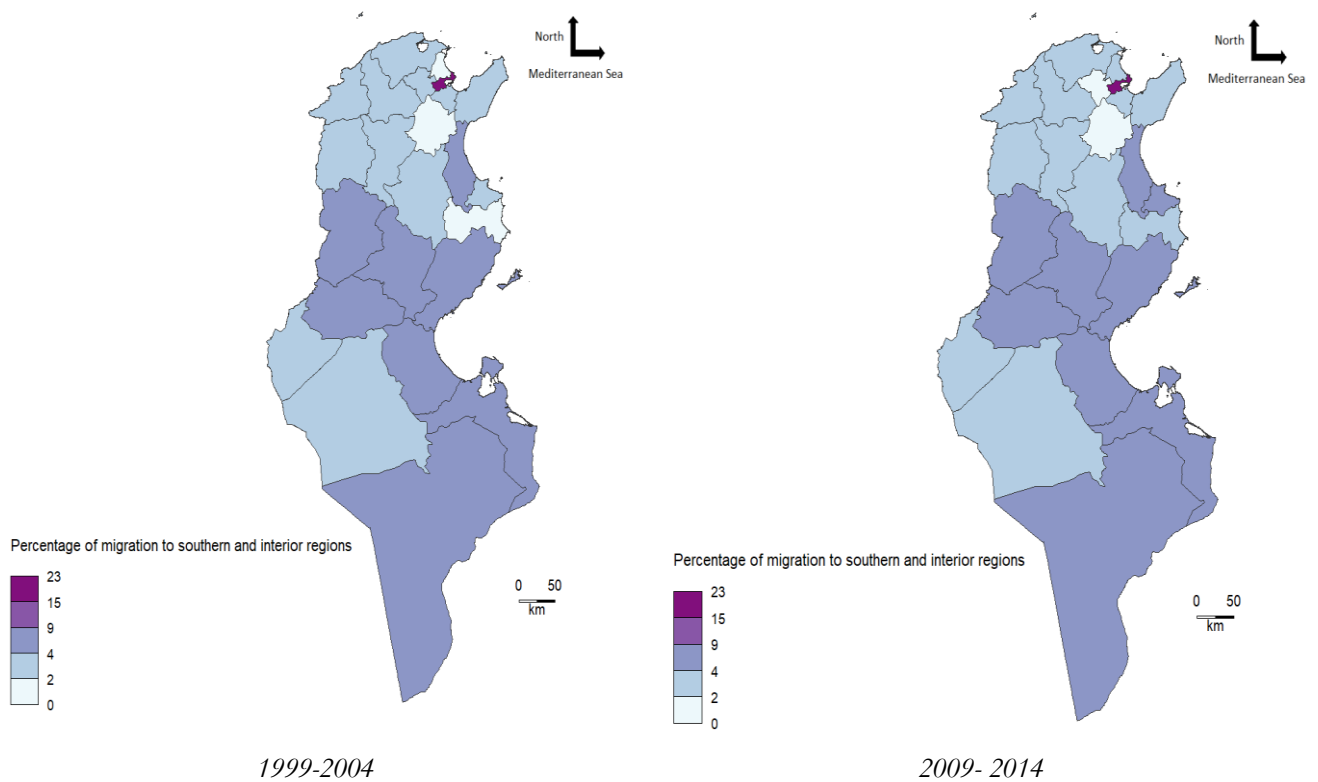


Figure 3.4: Departing migrants to southern and interior regions

Source: authors based on data provided by the censuses of Tunisian National Institute of Statistics

Finally, Table 3.3 displays the spatial distribution of outgoing migrants according to their education level. The percentage shown in this table is the ratio of migrants for each education level to total migrants in each governorate. The highest share of migrants concerns secondary migrants (42%) following by university migrants (32%) between 2009 and 2014.

Table 3.3: Distribution of migrants according to their education level between 2009 and 2014

Outgoing migrants	2009-2014							
	Illiterates	%	Primary level	%	Secondary level	%	University level	%
Tunis	6336	4.6	25341	18.4	54816	39.8	51233	37.2
Ariana	1739	4.5	7384	19.1	14920	38.6	14609	37.8
Ben Arous	1935	4.2	8888	19.3	19528	42.4	15706	34.1
Manouba	972	4.8	4114	20.3	8592	42.4	6588	32.5
Nabeul	1157	3.5	4856	14.7	14899	45.1	12124	36.7
Zaghouan	575	6.8	2003	23.71	3650	43.2	2221	26.29
Bizerte	1327	5	4483	16.9	11912	44.9	8809	33.2
Bèja	1635	9.5	3768	21.9	7776	45.2	4025	23.4
Jendouba	2406	10.6	5605	24.7	9942	43.8	4744	20.9
Le Kef	1887	10.2	4180	22.6	7896	42.7	4529	24.5
Siliana	1900	11.5	4164	25.2	7073	42.8	3388	20.5
Sousse	2039	4.9	8525	20.5	16802	40.4	14226	34.2
Monastir	898	4.4	3983	19.5	8006	39.2	7537	36.9
Mahdia	784	5.6	3024	21.6	6229	44.49	3963	28.31
Sfax	2392	4.1	9629	16.5	22406	38.4	23923	41
Kairouan	3611	10.4	10450	30.1	14268	41.1	6388	18.4
Kasserine	2336	10.3	5830	25.7	10253	45.2	4264	18.8
Sidi Bouzid	1404	7	4532	22.6	9526	47.5	4593	22.9
Gabès	1296	5.4	5404	22.5	9728	40.5	7589	31.6
Medenine	943	3.6	4902	18.7	13707	52.3	6656	25.4
Tataouine	515	5.21	2066	20.9	4961	50.19	2343	23.7
Gafsa	918	4.8	3325	17.4	8789	46	6077	31.8
Tozeur	185	3.78	866	17.71	2372	48.5	1468	30.01
Kébili	197	2.91	872	12.89	3586	53	2111	31.2
Total	39387	5.72	138194	20.08	291637	42.37	219114	31.83

Source: authors based on data provided by the censuses of Tunisian National Institute of Statistics

3.4.2. Variables used in the analysis

In this section, we describe the variables used in this study. Our dependent variable is the migration flows F_{ijt} from governorate i to governorate j at time $t = 1, 2$ and our explanatory variables are the multilateral

resistance variables, the human capital proxies, a set of macroeconomic and amenity variables We first present our variables of interest, the human capital proxies. Then we describe the remaining variables.

Regarding the human capital proxies, we divide human capital into two categories: average years of high education and average years of low education. The first variable, “high skilled proxy”, is the resident population rate with secondary and university education, and the second variable, “low skilled proxy” is the resident population rate with primary education and no education. We adopt the International Standard Classification of Education developed by the United Nations Educational, Scientific and Cultural Organization. The same classification is suggested and used by the human capital literature (Basile et al., 2018). This classification divides the duration of schooling into 4 education levels ($s = 1, 2, 3, 4$) as follows: 18 years for people with a university schooling, 13 years for people with an upper secondary schooling, 8 years for people with a lower secondary schooling and, finally, 3 years for people with either a primary schooling or without any formal schooling. In our case, we adapt this classification according to our data: 18 years for people with a university schooling, 13 years for people with a secondary schooling, 8 years for people with a primary schooling and, finally, 3 years for people without any formal schooling. We divide human capital into two categories within four categories in the same way as this classification, as we consider that the first two levels of this classification describe low-skilled people, whereas the last two levels represent highly qualified people. Our decision is based on the economic literature. The level of human capital varies the level of migratory flows between regions and highly skilled people may affect internal migration differently from low-skilled people (Borjas, 1991). Moreover, these two categories differ in their role in the production process; low-skilled labor is mainly used as a production resource input factor, while high skilled labor is considered the creative class (Changa and Shi, 2016). Hence, our two proxies for human capital are defined for each governorate k (k represents the governorates of origin i at and of destination _{j}) as following:

$$\text{High skilled proxy:} \quad hh_k = \frac{\sum_{s=1}^2 sch_s POP_{ks}}{POP_k} \quad (7)$$

$$\text{Low skilled proxy:} \quad hl_k = \frac{\sum_{s=3}^4 sch_s POP_{ks}}{POP_k} \quad (8)$$

where s is the education level, hh_k and hl_k are the average years of high education and average years of low education respectively, sch_s is the classified number of schooling years for each education level s . POP_{ks} is the number of populations for each education level s in each governorate k and POP_k is the total population in each governorate k ²².

Table 3.4 displays the values of these two proxies by governorate and by year. By comparing the statistics in 2004 and 2014, we observe an increase in the high skilled proxy and a decrease in the low skilled proxy in all the Tunisian governorates, which may be related to the increase in the enrolment rate in Tunisia.

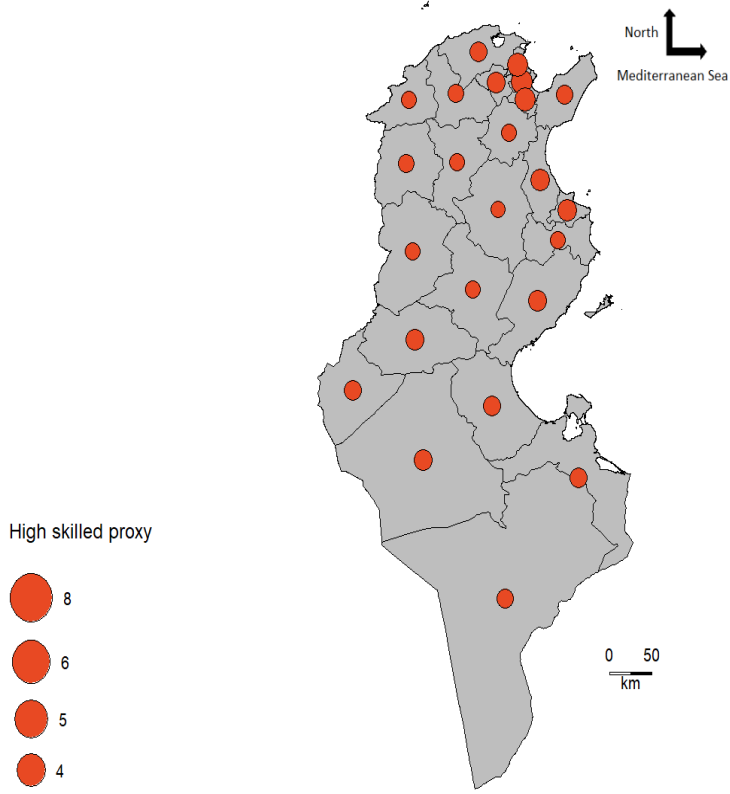
²² We exploit data from the population aged 10 and over to construct our human capital proxies because the National Institute of Statistics in Tunisia only uses the population aged 10 and over for education variables. Consequently, POP_{ks} and POP_k represent the population aged 10 and over.

Figures 3.5 and 3.6 display the spatial distribution of these two proxies. These maps do not seem to highlight an unequal distribution of these proxies between Tunisian governorates. The three first governorates with the highest proxy for high skilled persons belong to the Grand-Tunis metropolis. The rest of the ranking is mixed as some governorates of the interior and south are also high in the ranking. The distribution of the low skilled proxy displays almost the opposite distribution: the governorates of the Grand-Tunis metropolis show the lowest proxy for low skilled persons and the rest of the ranking is also well mixed. We also calculate the ratios of each education level to population for each governorate in order to generate the comparison between these two measures of human capital for the year of 2014. Table 3.10 in the appendix 3 displays the values of these ratios and also the ranking of governorates according to human capital proxies and human capital ratios. Overall, these two measures of human capital do not display much of a difference. For low skilled persons, only the governorate of Tataouine registers the highest ratio, i.e., it contains the highest share of people with primary education or no education, while this governorate is in the middle of the ranking according to the low skilled proxy. As regards our expectation of human capital proxies, we expect these two proxies to operate with opposite effects in the origin and destination governorates and even within the same governorate.

