This project is funded by the European Union

INSTAT
Republic of Albania
Institute of Statistics

ALBANIA

COMMUTING FROM HOME TO WORK

2011 CENSUS-AL

May, 2014

ALBANIA COMMUTING FROM HOME TO WORK
MAY, 2014

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Printed with the support of the Swiss Agency for Development and Cooperation

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Preface and Acknowledgment

This publication on commuting from home to work in Albania is one of the thematic reports prepared by the EU Technical Assistance project team in collaboration with INSTAT staff. The study of commuting flows is important for many reasons including transport planning, housing development and economic development. Information on place of work also enables profiles in terms of daytime population (as opposed to demographic profiles by place of usual residence) to be drawn.

INSTAT wishes to offer its special thanks to the EU technical assistance team who contributed to produce a report on commuting in Albania for the first time and which will briefly analyse employed with regard to their commuting status. INSTAT also wishes to acknowledge the contributions of the staff of INSTAT Sector of Labour Force and cartography Unit who showed high professionalism and dedication.

Special appreciation also goes out to all other INSTAT staff involved in the census operation, and in the production and analysis of the data required for this report. Finally, INSTAT also takes the opportunity to extend its thanks to the Swiss Agency for Development and Cooperation for its support in the realisation of this publication.

Gjergji FILIPI, PhD

Director General of INSTAT

Lista e publikimeve tematike të Censusit 2011, Maj 2014
List of 2011 Census thematic publications, May 2014

- Censusi i Popullsisë dhe Banesave 2011: karakteristikat ekonomike
- 2011 Population and Housing Census: Economic Characteristics

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- Shqipëria 2011 Censusi në harta
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- Tipologjia e komunave dhe bashkive
- Communes and Municipalities Typology

- Lëvizjet vajtje-ardhje për qëllime punësimi
- Commuting from home to work

- Dinamikat e tregut të punës, 2001-2011
- Labour market dynamics, 2001-2011

- Aplikimi INSTATGIS – hartat në web (www.instatgis.gov.al)
- INSTATGIS – Atlas web application (www.instatgis.gov.al)

Abstract

The aim of the study is to analyse work commuting flows in Albania, through a spatial perspective of analysis, in order to identify commuting patterns. It is based on the 2011 Population and Housing Census data, which has collected the following information for employed persons: type of place of work, geographic location of the place of work, mode of transport to work, frequency of travelling from home to work.

The main demographic and socio-economic features and the territorial distribution of both commuters and non-commuters are analysed, with a focus on inner work commuters.
Daily commuting inflows and outflows are then analysed at the prefecture, district and municipality/commune levels, while differences in the use of means of transport to work are examined at the municipality/commune level.

A further focus is done on the role played by big municipalities. Daily inflows and outflows towards/from big municipalities are the point of departure for computing day-time population and comparing it to the usually resident one; while distances of incoming flows are used for identifying big municipalities' areas of influence.

Finally, daily commuting flows are analysed by means of a spatial clustering, whose results are used for the multivariate visualization of daily spatial interactions in Albania.

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1. INTRODUCTION

1.1 Data sources

The aim of this study is to analyse work-related commuting flows in Albania, through a spatial analysis perspective, in order to identify commuting patterns and to classify Albanian territories (at the different levels of analysis, i.e. prefectures, districts and municipalities/communes) by the role played in the system of work-related daily interactions.

The study is based on the outcomes of the 2011 Population and Housing Census, which devoted some questions of its individual questionnaire to the issue of commuting from home to work. Namely, the census collects the following information on commuting for all currently (at the time of the census) employed persons:

- type of place of work;
- geographic location of the place of work;
- mode of transport to work;
- frequency of travelling from home to work.

Type of place of work information refers to the nature of the workplace and distinguishes between home and other workplaces (whether fixed or otherwise) and it is useful for the analysis of employment characteristics, including employment in the informal sector.

The main reason why information on workplace location is collected is to link it with the place of usual residence, in order to establish accurate commuter flows from the place of usual residence to the place of work. Frequency of travelling and mode of transport to work are also variables of primary importance when analysing commuting flows, especially from the viewpoint of urban development planning and transport networks.

The study of commuting flows is important for many reasons, including transport planning, housing development and economic development. Information on place of work also enables profiles in terms of daytime population, as opposed to demographic profiles by place of usual residence, to be drawn.

We will begin by classifying employed persons according to their commuting status, i.e. to their (type of) place of work and by analysing the characteristics of both commuters and non-commuters. Afterwards, we will focus on the object of our study: the spatial analysis of commuting flows at the various territorial levels of analysis (prefectures, districts, municipalities/communes).

We have to recall that commuting is also often associated with commuting from home to school, college or university. Nevertheless, it is not the case of this study, since the census has not collected information on students' commuting flows; nor it has collected information on mobility for reasons other than work or study (which would have allowed us to draw a complete picture of mobility in Albania). Furthermore, a more in-depth analysis of work-related commuting flows should take into account time taken to travel from home to work, which would be necessary for the estimation of factors such as friction to movement and time costs, thus allowing for a more comprehensive understanding of commuting patterns.

Yet, the analysis of daily commuting flows based on the origin-destination approach is of primary importance, for many reasons. Indeed, as it will be clear by reading the report, it provides important insights on the Albanian system of work-related daily spatial interactions. Furthermore, it represents the first study of this kind on commuting in Albania. Thanks to the tools and techniques of the geographic information system and to the use of advanced spatial analysis methodology, space (territory) plays a key role in this study (differently from traditional analyses based just on non-spatial attributes of data). This kind of analysis also allows identifying an alternative classification of Albanian territories, as the one proposed in chapter 4, which could be useful in view of the possible construction of local labour systems, which in their turn could become the basis of regional development planning.

1.2 Definitions

As for the whole questionnaire, questions on commuting topics have been designed (and instructions for respondents have been drafted) in accordance with international standards. Namely, they have been designed on the basis of the concepts and definitions provided by the *CES Recommendations for the 2010 Round of Population and Housing Censuses*, which provide guidance and assistance to countries in the planning of their population and housing census (through the selection of a core set of census topics and the harmonization of definitions and classifications), in order to facilitate and improve the comparability of the data.

The question on place of work has been used to collect information on both location and type of workplace. It included a filter question, distinguishing respondents who work in Albania from those working abroad and then asking to the former to specify the type of workplace and to the latter the country of destination. The type of workplace has been classified according to the following categories:

- "Fixed workplace, away from home", including persons who do not have a fixed place of work but who report to a fixed address at the beginning of their work period (e.g. bus drivers), as well as operators of street or market stalls which are not removed at the end of the workday;
- "Work mainly at home", including home-based workers, farmers who work and live on their farms, and self-employed persons operating shops inside their own home;
- "No fixed place of work" i.e. persons whose work involves travelling to different areas and who do not report daily to a fixed address (e.g. travelling salesmen and long-distance lorry drivers), as well as ambulant vendors and operators of street/market stalls which are removed at the end of the workday, and construction workers working at different sites during the reference period.

As for the frequency of travel from home to work, the possible choices were: a) daily; b) 1 to 4 times a week; c) less than once a week. As for the mode of transport to work, the questionnaire asked to specify the means of transport most used. People who make several journeys or use more than one mode of transport were asked to indicate the means used for the greatest distance in the daily journey to work (in accordance with UNECE definition).

1.3 Objectives and structure

The specific objectives of this study are to:

- describe the characteristics of employed persons with regard to their commuting status;
- describe the socio-demographic characteristics and the territorial distribution of both commuters and non-commuters, and to highlight the major differences between them;
- analyse daily work-related commuting and identify commuting spatial patterns at various territorial levels of analysis (prefectures, districts, municipalities/communes);
- study the role played by the largest municipalities in the system of work-related daily spatial interactions;
- evaluate the impact of work-related commuting flows on the population of destination areas;
- propose a re-classification of Albanian territory based on daily work-related commuting flows.

The report is structured as follows.

In chapter 2 we will first briefly analyse employed persons with regard to their commuting status, distinguishing those working at home from those working in a fixed place outside home or with no fixed place of work. We will then describe the main demographic and socio-economic features and the territorial distribution of each of the groups so identified.

We will especially focus on commuters' characteristics, analysing also their profile by frequency of travel and mode of transport from home to work.

After this descriptive analysis, aimed at highlighting similarities and differences between the various groups of employed persons identified on the basis of the type of workplace, we will carry on with an in-depth spatial analysis of daily work commuter flows at various territorial levels of analysis. In chapter 3 we will first analyse daily inflows and outflows occurring at the prefecture and district levels and then examine daily interactions taking place at the municipality/commune level.

We will also examine the differences in the use of means of transport to work at the municipality/commune level.

We will then focus on the role played by big municipalities within the system of daily spatial interactions. Daily inflows and outflows towards/from big municipalities will be the point of departure for computing daytime population and comparing it to the usually resident one; while distance of incoming flows will be used to identify their areas of influence.

In chapter 4 we will carry on a multivariate analysis of daily commuting flows. We will first use a non-constraining strategy in order to get a spatial clustering and then proceed to obtain a regionalization (i.e. a spatial clustering obtained by imposing a spatial constraining strategy). Then, the results of the spatial clustering will be used for the multivariate visualization of daily spatial interactions in Albania.

Finally, we will try to summarize the results of the analyses conducted at the various territorial levels and provide useful hints for policy makers and regional planners.

2 COMMUTING FROM HOME TO WORK IN ALBANIA: A GENERAL OVERVIEW

2.1 The meaning of commuting

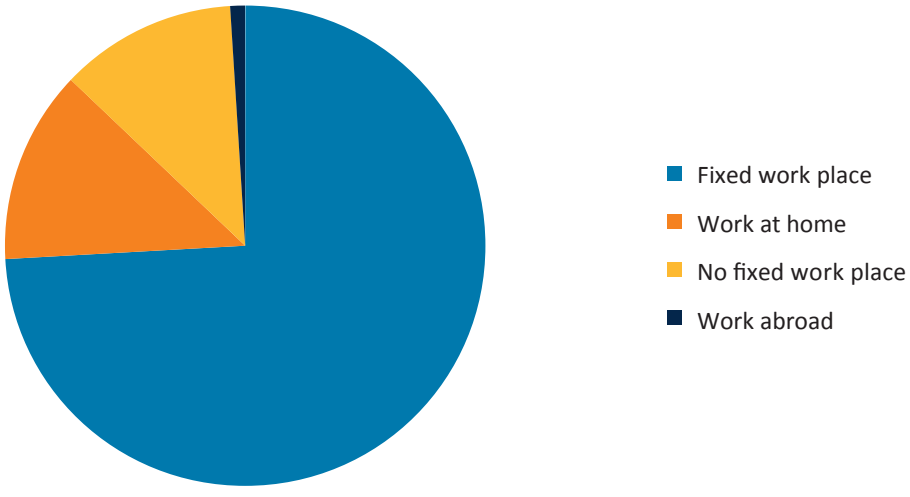
In this chapter, we will analyse the status of the currently employed population with regard to commuting and describe the characteristics of commuters and non-commuters in terms of the main demographic and socio-economic variables.

To begin with, we have to clarify what we mean when we talk about commuting. The breakdown by type of workplace enables us to distinguish employed persons working in Albania from those working abroad, and to classify the former by distinguishing those working at home from those working in a fixed place outside home and those with no fixed place of work[1]. Generally speaking, commuters are all employed persons who have a fixed workplace outside home, though the destination of the journey from home to work may vary from being within the same town/village of the usual residence to being in a different country. In this broad sense, 3 out of 4 employed persons in Albania may be defined as commuters, if we do include in this category both workers having a fixed workplace outside home in Albania and those working abroad (see figure 1). Indeed, a small percentage of commuters are individuals who travel on a regular basis across the border to a neighbouring country (1% of the overall employed population). However, although we will briefly describe the main features of this group of employed persons (paragraph 2.3.3), flows originated by commuters abroad will be excluded from the scope of the analysis of commuting flows (to which chapters 3 and 4 are devoted). In fact, although commuters abroad constitute surely an interesting part of the commuting phenomenon, studies on commuting flows typically focus on commuter flows within the country. For practical reasons, information on workplace location to the smallest possible civil division of the country concerned is often not being collected in censuses (as it is the case for the 2011 Albanian census), thus not allowing for an analysis of such flows in terms of distance from home to work (or, more precisely, in terms of the origin-destination matrix between place of usual residence and place of work).

If three-quarters of employed persons may be defined as commuters (in the above mentioned broad sense), the remaining quarter is composed almost equally of home-based workers (13% of the overall employed population), and of workers with no fixed workplace (11.9% of the overall employed population)[2] .

Figure 1: Employed persons by type of place of work

(%)



1 The wording of the question on the place of work was: "Where is your place of work? 1) In Albania 2) Abroad". Those answering "In Albania" had to choose among the following 3 options: 1 "Fixed work place, away from home", 2 "Work mainly at home"; 3 "No fixed place of work". In case of a fixed work place away from home, the name of the town/village and the code of the district had to be specified. In case of a place of work abroad, the country had to be specified.

2 Please note that percentages of commuters (494,341), home-based workers (85,944), workers with no fixed place of work (78,326) and commuters working abroad (6,546) have been calculated based on valid answers (658,611) i.e. excluding from the total number of employed persons (677,950) the 2.8% of records (19,339) that could not be classified by place of work, due to inconsistent answers.

The latter, though not working at home, may not be considered commuters, since the absence of a fixed destination makes it impossible to identify proper commuting flows (i.e. systematic – daily or not – movements between place of usual residence and workplace). Hence, they too will be excluded from the scope of the analysis of commuting flows, though their peculiarities as a group will be briefly illustrated (paragraph 2.3.2).

Once specified that commuters abroad and workers with no fixed workplace location will not be included within the scope of our analysis of commuting flows[3], we have eventually identified our specific object of interest which is represented by in-country commuters (from now on, inner commuters). In other words, when we talk about commuting we talk about employed persons with a fixed workplace outside home in Albania.

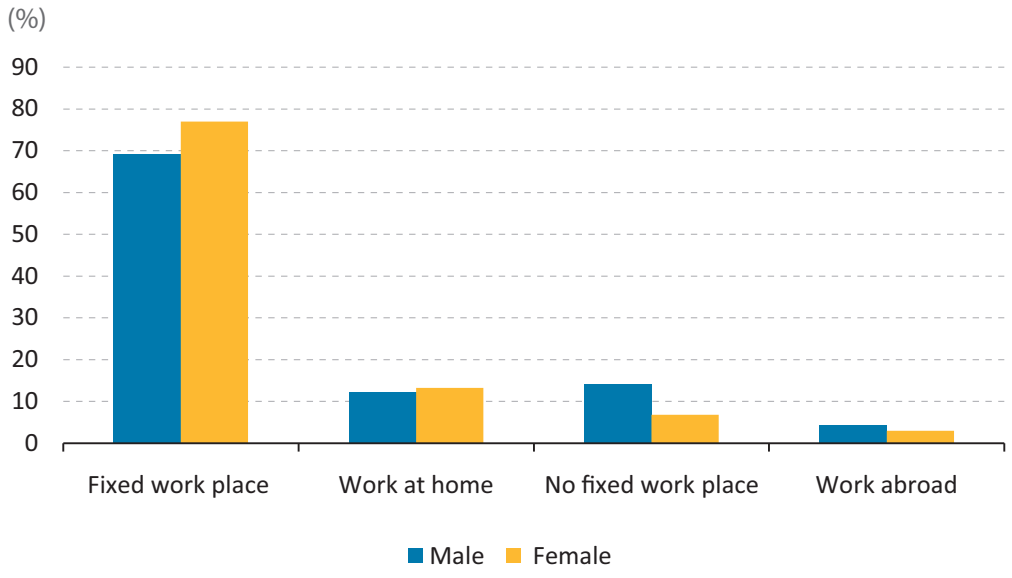
As we will proceed with the analysis, we will further circumscribe this object (see chapters 3 and 4), focusing on movements between municipalities (i.e. not taking into account movements from home to work within the same village/town or between different villages/towns belonging to the same municipality).

However, before examining commuting flows, we will look further into the commuting status of employed persons (i.e. into the distribution of employed persons by type of place of work) and describe the main characteristics of the identified groups: commuters (both inner work commuters and out-of-country commuters), home-based workers and workers without a fixed place of work.

2.2 Type of place of work and commuting status

The gender distribution by type of place of work shows some interesting differences, though not so marked. We observe a higher percentage of commuting workers and a slightly higher percentage of home-based workers among females (respectively 77% versus 69.1% and 13.3% versus 12.3%) balanced by a share of female workers with no fixed place of work, which is half the one of males (6.8% versus 14.2%) and by a smaller percentage of commuters abroad (3% versus 4.3%).

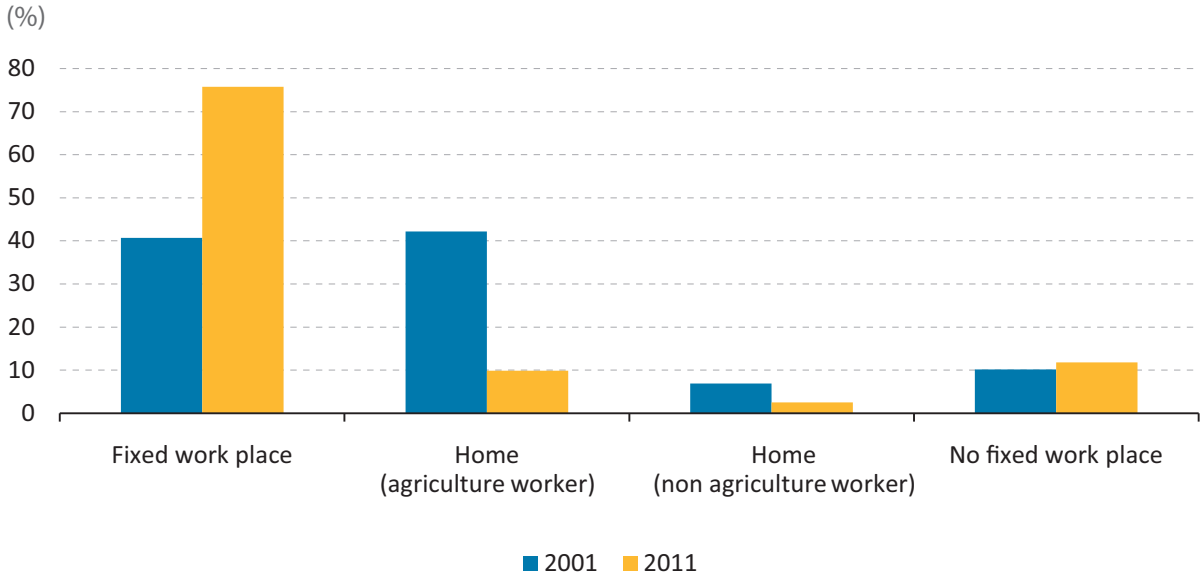
Figure 2: Employed persons by gender and type of place of work



3 Home-based workers are obviously excluded given that, in their case, home and place of work coincide.

The distribution by type of place of work is instead dramatically different from 2001, when the percentage of workers with a fixed place of work outside home was just 40.7% and almost half of the overall employed population declared to be working at home in a farm (being mainly, though not all of them, agricultural workers[4]), with just a slight percentage of home-based workers whose home was not a farm. Due to the different wording of the questions in the two questionnaires[5], it is not possible to make a direct comparison between home-based workers in 2011and those who were working at home in a farm in 2001. But, if we look at the share of home-based workers, whose branch of economic activity is agriculture (i.e. at the cross-tabulation between place of work and industry), we see a much significant decrease in the percentage of home-based workers employed in agriculture (Figure 3). The different distribution of workers by type of place of work in the two censuses reflects, of course, the different percentage of persons employed in agriculture, who accounted for half of the total employed labour force in 2001 (50.6%), and even for 83.4% in rural areas, and who currently constitute just 27.1% of the total employed population. This is also in line with the growth of urban population, which between the two censuses has outnumbered the population living in rural areas (from the 42.2% in 2001 to 53.5% in 2011), after the increase already recorded for the period between 1989 and 2001 (from 35.7% to 42.2%).

Figure 3: Employed persons in the 2001 and 2011 censuses by type of place of work and agriculture/non agriculture home working

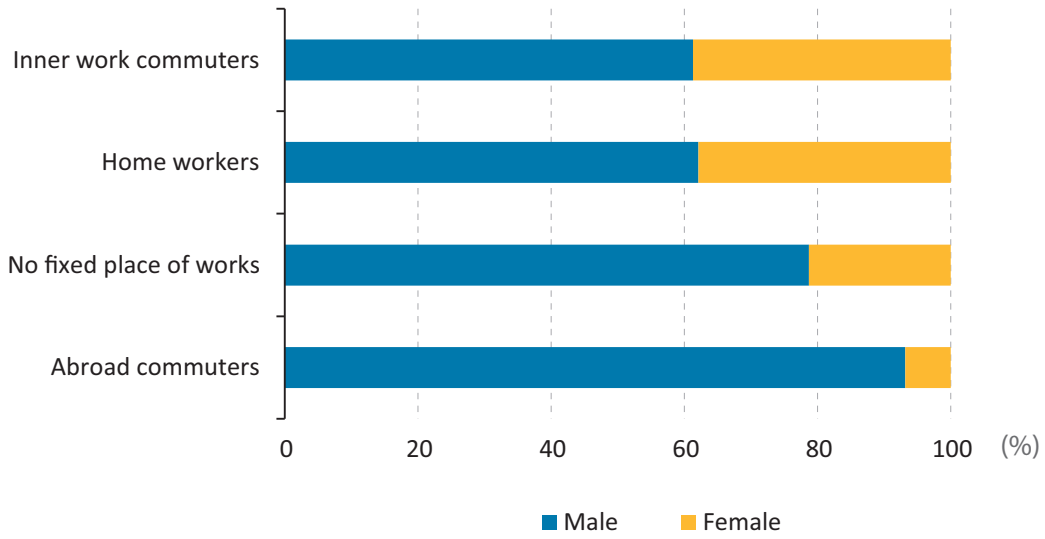


If we begin to look into the main features of the four groups identified among employed people on the basis of their commuting status, we observe that men are the majority in every group (as, indeed, in the group of employed persons as a whole). But, if women are only they 6.8% of commuters abroad, they account for 21.3% of employed persons with no fixed place of work and for more than one third of home-based workers and of inner work commuters (respectively 37.9% and 38.7%).

4 About 14% of them were non-agricultural workers engaged in economic activities, such as food production or textile works carried out at home (INSTAT, 2004: 41).

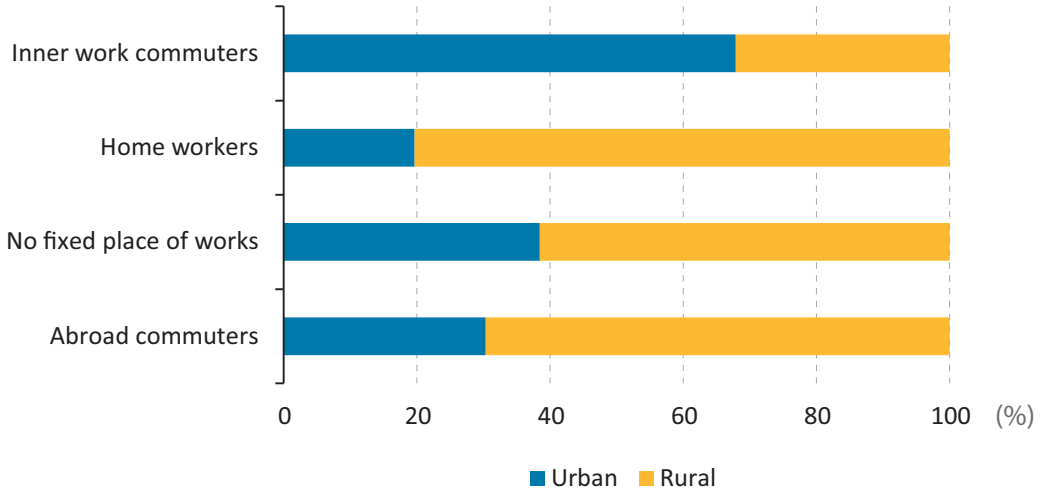
5 The 2001 census question on the type of place of work included two separate answer categories for home-based workers ("Home (not a farm)" and "Farm, which is home"), differently from 2011 when, as already mentioned, only one answer category was devoted to home-based workers ("Work mainly at home").

Figure 4: Employed persons by type of place of work and gender



Furthermore, we see that the percentages of urban/rural population within each group are significantly different. Namely, while more than two thirds of inner work commuters live in urban areas, members of the other groups live mainly in rural areas: rural dwellers are the vast majority of commuters abroad (90.6%), more than four-fifths of home-based workers and almost two-thirds of employed persons with no fixed place of work.

Figure 5: Employed persons by type of place of work and urban/rural area



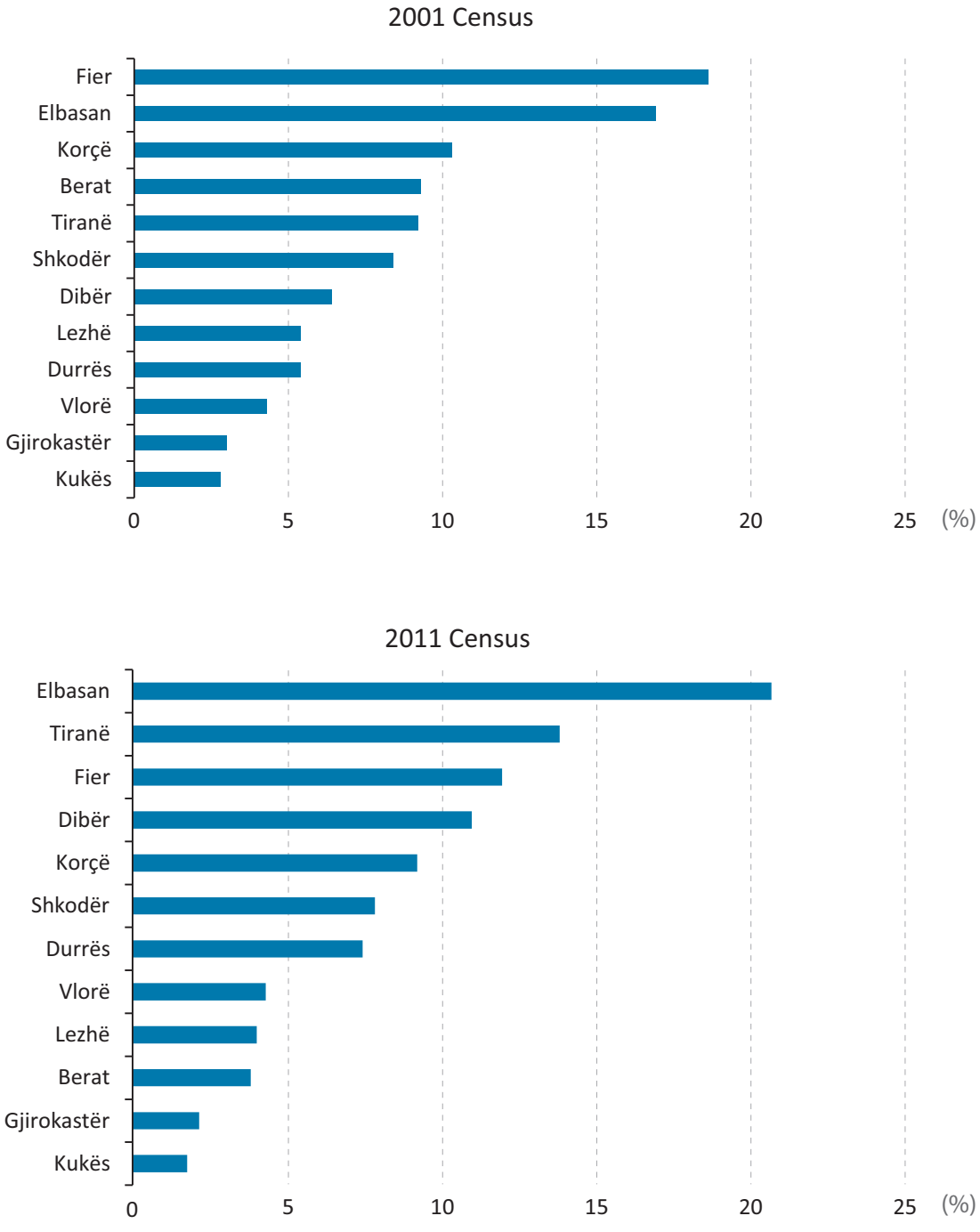
We will now give a look at the demographic and socio-economic profile of the groups which, in a strict sense, cannot be considered commuters, to then focus on the subject of our study, i.e. inner work commuters. More precisely, paragraph 2.3 will be devoted to home-based workers, workers with no fixed place of work, and workers commuting abroad, while paragraph 2.4 will be focused on people with a fixed place of work outside home in Albania.

2.3 A quick glance at non-commuters

2.3.1 Working at home

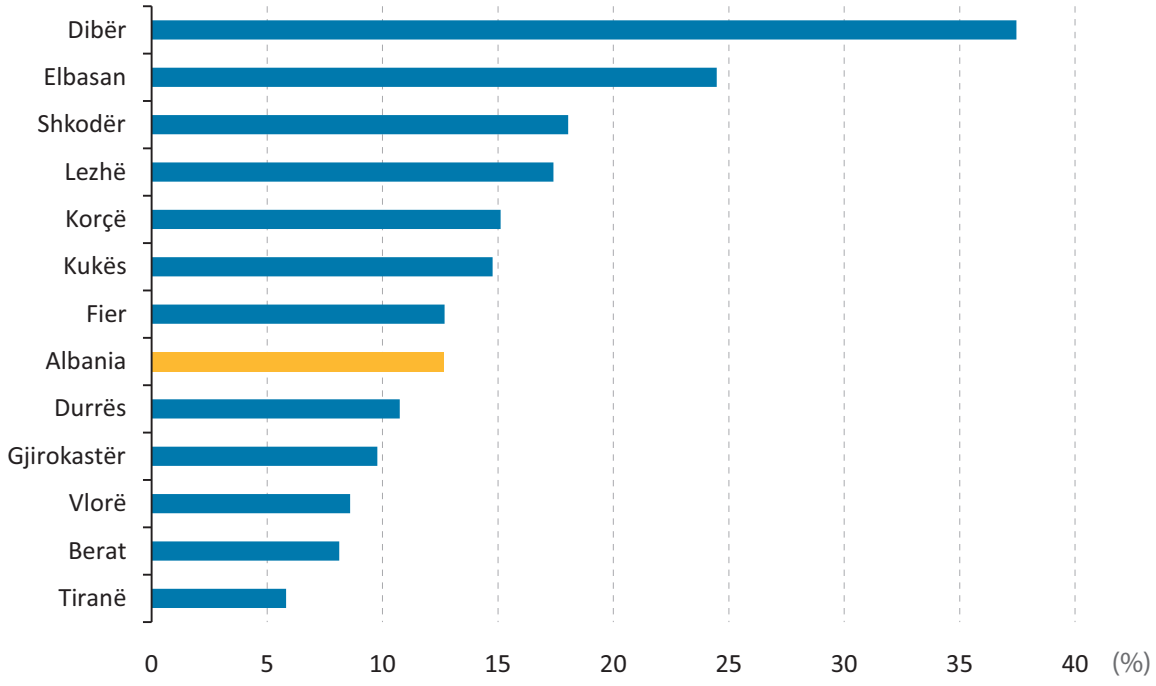
Home-based workers are about 86 thousands, accounting for 13% of the total employed population. One in every five of them lives (and works) in the prefecture of Elbasan (21.1%), and especially in the district of Elbasan (almost 60% of the whole prefecture, equal to 12.4% of the total home-based workers in Albania). After Elbasan we find the prefectures of Tirana, Dibër and Fier, with respectively 14.1%, 12.2% and 11.2% of the total home-based workers. We observe some differences in the territorial distribution with respect to 2001, when 18.6% of the home-based workers lived in Fier, 16.9% in Elbasan and 10.3% in Korçë, followed by Berat, Tirana and Shkodër (figure 6).

Figure 6: Home-based workers in the 2001 and 2011 censuses by prefecture



The distribution of home-based workers by prefecture is affected not only by the socio-economic profile of Albanian territory (e.g. by the more or less agricultural vocation of each prefecture), but also by prefectures' demographic size (hence, the role played by Tirana in every territorial distribution). If instead we look at the percentage of home-based workers on the total employed population of each prefecture (figure 7), we notice that the highest proportion is recorded in the prefecture of Dibër, where home-based workers constitute more than one-third of the total employed persons, while the lowest is observed in Tirana (5.8%). Furthermore, we see that the prefectures of Elbasan, Shkodër, Lezhë, Korçë, Kukës all have a higher value compared to the Albanian average one (12.7%); while only Durrës, Gjirokastër, Vlorë, Berat and Fier (besides the already mentioned prefecture of Tirana) have a lower proportion (and Fier has just the same as the average value).

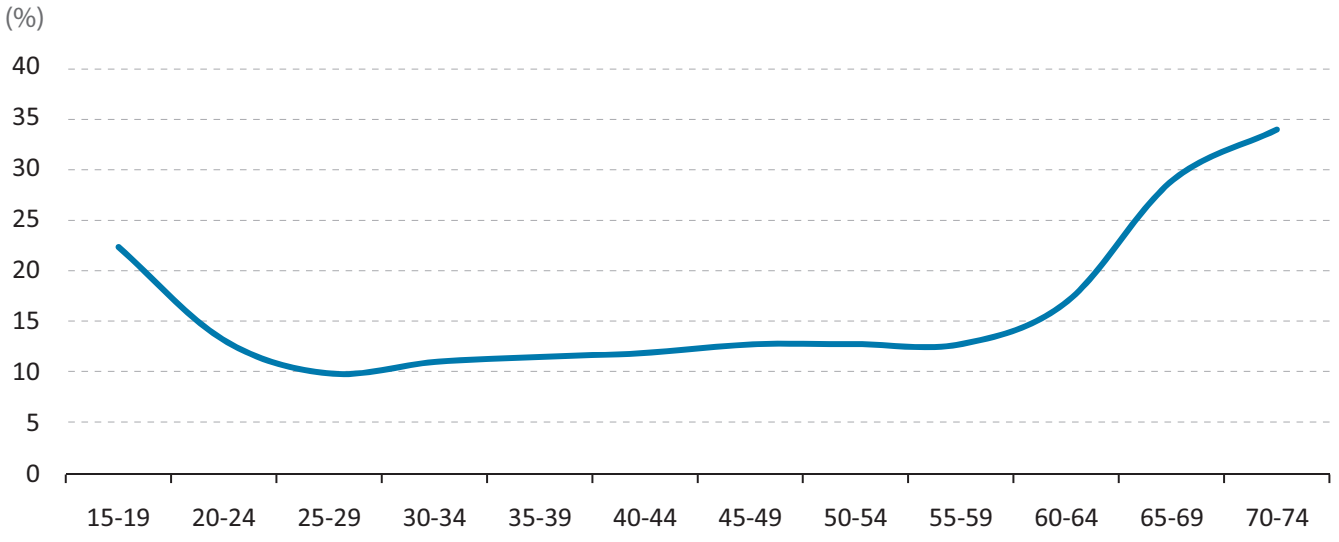
Figure 7: Percentage of home-based workers on employed population by prefecture



The demographic profile of home-based workers is similar to the average of the employed population as to gender and marital status and just a bit older for what regards age: 62.1% are males, mostly married (81.8%), 40.3% are between 40 and 54 years of age (with 9.2% of individuals aged 60 years or more versus the 5.9% of the employed population as a whole; while 28.1% is aged 25-34 versus the 32.9% of the employed population as a whole).

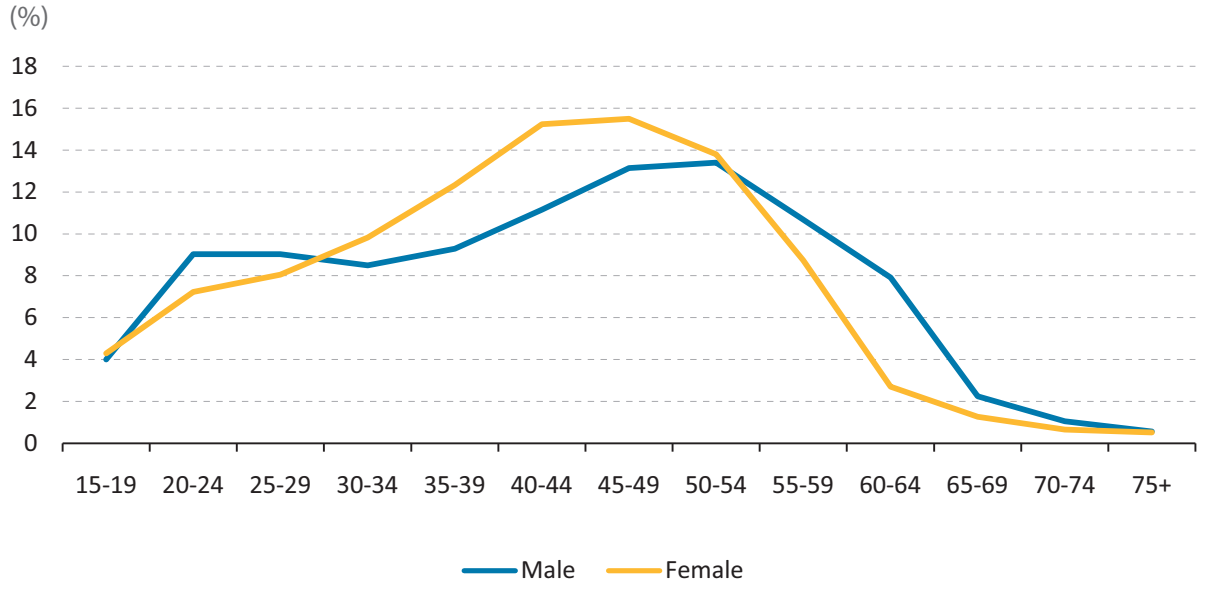
If instead we look at the percentage of home-based workers on the total employed population of each age-group (figure 8), we notice that the presence of home-based workers is much higher in the oldest age classes than in the total employed population. Indeed, the highest proportions of home-base workers are recorded among workers aged 65 and over (home-based workers are 33.8% of employed persons aged 70-74, 28.7% of those aged 65-69). We also notice that more than one fifth of employed persons aged 15-19 are home-based workers.

Figure 8: Percentage of home-based workers on employed persons by age-groups



Quite a distinct age profile may be observed for male and female home-based workers (figure 9), with a higher presence of men in the youngest age classes, an opposite higher presence of women from the age of 30 up to 60, and again a higher presence of men in the oldest age classes.

Figure 9: Home-based workers by gender and age-groups



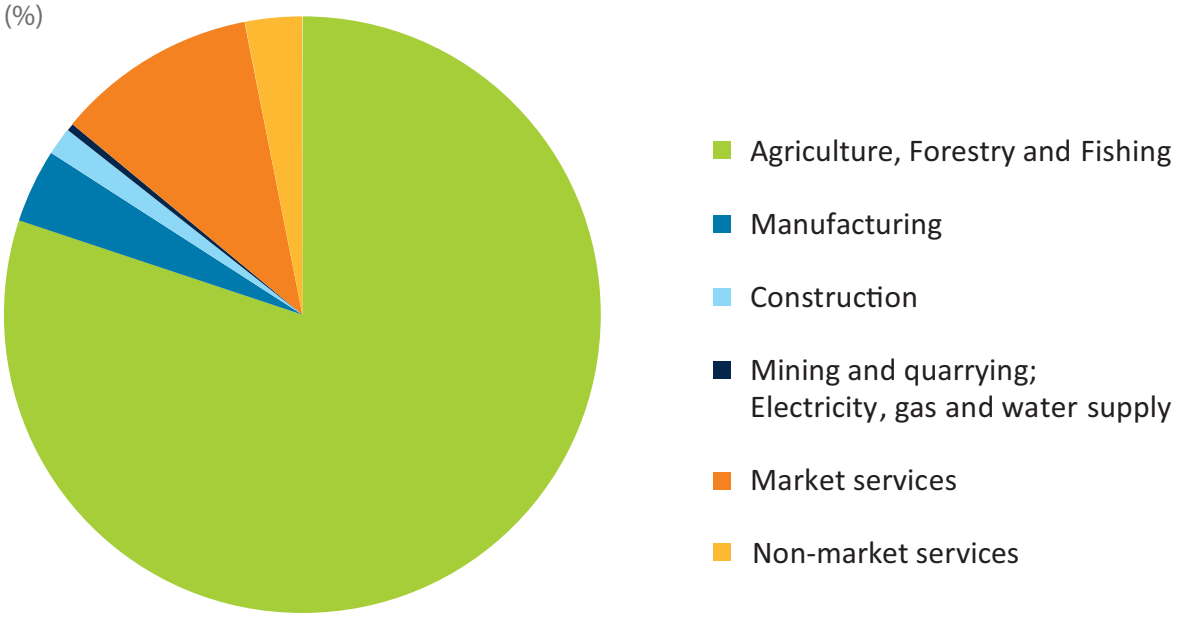
A big difference may be noticed between the home-based workers subgroup and the employed population considered as a whole with regard to the urban/rural distribution. Indeed, it is worth recalling that 80.3% of home-based workers live in rural areas, while this share among the overall employed population is only 57.3%.