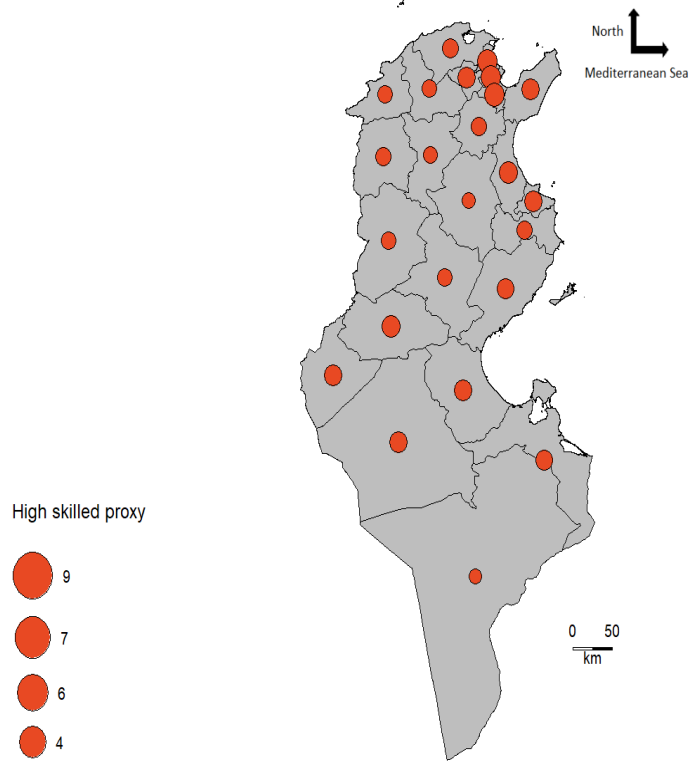
Table 3.4: Human capital proxies

Governorate	Proxy for high skilled human capital		Proxy for low skilled human capital	
	2004	2014	2004	2014
Tunis	7.8	9.07	2.91	2.46
Ariana	7.5	9.15	3.06	2.49
Ben Arous	7.53	8.96	3.03	2.52
Manouba	5.71	7.24	3.65	3.07
Nabeul	5.14	7.57	3.95	3.29
Zaghouan	4.23	5.72	3.94	3.38
Bizerte	5.3	6.45	3.74	3.29
Béja	4.35	5.57	3.83	3.35
Jendouba	4.11	5.11	3.83	3.43
Le Kef	4.65	5.67	3.76	3.46
Siliana	4.28	5.07	3.85	3.5
Sousse	6.33	7.75	3.48	2.99
Monastir	6.34	7.63	3.6	3.12
Mahdia	4.32	5.72	4.11	3.61
Sfax	5.78	7	3.7	3.22
Kairouan	3.58	4.57	4.02	3.62
Kasserine	3.96	5.14	3.92	3.42
Sidi bouzid	4.17	5.4	3.82	3.42
Gabès	5.38	7.67	3.83	3.28
Médenine	5.25	6.63	3.93	3.43
Tataouine	4.97	4.14	3.99	3.16
Gafsa	5.8	7.75	3.44	3.32
Tozeur	5.45	7.52	3.84	3.32
Kébili	5.75	7.49	3.58	3.39

Source: Computed by the authors



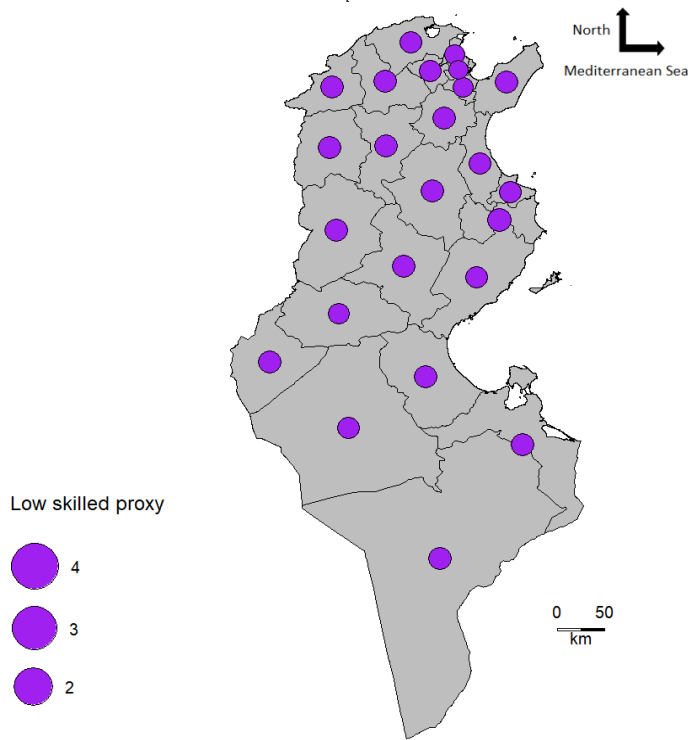
2004



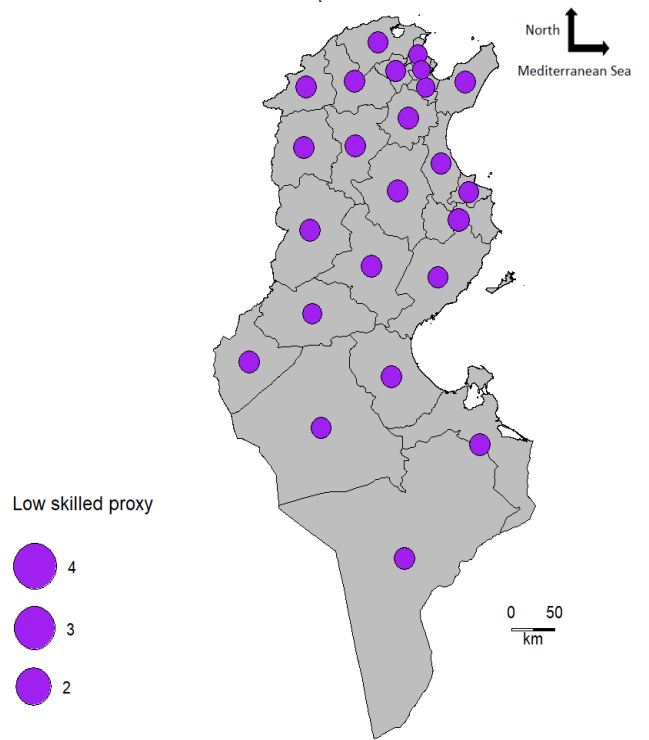
2014

Figure 3.5: Distribution of high skilled capital proxy by governorate

Source: authors based on data provided by the censuses of Tunisian National Institute of Statistics



2004



2014

Figure 3.6: Distribution of low skilled capital proxy by governorate

Source: authors based on data provided by the censuses of Tunisian National Institute of Statistics

We now present the control variables used in our empirical analysis. Table 3.11 in the appendix 3 provides a complete description of all the variables.

Choosing the most appropriate control variable for multilateral resistance is still a challenge in the empirical literature (Yotov et al., 2016). We first consider the unemployment rate differential as a multilateral resistance variable. In fact, unemployment rate is an adequate economic variable to measure interregional differences in employment opportunities (Biagi et al. 2011). According to the economic literature, the higher the unemployment rate at origin, the more people emigrate (Etzo, 2011; Piras, 2012a, 2012b, 2017). Second, we use the road distance, which is the usual resistance variable. We expect that the higher the distance between governorates, the lower the interregional flows.

The remainder of the control variables are described in Table 3.11 in the appendix 3 and are divided into five main categories: demographic, economic, geographical, cultural and quality of life. The first classical demographic variable of the gravity model is population size. Its expected size is ambiguous. On the one hand, we expect that the more populated a source region, the more it can generate higher emigration outflows. On the other hand, the densely populated regions can exploit scale economies, and therefore may be even more attractive to workers. Therefore, the sign of this variable is also related to the social and economic characteristics of the origin governorate as well as that of the destination.

In order to correctly specify the migration gravity model, a variable reflecting regional economic development, such as regional per capita GDP, is necessary. However, in Tunisia, such a measure is not available at the regional level. Therefore, we use the nighttime lights satellite imagery developed by the Earth Observations Group (EOG) at the National Center for Environmental information (NCEI/NOAA).²³ This night light proxy is considered as an alternative means for measuring economic activity (Ghosh et al., 2010) and is assumed to be correlated with socioeconomic variables including urbanization, economic activity, and population (Elvidge et al., 1997b; Imhoff et al., 1997; Bennett and Smith, 2017), with the argument that electric lights can determine the regional level of economic activities. Several authors exploit this proxy in their empirical studies to control, for example, for urbanization (Henderson et al., 2003; Ma et al., 2012; Henderson et al., 2012; Pandey et al., 2013; Zhang and Seto, 2013), population (Sutton, 1997; Elvidge et al., 1997b; Sutton et al., 2001; Zhuo et al., 2009; Raupach et al., 2010), estimates of gross domestic product (Doll et al., 2006; Ebener et al., 2005; Sutton et al., 2007; Chen et al., 2019); socioeconomic dynamics (Bennett and Smith, 2017) and disasters and economic activity (Qiang et al., 2020, Zhao et al. 2020). It can provide a consistent and reliable estimate of economic activity that encompasses both formal and informal activities (Doll et al., 2006, Ghosh et al., 2010) and can help pinpoint the variation in economic activities over time (Bennett and Smith, 2017). The NOAA/NGDC provides a database from 1992 to 2013. Therefore, for the night light proxy for the year 2014, we calculate the average over four years: 2010, 2011,

²³ Source: The data are collected from the following website:
<https://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html#AVSLCFC>

2012 and 2013. Table 3.5 summarizes the values of this proxy and the corresponding choropleth maps are in Figure 3.7.

The night light proxy exhibits almost the same spatial distribution in 2004 as in 2014 and clearly shows the disparity between the eastern littoral governorates and the interior and southern governorates in Tunisia. The same 10 governorates of the interior and south always belong to the poorest class in these two years, whereas the eastern littoral governorates record the highest value of this proxy. Interestingly, the governorate of Zaghouan is in the middle of this ranking, after some southern and interior governorates, while this governorate is considered among the most developed areas in terms of manufacturing sector in Tunisia (Kriaa and Montacer, 2009; Karray and Driss, 2014). Obviously, the capital Tunis displays the highest proxy in these two years with a large difference between its value and those of all other governorates. We expect this proxy to positively affect flows when it is high and negatively when it is low. Indeed, Furceri (2006) and Etzo (2011) find that low levels of economic development represent push factors in origin regions and pull factors in destination regions.

Table 3.5: The nighttime electric light proxy for regional GDP

Governorate	2004	2014
Tunis	51.74	55.65
Ariana	18.28	25.75
BenArous	20.6	24.79
Manouba	8.908	12.03
Nabeul	11.65	14.52
Zaghouan	4.730	6.550
Bizerte	5.667	7.205
Beja	4.607	5.886
Jendouba	5.045	6.294
LeKef	4.6	5.096
Siliana	3.877	4.862
Sousse	9.605	13.10
Monastir	19.71	24.18
Mahdia	8.273	10.19
Sfax	6.745	8.948
Kairouan	5.170	6.479
Kasserine	3.943	5.351
Sidibouazid	4.303	5.768
Gabès	4.506	5.631
Médenine	5.381	6.774
Tataouine	3.187	4.124
Gafsa	4.239	5.263
Tozeur	3.683	4.381
Kébili	3.283	4.002

Source: authors based on data provided by the Geoscientific Data Center of the National Oceanic and Atmospheric Administration

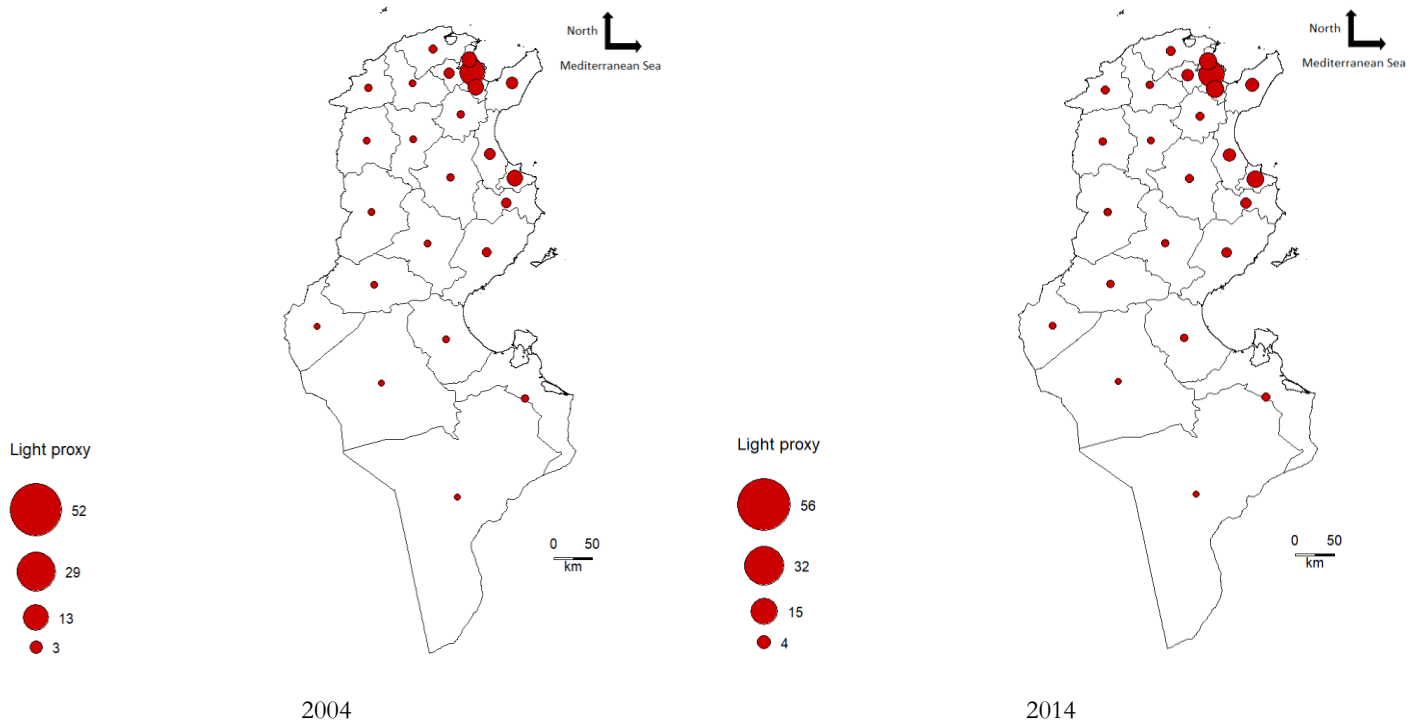


Figure 3.7: Spatial pattern of night light proxy (proxy for regional GDP)

Source: authors based on data provided by the Geoscientific Data Center of the National Oceanic and Atmospheric Administration

With respect to geographical variables, spatial continuity captures the effect of neighboring governorates on migration flows. We also include a dummy variable in order to assess the attraction of the eastern littoral governorates. According to Glaeser et al. (2001) and Partridge and Rickman (2003), these variables can capture the role of natural amenities. We also introduce economic variables which represents the number of private firms in various sectors: tourism, financial and insurance activities and trade activities.