This vast majority of rural dwellers among home-based workers is in line with the proportion of agricultural home-based workers, who amount to 80.2% of the total (figure 10), thus confirming home working in Albania as essentially a rural phenomenon. Again, the highest percentage is observed in Elbasan district, where 13.8% of the total agricultural workers live and work. These data confirm the agricultural vocation of the district of Elbasan, which will be further highlighted later on.

The remaining part of home-based workers is mainly service workers and especially workers of the market services sectors (accommodation and food services, business and administrative services, trade and transportation). A small percentage is made up of manufacturer workers (4%).

Figure 10: Home-based workers by industry

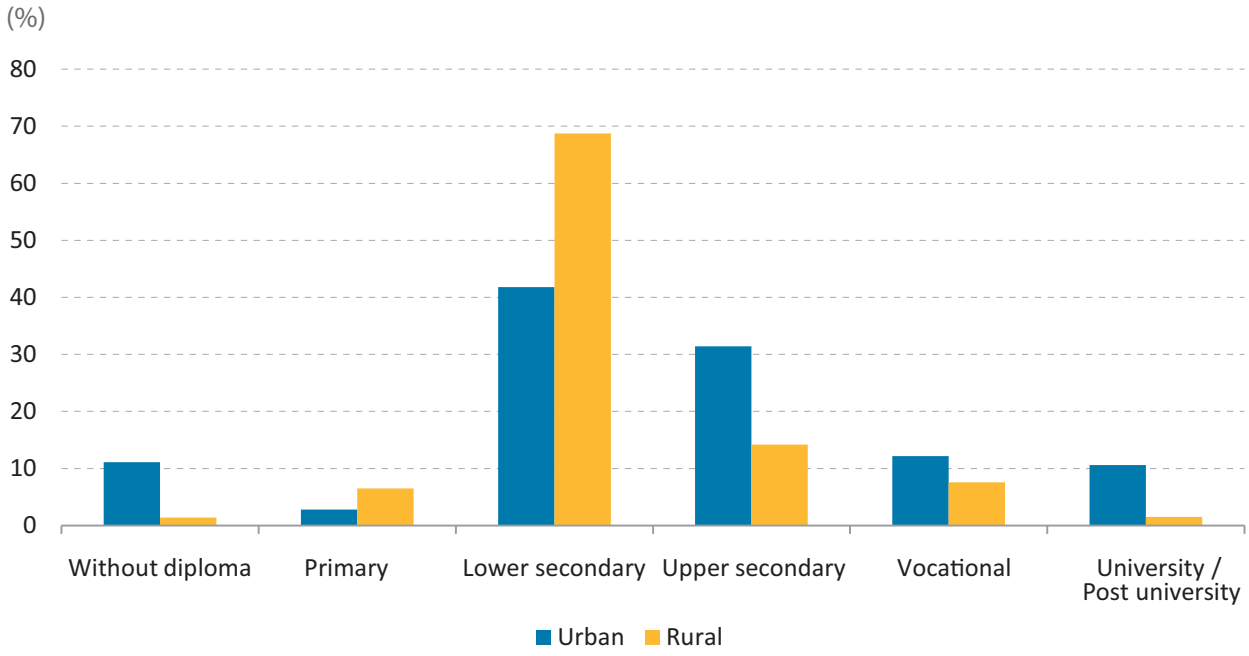
(%)



As to the level of education, we record quite big differences in comparison to the educational profile of the employed population as a whole. Namely, among home-based workers we register the highest percentages of people not having attended school or without any school certificate (1.3% against the 0.8% of the total employed population) and of people with primary education (5.8% against the 2.5% of the employed population as a whole); while almost two-thirds of them have a lower secondary diploma (63.4%, not far from doubling the 35.6% of the total employed population) and more than one-fourth have an upper secondary diploma (in this case, it is similar to the total employed population – 26.2% versus 25.9%).

Though the large majority of home-based workers live in rural areas, it is worth noting that the share of lower secondary graduates drops down to 41.8% and that of upper secondary graduates rises to 31.4% for home-based workers living in urban areas (with an additional 10.6% of university or post university graduates). On the contrary, the proportion of lower secondary school graduates, among home-based workers living in rural areas, increases and that of upper secondary school graduates decreases becoming respectively 68.7% and 14.3% (figure 11).

Figure 11: Home-based workers by level of education and urban/rural area

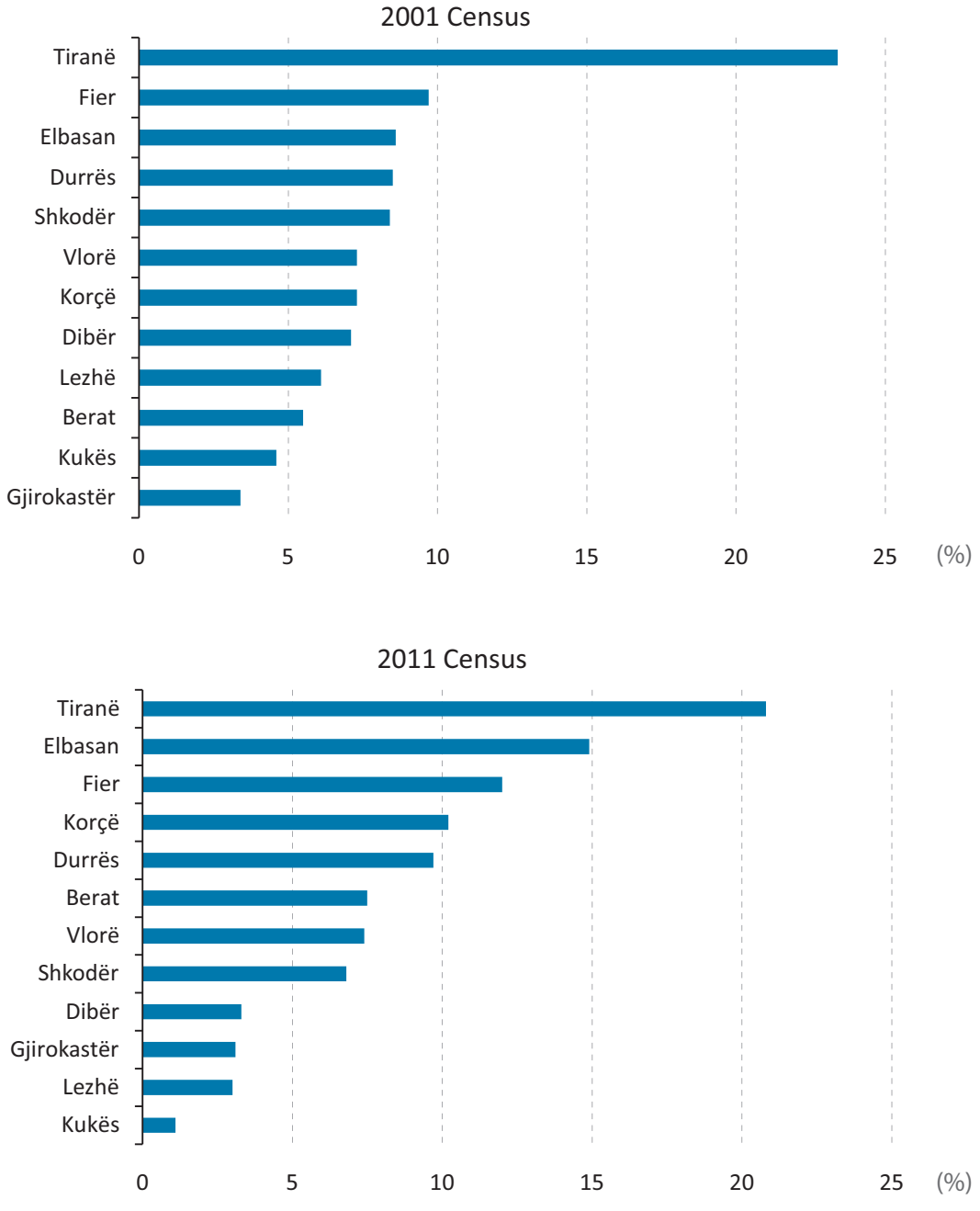


2.3.2 Having no fixed place of work

Workers with no fixed place of work are about 78 thousands and they account for 11.9% of the total employed population. The prefecture of Tirana comprises 20.8% of them (mostly in the district of Tirana – 71.4%, accounting for 5% of the total workers with no fixed place of work), followed by Elbasan (14.9%), Fier (12%) and Korçë (10.2%).

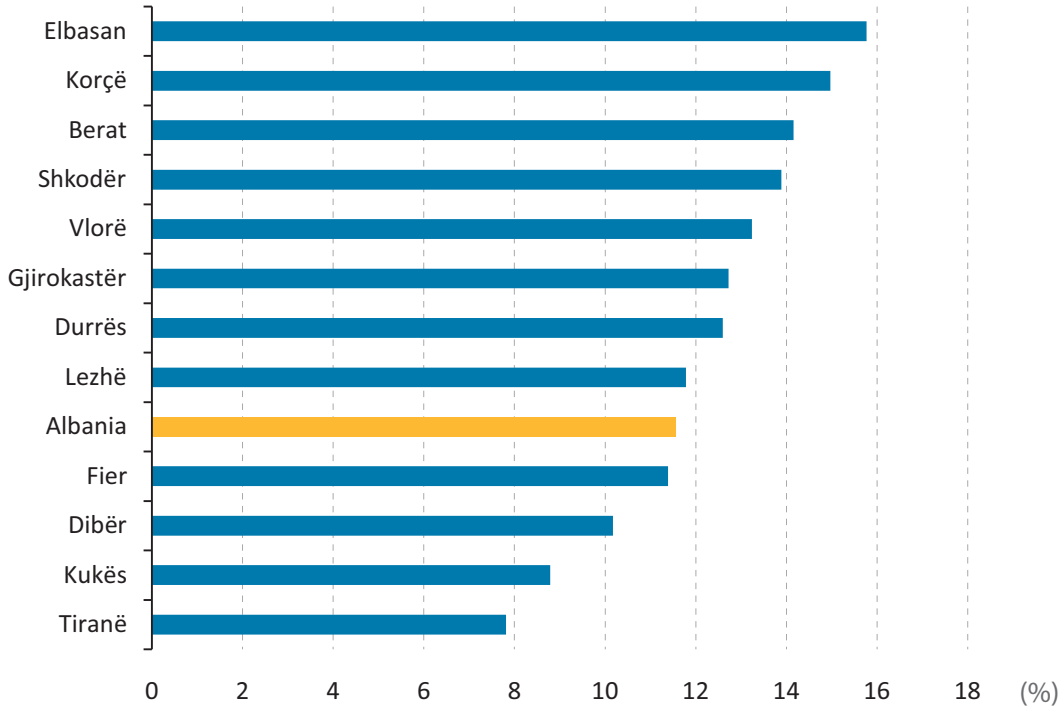
They appear more distributed than in 2001 (figure 12), when the district of Tirana had an even larger share (23.4%), followed at quite a distance by Fier (9.7%), Elbasan (8.6%), Durrës (8.5%) and Shkodër (8.4%).

Figure 12: Employed persons with no fixed place of work in the 2001 and 2011 censuses by prefecture



On the other hand, if we look at the proportion of workers with no fixed place of work on the total employed population of each prefecture (figure 13), we observe that the maximum weight of this component is recorded in the prefecture of Elbasan (15.8%), while the average country value is 11.6% and Tirana is again (as observed for home-based workers) at the bottom of the ranking, with just 7.8% of workers with no fixed place of work on the total employed population. The other prefectures where the proportion of workers with no fixed place of work is higher than the country average are Korçë, Berat, Shkodër, Vlorë, Gjirokastër, Durrës and Lezhë. Finally, we notice that some of them (Elbasan, Shkodër, Lezhë, Korçë) had recorded also a higher (than the country average) proportion of home-based workers.

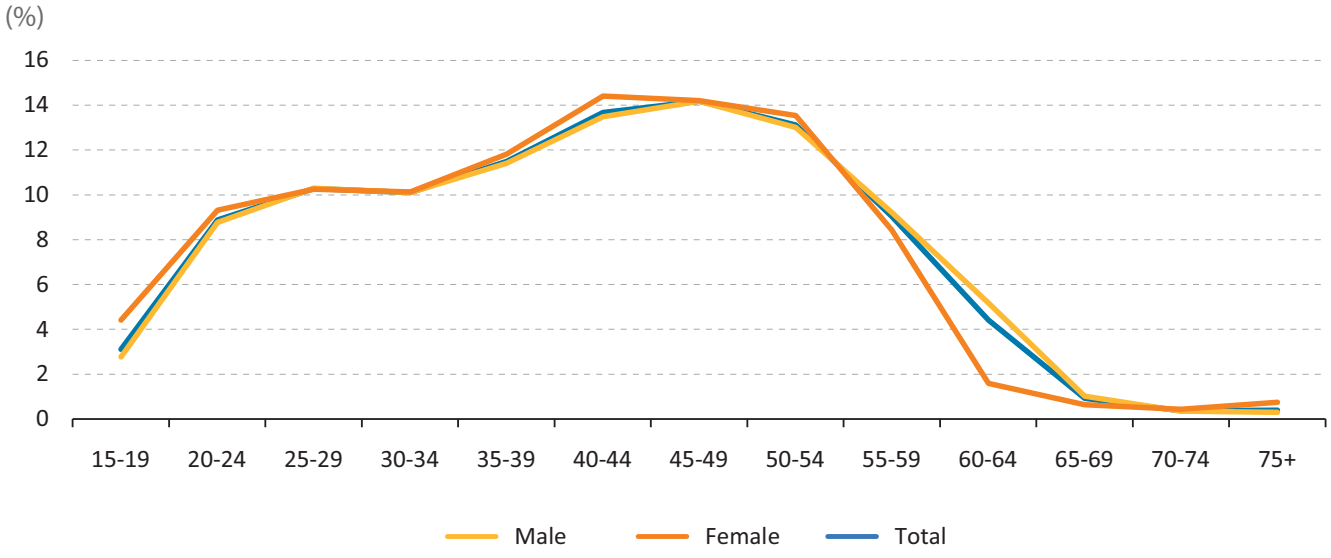
Figure 13: Percentage of workers with no fixed place of work on employed population by prefecture



In this group we observe a significantly higher percentage of males compared to the total employed population (78.7% versus 63.8% of the total employed population), while the profile by marital status (80.7% are married and 17.3% never married) is just the same as the average (79.3% of the total employed population as a whole are married and 18% never married).

As to the age distribution (figure 14), no differences are registered in comparison to the age profile of the overall employed population. In both cases, the modal class is 45-49 (which is also the modal class for both males and females). Some substantial differences may be noted between the males and females age profiles, concerning the youngest (< 24 years) and the oldest (55 and over), with respectively a higher and a lower percentage registered among women.

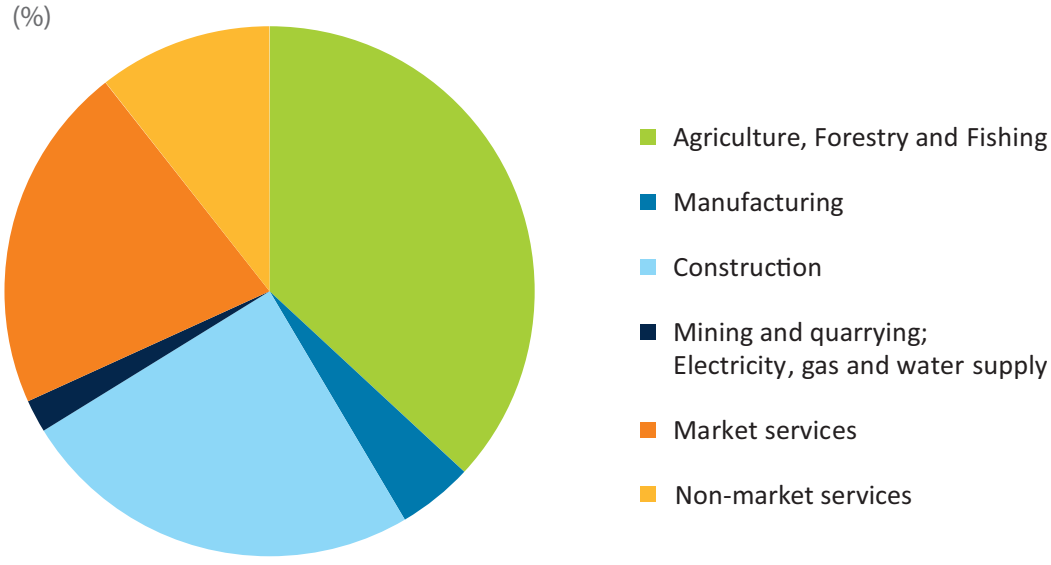
Figure 14: Employed persons with no fixed place of work by gender and age-groups



Looking at the distribution by branch of economic activity (figure 15), we get the idea of a more diverse group (compared to that of home-based workers), with a much smaller share of agriculture workers (36.9%) and a larger share of workers belonging to the services sector and especially to the market services (21.2%). An additional 24.7% is constituted by construction workers and, finally, a small percentage by manufacturer workers (4.6%).

The urban/rural distribution of the "no fixed place of work" group, among which the rural population (though still being the majority) accounts only for 61.5% of the total (versus the 80.3% of home-based workers), contributes to a better delineation of the image contours. Thus, the picture may be sketched of a mix of "mobile" and occasional workers: people working at different sites during the reference period, such as agriculture day labourers, construction workers, ambulant vendors and precarious service workers, as well as people whose work involves travelling to different areas and who do not report daily to a fixed address (e.g. travelling salesmen and truck/lorry drivers).

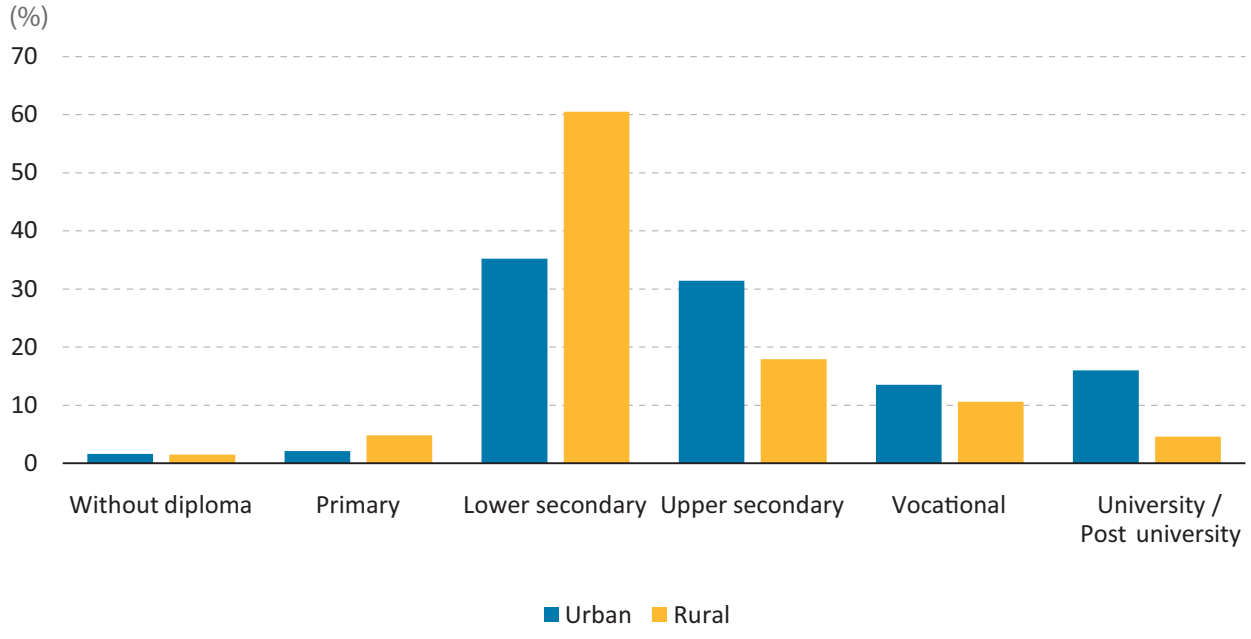
Figure 15: Employed persons with no fixed place of work by industry



The mixed characterization of this group is confirmed also by its educational profile. The overall education level is higher than that of home-based workers, though still much lower than that of the total employed persons. Namely, we notice an almost triple percentage of people with university or post-university compared to that of home-based workers (9% versus the 3.3% of home-based workers), a significantly lower share of people with lower secondary education (50.8%, versus the 63.4% of home-based workers), and a higher proportion of upper secondary school graduates (23.1% versus the 17.7% of home-based workers).

Looking at the breakdown by education level and urban/rural area (figure 16), in urban areas we observe, as expected, a much smaller share of lower secondary school graduates, an almost double share of upper secondary school graduates and an almost fourfold one of university/post-university graduates (respectively 35.2%, 31.4% and 16% versus 60.5%, 17.9% and 4.6%).

Figure 16: Employed persons with no fixed place of work by level of education and urban/rural area

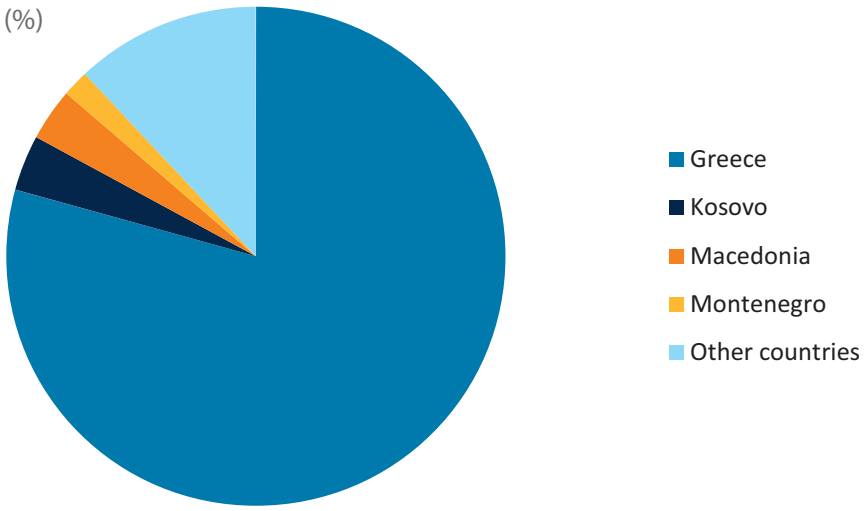


Three quarters of workers with no fixed place of work travel from home to work daily, while 21.8% of them travels 1-4 times a week, and the remaining 3% less than once a week. More than half of them go to work on foot (52.4%), while 17.6% drive a car, 11% catch a bus, and 6.1% travel as car passengers.

2.3.3 Commuting abroad: young-adult males going to Greece

As already mentioned, workers abroad constitute just 1% of the total employed population (6,546). Greece is the main country of destination, being the place of work for almost 80% of them, followed by Kosovo, Macedonia and Montenegro (figure 17).

Figure 17: Commuters abroad by country of destination



Their distribution by place of origin is quite dispersed (table 1), with 6.8% of commuters abroad residing in the municipality of Tirana, followed by Gostimë, Durrës, Kamëz (all of them with about 200 commuters abroad, each accounting for about 3% of the total abroad commuters). Though, the highest share of workers abroad coming from Tirana is obviously due to its share of employed persons (20.4% of the total Albania's employed persons). Instead, if we consider the proportion of workers abroad compared to the total employed population (table 1), the situation is very different, and the highest values are obviously recorded in municipalities close to the border, such as Pogon, where workers abroad constitute more than one third of the total employed population (33.8%), Dropull i Poshtëm, where a quarter of the employed persons work abroad, Trebisht, with almost one in every five employed persons working abroad (19.2%), followed by Kolsh (where the proportion of workers abroad is 14.3%), Dropull i Sipërm (13.9%), Klos (12.2%), Shalës (10.1%), Ostren (9.2%), Konispol (8.9%), Markat (8.5%), Ujëmisht (8.1%), Shushicë (8.1%).

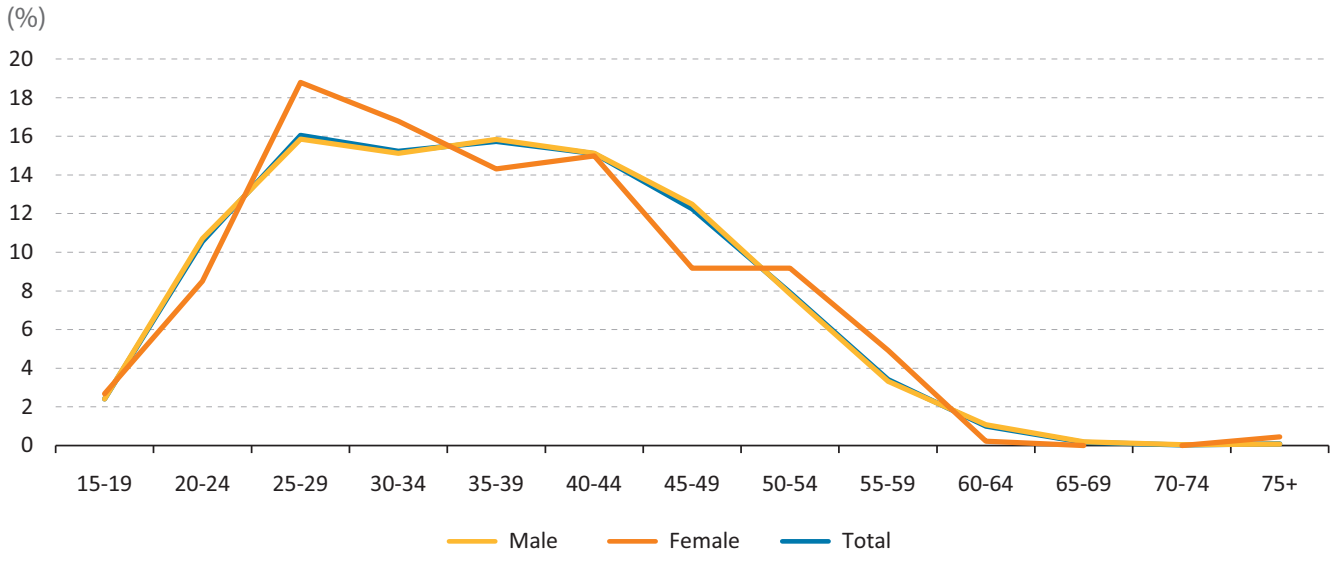
Table 1: Commuters abroad by municipality/commune and percentage on the total employed population. First ten municipalities/communes

Municipality / Commune	% on Albanian total commuters abroad	Municipality / Commune	% on total employed population
Tirana	6.8	Pogon	33.8
Gostimë	3.3	Dropull i Poshtëm	24.7
Durrës	3.1	Trebisht	19.2
Kamëz	3.0	Kolsh	14.3
Shushicë	2.8	Dropull i Sipërm	13.9
Maqellare	2.3	Klos	12.2
Elbasan	2.3	Shalës	10.1
Miras	2.1	Ostren	9.2
Klos	2.0	Konispol	8.9
Paskuqan	1.9	Markat	8.5

Commuters abroad are for the vast majority men (93.2%), and very young (the modal class is 25-29, accounting for 16.1% of the total). It is worth noting that they are also much younger than the overall employed population, with 44.3% of people aged below 30, three quarters aged below 44, and only 4.7% aged 55 and over (against respectively the 31.8%, 56.8% and 15.7% of employed persons considered as a whole). Even though women are just a slight share of this subgroup, their age profile is quite peculiar compared to that of men (figure 18).

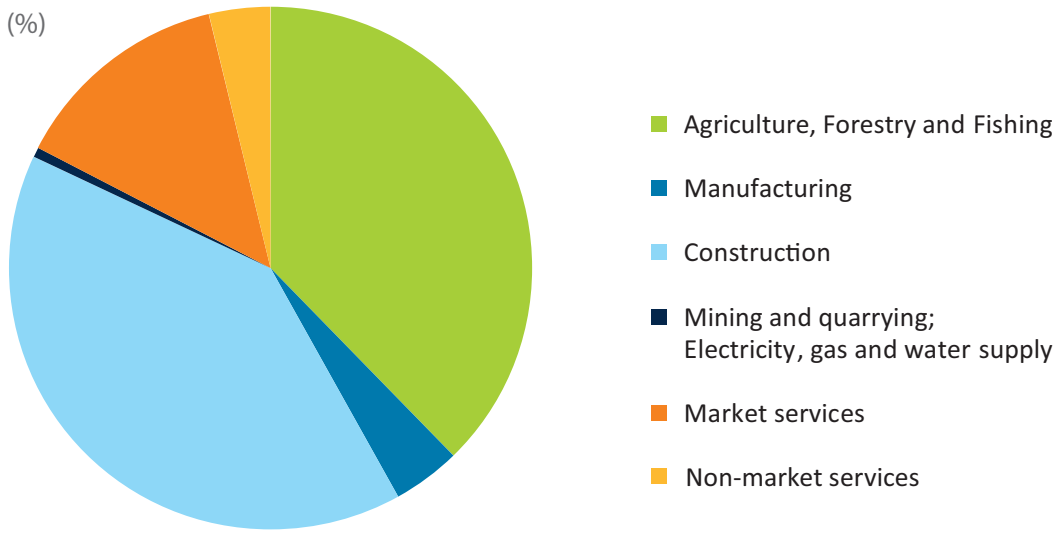
As for the marital status, in line with the age profile, commuters abroad register the highest percentage of never-married persons, quite higher than the proportion of never-married persons in the overall employed population (22.8% versus 18%).

Figure 18: Commuters abroad by gender and age-groups



As already mentioned, the vast majority of abroad commuters come from rural areas (90.6%). They are mainly construction (40.2%) and agriculture workers (37.7%). We also notice a small percentage of workers in the market services sector (13.6%).

Figure 19: Commuters abroad by industry



The overall education level is similar to that of home-based workers (therefore much lower than that of the total employed population). Namely, the majority of abroad commuters have a lower secondary school certificate (60.4%), while the proportion of upper secondary school graduates is equal to 23%; the share of those with vocational education is of 8.5% and the percentage of university/post-university graduates is 4.9%. Compared to the educational profile of the total employed population, we notice a much higher share of lower secondary school graduates and university and post-university graduates (respectively 60.4% and 4.9% versus the 35.6% and 23% of the overall employed population), while the proportions of people without a diploma and of people with primary education are in line (respectively 0.7% and 2.4% versus 0.8% and 2.5%).

Quite remarkably, half of the commuters who work across the border are daily commuters while the remaining half is divided almost equally between those who commute less than once a week (22.6%) and those who commute 1-4 times a week (21.2%). Cars are the main means of transport (a quarter of commuters abroad use the car as drivers and an additional 16.7% travel as passengers), followed by buses (18.2%).

2.4 Commuting from home to work

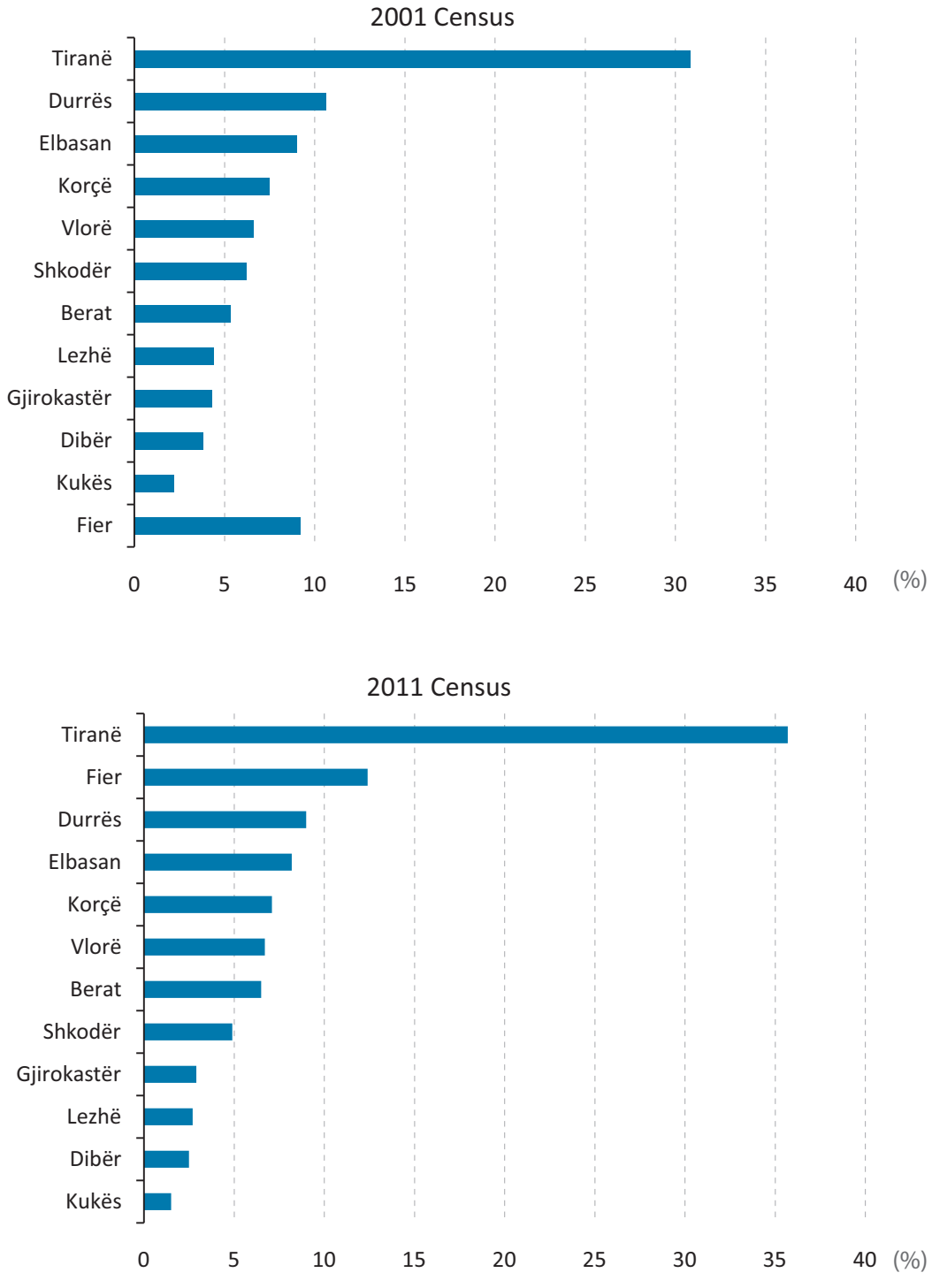
2.4.1 Inner work commuters and territory

Inner work commuters, i.e. employed with a fixed workplace outside home in Albania, are almost 490 thousands and, differently from 2001, they constitute the large majority of the employed population (74.1% versus 40.7%).

The majority of them live in urban areas (67.9%), in a higher proportion with regard to employed persons as a whole (57.3%) and different from all other subgroups (as we have seen, the proportion of people living in rural areas was equal to 80.3% among home-based workers, 61.5% among workers with no fixed place of work, and 69.7% among abroad commuters).

As expected on the basis of the distribution of employed persons by prefecture of usual residence (figure 20), inner work commuters live mainly in the prefectures of Tirana (35.7%), Fier (12.4%) and Durrës (9.0%). Compared to 2001, the share of Tirana has further increased, together with that of Fier, at the expenses of the other prefectures, with the exceptions of Berat, which has slightly increased its quota of Albanian inner work commuters and of Vlorë, which has maintained the same share as 2001.

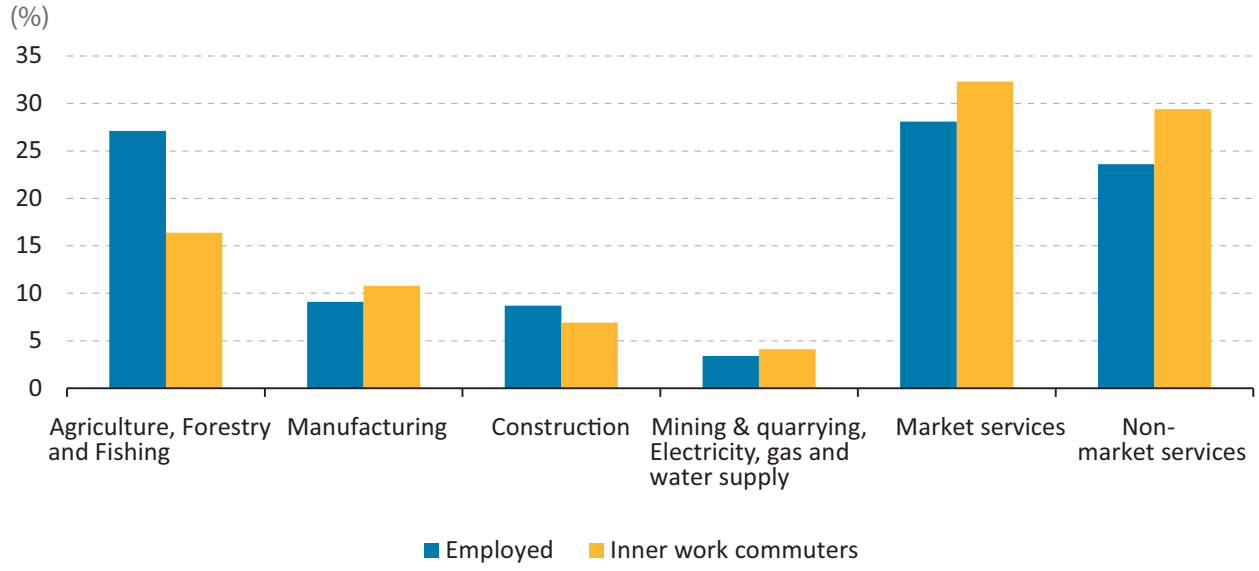
Figure 20: Inner work commuters by prefecture in the 2001 and 2011 censuses



Most probably, this relates to the urban characterization of inner work commuters, and to the role played among them by the workers in the services sector (figure 21). In fact, almost two thirds of them work in services (against the 51.7% of the overall employed population) while only 16.4% of inner work commuters are employed in agriculture (against the 27.1%

of the total employed population – as we have seen this proportion was instead as high as 80% among home-based workers). More precisely, almost a third of them work in market services (accommodation and food services, trade and so on) and another quite important share (30.4%) work in non-market services (public administration, community, social and other services and activities). Finally, the percentage of inner work commuters working in manufacturing is a bit higher than that recorded on employed population as a whole (10.8% versus 9.1%) while the percentage of construction workers is smaller (6.9% versus 8.7%).

Figure 21: Employed persons and inner work commuters by industry

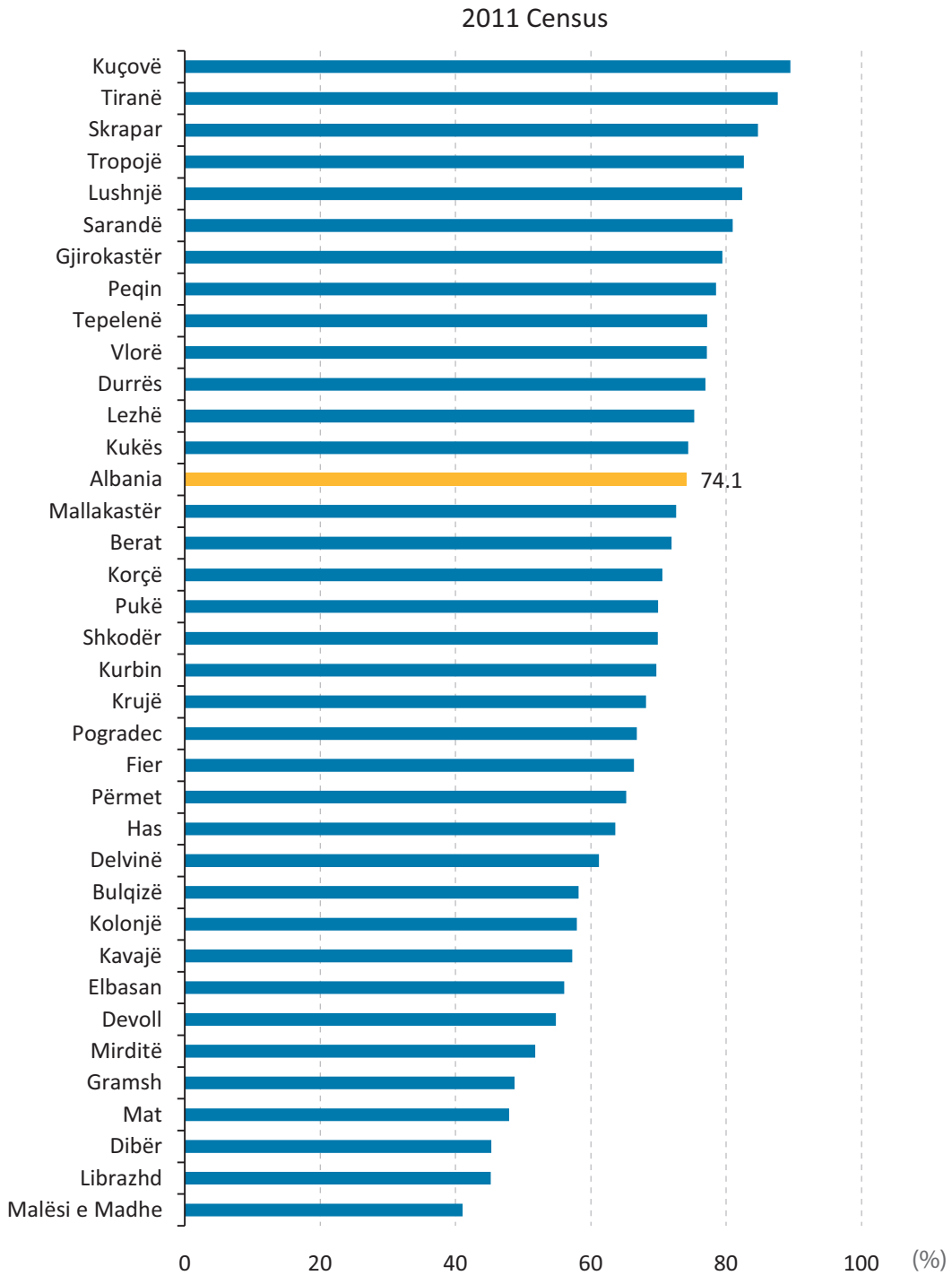


Going back to the territorial distribution and further down the geographical scale, more than one third of inner work commuters live in the district of Tirana (34%), where indeed 28.5% of the total employed population of Albania reside, followed at quite a distance by Durrës (7.2%), Lushnjë (6.7%), Elbasan (5%), Vlorë (4.8%), Fier (4.7%), Korçë (4.5%), Shkodër and Berat (both with 4.1%).