Finally, we also include the level of regional cultural infrastructure through two variables, number of university institutes and number of movie theatres, in order to control for the influence of cultural capital on interregional flows in Tunisia. This relationship between internal migration and cultural capital is not traditionally treated in the economic literature. Yet, these variables can be based on the concept of creative class (Florida, 2002a, 2002b), which describes the role of people whose jobs are to create innovations and fully engage in the creative process (Florida, 2002a, 2002b). Talented workers are attracted to spatial areas that meet their psychic satisfactions (Scott, 2010). Hence, the migration of these creative classes is related to their preferences for cities and urban zones, based on the amenities of these areas such as the cultural, musical and artistic scenes, the natural environment and the quality of social life (Scott, 2010). Vossen et al. (2019) find that cultural facilities have a significant positive impact on interregional migration flows of this class in Germany between 2003 and 2010. Sternberg (2017) argues that developing countries have also started to support creative and cultural industries. Because of unavailability of data on the creative class in Tunisia, we cannot precisely describe such phenomena but we add a series of control variables to capture the impact of cultural infrastructure on internal migration in Tunisia. According to descriptive statistics of

the variable “Number of movie theaters”, the median is equal to zero; more than half of governorates do not have a movie theater. For this reason, instead of using raw data, we introduce a dummy variable: if a governorate has a movie theater, it is equal to 1, otherwise 0. As regards the variable “number of university institutes”, there is an almost equal distribution of university establishments since each governorate contains at least one university establishment. Regional living conditions are measured by three variables: number of households connected to the internet, number of bank branches and average number of crimes.

3.5. Estimation methods, empirical specification and results

3.5.1. Empirical specifications

Turning the model presented in section 3 to the data, we take logs of both sides of equation (1) to obtain a pooled model estimated by Ordinary Least Squares (OLS)²⁴ and varying depending on the multilateral resistance variable included. The first specification includes the differential in unemployment rates between the origin and destination governorates as the benchmark resistance variable:

$$\begin{aligned} \ln F_{ijt} = & \alpha_0 + \alpha_1 \ln \text{diff_uemp_rate}_{ijt} + \alpha_2 \ln y_{it} + \alpha_3 \ln y_{jt} + \alpha_4 \ln n_{it} + \alpha_5 \ln n_{jt} \\ & + \alpha_6 \ln hh_{it} + \alpha_7 \ln hh_{jt} + \alpha_8 \ln hl_{it} + \alpha_9 \ln hl_{jt} + \delta_t I_t + \varepsilon_{ijt} \end{aligned} \quad (9)$$

where index i refers to the region of origin, j to the region of destination and t to time, with $t = 2004, 2014$. The observations in each year refer to pairs of OD regions, $ij = 1, 2, \dots, N = 552$. F_{ijt} is the migration flows between origin governorate i and destination governorate j . y_{it} and y_{jt} are the night light measures as proxies for regional GDP at origin i and at destination j respectively; n_{it} and n_{jt} are the population at origin i and at destination j respectively; hh_{it} and hh_{jt} are the high skilled proxies at origin i and at destination j respectively; hl_{it} and hl_{jt} are the low skilled proxies at origin i and at destination governorate j respectively, $\text{diff_uemp_rate}_{ijt}$ corresponds to the unemployment rate differential between the origin i and at destination j respectively. Finally, the empirical specification includes year effects I_t , which corresponds here to the 2004 dummy.

We also estimate the classical gravity model with spatial distance D_{ijt} as resistance variable, which corresponds to the road distance between regions in each origin-destination pair. We consider the road distance between the centers of the governorates as a proxy for geographical distance. This model is as follows:

²⁴ A common limitation of gravity models is the presence of zero flows between observations with the logarithmic transformation when estimated with the Ordinary Least Squares (OLS) approach. Our study is not affected by this issue as our database contains only one zero migration flow, which we replace with one.

$$\begin{aligned} \ln F_{ijt} = & \alpha_0 + \alpha_1 D_{ijt} + \alpha_2 \ln y_{it} + \alpha_3 \ln y_{jt} + \alpha_4 \ln n_{it} + \alpha_5 \ln n_{jt} + \alpha_6 \ln hh_{it} + \alpha_7 \ln hh_{jt} \\ & + \alpha_8 \ln hl_{it} + \alpha_9 \ln hl_{jt} + \delta_t I_t + \varepsilon_{ijt} \end{aligned} \quad (10)$$

We also opt for a third specification where the resistance variables are both the unemployment rate differential and geographical distance in order to find the effect of these variables in the same specification (model 11), since these two resistance variables do not capture the same impact on interregional flows.

$$\begin{aligned} \ln F_{ijt} = & \alpha_0 + \alpha_1 D_{ijt} + \alpha_2 \ln uemp_rate_{ijt} + \alpha_3 \ln uemp_rate_{ijt} + \alpha_4 \ln y_{it} + \alpha_5 \ln y_{jt} \\ & + \alpha_6 \ln n_{it} + \alpha_7 \ln n_{jt} + \alpha_8 \ln hh_{it} + \alpha_9 \ln hh_{jt} + \alpha_{10} \ln hl_{it} + \alpha_{11} \ln hl_{jt} + \delta_t I_t \\ & + \varepsilon_{ijt} \end{aligned} \quad (11)$$

Then we introduce control variables from different categories sequentially, to limit multicollinearity. They are denoted by X_{ijzt} in models with respectively unemployment rate differential (model 12) and road distance (model 13) as resistance variable:

$$\begin{aligned} \ln F_{ijt} = & \alpha_0 + \alpha_1 \ln diff_uemp_rate_{ijt} + \alpha_2 \ln y_{it} + \alpha_3 \ln y_{jt} + \alpha_4 \ln n_{it} + \alpha_5 \ln n_{jt} + \alpha_6 \ln hh_{it} \\ & + \alpha_7 \ln hh_{jt} + \alpha_8 \ln hl_{it} + \alpha_9 \ln hl_{jt} + \sum_{z=1}^Z \gamma_z X_{ijzt} + \delta_t I_t + \varepsilon_{ijt} \end{aligned} \quad (12)$$

$$\begin{aligned} \ln F_{ijt} = & \alpha_0 + \alpha_1 D_{ijt} + \alpha_2 \ln y_{it} + \alpha_3 \ln y_{jt} + \alpha_4 \ln n_{it} + \alpha_5 \ln n_{jt} + \alpha_6 \ln hh_{it} + \alpha_7 \ln hh_{jt} \\ & + \alpha_8 \ln hl_{it} + \alpha_9 \ln hl_{jt} + \sum_{z=1}^Z \gamma_z X_{ijzt} + \delta_t I_t + \varepsilon_{ijt} \end{aligned} \quad (13)$$

Because the impact of some variables may evolve over time, we also estimate a pooled model with interaction effects between a subset of explanatory variables and time dummies for each specification. After an intermediate phase where we include the interactions of all the variables with time dummies, we consider the significance level of all the interactions and keep X_{ijct} which include the variables for which the interaction with the time dummy is not significant, and X_{ijvt} which include the variables for which the interaction with the time dummy is significant. Equation 14 displays this specification:

$$\ln F_{ijt} = \alpha_0 + \sum_{c=1}^C \alpha_c X_{ijct} + \delta_t I_t + \sum_{t=2004,2014}^T \sum_{v=1}^V \beta_{vt} X_{ijvt} + \varepsilon_{ijt} \quad (14)$$

Note that as all covariates are log-transformed; the estimated parameters can be interpreted as elasticities. In all models, we apply robust inference using the White correction. Usually, the empirical specification of gravity models also includes destination and origin region fixed effects. Unfortunately, because only 2 years are available, we do not have enough degrees of freedom to include these origin and destination fixed effects and control for unobserved origin and destination heterogeneity. The wide range of control variables that we consider should mitigate the resulting omitted variable bias.

3.5.2. Results for the whole sample of 24 Tunisian governorates

The Benchmark Extended Gravity Model

We first estimate a benchmark gravity model similar to Piras (2017) (Table 3.6), without distinguishing between low and high skilled human capital, using respectively differential in unemployment rate (column 1), road distance (column 2) and both (column 3) as resistance variables. The coefficient of the 2004-time dummy is significant and positive, which corresponds to an overall decrease in interregional flows over time in Tunisia. Most estimated elasticities are highly significant. As expected, interregional flows are negatively related to geographical distance and unemployment rate differential, even when both variables are included. Interregional flows are significantly positively correlated with population in all three models, thereby highlighting a push factor at origin and a pull factor at destination. The estimated elasticity of the night light proxy at origin is significantly negative only in the models where spatial distance is included as a resistance variable. At destination, this variable has a significant and positive impact on interregional flows in all models. Global human capital at origin has a significantly positive impact only in model 3 with both unemployment rate differential and spatial distance as resistance variables, while it displays a significant and positive sign in all models at destination. Thus, global human capital encourages people to leave their home governorates and attracts them to destination governorates.

Table 3.6: Pooled Regressions with the global human capital

	Dependent variable: $\log(f_{ij})$		
	Model 1	Model 2	Model 3
Road Distance	-0.775*** (0.040)		-0.783*** (0.040)
Unemployment rate differential		-0.220*** (0.078)	-0.295*** (0.070)
Population at origin	0.876*** (0.060)	0.916*** (0.070)	0.907*** (0.061)
Population at destination	0.697*** (0.065)	0.690*** (0.076)	0.666*** (0.066)
Night light proxy at origin	-0.240*** (0.073)	0.030 (0.077)	-0.213*** (0.073)
Night light proxy at destination	0.350*** (0.069)	0.575*** (0.075)	0.315*** (0.069)
Global capital human at origin	0.235 (0.291)	-0.316 (0.361)	0.473* (0.285)
Global capital human at destination	2.640*** (0.377)	1.755*** (0.407)	2.443*** (0.378)
Factor. Year. 2004	0.476*** (0.062)	0.482*** (0.071)	0.495*** (0.062)
Constant	-17.258*** (1.695)	-18.990*** (1.840)	-16.473*** (1.728)
Observations	1,104	1,104	1,104
R2	0.664	0.519	0.670
Adjusted R2	0.662	0.516	0.667
Residual Std. Error	0.802 (df = 1095)	0.960 (df = 1095)	0.795 (df = 1094)

*Level of significance: *** 1%. ** 5%. * 10%*

The Pooled Extended Gravity Model with Unemployment Rate Differential as a resistance variable

We now turn to results with differentiated human capital proxies. Table 3.7 reports the results from pooled models with unemployment rate differential as the resistance variable. Column 1 displays results obtained from the estimation of a baseline specification without human capital proxies. Column 2 displays results from estimations of our baseline specification with the human capital proxies. All other columns present the models including various sets of additional control variables. All the abbreviations of the variables are given in Table 3.12 in the appendix 3.

In general, almost all the models provide similar results and highly statistically significant estimated elasticities. Again, the coefficient of the 2004-time dummy is significant and positive. Unemployment rate differential turns out to be an adequate resistance factor, since the corresponding elasticities are significant and negative in all models. An increase in unemployment rate differential discourages migration flows; the greater the unemployment rate differential, the less migrants tend to emigrate. This discouragement of migration may therefore help to establish a balance in unemployment rates between the different governorates, following the logic of neoclassical theory. Hence, unemployment rate differential works as a restraining factor for migration. This is understandable, because in Tunisia, though there is a disparity in the values of unemployment rates, it remains very high, varying between 7.6% and 21.9% in 2004 and 9.3% and 26.2% in 2014.

Interregional flows are always significantly and positively correlated with population at origin and at destination for all models, and the corresponding estimated coefficients are very high in almost all models. For instance, according to model 2, a 1% increase in population size raises inflows by 0.947% and outflows by 0.767%. This population coefficient at origin has a greater impact than that at destination: densely populated regions are more attractive and individuals in sparsely populated regions are less likely to migrate. While the sign of population at origin is expected - demographic growth encourages persons to emigrate - the sign of population at destination shows that even though the number of population at destination is high, it remains a pull factor and does not prevent people from emigrating.

With respect to the second gravity variable, the night light proxy has a significant and positive impact on interregional flows at destination. Nevertheless, none of the estimates points to a statistically significant impact for this proxy at origin. The fact that we use a proxy for regional GDP as an approximation of the regional incomes that a potential migrant may have explains this feature. Hence, our result is in line with the hypothesis that individuals migrate to regions based on expected benefits regions (Todaro, 1980). Note that to control for income at origin or at destination, Piras (2017) includes a human capital variable with per capita GDP in empirical models, with the argument that per capita GDP depends on the rates of labor; a higher per capita GDP at destination can also be explained by the higher levels of average human capital. Moreover, Mayda (2010) points out that a higher per capita GDP at destination does not mean that the migrant would get it automatically.

Our variables of interest are the human capital proxies. At origin, the high and low skilled proxies are not significant in all models. In contrast, at destination, the estimates of these proxies show more interesting results. Interregional flows are always significantly and positively related to the high skilled proxy and negatively related to the low skilled proxy. If we consider the baseline model 2, a 1% increase in high skilled level at destination raises migration flows by 0.709% and a 1% increase in the low skilled proxy at destination lowers migration flows by 1.476%. These results confirm that different levels of human capital may affect the interregional migration in the same region differently and may support the idea that more skilled people are more likely to be employed in destination regions. We can interpret this result in relation to the existence of agglomeration economies in destination regions that incite people to migrate. Nowadays, Tunisian youth are more qualified and specialized in different fields, and can find a better reward for their skills in the most developed coastal areas in Tunisia (Amara et al. 2018) characterized by industrial agglomerations. In contrast, low human capital in destination regions prevents people from migrating, which show that less skilled people are less likely to migrate and have a lower propensity to emigrate. This result is consistent with the findings of Jelili and Mzali (1998) who consider that people from the rural population choose not to migrate because they do not perceive more favorable returns elsewhere. Moreover, our results are similar to those from Fu and Gabriel (2012), who show that individuals with high education level are more likely to migrate to regions with high human capital concentration, in contrast to individuals with no education.