As obvious, the distribution of inner work commuters by district is related to the district proportion of employed persons (since inner work commuters constitute the large majority of employed persons), as well as to the economic vocation of each district. Though, if we look at the percentage of inner work commuters on the total employed population (figure 22), we find a quite different ranking, with the district of Kuçovë (89.5%) in the first place, followed by Tirana (87.6%), Skrapar (84.7%), Tropojë (82.6%), Lushnje (82.3%), Sarandë (81%), Gjirokastër (79.4%), Peqin (78.5%), Tepelenë and Vlorë (both with 77.2%), Lezhë (75.3%), and Kukës (74.4%), all above the Albanian average value of 74.1%. At the other end of the distribution we find, with values well below the average value, and all less than half of the total employed population:

- the district of Malësi e Madhe (41.1%) where, instead, both the proportion of home-based workers is much higher than the country mean (41% versus 13%) and the proportion of employed persons with no fixed place of work is 18.3% compared to the Albanian average value of 11.9%;
- the district of Librazhd, where inner work commuters constitute 45.2% of the total employed population (home-based workers and workers with no fixed place of work being respectively 33.6% and 18.9%);
- the district of Dibër (with 45.3% of inner commuters and 40.2% of home-based workers);
- the district of Mat (with 47.9% of inner commuters and 41.8% of home-based workers);
- the district of Gramsh (with 48.7% of inner commuters, 28.7% of home-based workers and 21.1% of workers with no fixed place of work).

Figure 22: Percentage of inner work commuters on employed population by district



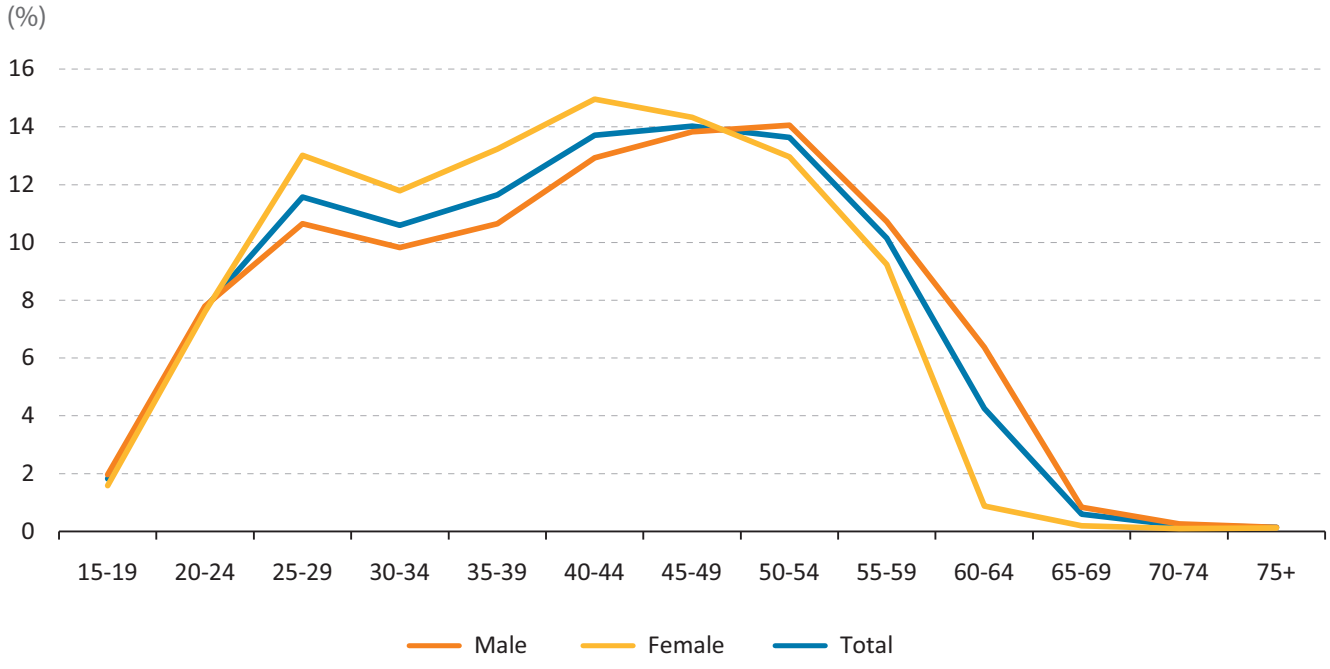
These data contribute to outline the distinction between districts with a strong agricultural vocation and districts with a more urban socio-economic character.

2.4.2 Socio-demographic profile of inner work commuters

The profiles by age and marital status of inner work commuters are just about the same as the average value of employed persons as a whole, as expected given that inner work commuters constitute the large majority of the employed population. As to the marital status, 78.8% of inner work commuters are married and 18.2% have never married. As to the age, we notice that the modal class is the class of people aged 45-49 years, which accounts for 14% of the total, while more than a third of inner work commuters are between 30 and 44 years of age, 21.1% are less than 30 years old, and 15.3% are aged 55 and over.

Some differences may be noted in the age profile by gender (figure 23), with higher percentages in the age class of 30-44 among women and higher percentages in the age range of 55 and over among men.

Figure 23: Inner work commuters by gender and age-groups



As to the distribution by level of education, inner work commuters are on average much more educated than the other groups of employed persons. Namely, among them we record an almost equal share of lower secondary school graduates and upper secondary school graduates (respectively 27.4% and 27.9%), and an even higher percentage of university or post-university graduates, which is also the highest of the four groups (29.4% against the 23% of the overall employed population). This higher education profile is related on the one hand to the quite high presence of women (who constitute almost 40% of this group) and on the other hand to the urban connotation of inner work commuters. As we can see (figures 24 and 25), the percentage of university graduates is equal to 39.3% among women (and only to 23.2% among men), while men record higher percentages of lower secondary, upper secondary and vocational education; and it is almost triple among inner work commuters living in urban areas (36.7% against 14.1%), with almost the same share of people having completed vocational studies and a much higher proportion of lower secondary school graduates in rural areas (47.4% against 18%).

Figure 24: Inner work commuters by gender and level of education

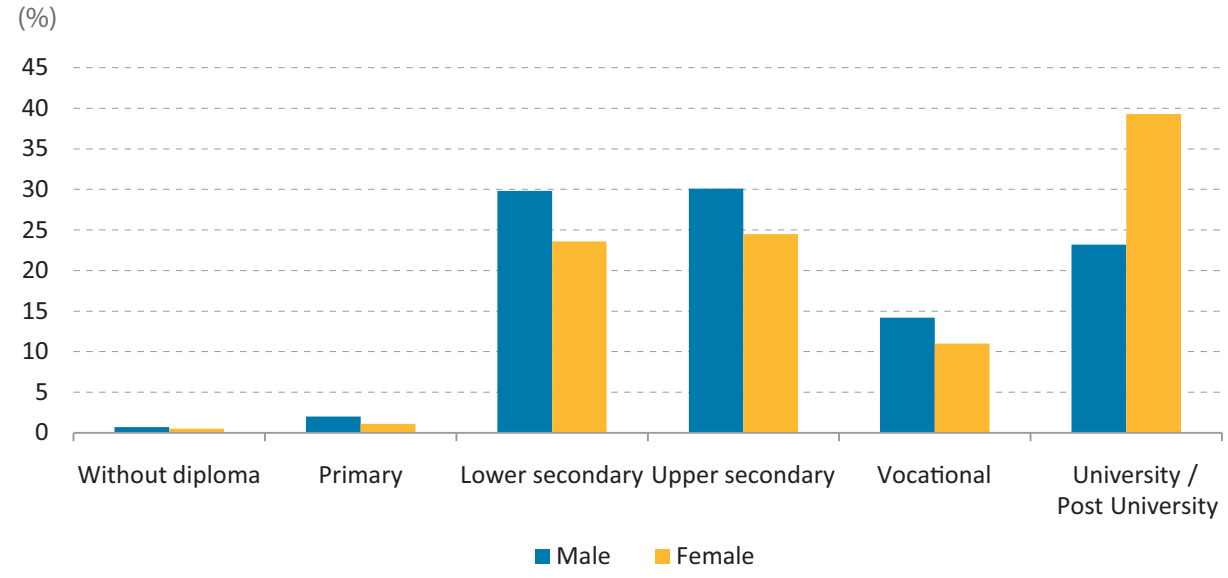
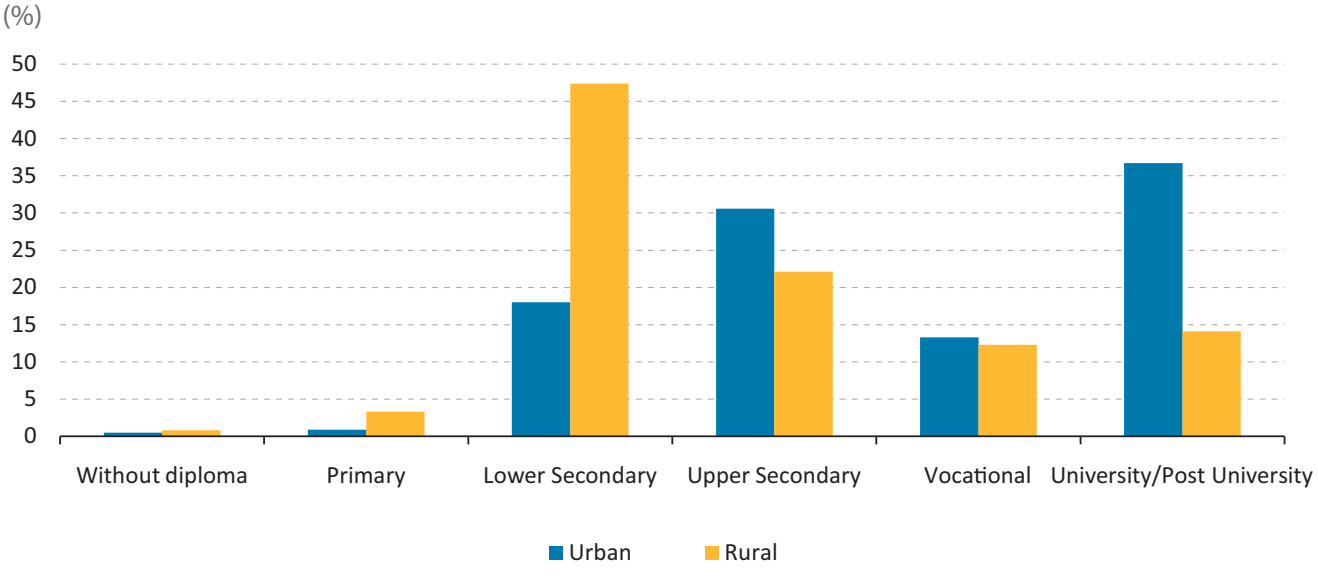


Figure 25: Inner work commuters by urban/rural area and level of education



Coming back to the profile by industry, we have seen that the majority of inner work commuters are services workers. Again, there is quite a difference between male and female profiles (figure 26), with an almost double percentage of women working in non-market services, such as public administration (40.7% versus 22.3%), more than a third of men working in market services (versus 28.8% of women), and significant differences in all other sectors (construction, mining, agriculture, with a higher male presence; manufacturing, with a higher female presence). At the same time, as expected, a significant difference can be noted between the urban and rural profiles by industry (figure 27), with 44.3% of inner work commuters living in rural areas and working in agriculture (against the 3.2%) and 37.9% of them working in the services sector (against the almost three quarters of commuters living in urban areas).

Figure 26: Inner work commuters by gender and industry

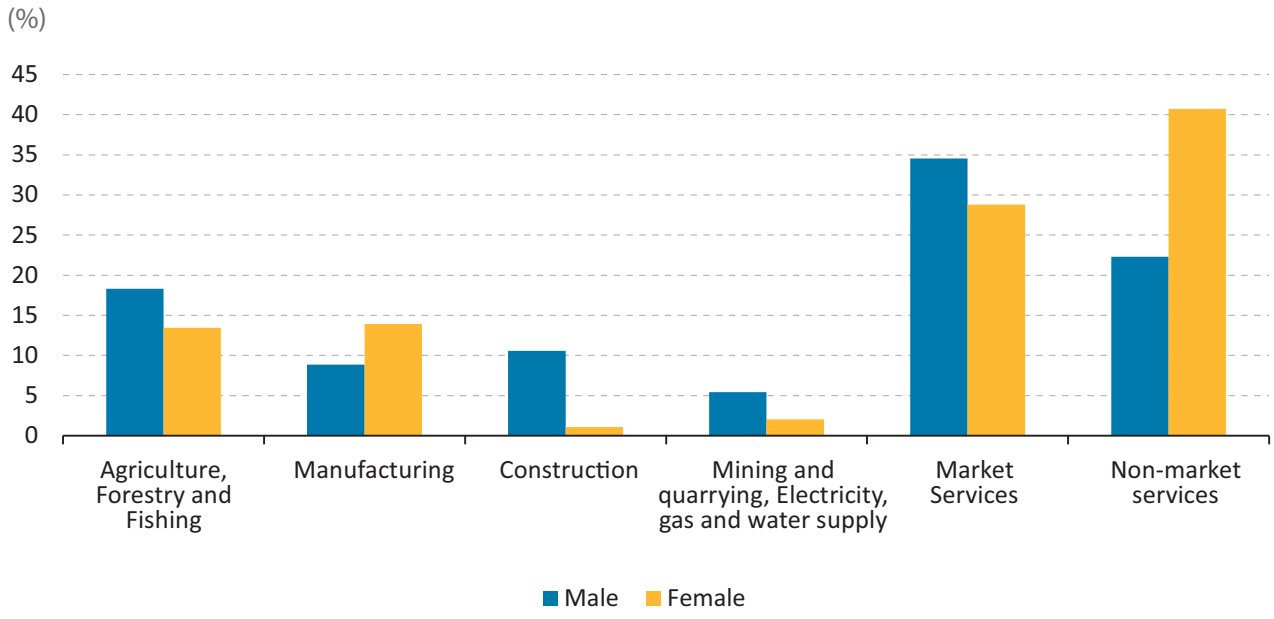
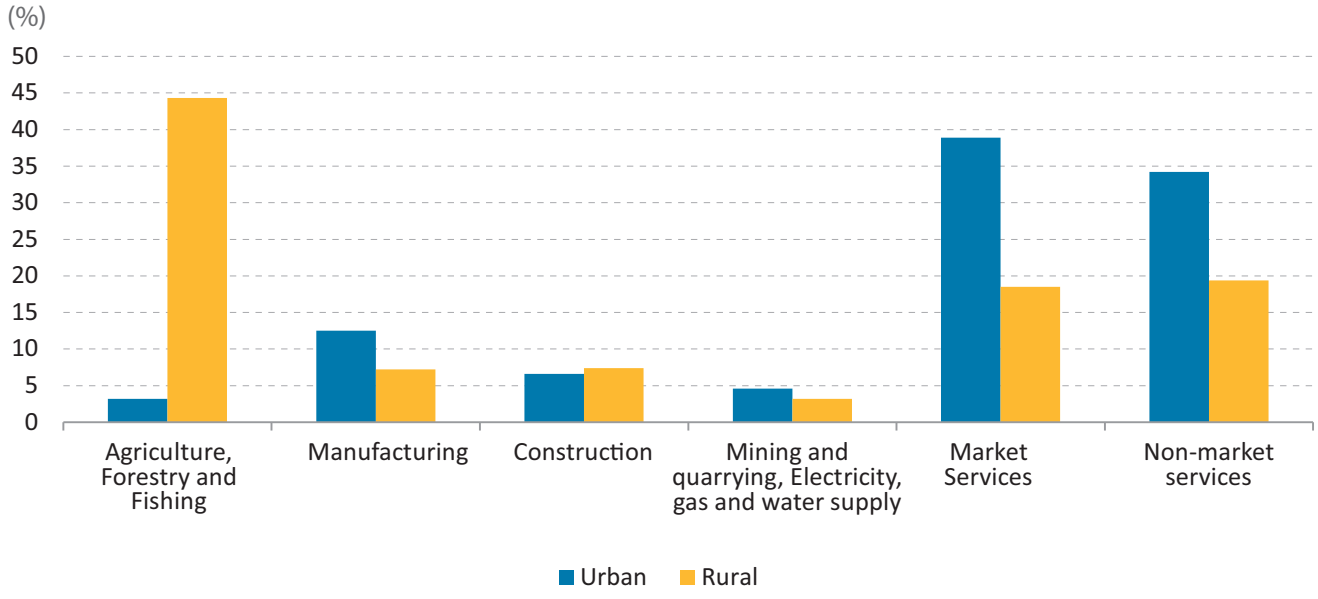


Figure 27: Inner work commuters by urban/rural area and industry



Finally, it is interesting to give a look at the distribution of inner work commuters by status in employment (figure 28).

As we can see, 60% of men work as employees and 28.6% are self-employed without employees, while 73% of women are employees and only 19% of them are self-employed (respectively 16.3% without employees and 2.7% with employees).

The vast majority of university graduates work as employees (87.6%) as well as approximately two thirds of people with upper secondary and vocational education (respectively 66.5% and 63.5%). The highest percentages of the category of self-employed with employees, though still low, are registered among upper secondary school graduates and vocational education graduates (5.5% and 6.8% respectively); while among people who have completed primary education, 50% are self-employed without employees (among university graduates this percentage is only 6.2%). Finally, the highest share of contributing family workers is to be found among people with a primary school certificate and people with lower secondary education (14.6% and 13.1% respectively) whilst the lowest is recorded among university/post-university graduates (1.2%).

Figure 28: Inner work commuters by gender and status in employment

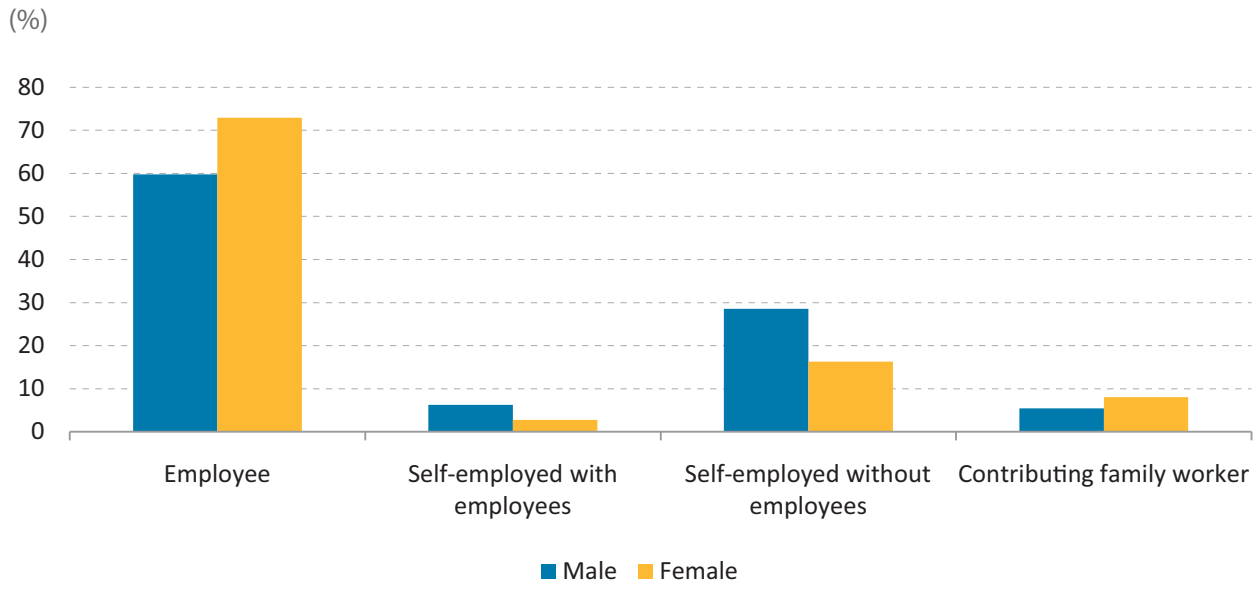
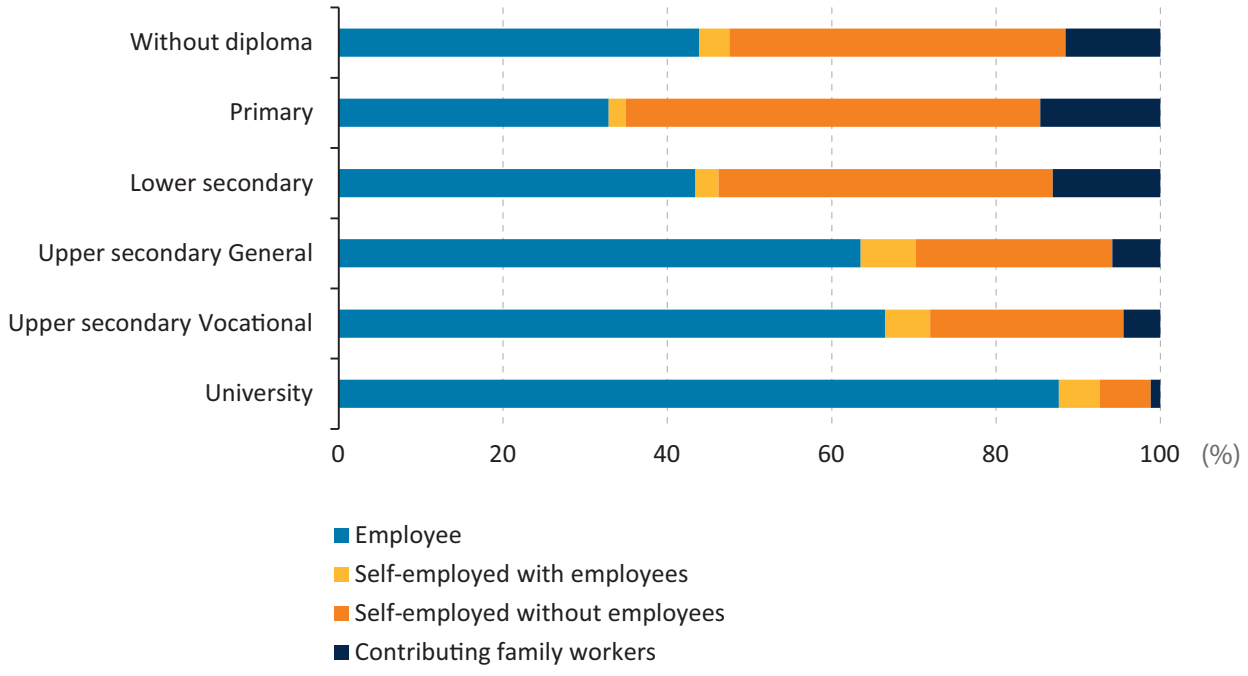


Figure 29: Inner work commuters by level of education and status in employment



2.4.3 Frequency of travelling from home to work and mode of transport to work

As already mentioned, the frequency of travelling and mode of transport to work are variables of primary importance when analysing commuting flows, both for planning transport networks and urban development.

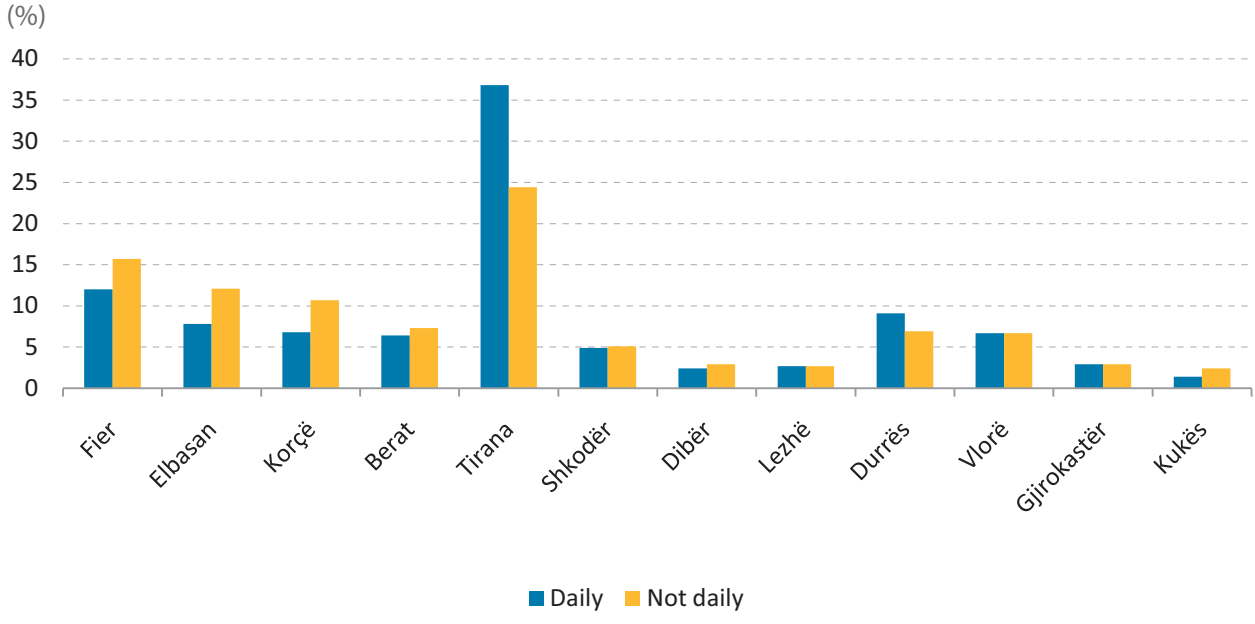
As to the frequency of travelling, the three answering categories to the question "How frequently do you travel from your usual residence to your place of work?" (daily; 1-4 times a week; less than once a week)[7], help us distinguish between daily commuters and periodic (not daily) commuters.

The vast majority (91.2%) of inner commuters are made up of daily commuters; while periodic commuting consists mainly of people travelling 1-4 times a week (7.9%) and only 0.9% travel to work less than once a week. With reference to 2001, we observe a slight decrease of daily work commuters (who constituted 93.4% of the total work commuters) while people travelling at least weekly and those travelling less than once a week have almost disappeared (in 2001 these two proportions were respectively 4.4% and 2.2%).

If we cross-tabulate the frequency of travel by the prefecture of residence (figure 30), we observe that (as expected) more than a third of the total daily commuters come from the prefecture of Tirana (36.8%), followed by daily commuters coming from Fier (12%) and Durrës (9.1%), while for the non-daily commuters (considering together "weekly commuters" and "less than weekly commuters"), at the top of the ranking we find again Tirana with about a quarter of the total (24.4%), followed by the prefectures of Fier (15.7%) and Elbasan (12.1%).

From the reverse point of view, i.e. if we look at the percentage of daily or not daily commuters on the total number of inner work commuters of each prefecture, we can see that Tirana and Kukës are the prefectures with respectively the highest and the lowest share of daily commuters (94% versus 85.9%); that the same prefectures, but in the reverse order, are the prefectures with respectively the lowest and the highest share of weekly commuters (5.3% versus 13.1%); and that Dibër is the prefecture with the highest proportion of commuters who travel less-than-once-a-week (1.3%) while Berat, Elbasan and Tirana are at the opposite side of the ranking (all of them with 0.7%).

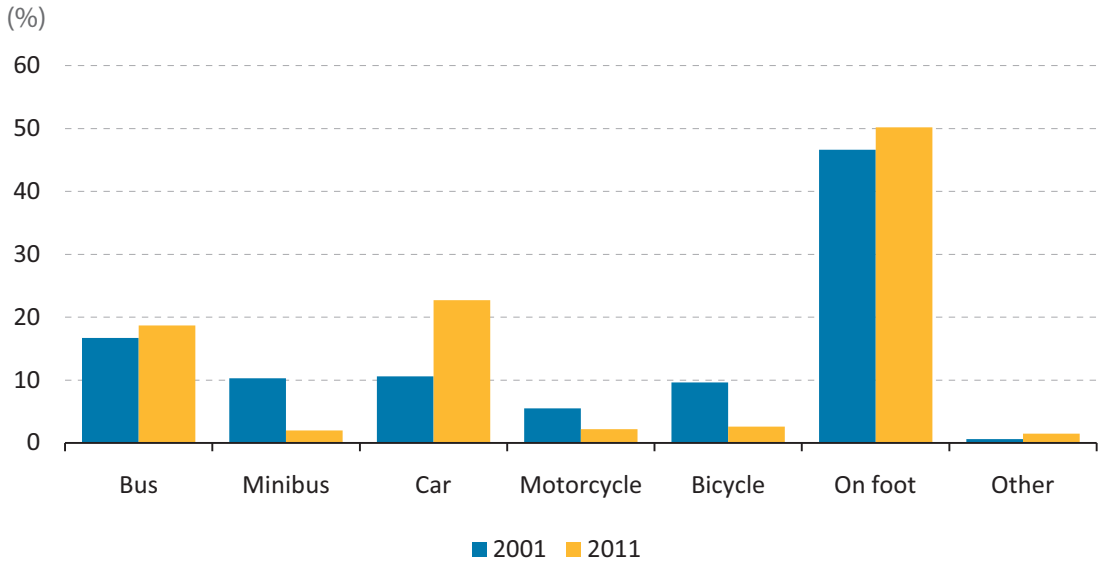
Figure 30: Inner work commuters by frequency of travel to work and prefecture of usual residence



7 The question relates to the frequency of travel to the place of work where the person has spent most of the working time during the week before the census (or in a typical week for a person not working during the reference week).

As regards the distribution by mode of transport to work, compared to the total of inner commuters, we observe that: half of them walk to work (50.2%), more than a fifth of them use a car (22.7%) – either as a driver (16.8%) or as a passenger (5.9%), 18.7% use the bus, while all the percentages of other means are quite low. Compared to 2001 (figure 31), we observe a small decrease of people going to work on foot, by bicycle and by motorcycle (in 2001 respectively 46.6%, 5.5% and 9.6%) and a large increase in the number of people travelling by car or bus (in 2001 respectively 22.7% and 18.7%).

Figure 31: Inner work commuters in the 2001 and 2011 censuses by means of transport to work



As expected, the means of transport to work differ considerably according to the urban/rural character of the place of usual residence[8]. In rural areas we record (table 2) a higher percentage of people going from home to work on foot (though even among people living in urban areas this share is quite high), and an almost double share of people using a motorcycle, besides, of course, a higher percentage of workers going to work by typically rural means of transport (animal/tractor).

Table 2: Inner work commuters by urban/rural area of usual residence and means of transport to work (%)

Means of transport	Urban	Rural
On foot	46.9	57.3
Bus	21.3	13.2
Motorcycle	1.5	3.6
Car	24.8	18.3
Bicycle	3.1	1.7
Minibus	2.0	2.1
Animal/Tractor	0.2	3.6
Other	0.2	0.3
Total	100	100

8 As we can imagine, the distribution by means of transport is influenced both by the distance between home and work and by the existing infrastructures (roads and public transportation networks). For example, such a low percentage of Albanian commuters traveling to work by train is clearly related to the poorly developed railway network. Under equal conditions, individual preferences are certainly another factor that contributes to the choice of the means of transport.

Quite interesting is the breakdown by mode of transport and prefecture of usual residence (table 4). Indeed, we can see that:

- Tirana has the lion's share of bus users (61.7%), and it has more than a quarter of commuters going to work by minibus (followed by Durrës with 17.1%) and more than 30% of commuters going to work by other means of transport (such as train and taxi);
- more than 40% of those who go to work by animal/tractor live in the prefecture of Kor]ë, while a fifth of them live in the prefecture of Fier, followed by Berat (8.8%), Vlorë (6.8%), Gjirokastër (6.5%) and Elbasan (6.3%);
- almost a quarter of those who go to work on foot reside in the prefecture of Tirana, followed by Fier (16.3%), Elbasan (10.3%) and Berat (9.2%);
- more than 40% of commuters going to work by car reside in Tirana, followed by Durrës (10%), Fier (8.4%) and Vlorë (8.2%);
- and finally, 38% of bicycle users live in the prefecture of Shkodër and another quarter live in Tirana.

Table 3: Inner work commuters by mode of transport and prefecture of usual residence (%)

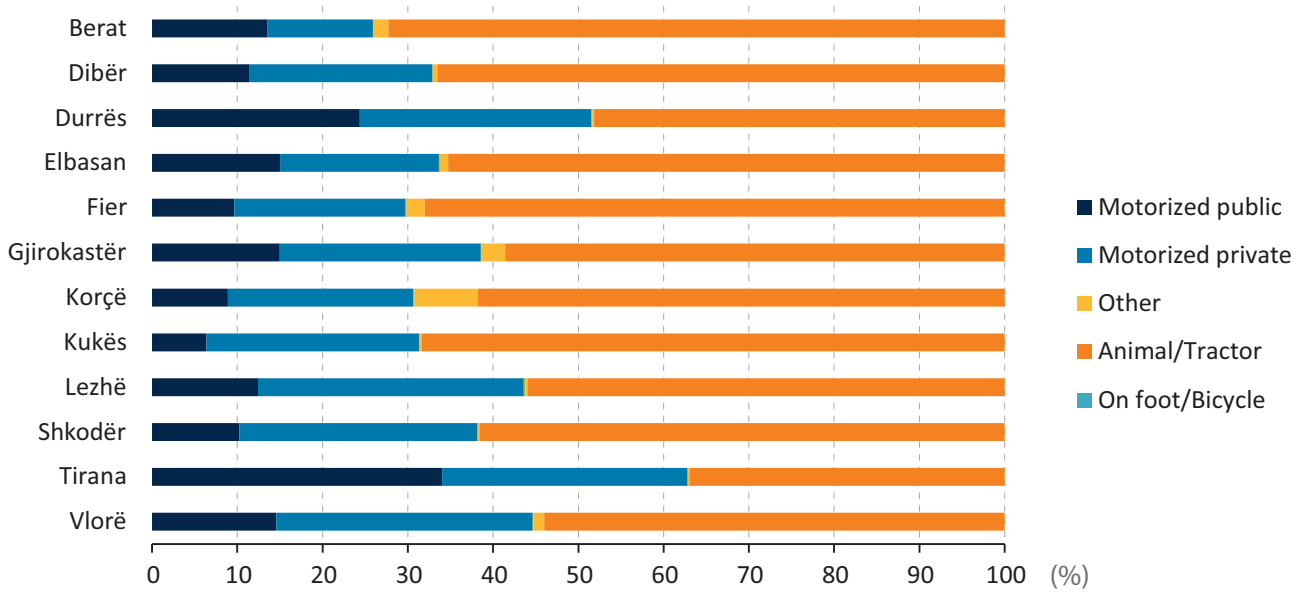
Prefecture	Means of transport							
	On foot	Bus	Motorcycle	Car	Bicycle	Minibus	Animal / tractor	Other
Berat	9.2	4.4	6.4	2.9	3.0	2.4	8.8	3.5
Dibër	3.3	0.8	1.0	2.2	0.1	6.7	1.0	1.6
Durrës	8.2	9.7	6.9	10.0	6.7	17.1	1.5	8.5
Elbasan	10.3	5.9	7.9	5.9	5.7	5.4	6.3	10.1
Fier	16.3	5.3	26.1	8.4	8.1	8.6	20.6	15.4
Gjirokastër	3.4	2.0	0.5	3.0	0.2	2.5	6.5	1.8
Korçë	8.4	2.7	3.9	6.4	6.7	5.5	41.8	15.0
Kukës	2.0	0.2	0.1	1.6	0.1	2.5	0.3	1.6
Lezhë	3.0	1.0	4.0	3.4	1.0	7.1	0.7	2.4
Shkodër	4.1	1.8	8.2	5.3	38.0	8.3	0.8	3.7
Tirana	24.9	61.7	28.3	42.6	26.1	27.4	5.0	30.9
Vlorë	6.9	4.4	6.7	8.2	4.4	6.5	6.8	5.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

If we group the means of transport according to their public/private character, we see that more than half of the inner work commuters go to work on foot or by bicycle (private non-motorized), a quarter of them use private motorized means of transport (car and motorcycle), that public means of transport (bus, minibus, taxi and train) are used by 20% of commuters and that rural means of transport are used by 1.3% of commuters. Therefore, we may say that private means (putting together private non-motorized and private motorized means that amount to 75% of the total) prevail, while public means of transport are used only by a fifth of work commuters. Though, the most important feature of the distribution by means of transport is the large use of non-motorized means and especially the large number of commuters going to work on foot. This is explained mainly by the fact that the vast majority of work commuting flows take place within the same municipality/commune of the usual residence (as we will see in chapter 3) and partly by the rural character of many areas of the country (though, as already mentioned, the share of commuters going to work on foot is quite high even among those living in urban areas – see table 2).

The agricultural or tertiary characterization of each prefecture clearly emerges from the analysis of the percentage of use of each of the above mentioned categories of the means of transport (figure 32):

- almost three quarters of commuters living in Berat (72.3%) go to work on foot or by bicycle, while the lowest percentage (37%), though still quite high, is recorded in the prefecture of Tirana;
- Tirana (34%) is instead the prefecture with the highest use of motorized public means of transport while the lowest percentage of use is recorded in Kukës (6.4%);
- Lezhë (31.1%) is the prefecture with the highest use of motorized private means of transport and Berat the one with the lowest use (12.3%);
- animals/tractors are the most used means of transport in the prefecture of Korçë (7.4%), while they are used only by 0.2% of commuters leaving in Tirana.

Figure 32: Inner work commuters by prefecture of usual residence and mode of transport



3 DAILY COMMUTING IN ALBANIA: A SPATIAL ANALYSIS PERSPECTIVE

3.1 Introduction

In this chapter we will analyse the system of daily spatial interactions in Albania based on inner work flows.

The analysis will be carried on at the following three territorial levels: prefectures, districts and communes/municipalities.

Before going further, it is necessary to explain the mathematical language adopted and define the aggregates which are the object of this study.

The processed data refer to respondents who declared to have a fixed place of work outside home in Albania and who travel daily from their place of residence (i) to their place of work (j). Therefore, we will take into account a sub-aggregate of inner work commuters, W^{IC}, who may be defined as daily inner work commuters, W^{D}.

In terms of the origin (place of residence) / destination (place of work) square matrix, this sub-aggregate may be defined as:

$$W^{D} = \sum_{1}^{n} {}_{i}W_{i.}^{D} = \sum_{1}^{n} {}_{j}W_{.j}^{D} = \sum_{1}^{n} {}_{i} \sum_{1}^{n} {}_{j}w_{ij}^{D}$$

where

$W_{i.}^{D} = \sum_{k} w_{ik}^{D}$ represents the total of daily work commuters residing in the territorial unit i and working in Albania;

$W_{.j}^{D} = \sum_{k} w_{kj}^{D}$ represents the total of daily work commuters working in j and residing in Albania;

w_{ij}^{D} represents the daily work commuters residing in the territorial unit i (prefectures, districts, municipalities/communes) who work in the territorial unit j (prefectures, districts, municipalities/communes in Albania)

w_{ji}^{D} represents the daily work commuters residing in the territorial unit j who work in the territorial unit i (in Albania)

and w_{ii}^{D} represents the daily work commuters residing in the territorial unit i and working in the same unit. The sub-aggregate of daily work commuters (W^{D} i.e. employed persons commuting daily from home to work) equals about 432 thousands commuters[1]. The volume of movements increases as we go down the geographical scale. Indeed, the majority of daily spatial interactions in terms of commuting from home to work takes place within the municipality/commune of the usual residence (79% of daily commuters), therefore only the 21% of daily commuters work outside their municipality/commune of usual residence. The latter is, in fact, the commuting flow typically analysed in studies on commuting, and also the focus of our analysis.