We then add control variables sequentially. We include the variable “spatial continuity” in all columns except the first two basic models and the variable “littoral eastern attraction” in columns 3 and 10. We also introduce economic variables: tourism indicator in column 4, and trade activities in column 6. To control for culture infrastructure, we add the dummy variable of presence of movie theaters in column 9 and the number of university institutes in column 8. Finally, we include three variables to measure regional living conditions: number of bank branches in columns 5, 6 and 7, average number of crimes in column 7, and number of households connected to the internet in column 10.

The estimated elasticities of spatial continuity are significantly positive; people migrate by more than 1.4% when the two governorates share the same spatial border. Interregional flows are positively related to eastern littoral attraction. If the destination governorate belongs to the coastal region, people are more likely to migrate at least by 1.6%.

We find that the tourism indicator is significantly positively related to interregional flows only at destination. This confirms our expectation: people leave governorates without tourism infrastructure for those with tourism infrastructure. In Tunisia, the governorates considered as tourism centers are also characterized by a high level of quality of life, strong public infrastructure, various facilities and a large pool of tourism jobs. Thus, people emigrate from their origin governorates in search of jobs offered by the tourism sector and also expect to benefit from these facilities. For the economic variable “trade indicator”, column 8 shows that this variable has a significant and negative impact on migration flows at origin. This sector discourages people to leave their home governorates.

With respect to cultural variables, interregional flows are significantly and positively correlated with the dummy variable of presence of movie theaters and the number of university institutes only at origin. Interestingly, in Tunisia, cultural variables have a strong influence on internal inflows. Tunisians emigrate in order to escape cultural deficiencies in their origin governorates. For the quality of life variables, the number of households connected to the internet shows an insignificant impact on interregional flows. However, we find that interregional flows are significantly and positively related to the number of bank branches at origin. This result may be explained that inflows are also caused by the poor living conditions at origin governorates: human mobility in all its forms can be a response to the escape of constraints, rather than the pursuit of opportunities (Bell et al., 2015). Contrary to our expectation, the elasticities of the average number of crimes are significantly positive at destination. This result is quite surprising since it shows that the number of crimes acts as a pull factor. but it may be due to a lack of adequate control of our variable on social disamenities related to crime. The results found for life quality and cultural variables confirm that location-specific amenities matter in migration decisions (Treyz et al., 1993; Maza, 2006). These variables can be considered as indicators of urbanization levels. In the rural-urban model developed by Harris and Todaro (1970), a significant increase in labor demand from large industries, mainly located in urban areas, triggered the migration of people from rural areas, which is consistent with our results.

Table 3.7: Pooled Regressions with the unemployment rate differential as a resistance variable

	Dependent variable: $\log(\hat{f}_i)$									
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Unemployment rate differential	-0.298*** (0.080)	-0.257*** (0.082)	-0.325*** (0.068)	-0.355*** (0.067)	-0.384*** (0.070)	-0.369*** (0.070)	-0.388*** (0.069)	-0.330*** (0.069)	-0.384*** (0.070)	-0.307*** (0.070)
Population at origin	0.935*** (0.072)	0.947*** (0.071)	0.928*** (0.063)	0.917*** (0.100)	0.722*** (0.076)	0.988*** (0.165)	0.520*** (0.169)	0.818*** (0.075)	0.901*** (0.064)	1.035*** (0.114)
Population at destination	0.613*** (0.073)	0.767*** (0.075)	0.709*** (0.065)	0.603*** (0.097)	0.680*** (0.076)	0.491*** (0.173)	0.441*** (0.161)	0.683*** (0.074)	0.721*** (0.066)	0.657*** (0.114)
Night light proxy at origin	0.005 (0.063)	-0.038 (0.091)	0.021 (0.074)	0.023 (0.079)	-0.022 (0.072)	0.044 (0.079)	-0.065 (0.072)	-0.011 (0.072)	0.011 (0.075)	0.031 (0.075)
Night light proxy at destination	0.781*** (0.055)	0.379*** (0.086)	0.332*** (0.073)	0.321*** (0.084)	0.380*** (0.068)	0.330*** (0.082)	0.328*** (0.073)	0.389*** (0.070)	0.416*** (0.071)	0.332*** (0.073)
High skilled proxy at origin		-0.284 (0.234)	-0.123 (0.181)	-0.111 (0.191)	-0.255 (0.180)	-0.156 (0.191)	-0.288 (0.184)	-0.217 (0.182)	-0.182 (0.187)	-0.003 (0.214)
High skilled proxy at destination		0.709*** (0.268)	0.684*** (0.239)	0.678*** (0.235)	0.707*** (0.231)	0.634*** (0.239)	0.662*** (0.233)	0.732*** (0.234)	0.733*** (0.235)	0.631** (0.255)
Low skilled proxy at origin		-0.713 (0.491)	-0.495 (0.382)	-0.452 (0.385)	-0.355 (0.380)	-0.386 (0.382)	-0.345 (0.382)	-0.606 (0.376)	-0.526 (0.387)	-0.571 (0.380)
Low skilled proxy at destination		-1.476*** (0.516)	-1.529*** (0.453)	-1.554*** (0.454)	-1.456*** (0.439)	-1.448*** (0.437)	-1.453*** (0.438)	-1.474*** (0.456)	-1.454*** (0.446)	-1.484*** (0.457)
Spatial continuity			1.419*** (0.060)	1.422*** (0.060)	1.443*** (0.061)	1.442*** (0.060)	1.438*** (0.061)	1.412*** (0.060)	1.425*** (0.060)	1.417*** (0.060)
Eastern littoral attraction			0.180** (0.084)							0.168* (0.087)
Tourism indicator at origin				0.017 (0.090)						
Tourism indicator at destination				0.180* (0.098)						
Trade indicator at origin						-0.322* (0.167)				
Trade indicator at destination						0.230 (0.185)				
Movie theaters at origin									0.132** (0.061)	

Movie theaters at destination										-0.053 (0.054)
Number of university institutes at origin									0.118*** (0.038)	
Number of university institutes at destination									0.064 (0.043)	
Bank branches at origin					0.208*** (0.034)	0.224*** (0.034)	0.222*** (0.036)			
Bank branches at destination					0.059 (0.046)	0.048 (0.045)	0.075 (0.046)			
Crimes average at origin							0.170 (0.117)			
Crimes average at destination							0.201* (0.118)			
Connected to the Internet at origin										-0.075 (0.069)
Connected to the Internet at destination										0.039 (0.068)
Factor.Year.2004	0.398*** (0.061)	0.468*** (0.085)	0.493*** (0.077)	0.565*** (0.072)	0.612*** (0.071)	0.611*** (0.071)	0.521*** (0.085)	0.546*** (0.071)	0.492*** (0.076)	0.535*** (0.124)
Constant	-15.115*** (1.319)	-14.651*** (1.766)	-14.291*** (1.632)	-13.991*** (1.804)	-12.060*** (1.719)	-12.354*** (1.927)	-9.553*** (2.058)	-12.668*** (1.782)	-14.072*** (1.619)	-14.871*** (2.028)
Observations	1,104	1,104	1,104	1,104	1,104	1,104	1,104	1,104	1,104	1,104
R ²	0.508	0.527	0.685	0.684	0.691	0.692	0.692	0.686	0.685	0.685
Adjusted R ²	0.505	0.522	0.681	0.681	0.687	0.688	0.688	0.683	0.681	0.681
Residual Std. Error	0.970 (df = 1097)	0.953 (df = 1093)	0.779 (df = 1091)	0.779 (df = 1090)	0.772 (df = 1090)	0.770 (df = 1088)	0.770 (df = 1088)	0.777 (df = 1090)	0.779 (df = 1090)	0.779 (df = 1089)

*Level of significance: *** 1%. ** 5%. * 10%.*

The Pooled Extended Gravity Model with Road Distance as a resistance variable

Table 3.8 displays the results of our extended gravity model when road distance is the resistance variable. As previously, columns 1 and 2 display results obtained from the baseline specification without human capital proxies and with human capital proxies, respectively. We include the variable “spatial continuity” in all columns except the first two basic models and the variable “littoral eastern attraction” in columns 3 and 9. The economic variables are included in column 4 (tourism indicator) and in column 5 (trade indicator). We add the dummy variable of presence of movie theaters in column 6 and the number of university institutes in column 9. The living conditions variables are added in column 7 (number of bank branches and number of households connected to the internet) and in column 8 (average number of crimes).

As expected, interregional flows are negatively correlated with road distance. The longer the distance, the less migrants tend to emigrate. The estimated elasticity of this variable varies between -0.771 and -0.429. In this case also, the elasticities of population at origin and destination are significantly positive. The night light proxy at destination keeps the same positive sign as in the previous specification. However, the elasticity of this proxy becomes significantly negative at origin in this specification; therefore, this variable reduces the outflows of migrants and acts as a restraining factor in the origin governorate.

With respect to human capital, the high skilled proxy at both origin and destination displays the same results as previously. It has an insignificant impact at origin and a significantly positive impact at destination. However, in this specification, the corresponding estimated elasticities are higher than in the previous specification. According to baseline model 2, a 1% increase in the high skilled proxy at destination generates an increase in migration flows of 1.423%. Unlike the first specification, this specification does not provide the same results for the low skilled proxy. In fact, results are not clear at destination: its coefficient is significantly negative only in models 3 and 9. At origin, its coefficient is not significant in the baseline model 2 but turns out to be significantly negative in all other models. Therefore, the low skilled level reduces migration outflows in origin governorates and also migration inflows in destination governorates. This result seems to support the idea that low-skilled people have a greater chance of being employed in their region than in destination regions.

No differences are found for the spatial continuity, the eastern littoral attraction, the tourism indicator, the dummy variable of movie theaters and the number of university institutes. However, in this specification, the trade indicator provides a significant and positive impact on migration flows at destination and insignificant impact at origin. Based on these two specifications, we can conclude that all included economic variables act as a pull factor in destination governorates and induce people to emigrate. Unlike the first specification, the quality of life variable “Number of Households connected to the Internet” reveals a significant and negative impact at origin and an insignificant impact at destination in this specification. We expect this sign for this variable: in Tunisia, there is an almost equitable telecommunication infrastructure between governorates, so it does not represent a real reason for migrants to leave their home governorates. Moreover, the elasticities of bank branches are significantly positive at both origin (0.248%) and destination

(0.115%). This can be interpreted as evidence that governorates specialized in this tertiary sector are likely to attract migrants from the governorates not specialized in this sector. Usually, banks recruit highly qualified people. This sector is mainly located in the most developed governorates with a high population rate, which also has a high proportion of highly qualified people. Hence, this result illustrates the snowball mechanism introduced by Fujita (1989): firms are located in regions that offer a pool of jobs and therefore these regions attract more persons.

Table 3.8: Pooled Regressions with road distance as a resistance variable

	Dependent variable: $\log(f_{ij})$								
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Road Distance	-0.737*** (0.039)	-0.771*** (0.041)	-0.433*** (0.050)	-0.435*** (0.050)	-0.436*** (0.050)	-0.445*** (0.050)	-0.470*** (0.049)	-0.436*** (0.051)	-0.429*** (0.049)
Population at origin	0.868*** (0.061)	0.903*** (0.061)	0.904*** (0.060)	0.916*** (0.098)	1.107*** (0.162)	0.874*** (0.061)	0.920*** (0.108)	0.945*** (0.150)	0.766*** (0.072)
Population at destination	0.591*** (0.063)	0.746*** (0.063)	0.706*** (0.062)	0.624*** (0.093)	0.477*** (0.167)	0.738*** (0.064)	0.495*** (0.108)	0.705*** (0.135)	0.683*** (0.075)
Night light proxy at origin	-0.203*** (0.059)	-0.308*** (0.079)	-0.193** (0.076)	-0.187** (0.078)	-0.140* (0.080)	-0.223*** (0.077)	-0.238*** (0.075)	-0.185** (0.073)	-0.234*** (0.072)
Night light proxy at destination	0.690*** (0.048)	0.240*** (0.071)	0.256*** (0.072)	0.282*** (0.083)	0.279*** (0.081)	0.364*** (0.070)	0.292*** (0.067)	0.346*** (0.070)	0.251*** (0.073)
High skilled proxy at origin		0.047 (0.184)	-0.105 (0.171)	-0.095 (0.184)	-0.017 (0.186)	-0.198 (0.176)	0.036 (0.197)	-0.100 (0.173)	-0.229 (0.172)
High skilled proxy at destination		1.423*** (0.250)	1.122*** (0.248)	1.175*** (0.243)	1.139*** (0.250)	1.257*** (0.240)	1.012*** (0.254)	1.255*** (0.237)	1.100*** (0.253)
Low skilled proxy at origin		-0.562 (0.386)	-0.737** (0.355)	-0.734** (0.358)	-0.746** (0.356)	-0.853** (0.357)	-0.774** (0.344)	-0.737** (0.354)	-0.886** (0.347)
Low skilled proxy at destination		-0.449 (0.470)	-0.810* (0.458)	-0.747 (0.455)	-0.651 (0.445)	-0.616 (0.445)	-0.551 (0.434)	-0.639 (0.448)	-0.835* (0.464)
Spatial continuity			0.885*** (0.081)	0.883*** (0.082)	0.879*** (0.081)	0.873*** (0.082)	0.866*** (0.082)	0.879*** (0.082)	0.885*** (0.081)
Eastern littoral attraction			0.232*** (0.082)						0.230*** (0.081)
Tourism indicator at origin				-0.017 (0.087)					
Tourism indicator at destination				0.163* (0.096)					
Trade indicator at origin					-0.230 (0.162)				
Trade indicator at destination					0.312* (0.177)				
Movie theaters at origin						0.132** (0.057)			
Movie theaters at destination						-0.030			

Number of university institutes at origin						(0.052)			0.147***
									(0.037)
Number of university institutes at destination									0.024
									(0.040)
Bank branches at origin							0.248***		
							(0.032)		
Bank branches at destination							0.115***		
							(0.043)		
Crimes average at origin								-0.037	
								(0.115)	
Crimes average at destination								0.039	
								(0.112)	
Connected to the Internet at origin							-0.185***		
							(0.066)		
Connected to the Internet at destination							0.096		
							(0.063)		
Factor.Year.2004	0.301***	0.547***	0.490***	0.566***	0.540***	0.497***	0.745***	0.543***	0.501***
	(0.052)	(0.076)	(0.077)	(0.072)	(0.072)	(0.075)	(0.123)	(0.085)	(0.077)
Constant	-10.240***	-12.884***	-13.243***	-13.514***	-14.078***	-13.477***	-11.375***	-14.343***	-10.927***
	(1.174)	(1.615)	(1.624)	(1.775)	(1.812)	(1.598)	(1.971)	(1.757)	(1.861)
Observations	1,104	1,104	1,104	1,104	1,104	1,104	1,104	1,104	1,104
R ²	0.639	0.668	0.703	0.702	0.703	0.703	0.714	0.701	0.707
Adjusted R ²	0.637	0.665	0.700	0.698	0.699	0.699	0.710	0.698	0.704
Residual Std. Error	0.831	0.798	0.755	0.757	0.756	0.756	0.742	0.758	0.751
	(df = 1097)	(df = 1093)	(df = 1091)	(df = 1090)	(df = 1090)	(df = 1090)	(df = 1088)	(df = 1090)	(df = 1089)

Level of significance: *** 1%. ** 5%. * 10%.