Indeed, based on the origin-destination matrix between municipalities of usual residence and municipalities of the workplace (flows pertaining to people working in a different municipality/commune from the one of their usual residence, i.e. moving **between** municipalities/communes), we will analyse commuting flows at the municipality/commune level and at the higher territorial levels (district and prefecture). Commuting flows pertaining to people commuting from home to work **within** the same municipality/commune where they live will not be taken into account.

As mentioned above, commuters working outside their municipality/commune of usual residence constitute 21% of daily commuters. Some of them are at the same time commuters at the district level, i.e. people travelling between municipalities belonging to different districts (accounting for 15.2% of the total flows between municipalities/communes), while some other (a smaller part) are also commuters at the prefecture level, i.e. people travelling between municipalities belonging to different prefectures (amounting to 11.5% of the total flows between municipalities/communes).

1 From the original 442,837 we have excluded 5,013 records for which information on municipality of work (j) is missing. Furthermore, we have decided not to take into account 6,057 inter-district daily commuters who have declared to travel daily between non-contiguous districts on foot or by bicycle, animal, tractor or other means of transport different from car, train, bus, minibus, motorcycle. Therefore, our aggregate of analysis is actually equal to 431,767.

As already mentioned, the spatial analysis will proceed from the largest territorial level (prefectures, which are also administrative divisions) to the smallest (on the basis of the available data) available territorial unit of analysis (municipality/commune), through the intermediate geographical and statistical level of districts. Therefore we will first analyse commuting flows between prefectures (about 10 thousand people); then focus on commuting flows between districts (almost 14 thousand people); and finally go down to the municipalities/communes level, which involves more than 89 thousand people.

The chapter is structured as follows: in paragraph 3.2 we analyse the daily spatial interactions system at prefectures and districts levels; in paragraph 3.3 we focus our attention on daily spatial interactions at municipalities/communes level; in paragraph 3.4 we analyse the system of daily spatial interactions taking into account the largest Albanian municipalities.

3.2 Daily spatial interactions among prefectures and among districts

Daily commuters at the prefecture level of the analysis (i.e. people travelling between municipalities belonging to different prefectures) are about 10 thousands (10,242), therefore inter-prefecture daily commuters represent 2.4% of the total daily commuters. As already mentioned, they represent 11.5% of the total flows between municipalities/communes.

Starting from the origin (place of residence, i) / destination (place of work, j) square matrix, for each spatial object (in this case the prefectures) we have calculated three indicators:

a. the daily inflow, with $i = j$:

$d_j^I = W_{.j}^D - w_{ii}^D$ that represents the total daily volume going to a generic location (j).

b. the daily outflow, with $i = j$:

$d_i^O = W_{i.}^D - w_{ii}^D$ that represents the total daily volume going out of a generic location (i).

c. the daily net flow, with $i = j$:

$d_i^N = d_j^I - d_i^O = (W_{.j}^D - w_{ii}^D) - (W_{i.}^D - w_{ii}^D)$ that represents the daily balance between "profit and loss" of a generic location i in terms of daily commuting movements.

The values of these indicators for each Albanian prefecture are shown in table 4.

Table 4: Daily inflow, daily outflow and daily net flow. Albanian prefectures

Prefectures	d_j^I	d_i^O	d_i^N
Berat	377	310	67
Dibër	325	157	168
Durrës	2,074	2,938	-864
Elbasan	582	552	30
Fier	863	882	-19
Gjirokastër	208	109	99
Korçë	232	393	-161
Kukës	285	82	203
Lezhë	493	596	-103
Shkodër	366	357	9
Tirana	3,951	3,455	496
Vlorë	486	411	75

As we can see, four prefectures are characterized by negative values of the daily net flow (Durrës,-864; Fier, -19; Korçë, -161; Lezhë, -103) while nine prefectures by positive ones (Berat,+67; Dibër, +168; Elbasan, +30; Gjirokastër, +99; Kukës, +203; Shkodër,+9; Tirana,+496; Vlorë, +75).

However, we may observe different situations when the value of the daily net flow is compared to the daily inflow and daily outflow values. Within the group of prefectures with a negative daily net flow, the prefecture of Durrës records a negative daily net flow (-864) as a result of comparatively high values of daily inflow (2,074) and daily outflow (2,938). On the contrary, the other prefectures that belong to this group are characterized by comparatively low levels of both daily inflow and outflow. This means that the prefecture of Durrës qualifies itself as a dynamic territory in terms of daily spatial interactions. A similar profile is observed for the prefecture of Tirana, though in this case, a positive value of the daily net flow is recorded. Indeed, the comparatively high value of the daily net flow (+496) is determined by very high values of both the daily inflow (+3,951), and the daily outflow (+3,455). This means that, as expected, the prefecture of Tirana is a dynamic territory in terms of daily spatial interactions. The rest of the prefectures present, to a larger or smaller extent, relatively low values of the daily net flow and of the daily inflow and outflow, which are not so different from each-other. The only two exceptions are represented by the prefectures of Dibër and Kukës; in both cases the values of the daily net flow are not comparatively so high, but the values of the daily inflow and the daily outflow are very different.

However, considering only absolute measures may be misleading. Therefore we will also analyse three ratios. They all have the same denominator, total daily flow volume (daily inflow + daily outflow), while the numerator changes. Namely, they are:

d. the daily inflow ratio, with $i = j$:

$$rd_j^I = \frac{d_j^I}{d_j^I + d_i^O} = \frac{(W_{.j}^D - w_{ii}^D)}{(W_{.j}^D - w_{ii}^D) + (W_{i.}^D - w_{ii}^D)}$$

that represents, for a generic location (j), the proportion of daily inflow on the total daily flow volume of the same generic location (in this case the prefecture).

e. the daily outflow ratio, with $i = j$:

$$rd_i^O = \frac{d_i^O}{d_j^I + d_i^O} = \frac{(W_{i.}^D - w_{ii}^D)}{(W_{.j}^D - w_{ii}^D) + (W_{i.}^D - w_{ii}^D)}$$

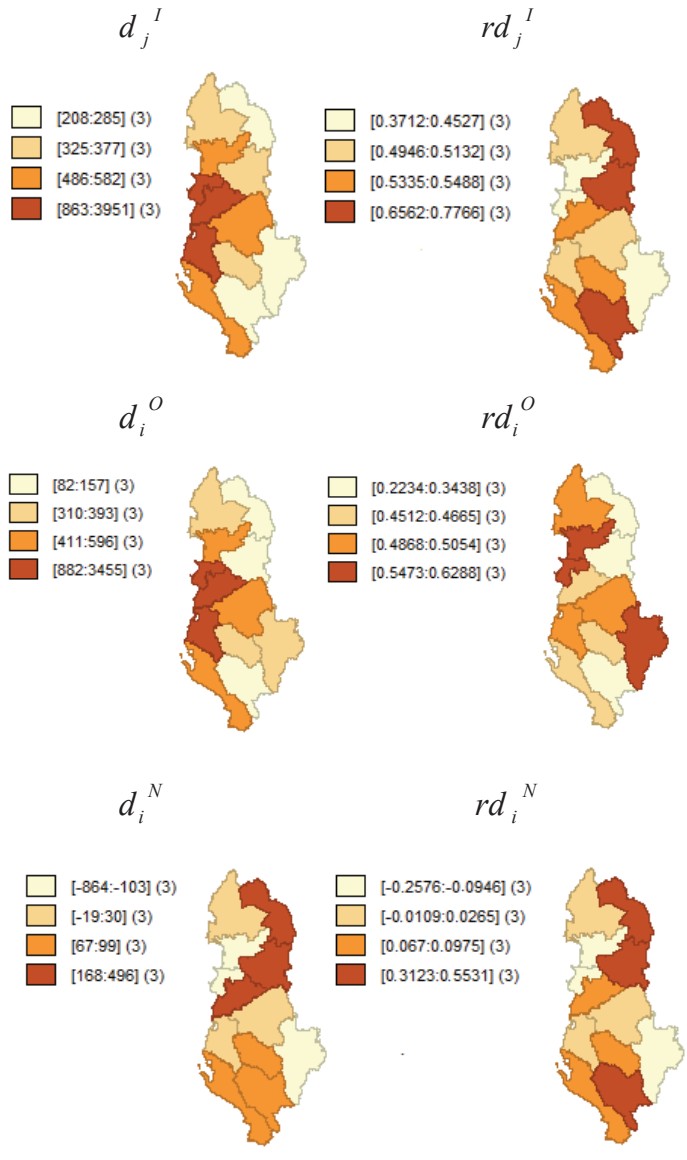
that represents, for a generic location (i), the proportion of daily outflow on the total daily flow volume of the same generic location (in this case the prefecture).

f. the daily net flow ratio, with $i = j$:

$$rd_i^N = \frac{d_i^N}{d_j^I + d_i^O} = \frac{(W_{.j}^D - w_{ii}^D) - (W_{i.}^D - w_{ii}^D)}{(W_{.j}^D - w_{ii}^D) + (W_{i.}^D - w_{ii}^D)}$$

that represents, for a generic location (i), the proportion of the balance between daily inflow and daily outflow on the total daily flow volume of the same generic location (in this case the prefecture). Figure 33 shows the above mentioned absolute (a. b. and c.) and relative measures (d. e. and f.) for each Albanian prefecture.

Figure 33: Maps of daily inflow and daily inflow ratio, daily outflow and daily outflow ratio, daily net flow and daily net flow ratio. Albanian prefectures



As we may see, the situation changes if we take into account the distribution of absolute indicators or if we refer to the relative measures (ratios). This is due to the fact that, as said, the ratios take into account also the total daily flow volume of each prefecture (the denominator of each ratio).

For example, taking ratios into consideration, we may observe that the highest values of the daily inflow ratio (4th class) are recorded in the prefectures of Kukës, Dibër, and Gjirokastër; while the lowest ones (1st class) are recorded in the prefectures of Korçë, Lezhë and Durrës. The latter are also the ones for which the highest values of the daily outflow ratio are registered (4th class), while the prefecture of Kukës, Dibër and Gjirokastër record the lowest ones (1st class).

Finally, taking into account the daily net flow ratio, we can observe that the lowest values are recorded in the prefectures of Durrës, Lezhë and Korçë (which are in the first class of the distribution), while the highest are recorded in the prefectures of Kukës, Dibër and Gjirokastër (fourth class of the distribution).

To synthesize, we have noticed that, in absolute terms, Tirana and Durrës emerge as the most dynamic territories in terms of daily spatial interactions, as a result of comparatively high values of the daily inflow and daily outflow (though with, respectively, a positive and a negative value of the daily net flow); while all the other prefectures, with the exception of Dibër and Kukës, register a relatively low value of the daily net flow. In relative terms, i.e. when the daily inflows and outflows are compared taking into account the total daily flow volume (daily inflow + daily outflow), we can see that Kukës, Dibër and Gjirokastër are the most attractive prefectures for workers coming from other prefectures, while the least attractive are the prefectures of Korçë, Lezhë and Durrës , which are also the prefectures that generate the highest volume of outflows.

We will now calculate the same indicators at the district level. Daily commuters at the district level of analysis (i.e. people travelling between municipalities belonging to different districts) are about 14 thousands (13,587), that is to say that inter-district commuters constitute 3.1% of daily inner work commuters. As already mentioned, they represent 15.2% of the total flows between municipalities/communes.

Table 5 shows the values recorded for the absolute measures (a. b. and c). As for the prefectures, we may observe that some districts register negative values of the daily net flow, while others register positive values. In the first group, the districts of Durrës (-917) and Tirana (-571) record the highest values; while in the second group, the districts of Kavajë and Mallakastër emerge with respectively: + 1,067 and + 341.

Table 5: Daily inflow, daily outflow and daily net flow. Albanian districts

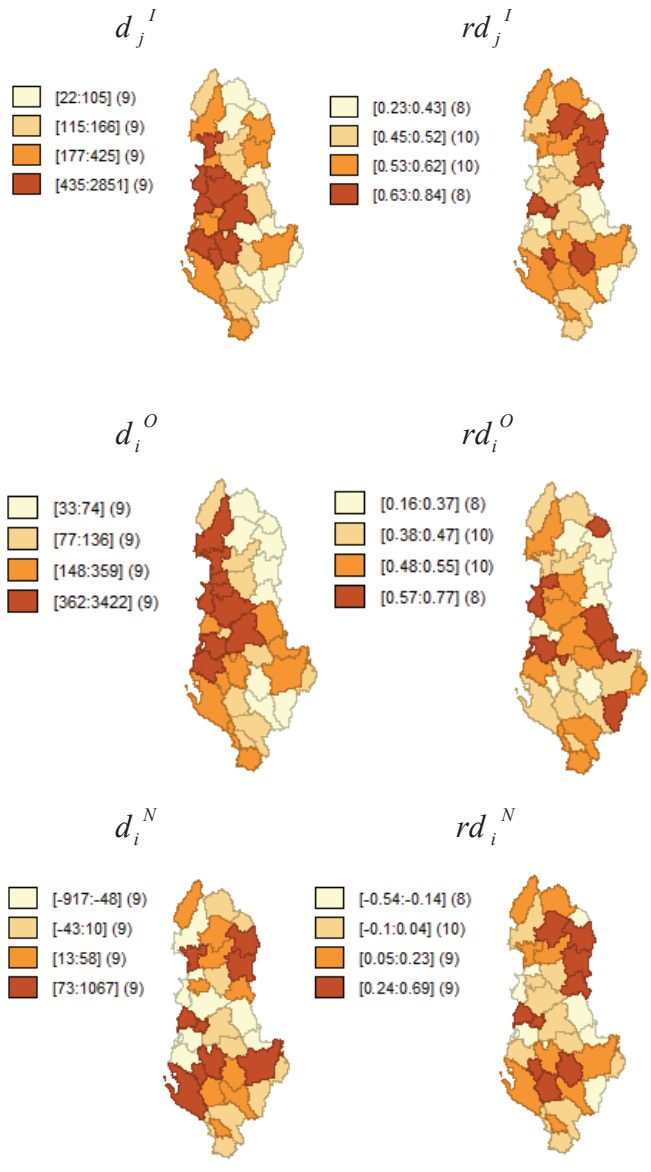
Districts	d_j^I	d_i^O	d_i^N
Berat	548	342	206
Bulqizë	105	55	50
Delvinë	166	136	30
Devoll	103	118	-15
Dibër	177	62	115
Durrës	1,411	2,328	-917
Elbasan	540	571	-31
Fier	632	774	-142
Gramsh	65	77	-12
Gjirokastër	120	110	10
Has	22	37	-15
Kavajë	1,310	243	1,067
Kolonjë	40	74	-34
Korçë	413	317	96
Krujë	871	818	53
Kuçovë	162	359	-197
Kukës	263	54	209
Kurbin	184	373	-189
Lezhë	435	362	73
Librazhd	143	191	-48
Lushnjë	327	545	-218
Malësi e Madhe	162	135	27
Mallakastër	489	148	341
Mat	133	130	3
Mirditë	127	114	13
Peqin	229	108	121
Përmet	85	53	32
Pogradec	88	296	-208
Pukë	85	50	35
Sarandë	187	230	-43
Skrapar	115	57	58
Shkodër	387	440	-53
Tepelenë	145	88	57
Tirana	2,851	3,422	-571
Tropojë	42	33	9
Vlorë	425	337	88

Continuing with relative measures, and referring to the daily inflow ratio (figure 34), we can observe that the districts of Pukë, Kukës, Dibër, Bulqizë, Kavaja, Peqin, Mallakastër and Skrapar are in the fourth class of the distribution (i.e. they record the highest values), therefore they are the most attractive ones for workers coming from other districts, while the districts of Has, Kurbin, Durrës, Lushnje, Kuçovë, Librazhd, Pogradec, Kolonjë are the least attractive ones (i.e. they record the lowest values of the inflow ratio and, therefore, are in the first class of the distribution).

Considering the daily outflow ratios (figure 34), the highest values are registered in the districts of Has, Kurbin , Durrës, Lushnje, Kuçovë, Librazhd, Pogradec and Kolonjë (fourth class of the distribution). On the contrary, the lowest ones are registered in the districts of Pukë, Has, Kukës, Dibër, Skrapar, Mallakastër, Peqin and Kavajë (first class of the distribution). Therefore, the latter are more self-containing (and the former are less self-containing) with regard to the labour force residing in them.

Finally, in terms of daily net flow ratio (figure 34), the districts of Pukë, Kukës, Diber, Bulqizë, Kavajë, Peqin, Mallakastër, Tepelenë, and Skrapar are the most dynamic ones, being in the fourth class of the distribution (i.e. they register the highest values) while the districts of Has, Kurbin, Durrës, Lushnje, Librazhd, Kuçovë, Pogradec and Kolonjë are in the first class (i.e. they register the lowest values).

Figure 34: Maps of daily inflow and daily inflow ratio, daily outflow and daily otuflow ratio, daily net flow and daily net flow ratio. Albanian districts



The picture we get from this first analysis is that there is a quite relevant spatial heterogeneity with regard to daily commuting interactions. Namely, there are prefectures (Kukës, Dibër and Gjirokastër) and districts (Pukë, Kukës, Dibër, Bulqizë, Kavajë, Peqin, Mallakastër, Tepelenë, Skrapar) where the imbalance between inflows and outflows is positive; and prefectures (Durrës, Lezhë and Korçë) and districts (Kurbin, Durrës, Lushnje, Librazhd, Kuçovë, Pogradec and Kolonjë) where, on the contrary, such an imbalance is negative.

As already mentioned, we have to recall that absolute measures (and to some extent even relative ones) might be deceptive. This is due to the fact that the same value recorded for the daily net flow could be originated by very high levels of both daily inflow and daily outflow, as well as by very low levels of both. Similarly, high values of the daily net flow could be determined by a not so high level of daily inflow combined with a very low level of daily outflow, as well as by a very high level of daily inflow combined with a low level of daily outflow. The district of Tirana is an example of the first situation: the negative net flow is the result of a high daily inflow and of a higher daily outflow. The same is, though on a different scale, for the district of Devoll, which, on the other hand, records the same value of the daily net flow registered for the district of Has, where instead the total flow volume (daily inflow + daily outflow) is comparatively much lower.

Furthermore, the results might be affected even by the territorial division chosen for the analysis. Again, we may bring the example of Tirana, where the net flow recorded at the district level actually disguises relevant profits in terms of population commuting to the municipality of Tirana. These will become evident later on, but since these profits are not computed at the district level of the analysis, at this higher level of the analysis they result in a negative net flow.

For such reasons, it is appropriate to analyse commuting flows at a more detailed level of analysis i.e. at the municipality/commune level, as it will be done in the following paragraph.

3.3 Daily spatial interactions among Municipalities/Communes

3.3.1 Daily inflows and outflows

Daily commuters at the municipality/commune level of analysis (i.e. people working in a municipality/commune different from the one of their usual residence) are about 89 thousands (89,215). As already mentioned, they represent almost a fifth of the total daily commuters (20.7%).

Maps in figures 35, 35.a, 36, 36.a, 37 and 37.a[3] show the values of, respectively, the daily inflow, the daily inflow ratio, the daily outflow, the daily outflow ratio, the daily net flow, and the daily net flow ratio, calculated for each Albanian municipality/commune.

Starting from the first indicator, daily inflow (figure 35), we may clearly observe the role played by some Albanian big municipalities (e.g. Tirana and Durrës) as attraction poles for commuters and especially for those coming from the surroundings of these big municipalities. The value of the daily inflow is in fact comparatively high in these municipalities and comparatively low in their surrounding areas. A comparatively high value of the daily inflow is also recorded in the area near Vlorë - coastal area on the southern-east part of the country. This pattern is confirmed also when we take into account the inflow ratio (figure 35.a). Though, in this case, also some municipalities and communes located in the South West and in the northern part of the country, record comparatively high values of this indicator, due to the fact that in these peripheral municipalities and communes the total flow volume (denominator of the ratio) is relatively low. These elements seem to indicate that big municipalities and their surrounding areas constitute systems of spatial interactions. We will come back to this point in more details later on.

3 The sea shape files have been downloaded from the following open web system http://openstreetmapdata.com/data/water-polygons.