The Pooled Extended Gravity Model with Unemployment Rate Differential and Road Distance as Resistance Variables

We also include in the same specification with unemployment rate differential and road distance as resistance variables. The estimation results displayed in Table 3.13 in the appendix 3 show that all the coefficients are high statistically significant except for the low and high skilled proxies at origin. Overall, the findings are consistent with the previous results obtained from the specification with unemployment rate differential as a resistance variable.

Interaction Effects with the Time Dummies in the Extended Gravity Model

Table 3.9 provides results obtained from the models including the significant interaction effects detected between the variables and the time dummies in pooled regressions with unemployment rate differential as a resistance variable. We focus in this section on the interpretation of the variables for which significant differences in impacts over time were found, since the results for the variables without interaction effects are similar to previously. Tables 3.14 and 3.15 in the appendix 3 display pooled regressions with these interaction effects, respectively with road distance as a resistance variable (Specification 2) and with both unemployment rate differential and road distance as resistance variables (Specification 3). Table 3.16 in the appendix 3 reports the intermediate phase of this analysis in order to detect the significant interaction coefficients between variables and the time dummy.

Four variables have the same impact on migration flows for both periods: unemployment rate differential, population at origin and at destination, light night proxy at destination and low skilled proxy at origin. The interaction coefficients of the light night proxy at origin and high skilled proxy at origin are not significant. In fact, we keep these interaction effects because in the intermediate phase, their interaction coefficients are significant between this variable and time dummies (Table 3.16 in the appendix 3).

Conversely, the impact of high and low skilled proxies at destination is significantly different between 2004 and 2014. An interesting result comes from the interaction coefficients of these variables; the high skilled proxy at destination has a significant and positive impact on interregional flows in 2004 but an insignificant impact in 2014. A 1% increase in the high skilled proxy at destination raises interregional flows by 1.444% in 2004. We also note a decrease in the value of the interaction coefficients over time. This can be explained by the high unemployment rate among graduates at destinations and a limited labor market for residents of these governorates, which prevents graduates from emigrating. Furthermore, the low skilled level at destination has no impact on interregional flows in 2004, while it turns out to be a factor that reduces inflows in 2014. This can be explained by the fact that destination governorates are characterized by a large employment pool for all levels of human capital, whereas after the revolution, the deterioration of the economic situation and the terrorist incidents in Tunis and Sousse restrict this pool, which becomes less attractive to least qualified migrants.

Comparing with the two other specifications (Tables 3.14 and 3.15 in the appendix 3), the night light proxy at origin displays different results. In specification 2 with road distance as resistance variable, it has a significant and negative impact on internal flows for the two periods 2004 and 2014. In specification 3 with both unemployment rate differential and road distance as resistance variables, the interaction coefficient of this variable is significant and negative in 2004 and insignificant in 2014. These results can be explained by the fact that after the revolution of 2011, the economic situation in destination governorates deteriorated more and more, leading people to stay at origin governorates; thus this variable acts as a factor that reduces migration outflows.

For human capital proxies, in specification 3 with road distance and unemployment rate differential as resistance variable, the interaction coefficient of the high skilled proxy at origin is significantly positive in 2004 and insignificant in 2014. This result shows that the high skilled level has a positive impact on interregional flows and presents as a push factor in 2004, but in 2014, this variable no longer has this impact. Different results are also found for this proxy at destination in these two specifications, the corresponding interaction coefficient shows a significant and positive sign in 2004 and 2014 and also a decrease in its value. Hence, the high skilled level still plays an attraction role for migrants over time with but with a lower percentage.

In model 2 in specification 2, the low skilled proxy at destination positively affects migration flows in 2004 and negatively in 2014. The increase by 1% in this variable leads to an increase in migrations flows of 1.868% in 2004 and to a decrease of 1.726% in 2014. The third specification shows the same sign of interaction coefficients for this proxy. Thus, the low skilled level at destination is an attraction source for migrants in 2004 while it becomes a limiting factor for migration inflows in 2014. In the previous specification 1 (Table 3.9), the corresponding interaction coefficient is insignificantly negative in 2004 and becomes significantly negative in 2014.

Regarding resistance variables, interaction coefficients of road distance have a negative in these two years. The unemployment rate differential has the same negative impact for two periods. This might mean that migrants consider the unemployment rate as a factor preventing migration and reducing their probability of finding a job in the destination governorates. This may also be linked to the variation in unemployment rates between the different Tunisian governorates. Only in eight governorates do the unemployment rates decrease between 2004 and 2014, while in the interior and southern governorates, the unemployment rate increases by more than nine points for the governorates of Tataouine and Kebli and between three and five points in the governorates of Gafsa, Medenine Sidi bouzid and Kasserine.

Table 3.9: Interaction effects in regressions with unemployment rate differential as a resistance variable

	Dependent variable: $\log(f_{ij})$	
	Model 1	Model 2
Unemployment rate differential	-0.313*** (0.081)	-0.262*** (0.085)
Population at origin	0.928*** (0.072)	0.938*** (0.072)
Population at destination	0.612*** (0.073)	0.780*** (0.075)
Light night proxy at destination	0.778*** (0.055)	0.346*** (0.086)
Low skilled proxy at origin		-0.598 (0.522)
Factor. Year. 2004	0.638*** (0.207)	-3.539* (2.109)
Night light proxy at origin: Factor.Year.2004	-0.045 (0.077)	-0.084 (0.107)
Night light proxy at origin: Factor.Year.2014	0.073 (0.083)	0.033 (0.122)
High skilled proxy at origin: Factor.Year.2004		-0.206 (0.368)
High skilled proxy at origin: Factor.Year.2014		-0.288 (0.271)
High skilled proxy at destination: Factor.Year.2004		1.444*** (0.453)
High skilled proxy at destination: Factor.Year.2014		0.476 (0.314)
Low skilled proxy at destination: Factor.Year.2004		-0.161 (0.792)
Low skilled proxy at destination: Factor.Year.2014		-2.225*** (0.621)
Constant	-15.116*** (1.320)	-13.593*** (1.848)
Observations	1,104	1,104
R ²	0.509	0.529
Adjusted R ²	0.506	0.523
Residual Std. Error	0.970 (df = 1096)	0.952 (df = 1089)

Level of significance: *** 1%. ** 5%. * 10%

Summary of findings

In general, the results for some variables are robust across specifications in terms of significance and sign: interregional flows are always positively correlated with the population at origin and at destination, the night light proxy at destination²⁵ and the high skilled proxy at destination. Unemployment rate differential, road

²⁵ Except in model 2 with interaction effects between the time dummies and variables and with the unemployment rate differential and road distance as resistance variables (Table 6 in the appendix 3).

distance and the low skilled proxy at destination²⁶ are always negatively linked with interregional migration flows.

Mixed results are found for the night light proxy at origin, the high skilled proxy at origin and the low skilled proxy at origin. The estimated elasticity of the night light proxy at origin are statistically significant and negative in the specification with road distance as resistance variable as well as in the specification with unemployment rate differential and road distance as resistance variables, but it turns out to be insignificant in the specification with unemployment rate differential as resistance variable. This result suggests that the night light proxy at origin is less informative in explaining migration flows in the specification with unemployment rate differential as resistance variable.

The estimated elasticities of the high skilled proxy at origin are significantly positive only in the specification with interaction effects and with unemployment rate differential and road distance as resistance variables and insignificant in the other two specifications. Hence, these two variables are more informative in these specifications which include the unemployment rate differential and road distance as resistance variables and the interaction effects.

The coefficient of the low skilled proxy at origin is the most unstable in these different specifications. This variable has a negative impact at origin in all regressions with road distance as a resistance variable, except in the baseline regression. This result suggests that the baseline gravity is not able to ensure the stability of the coefficients and to determine migration factors in Tunisia. Moreover, its coefficient is not significant in all regressions of two other specifications. Thus, the low skilled proxy at origin is more informative in explaining migration in the specification with road distance as resistance variable.

As for the specific case of Tunisia, our extended gravity model confirms that macroeconomic variables are the main determinants of internal migration, as highlighted in previous empirical studies for other countries. For human capital levels, the positive sign of the high skilled proxy at destination is consistent with the assumption of the role of high skilled persons as a pull factor that attracts migrants according to new economic geography models. This can also be explained by the fact that high qualified people are forced to leave their home governorates in search of a job and also because rewards for skills are higher at destination than at origin. Even the significant sign of the low skilled proxy at destination is in line with new economic geography, as the regional low skilled level represents a factor reducing migration inflows. In connection with the result of the unemployment rate differential, the least qualified people may prefer to stay in their home governorates because their chances of finding a job corresponding to their skills are higher in their region than destination regions.

In most cases, our findings show that not all variables affect interregional flows symmetrically. Most variables asymmetrically affect interregional flows; different results are found between origin and destination

²⁶ Estimated elasticities of the low skilled proxy at destination are negative in all models except the baseline model with road distance (Model 1, Table 8).

(either significant opposite sign or insignificant sign). Thus, the gravity model applied to migration confirms the need to analyze the variables separately rather than as ratios or differences, in order to fully understand their impacts on migration (Piras, 2017).

3.6. Conclusion

This paper provides novel insights into the nature of interregional migration in Tunisia. We have investigated bilateral migration flows across Tunisia for two years: 2004 and 2014, and have focused on the impact of differences in human capital levels on internal migration. We have estimated an extended gravity model of internal migration augmented with differentiated human capital levels in which bilateral flows have been regressed on different variables, mainly population, night light proxy, unemployment rate differential, population and high and low skilled human capital proxies.

Our results show that while the traditional variables of the gravity model are the main drivers of migration flows, other factors also matter with mostly asymmetric effects. Population size does exert a strong influence on internal migration in Tunisia. This variable is a real example of a push factor at origin and a pull factor at destination.

Novel and interesting results have been found regarding the role of human capital in a developing country like Tunisia. Leaving aside the mixed role of human capital levels at origin, the impact of high and low skilled levels on interregional migration is almost clear at destination. The low skilled level operates as a restraining factor and the high skilled level as a pull factor at destination. In line with new economic geography, this result can be explained by the fact that highly qualified level in specific regions favors the creation of agglomeration economies and turns out to be an attraction source for other highly qualified persons as well as economic activities. Furthermore, we include different non-economic variables in the empirical analysis. Our results show that these variables have a strong influence on internal migration in Tunisia. Thus, Tunisians migrate not only to find a job but also to benefit from a better quality of life and to escape the structural deficiencies of their home governorates. Given the reduced timescale, the conclusions we come to are nevertheless to be treated with some caution.

Our findings are consistent with both neoclassical theory and new economic geography. On the one hand, following new economic geography, Tunisians emigrate to governorates with a strong agglomeration of economic activities as well as a strong population concentration. The advantages of these economic concentrations outweigh the disadvantages of large and heavily populated cities, such as the unemployment rate and level of crime. On the other hand, other features are more consistent with the neoclassical model of migration. Interregional flows are negatively related to the night light proxy and the low skilled proxy at origin and unemployment rate differential. These factors prevent people from emigrating. These reduced inflows generated by these factors might be partially motivated by the need of these regions for workers and the desire to avoid the disadvantages of big cities.

Our results differ from those of the study of Amara and Jammeli (2018) on human capital variables. They find a strong significant impact of no education and university education in the origin governorates, while in the destination governorates, the university education variable has an insignificant impact and the no education variable gives mixed results. This difference can be explained by the different structure of human capital variables. Although we find the same impact of population on internal migration, they find that the coefficient of the destination population has a higher effect than the coefficient of the origin population, while we show the opposite case. We find the same impact of distance, spatial continuity and unemployment rate differential as the study of Amara and Jammeli (2018). Our contribution also lies in the fact that we used different explanatory variables, in particular the night light proxy, which provides interesting results, especially in case of unavailability of regional data on GDP or wages in Tunisia.

Our empirical study contributes to the literature in two main directions. The first contribution is to provide a new understanding of the determinants of internal migration in Tunisia, especially given the void in scientific works analyzing the mechanism of internal migration in Tunisia. In fact, comparative and statistical measures on internal migration remain underdeveloped and largely absent from international statistical standards (White and Lindstrom 2005; Bell et al., 2015). Our study is thus positioned in this gap and contributes to understand the internal migration mechanism in the literature on developing countries. The second is related to the distinction between the effects of high and low skilled levels on interregional levels.

Moreover, this study can help public policymakers to understand the main drivers of migration, beyond classical variables such as the unemployment rate and regional GDP. Currently, the position of public policies on internal migration is not clear in Tunisia, whether they want to encourage or restrict migration flows. However, we are certain that policymakers in Tunisia encourage regional development. Yet, to reach a developed regional level, it is necessary to provide a diversified labor pool (qualified or not qualified). Hence, we recommend that public policies on regional inequalities re-examine the spatial distribution of human resources across the country and decide whether or not to encourage migration based on regional economic needs.

More to the point, according to our findings, we recommend special attention to internal flows based on different human capital levels of Tunisians. Public policies on regional development should include in their strategies and action plans, the needs and specificities of migrants according to their level of human capital in order to improve growth based on population criteria in each region. In the Tunisian context of reducing regional inequalities, studying the role of different education levels in migration decisions may lead to more relevant initiatives such as offering more specific investment and job opportunities based on regional and individual skills (residents or migrants). Furthermore, our results indicate that Tunisians migrate in search of jobs but also in search of better living conditions. Public policymakers must therefore support more equitable regional development, not only through public and private economic investments, but also through improved quality of life and cultural infrastructure. Indeed, it might be interesting to study the role

of government in individuals' migration decisions, especially since in the economic literature the impact of the public sector on migration decisions is not always convincing (Greenwood, 1993).

Despite these contributions, this study leaves ample room for future investigation. In particular, the availability of more time series would allow the use of more sophisticated estimates and the exploitation of advanced econometric techniques in order to confirm or qualify our findings. Moreover, the explanatory variables analyzed in this paper might usefully be extended to encompass other factors such as clean water, agricultural land, health services and housing indicators. Given the limited number of studies on internal migration in Tunisia and the importance of migration flows in regional disparities and wealth redistribution, more attention should be paid to studies on interregional flows and their impact on the regional development and economic growth in Tunisia.

3.7. Appendix 3

Table 3.10: Human capital quotas (2014)

Governorates	Quota _{bb}	Ranking _{bb}	Ranking_ Quota _{bb}	Quota _{bl}	Ranking _{bl}	Ranking_Quota _{bl}
Tunis	0.62200078	2	1	0.37799922	24	24
Ariana	0.61829942	1	3	0.38170058	23	22
Ben Arous	0.62059941	3	2	0.37940059	22	23
Manouba	0.51259925	11	10	0.48740075	20	15
Nabeul	0.52219978	8	6	0.47780022	15	19
Zaghouan	0.40970155	16	15	0.59029845	10	10
Bizerte	0.4611003	14	14	0.5388997	14	11
Beja	0.3989008	18	18	0.6010992	11	7
Jendouba	0.36550119	21	21	0.63449881	5	4
Le Kef	0.40249797	17	17	0.59750203	4	8
Siliana	0.36220187	22	22	0.63779813	3	3
Sousse	0.54100009	5	4	0.45899991	21	21
Monastir	0.5374998	7	5	0.4625002	19	20
Mahdia	0.40960008	15	16	0.59039992	2	9
Sfax	0.49039945	12	12	0.50960055	17	13
Kairouan	0.3284678	23	23	0.6715322	1	2
Kasserine	0.36877886	20	20	0.63122114	8	5
Sidi bouzid	0.38489924	19	19	0.61510076	7	6
Gabes	0.52169983	6	7	0.47830017	16	18
Medenine	0.4704759	13	13	0.5295241	6	12
Tataouine	0.28099616	24	24	0.71900384	18	1
Gafsa	0.51479938	4	9	0.48520062	13	16
Tozeur	0.51919356	9	8	0.48080644	12	17
Kebili	0.50389985	10	11	0.49610015	9	14

Statistics computed by the authors

Table 3.11: Variables used in the empirical analysis

Variables	Definition	2004					2014				
		Minimum	Maximum	Mean	Median	SD	Minimum	Maximum	Mean	Median	SD
Demographic variables											
Population	Total population in thousand, year = 2004,2014. Source : Tunisian National Institute of Statistics	97526	983861	412953	403892	214180.88	107912	1056247	457615	420362	245478.1
Geographical variables											
Road distance	Road distance in kilometers between the centroids of the governorates	7.16	602.36	251.395	233.87	134.188	7.16	602.36	251.395	233.87	134.188
Spatial continuity	Dummy variable = 1 if there is a geographical continuity between the region i and j 0 otherwise										
Eastern littoral attraction variable	Dummy variable in order to assess the attraction of the eastern littoral governorates: 1 if Eastern littoral destination (among 10 governorates) 0 otherwise										
Economic variables											
Unemployment rate	(People looking for a job/labor force) *100, year = 2004, 2014. Source : Tunisian National Institute of Statistics.	7.6	21.9	15.02	15.1	3.99	9.3	26.2	16.58	16.1	4.93
Tourism indicator	Total number of hotels and restaurants in Tunisia, year = 2005, 2014. Source : National Business Register.	169	4288	908	606	853.19	308	6637	1395.96	949	1363.31
Trade indicator	Total number of wholesale and retail trade and repairs, year = 2005, 2014. Source : National Business Register.	2425	35065	9121	7656	6874.83	2464	45877	11914.9 6	8911	9696.12
Cultural variables											
Number of movie theaters	Source : Tunisian National Institute of Statistics.	0	12	1	0	2.56	0	12	0.88	0	2.53
Number of university institutes	Total number of university establishments, year = 2004, 2014. Source : Websites of each university	0	45	7	4	9.45	1	48	9	6	9.78

Living conditions variables

Number of Households connected to the Internet	Distribution of households according to possession of information and communication media: Households connected to the Internet, year = 2004, 2014. Source : Tunisian National Institute of Statistics.	1126	35247	6993	3991	7627.21	189	49636	7034	2160	10955.79
Number of bank branches	Total number of private bank branches, year = 2004, 2014 Source : Tunisian National Institute of Statistics.	0	207	36	22	42.99	11	400	67.75	32	84.77
Average number of crimes	Total number of crimes treated by the courts of first instance, year = 2004, 2014 Source : Tunisian National Institute of Statistics.	2047	74430	14898	10877	15117.65	2448	36706	12349.5	10116.5	8926.88

Table 3.12: Abbreviations of variables

Road Distance	Road Distance
Unemployment rate at origin	Unemployment rate at origin
Unemployment rate at destination	Unemployment rate at destination
Population at origin	Population at origin
Population at destination	Population at destination
Light night proxy at origin	Light night proxy at origin
Light night proxy at destination	Light night proxy at destination
High skilled proxy at origin	High skilled proxy at origin
High skilled proxy at destination	High skilled proxy at destination
Low skilled proxy at origin	Low skilled proxy at origin
Low skilled proxy at destination	Low skilled proxy at destination
Spatial continuity	Dummy variable of spatial continuity
Eastern littoral attraction	Dummy variable of eastern littoral attraction variable
Tourism indicator at origin	Tourism indicator at origin
Tourism indicator at destination	Tourism indicator at destination
Trade indicator at origin	Trade indicator at origin
Trade indicator at destination	Trade indicator at destination
Movie theaters at origin	dummy variable of presence of movie theaters at origin
Movie theaters at destination	dummy variable of presence of movie theaters at destination
Number of university institutes at origin	Number of university establishments at origin
Number of university institutes at destination	Number of university establishments at destination
Bank branches at origin	Number of bank branches at origin
Bank branches at destination	Number of bank branches at destination
Connected to the Internet at origin	Number of Households connected to the Internet at origin
Connected to the Internet at destination	Number of Households connected to the Internet at destination
Crimes average at origin	Average number of crimes at origin
Crimes average at destination	Average number of crimes at destination

Table 3.13: Pooled Regressions with the road distance and employment rate as resistance variables

	Dependent variable: $\log(f_{ij})$	
	Model 1	Model 2
Road Distance	-0.746*** (0.038)	-0.779*** (0.040)
Unemployment rate differential	-0.363*** (0.075)	-0.334*** (0.071)
Population at origin	0.895*** (0.062)	0.918*** (0.062)
Population at destination	0.563*** (0.062)	0.726*** (0.063)
Light night proxy at origin	-0.133** (0.060)	-0.225*** (0.081)
Light night proxy at destination	0.616*** (0.048)	0.160** (0.072)
High skilled proxy at origin		0.285 (0.183)
High skilled proxy at destination		1.216*** (0.251)
Low skilled proxy at origin		-0.027 (0.394)
Low skilled proxy at destination		-0.892* (0.473)
Factor. Year. 2004	0.321*** (0.051)	0.571*** (0.076)
Constant	-9.154*** (1.196)	-12.023*** (1.644)
Observations	1,104	1,104
R ²	0.649	0.675
Adjusted R ²	0.646	0.672
Residual Std. Error	0.820 (df = 1096)	0.790 (df = 1092)

*Level of significance: *** 1%. ** 5%. * 10%*

Table 3.14: Interaction effects in regressions with road distance as a resistance variable

	Dependent variable: log(fij)	
	Model 1	Model 2
Population at origin	0.863*** (0.062)	0.899*** (0.061)
Population at destination	0.592*** (0.063)	0.774*** (0.061)
Light night proxy at destination	0.690*** (0.048)	0.175** (0.072)
Low skilled proxy at origin		-0.308 (0.407)
Factor. Year. 2004	1.000* (0.534)	-6.218*** (1.716)
Road Distance : Factor.2004	-0.688*** (0.054)	-0.867*** (0.059)
Road Distance : Factor.2014	-0.786*** (0.055)	-0.698*** (0.057)
Night light proxy at origin: Factor.Year.2004	-0.155* (0.080)	-0.393*** (0.096)
Night light proxy at origin: Factor.Year.2014	-0.243*** (0.075)	-0.209** (0.107)
High skilled proxy at origin: Factor.Year.2004		0.360 (0.286)
High skilled proxy at origin: Factor.Year.2014		-0.049 (0.214)
High skilled proxy at destination: Factor.Year.2004		2.784*** (0.354)
High skilled proxy at destination: Factor.Year.2014		0.993*** (0.291)
Low skilled proxy at destination: Factor.Year.2004		1.868*** (0.622)
Low skilled proxy at destination: Factor.Year.2014		-1.726*** (0.575)
Constant	-10.548*** (1.197)	-11.464*** (1.678)
Observations	1,104	1,104
R ²	0.640	0.676
Adjusted R ²	0.637	0.672
Residual Std. Error	0.830 (df = 1095)	0.790 (df = 1088)

Level of significance: *** 1%. ** 5%. * 10%

Table 3.15: Interaction effects in regressions with road distance and unemployment rate as resistance variable

	Dependent variable: log(fij)	
	Model 1	Model 2
Unemployment rate differential	-0.378*** (0.076)	-0.352*** (0.072)
Population at origin	0.887*** (0.063)	0.910*** (0.061)
Population at destination	0.563*** (0.062)	0.752*** (0.061)
Light night proxy at destination	0.613*** (0.049)	0.096 (0.072)
Low skilled proxy at origin		0.408 (0.417)
Factor. Year. 2004	1.129** (0.521)	-5.809*** (1.702)
Road Distance : Factor.2004	-0.795*** (0.054)	-0.878*** (0.059)
Road Distance : Factor.2014	-0.698*** (0.054)	-0.706*** (0.056)
Night light proxy at origin: Factor.Year.2004	-0.194*** (0.073)	-0.351*** (0.095)
Night light proxy at origin: Factor.Year.2014	-0.052 (0.080)	-0.054 (0.111)
High skilled proxy at origin: Factor.Year.2004		0.783*** (0.283)
High skilled proxy at origin: Factor.Year.2014		0.136 (0.212)
High skilled proxy at destination: Factor.Year.2004		2.476*** (0.359)
High skilled proxy at destination: Factor.Year.2014		0.804*** (0.292)
Low skilled proxy at destination: Factor.Year.2004		1.229* (0.632)
Low skilled proxy at destination: Factor.Year.2014		-2.075*** (0.573)
Constant	-9.437*** (1.224)	-10.887*** (1.697)
Observations	1,104	1,104
R ²	0.650	0.683
Adjusted R ²	0.647	0.678
Residual Std. Error	0.819 (df = 1094)	0.782 (df = 1087)

Level of significance: *** 1%. ** 5%. * 10%

Table 3.16: Intermediate phase of the analysis of interaction effects with the time Dummies

	Dependent variable : log(fij)					
	Without human capital proxies			With human capital proxies		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Road Distance	-0.693*** (0.055)		-0.706*** (0.055)	-0.707*** (0.057)		-0.723*** (0.057)
Unemployment rate differential		-0.232** (0.102)	-0.317*** (0.101)		-0.293*** (0.104)	-0.394*** (0.092)
Population at origin	0.809*** (0.090)	0.856*** (0.102)	0.832*** (0.091)	0.843*** (0.094)	0.862*** (0.104)	0.833*** (0.095)
Population at destination	0.531*** (0.092)	0.542*** (0.104)	0.504*** (0.092)	0.695*** (0.092)	0.731*** (0.107)	0.692*** (0.091)
Light night proxy at origin	-0.123 (0.090)	0.089 (0.095)	-0.041 (0.092)	-0.226* (0.132)	0.108 (0.148)	-0.029 (0.137)
Light night proxy at destination	0.715*** (0.071)	0.804*** (0.083)	0.628*** (0.072)	0.150 (0.119)	0.175 (0.140)	-0.034 (0.123)
High skilled proxy at origin				-0.126 (0.216)	-0.256 (0.278)	0.103 (0.212)
High skilled proxy at destination				1.047*** (0.286)	0.585* (0.316)	0.887*** (0.286)
Low skilled proxy at origin				-0.802 (0.587)	-0.363 (0.727)	0.136 (0.591)
Low skilled proxy at destination				-1.958*** (0.661)	-3.019*** (0.722)	-2.698*** (0.675)
Factor. Year. 2004	-1.761 (2.354)	-2.190 (2.655)	-1.297 (2.396)	-12.465*** (2.980)	-7.438** (3.651)	-12.285*** (3.053)
Road Distance * Factor. Year. 2004	-0.088 (0.078)		-0.079 (0.077)	-0.156* (0.083)		-0.143* (0.083)
Unemployment rate differential * Factor. Year. 2004		-0.251 (0.165)	-0.196 (0.150)		-0.061 (0.183)	0.009 (0.151)
Population at origin * Factor. Year. 2004	0.104 (0.124)	0.144 (0.145)	0.110 (0.126)	0.128 (0.123)	0.154 (0.144)	0.170 (0.124)
Population at destination * Factor. Year. 2004	0.123 (0.126)	0.144 (0.146)	0.121 (0.124)	0.168 (0.123)	0.114 (0.152)	0.135 (0.123)
Light night proxy at origin * Factor. Year. 2004	-0.144 (0.120)	-0.141 (0.128)	-0.155 (0.121)	-0.200 (0.167)	-0.232 (0.188)	-0.363** (0.171)
Light night proxy at destination * Factor. Year. 2004	-0.045 (0.097)	-0.053 (0.112)	-0.030 (0.098)	0.024 (0.150)	0.252 (0.178)	0.185 (0.153)
High skilled proxy at origin * Factor. Year. 2004				0.842** (0.400)	0.175 (0.529)	1.025** (0.400)
High skilled proxy at destination * Factor. Year. 2004				1.715*** (0.460)	0.600 (0.586)	1.440*** (0.479)
Low skilled proxy at origin * Factor. Year. 2004				1.179 (0.816)	-0.152 (1.067)	0.885 (0.841)
Low skilled proxy at destination * Factor. Year. 2004				3.904*** (0.912)	2.924*** (1.099)	4.034*** (0.942)
Constant	-9.161*** (1.718)	-13.602*** (1.863)	-8.159*** (1.758)	-8.702*** (2.112)	-11.304*** (2.249)	-7.738*** (2.155)
Observations	1,104	1,104	1,104	1,104	1,104	1,104
R2	0.641	0.511	0.652	0.678	0.533	0.686
Adjusted R2	0.637	0.506	0.648	0.673	0.525	0.680
Residual Std. Error	0.831 (df = 1092)	0.969 (df = 1092)	0.819 (df = 1090)	0.789 (df = 1084)	0.951 (df = 1084)	0.780 (df = 1082)

Level of significance: *** 1%. ** 5%. * 10%

Conclusion générale

Plus de soixante ans après l'indépendance, la Tunisie est toujours à la recherche de leviers permettant de réduire les disparités flagrantes entre ses différentes régions, malgré toutes les politiques mises en œuvre au fil des années. Cette thèse s'inscrit dans ce cadre de la lutte contre les disparités régionales en s'intéressant aux choix de localisation des agents économiques en Tunisie. En effet, l'idée centrale de cette thèse est d'examiner les principaux déterminants de la localisation des agents économiques et leurs conséquences sur les inégalités régionales en Tunisie. Cette problématique a été fractionnée en trois thématiques, chaque thématique faisant l'objet d'un chapitre distinct. Le premier chapitre s'est penché sur une analyse spatiale du tissu manufacturier tunisien afin de détecter les schémas de concentration et de dispersion géographiques des industries en Tunisie. Dans le deuxième chapitre, nous avons sélectionné un échantillon de ces entreprises manufacturières implantées au sud-est de la Tunisie afin d'examiner l'impact des régimes spatiaux fiscaux sur leurs décisions de localisation tout en contrôlant des autres déterminants. Le dernier chapitre tente de mettre en lumière les facteurs influençant les flux interrégionaux d'individus en Tunisie, en se focalisant sur le rôle des différences de capital humain dans le modèle migratoire tunisien.

Ces trois chapitres permettent de caractériser les configurations spatiales des industries en relation avec les mouvements migratoires internes des individus, étant donné que le capital humain constitue un moteur fondamental de la croissance régionale et industrielle. Dans les paragraphes suivants, nous reprenons en détail les résultats de chaque chapitre, et nous concluons par un aperçu des implications politiques.

Premier chapitre

Dans le premier chapitre, nous avons caractérisé les configurations spatiales industrielles en exploitant des données individuelles des entreprises manufacturières. Pour répondre à cette requête, nous avons d'abord construit une base de données contenant les coordonnées géographiques de 5405 usines de plus dix employés dans toute la Tunisie, à partir de leurs adresses exactes. Ainsi, cette base de données nous permet de mettre en œuvre des méthodologies fondées sur les distances : fonctions développées par Duranton et Overman (2005) et par Diggle et Chetwynd (1991) afin de détecter les concentrations géographiques des entreprises manufacturières ainsi que des employés. Nous avons élargi l'analyse en employant la fonction bi-variée proposée par Duranton et Overman (2005, 2008) afin d'étudier les configurations spatiales de co-agglomération industrielle.

Malgré les différences méthodologiques entre les fonctions de Duranton et Overman (2005) et de Diggle et Chetwynd (1991), elles fournissent quasiment les mêmes résultats. Aucune répartition spatiale aléatoire des entreprises manufacturières dans tous les secteurs n'est détectée, chaque industrie étant caractérisée par une

configuration spatiale significativement différente d'une répartition spatiale aléatoire en Tunisie : soit une concentration, soit une dispersion. Pour les employés, un seul secteur industriel, celui du bois, du liège et de l'ameublement, est caractérisé par une répartition spatiale aléatoire qui s'explique par le faible nombre de salariés dans cette industrie.

Au niveau sectoriel, les résultats obtenus indiquent que les industries considérées de haute technologie en Tunisie (l'industrie électrique, électronique et de l'électroménager, l'industrie mécanique et métallurgique et l'industrie chimique) exhibent des concentrations spatiales significatives pour les entreprises manufacturières. En particulier, ces concentrations affichent un pic de concentration détecté à la même distance (11 km) montrant un rayon géographique où les entreprises de ces industries forment un cluster manufacturier de haute technologie. En effet, le rayon de 11 km correspond à une distance maximale entre deux entreprises situées dans la même délégation ou dans des délégations voisines en Tunisie. Ce résultat confirme ainsi l'existence de zones spécialisées dans les industries de haute technologie en Tunisie. L'industrie textile se caractérise par une concentration géographique à une distance moyenne qui correspond à une distance entre les gouvernorats voisins. Par ailleurs, trois gouvernorats voisins du Sahel tunisien (Sousse, Monastir et Mahdia) abritent la plus importante proportion d'entreprises manufacturières de ce secteur. Ainsi, nos résultats confirment que ces trois gouvernorats voisins sont le centre de la Tunisie, spécialisé dans la production textile. Cette spécialisation reflète le mécanisme de boule de neige décrit par Fujita (1989), où la spécialisation en production textile offre un bassin de travailleurs qualifiés et spécialisés dans ce domaine et conduit ainsi à l'implantation de nouvelles entreprises, qui attirent, à leur tour, plus de travailleurs. En outre, nos résultats montrent que deux industries considérées comme traditionnelles - l'industrie agro-alimentaire et l'industrie des matériaux de construction, de la céramique et du verre - se caractérisent par une dispersion géographique qui s'explique par le fait que les activités de ces industries sont localisées à proximité des matières premières.

L'analyse de co-agglomération montre que les attractions spatiales les plus importantes sont observées entre des industries d'activités manufacturières complètement différentes. Ces résultats indiquent que la diversification industrielle domine le tissu manufacturier tunisien, ce qui illustre la présence des externalités expliquées par la théorie de Jacobs (1969). D'ailleurs, le gouvernement tunisien contribue à définir le type d'agglomération (spécialisation ou diversification) par des investissements dans les infrastructures et la création de parcs industriels, principalement dans les régions côtières. De ce fait, ces actions améliorent les sources d'attractivité de ces régions et conduisent à ces agglomérations industrielles diversifiées. En outre, nous avons démontré que les concentrations géographiques sont dominées par le régime totalement exportateur. Ces concentrations des entreprises totalement exportatrices sont détectées principalement le long des gouvernorats côtiers de l'est. Cette région est ainsi caractérisée par une ouverture internationale qui peut contribuer à attirer les entreprises étrangères à s'y installer. Un autre point intéressant de nos résultats est que les entreprises étrangères et mixtes montrent une forte concentration géographique en Tunisie. Par conséquent, les IDE contribuent à la construction du paysage industriel tunisien et à la croissance régionale,

étant donné qu'ils servent de moteur clé pour le transfert des technologies de production, des compétences, des capacités d'innovation et des pratiques d'organisation et de gestion aux entreprises nationales.

Toutes les fortes concentrations géographiques sont détectées globalement à des distances relativement courtes et moyennes. Elles sont principalement situées dans un rayon de moins de 30 km pour les entreprises manufacturières, et de moins de 70 km pour les employés. Ces rayons spatiaux correspondent à une distance entre deux entreprises situées dans des délégations voisines du même gouvernorat ou dans deux gouvernorats voisins. Ces fortes concentrations géographiques sont dues au nombre élevé d'entreprises manufacturières implantées dans les régions côtières de l'est, ce qui s'explique par le fait que les industries ont tendance à se localiser dans les milieux urbains afin de bénéficier de la proximité des marchés locaux, des moyens de transport ainsi que du centre-ville.

Deuxième chapitre

Le deuxième chapitre examine l'impact des régimes fiscaux sur les décisions de localisation des entreprises manufacturières dans le sud-est de la Tunisie. Afin de mettre en œuvre les analyses empiriques de ce chapitre, nous avons interrogé 179 entreprises manufacturières situées dans quatre zones spatiales dans cette région, chacune offrant un régime fiscal différent. La Tunisie est spatialement divisée en quatre zones, la première est une zone spatiale qui ne bénéficie d'aucun avantage fiscal et la dernière est considérée comme la moins développée en termes économiques et la plus privilégiée en termes d'avantages fiscaux et financiers.

Sur la base de la littérature économique sur la localisation industrielle, nous avons rédigé un questionnaire structuré autour de cinq parties. Pour analyser les données de notre enquête, nous avons mobilisé diverses méthodes empiriques. Nous avons d'abord vérifié la fiabilité interne de notre questionnaire à l'aide du coefficient de fiabilité de Cronbach qui fournissait une valeur garantissant la fiabilité interne du questionnaire. Nous avons entamé notre étude empirique par une analyse factorielle multiple (AFM). Les quatre premiers axes expliquent environ 30% de la variance totale et les dix premiers axes 50% de la variance totale. Le premier axe reflète les facteurs traditionnels qui constituent les fondements de la théorie marshallienne tels que la main-d'œuvre, la disponibilité de terrains et de bâtiments et la proximité géographique des lieux liés au processus de production. Selon cet axe, les entreprises manufacturières de notre échantillon considèrent également la disponibilité de terrains ou de bâtiments comme un facteur majeur dans leurs choix de localisation. Ainsi, ces entreprises peuvent supporter des prix élevés pour un terrain ou un bâtiment afin de s'installer à proximité d'un voisinage particulier, ce qui démontre la nécessité d'arbitrer entre les coûts de transport et les prix des terrains (Alonso, 1964). Le deuxième axe identifie le rôle mineur des incitations fiscales et financières dans leur choix de localisation de ces entreprises. Le troisième axe souligne l'importance des moyens de transport et de la qualité des infrastructures dans leur choix de localisation de certaines entreprises de notre échantillon afin de faciliter leurs interactions, ce qui est cohérent avec les externalités décrites par Jacobs (1969). Cela peut mettre en lumière le rôle du gouvernement dans l'investissement dans les infrastructures et la création de parcs d'activités économiques. Le quatrième axe illustre l'importance d'être situé à proximité des entreprises manufacturières et des activités

liées à la production. Ainsi, certaines entreprises de notre échantillon mettent l'accent sur la proximité d'autres entreprises dans leur choix de localisation, elles s'installent dans une zone industriellement agglomérée et peuvent ainsi bénéficier des économies d'agglomération.

La Classification Ascendante Hiérarchique (CAH) identifie trois clusters intéressants. Dans le premier cluster, les opinions familiales sont toujours importantes dans le processus de décision des entreprises manufacturières concernant la localisation de leurs unités de production. En revanche, les facteurs traditionnels marshalliens ne sont pas pris en compte dans les choix de localisation des entreprises de ce cluster. Le deuxième cluster comprend les entreprises qui s'appuient sur des facteurs institutionnels pour choisir une localisation industrielle. En effet, ce cluster approuve l'impact des incitations fiscales et des subventions financières sur les choix de localisation de certaines entreprises de notre échantillon. Nous avons qualifié les entreprises du troisième cluster de modernes, étant donné qu'elles s'appuient sur des facteurs modernes pour se localiser dans une région. Ce cluster regroupe les entreprises à la recherche d'un capital humain hautement qualifié et de bâtiments prestigieux adaptés à leur production dans la région de leur implantation.

Nous avons approfondi notre étude par une analyse économétrique à l'aide de modèles Probit et en exploitant les neuf premières dimensions de l'AMF et des variables caractérisant les usines comme variables indépendantes. Les modèles Probit montrent également l'impact significatif des incitations fiscales sur les décisions de localisation. Les dimensions de l'AFM liées aux facteurs institutionnels ont un impact significatif sur les décisions de localisation des entreprises manufacturières. La prise en compte des incitations fiscales et des subventions lors du choix de localisation augmente de 15% la probabilité de se localiser dans une zone fiscalement avantageuse. Les résultats indiquent également que la nationalité de l'entreprise ne présente aucun impact sur les choix de localisation dans le sud-est de la Tunisie, tandis que le régime d'exportation a un impact positif sur les décisions de localisation des entreprises manufacturières. Les entreprises industrielles partiellement exportatrices sont plus susceptibles de s'installer dans des zones bénéficiant d'avantages fiscaux et financiers que les entreprises totalement exportatrices. Dans notre spécification, nous avons utilisé des variables catégorielles. En effet, nous avons constaté qu'au moins une modalité de chaque variable montre un impact significatif. Plus précisément, les entreprises ayant démarré leur production entre 2003 et 2009, comptant de 21 à 50 employés ou ayant le statut juridique d'affaire personnelle sont plus susceptibles de se localiser dans les zones spatiales fiscalement avantageuses du sud-est de la Tunisie, tandis que les entreprises des secteurs mécaniques, chimiques et des matériaux de construction sont moins susceptibles de s'installer dans ces zones.

Toutes ces méthodes empiriques valident le rôle des incitations fiscales et des subventions financières dans les décisions de localisation des entreprises manufacturières dans le sud-est de la Tunisie. En outre, les entreprises manufacturières de cette région possèdent des comportements différents en matière de localisation industrielle. Certaines s'appuient sur des déterminants traditionnels de localisation tels que les caractéristiques de la main-d'œuvre, la proximité des clients et/ou des fournisseurs et des infrastructures

appropriées, tandis que d'autres sont basés sur des déterminants modernes tels que des bâtiments prestigieux, un capital humain hautement qualifié et une qualité de vie élevée.

Troisième chapitre

Le troisième chapitre apporte un éclairage sur la nature de la migration interrégionale en Tunisie. Nous avons étudié les flux migratoires bilatéraux sur deux années : 2004 et 2014, en nous focalisant sur le rôle des différences de niveaux de capital humain. Nous avons estimé un modèle de gravité étendu de la migration interne augmenté par des niveaux différenciés de capital humain. Les flux bilatéraux ont été régressés sur différentes variables, principalement la population, un proxy du PIB régional, le différentiel de taux de chômage, la population et deux proxys du capital humain (hautement qualifié et faiblement qualifié). Nous avons construit nos proxys des différences de capital humain en adoptant la classification internationale type de l'éducation élaborée par l'Organisation des Nations Unies pour l'éducation, la science et la culture.

Compte tenu de l'importance observée des facteurs traditionnels, nos résultats indiquent que d'autres facteurs rapportent également un impact important sur les flux migratoires. La taille de la population exerce une forte influence sur la migration interne en Tunisie. Les gouvernorats peu peuplés incitent les gens à migrer vers ceux plus peuplés, de sorte que la taille de population représente à la fois une source d'attractivité des régions d'accueil et une source d'émigration de leurs régions d'origine. Des résultats intéressants ont été observés concernant le rôle du capital humain dans la migration interne en Tunisie. Même si les proxys du capital humain à l'origine montrent des impacts mitigés, à la destination, les résultats sont plus informatifs. Le capital humain peu qualifié fonctionne comme un facteur limitant la migration vers les gouvernorats de destination tandis que le capital humain hautement qualifié agit comme un facteur d'attraction vers ces gouvernorats. Conformément à la nouvelle économie géographique, ce résultat s'explique par le fait que le niveau élevé de qualification dans des régions spécifiques favorise la création d'économies d'agglomération et s'avère être une source d'attraction pour d'autres individus hautement qualifiés ainsi que pour les activités économiques. En outre, nous incluons diverses variables non économiques dans notre analyse empirique. Ces variables montrent une forte influence sur la migration interne en Tunisie. Ainsi, les Tunisiens migrent non seulement pour trouver un emploi mais aussi pour bénéficier d'une meilleure qualité de vie et échapper aux déficiences structurelles de leurs gouvernorats d'origine.

De nombreuses études ont débattu des prédictions des modèles néoclassiques ou de la nouvelle économie géographique (NEG) sans souligner que les résultats peuvent être interprétés simultanément grâce à ces deux modèles, montrant ainsi la coexistence de leurs prédictions. Nos résultats sont conformes à la fois à la théorie néoclassique et à la nouvelle économie géographique. D'une part, selon la NEG, les Tunisiens migrent vers les gouvernorats à forte concentration d'activités économiques ainsi que de population. Les avantages de ces concentrations économiques l'emportent sur les inconvénients des grandes villes densément peuplées, tels que le taux de chômage et le niveau de criminalité. En revanche, d'autres caractéristiques sont plus conformes au modèle néoclassique. Les flux interrégionaux sont négativement corrélés avec le proxy du PIB régional et le proxy du capital humain peu qualifié dans les gouvernorats

d'origine. Ces facteurs empêchent ainsi les gens de migrer. En effet, la réduction des flux migratoires sortants générée par ces facteurs peut être partiellement motivée par le besoin de ces travailleurs dans ces gouvernorats et par le désir d'éviter les inconvénients des grandes villes.

Le lien entre les inégalités régionales et la localisation des agents économiques dans un espace géographique demeure une préoccupation majeure dans la littérature économique. Cette thèse contribue à la littérature en fournissant une nouvelle étude sur les déterminants des choix de localisation dans les pays en développement. Dans les paragraphes suivants, nous présentons les implications politiques ainsi que les limites de notre thèse.

Implications politiques et limites

Les implications globales de notre thèse sont de nature à contribuer aux débats sur le rôle des politiques publiques, axées sur la délimitation territoriale dans la lutte contre les disparités régionales en Tunisie. Les politiques de développement régional mises en œuvre depuis l'indépendance ont fortement façonné l'espace économique tunisien en faveur des régions côtières orientales. Elles affectent explicitement cette structuration spatiale par l'aménagement et le développement de plusieurs zones industrielles dans les délégations côtières de l'est ainsi que la mise en place d'une infrastructure adaptée. En effet, les entreprises manufacturières et individus évitent de s'installer dans les gouvernorats de l'intérieur et du sud en raison de leurs déficiences structurelles. En revanche, la Tunisie souffre non uniquement d'un déséquilibre structurel et économique entre ses gouvernorats, mais également entre les délégations d'un même gouvernorat, même les plus développés.

À la lumière des résultats soulevés par ces différentes thématiques traitées, nous nous permettons de formuler les recommandations suivantes :

- La politique industrielle et les actions de développement régional devraient être analysées à une échelle spatiale très réduite, voire plus petite à celle de la délégation, afin de mettre correctement en évidence ce déséquilibre et de pouvoir le réduire, en évitant l'agrégation des spécificités régionales.
- La compréhension des choix de localisation industrielle permet d'améliorer l'efficacité et l'efficience des politiques de développement régional et d'aménagement du territoire. Il est ainsi préférable pour ces politiques d'inclure l'hétérogénéité des décisions de localisation dans leurs stratégies plutôt que de traiter toutes les entreprises manufacturières comme une entité unique prenant des décisions similaires.
- Notre étude sur des flux migratoires peut aider les responsables politiques à comprendre les principaux moteurs de la migration, au-delà des variables macroéconomiques. En effet, une attention particulière devrait être accordée aux flux internes basés sur différents niveaux de capital humain. Les politiques publiques de développement régional pourraient insérer dans leurs stratégies, les besoins et spécificités des migrants ainsi que des résidents en fonction de leur niveau d'éducation et de qualification afin d'améliorer la croissance régionale axée sur des critères démographiques de chaque région. Cela peut

conduire à des stratégies plus pertinentes, telles que la création d'opportunités locales plus ciblées d'investissements et d'emploi.

- Une politique régionale qui déplace les emplois vers les zones défavorisées, pourrait permettre d'économiser des coûts d'ajustement considérables (Pissarides and McMaster, 1990). Dans le contexte tunisien, pour attirer les activités économiques vers les régions les plus défavorisées et garantir cette transition, offrir des incitations fiscales et financières sans améliorer la qualité de vie régionale et sans fournir un bassin de main-d'œuvre spécialisée et qualifiée ne constitue pas la bonne stratégie. En outre, nos résultats pointent que les Tunisiens migrent à la recherche d'emplois mais aussi de meilleures conditions de vie afin d'échapper aux déficiences structurelles de leurs gouvernorats d'origine. Les décideurs publics devraient ainsi soutenir un développement régional plus équitable, non seulement en termes d'investissements économiques et industriels, mais également en termes de qualité de vie et d'infrastructures culturelles. Selon Stiglitz (1998), de nombreuses stratégies de développement antérieures ont échoué car elles n'analysaient pas de manière exhaustive et approfondie le contexte socio-économique d'un pays.
- De préférence, les pouvoirs publics mettent en place des mesures de développement régional basées sur la mobilisation des ressources spécifiques de chaque région ; par exemple la production agricole au nord et au centre, la production énergétique au sud, les services tertiaires dans la métropole tunisoise et activités touristiques dans la région méditerranée et au sud (régions désertiques). Au niveau industriel, une stratégie centrée sur les industries de haute technologie dans les agglomérations industrielles (observées dans notre étude) pourrait être bénéfique pour créer des avantages comparatifs et stimuler l'innovation. En effet, ces industries sont considérées comme des industries stratégiques (Guillou, 2006) qui permettent d'améliorer le bien-être social et de créer des effets externes positifs sur l'économie (Griliches, 1998). A cet effet, il pourrait être bénéfique de modifier l'échelle spatiale utilisée dans les politiques et stratégies économiques, basée sur un découpage administratif (délégations et gouvernorats) et d'établir un nouveau découpage spatial basée sur les caractéristiques et ressources régionales naturelles, humaines et physiques.
- Le contexte tunisien actuel exige des recherches supplémentaires sur les problématiques liées aux inégalités régionales. Cela nécessite des données plus adéquates et cohérentes sur la situation socioéconomique du pays à différentes échelles spatiales et temporelles. Pour relever ce défi, l'État devrait s'engager à lancer un processus plus robuste de décentralisation de la collecte de données, consacrer un budget plus important à la recherche scientifique et à la collecte de données, et mettre en place un système de coordination plus solide entre les chercheurs scientifiques et les décideurs politiques.

La portée de ces résultats est toutefois restreinte par certaines limites principalement liées à l'indisponibilité des données. De ce fait, cette thèse laisse la porte ouverte à de futures investigations. Dans le premier chapitre, la collecte de données a été effectuée manuellement sur une période d'un mois, le site web de l'Agence de Promotion de l'Industrie et de l'Innovation (APII), dédié à ces données étant mis à jour tous

les mois. Par conséquent, nous perdons automatiquement toutes les données des mois précédents. En outre, cette source ne fournit des données que sur les entreprises manufacturières de 10 employés ou plus. Par conséquent, nous n'avons pas pu analyser les entreprises manufacturières de moins de 10 employés qui représentent une part importante du tissu manufacturier tunisien. Nous nous sommes également focalisés sur le secteur manufacturier car ce site est le seul à fournir les adresses exactes des entreprises en Tunisie, uniquement pour les activités manufacturières et tertiaires. Nous n'avons pas exploité les données des services tertiaires, étant donné que la base de données correspondante n'est pas bien organisée et donc inexploitable.

Concernant le deuxième chapitre, nous avons réalisé l'enquête avec nos propres ressources, ce qui justifie la taille réduite de notre échantillon. Nous nous sommes focalisés sur une région spécifique de la Tunisie, par conséquent, l'élargissement de l'échantillon peut également donner une image plus large des choix de localisation des industries en Tunisie. Compte tenu de l'échelle temporelle réduite du troisième chapitre, les conclusions tirées ont été considérées avec une certaine prudence. En fait, les données sur la migration interne en Tunisie proviennent essentiellement du recensement de l'Institut National de la Statistique tous les dix ans. Ainsi, dans notre cas, pour toutes ces différentes études empiriques, il n'a pas été possible d'entreprendre une analyse incluant une large dimension temporelle. En revanche, une disponibilité d'un plus grand nombre de séries temporelles permettrait aux recherches futures d'exploiter des techniques économétriques de données de panel permettant de mieux contrôler l'hétérogénéité inobservable.

Dans l'avenir, les analyses sur les décisions de localisation des agents économiques pourraient être étendues en Tunisie. Une analyse plus approfondie pourrait inclure une analyse économétrique au niveau de la firme sur les décisions de (co)-localisation des industries afin de mieux informer sur l'hétérogénéité éventuelle de ces déterminants aux niveaux individuel et sectoriel en Tunisie. En outre, il pourrait être intéressant d'employer des modèles spatiaux afin d'étudier l'interdépendance spatiale entre les décisions de localisation des activités économiques. Étant donné le nombre limité d'études sur les déterminants et conséquences de la migration interne en Tunisie, des recherches complémentaires pourraient être menées sur les flux interrégionaux et leur impact sur les inégalités, le développement régional et la croissance économique. Par exemple, de futures études pourraient aborder les impacts de la migration interne sur le marché du logement en Tunisie, notamment avec la forte demande de logements dans la métropole tunisoise. En outre, il pourrait être intéressant de procéder à des analyses sur les effets des performances des migrants en fonction de leurs différences de capital humain sur la situation économique et sociale de leurs nouvelles régions d'accueil.

Pour conclure, notre thèse a privilégié d'étudier les configurations spatiales des agents économiques et leurs déterminants. Pour identifier plus complètement les conséquences des choix de localisation des agents économiques sur les inégalités régionales en Tunisie, des données supplémentaires et d'autres approches analytiques sont nécessaires, ce qui dépasse le cadre de la présente étude. Dans le cadre de nos prochaines recherches, nous espérons apporter un éclairage supplémentaire sur ces thématiques et d'autres, connexes, en Tunisie et dans d'autres pays en développement.

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