Figure 35: Map of daily inflow. Albanian municipalities/communes d_j^I

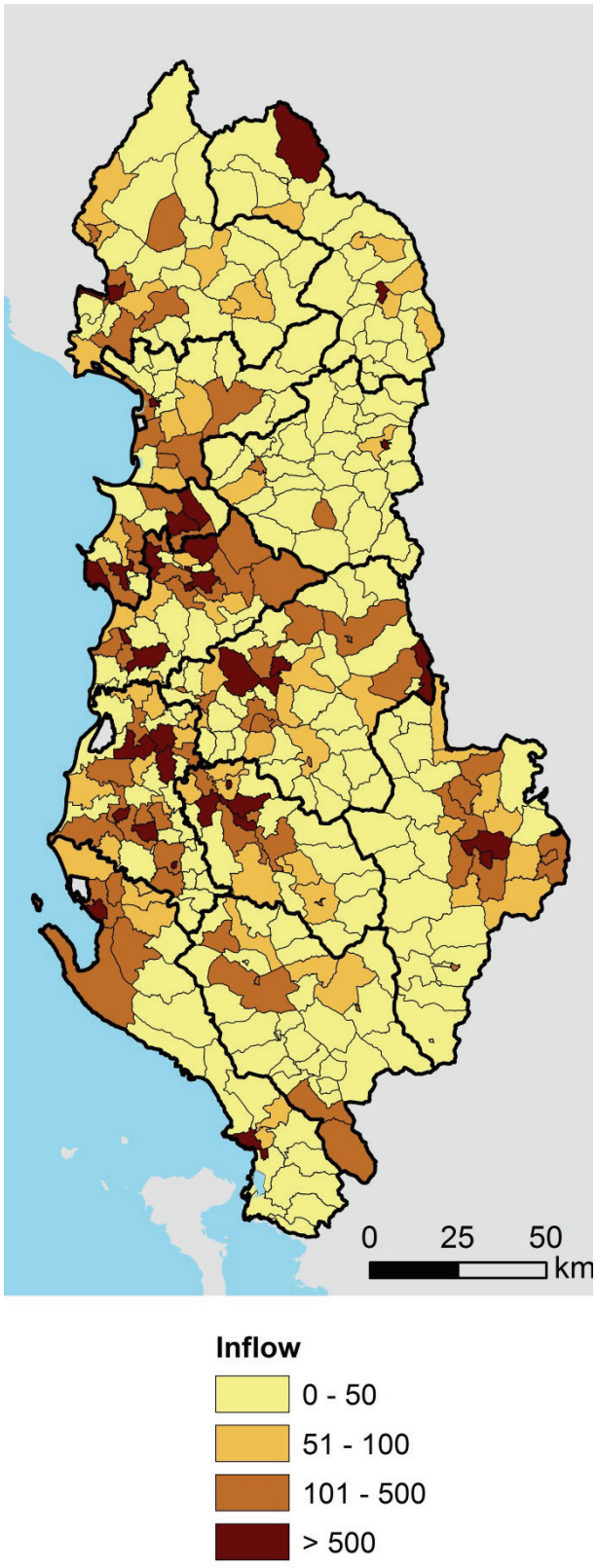
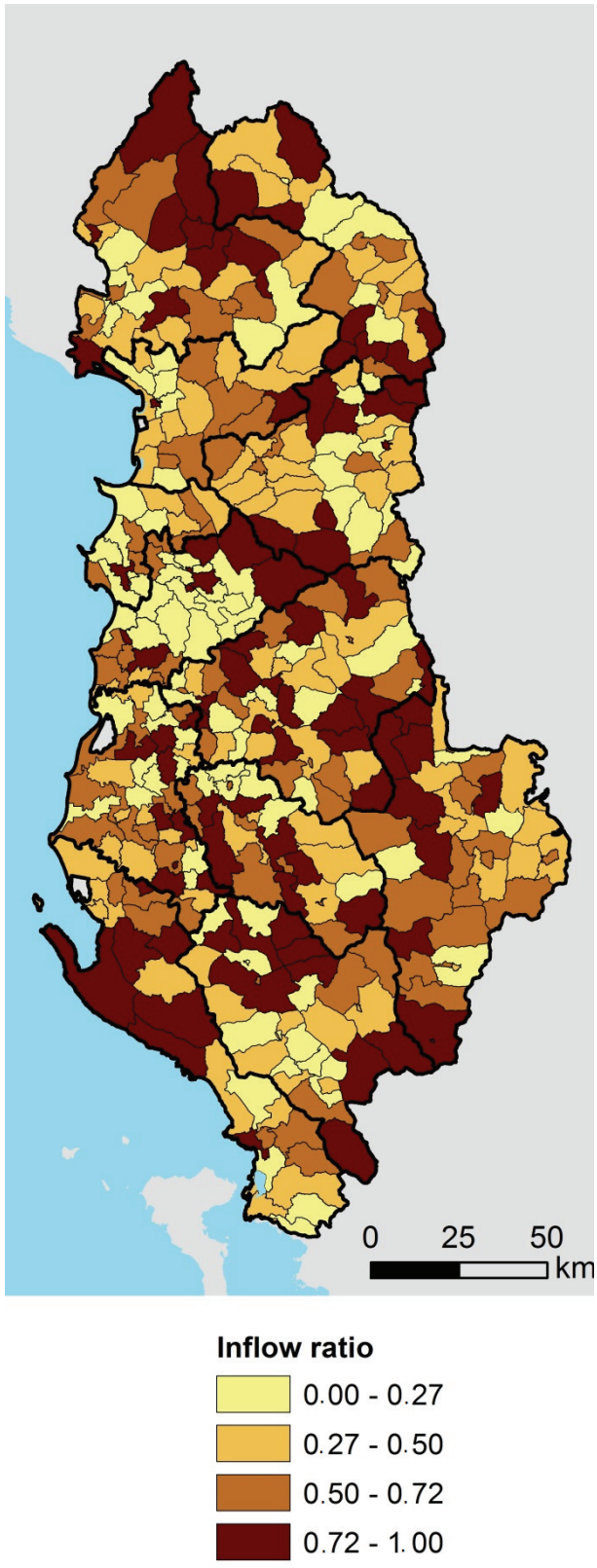


Figure 35.a: Map of daily inflow ratio. Albanian municipalities/communes rd_j^I



Almost the same spatial patterns emerge if we consider the daily outflow and the daily outflow ratios (figures 36 and 36.a). As expected, in this case the direction of the relationship is inverse: almost all of the largest municipalities present, in fact, comparatively low values of the daily outflow and the daily outflow ratio while, on the contrary, the municipalities/communes located in their surrounding areas have comparatively high values of these two indicators. In this perspective, it seems that the classic centre-periphery model (or core/rings) fits quite well to the role played by Albanian big municipalities and by their surrounding areas. This is especially the case of Tirana, Durrës and Shkodër. Indeed, on a functional scale, they appear to be hierarchically higher with respect to their surrounding areas, which revolve around these centres precisely to benefit from these functions.

Though, this centre-periphery dynamic, which concerns big municipalities and their surrounding areas (characterized by comparatively high volumes of, respectively, daily inflow and daily outflow), is only one of the dimensions along which it is possible to describe or represent the Albanian system of daily spatial interactions. Therefore, if one dimension is constituted by the role played by big municipalities, functioning as destination areas or poles of attraction for employed persons living in the surrounding areas, a second dimension is the one regarding non-urban areas or more peripheral municipalities and communes, that seem to be characterized by comparatively low volumes of daily inflow and daily outflow or, in other words, by scarce daily interactions.

Figure 36: Map of daily outflow. Albanian municipalities/communes d_i^o

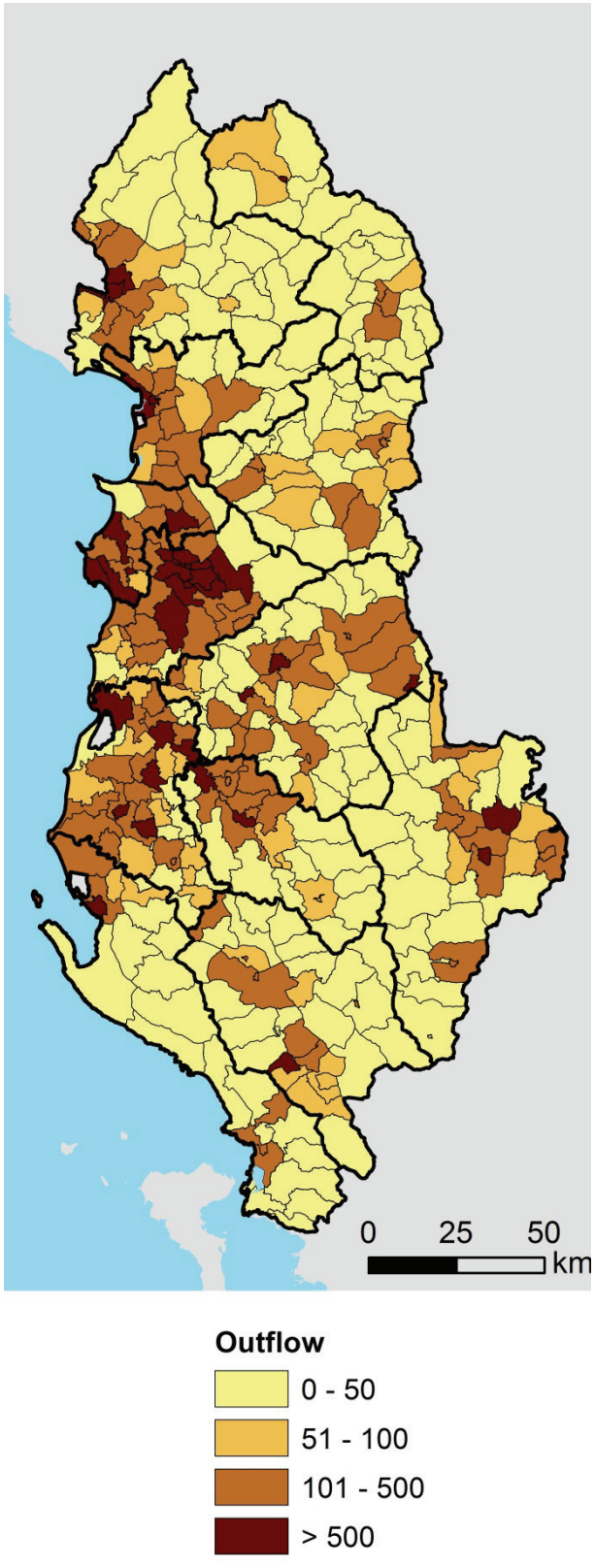
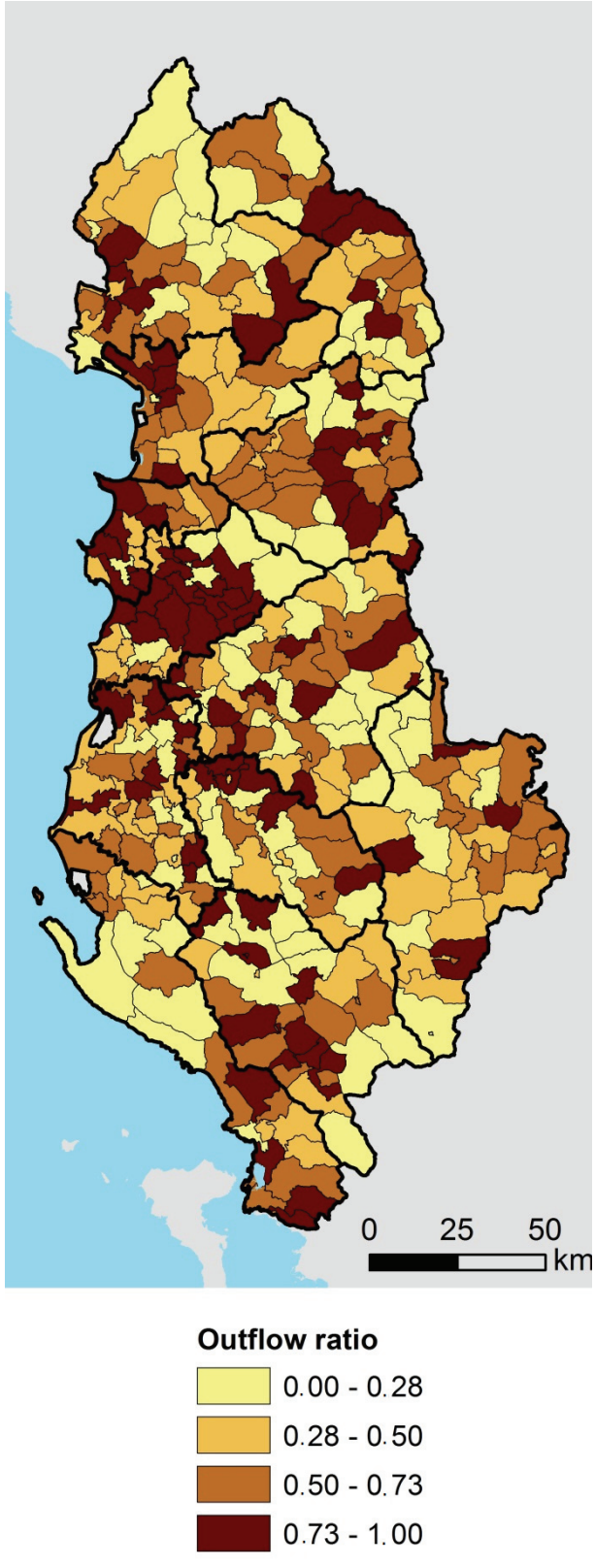


Figure 36.a: Map of daily outflow ratio. Albanian municipalities/communes rd_i^o



Obviously, these dynamics are reflected in the daily net flow and daily net flow ratio values (figures 37 and 37.a).

Almost all big municipalities record comparatively high positive values of these indicators; on the contrary, the municipalities located in the surroundings areas of these big municipalities have comparatively high negative values. This is especially the case of Durrës, Tirana, Shkodër, Vlorë, Elbasan and their surrounding areas (figures 37 and 37.a).

Figure 37: Map of daily net flow. Albanian municipalities/communes d_i^N

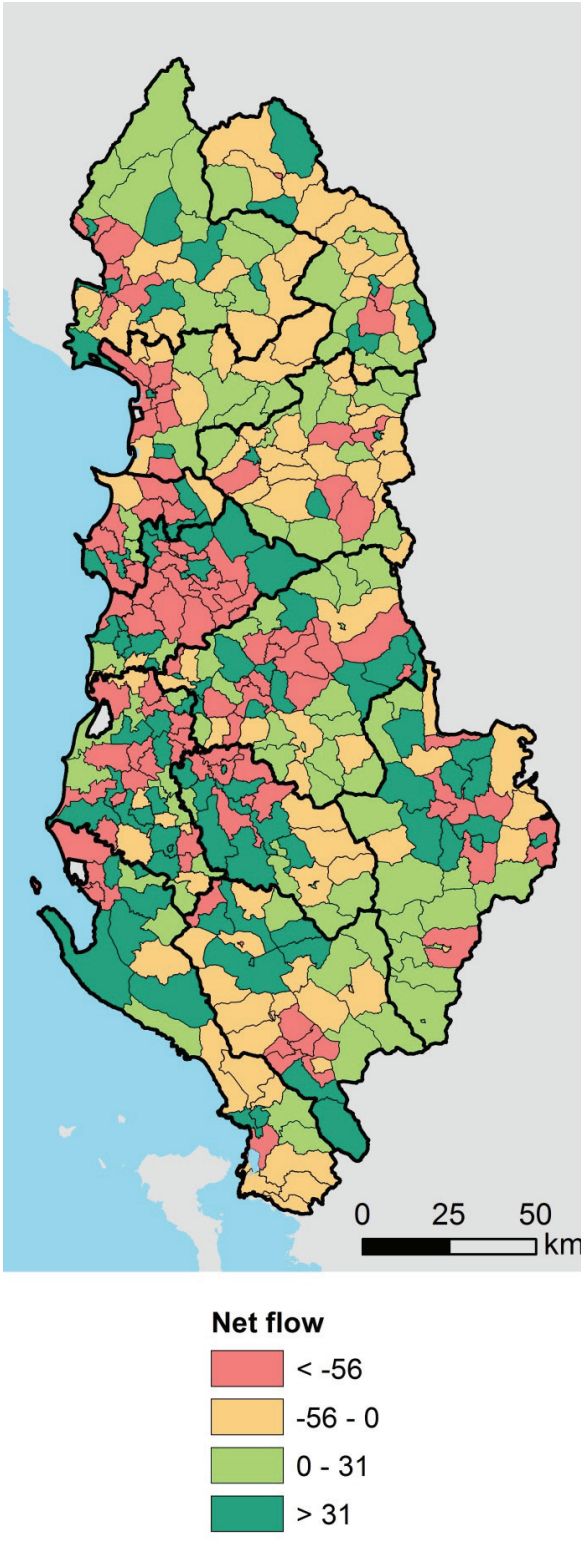
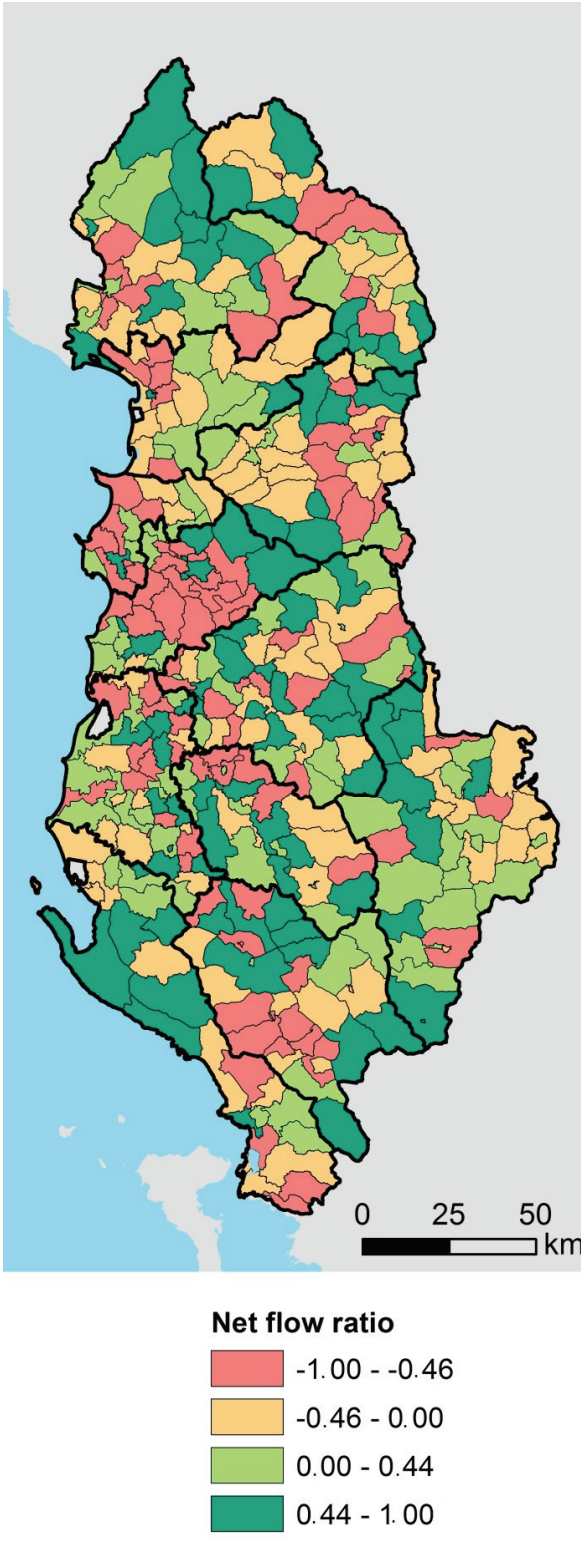


Figure 37.a: Map of daily net flow ratio. Albanian municipalities/communes rd_i^N



3.3.2 Impact of daily flows on usually resident population

We will now compute the day-time population in order to measure the impact of daily commuting flows at the municipality/commune level.,

If we represent the usually resident population of a generic municipality/commune i with the symbol P_i , then the day-time population of the generic municipality/commune i, P_i^d, may be defined, with $i = j$, as:

$$P_i^d = P_i + d_i^N = P_i + (d^I_j - d_i^O) = P_i + [(W_{.j} - w_{ii}) - (W_i - w_{ii})]$$

i.e. the day-time population equals the usually resident population minus those usual residents who travel, on a daily basis, outside their generic municipality/commune for work reasons plus the non-usual residents who daily go to the generic municipality/commune for work reasons.

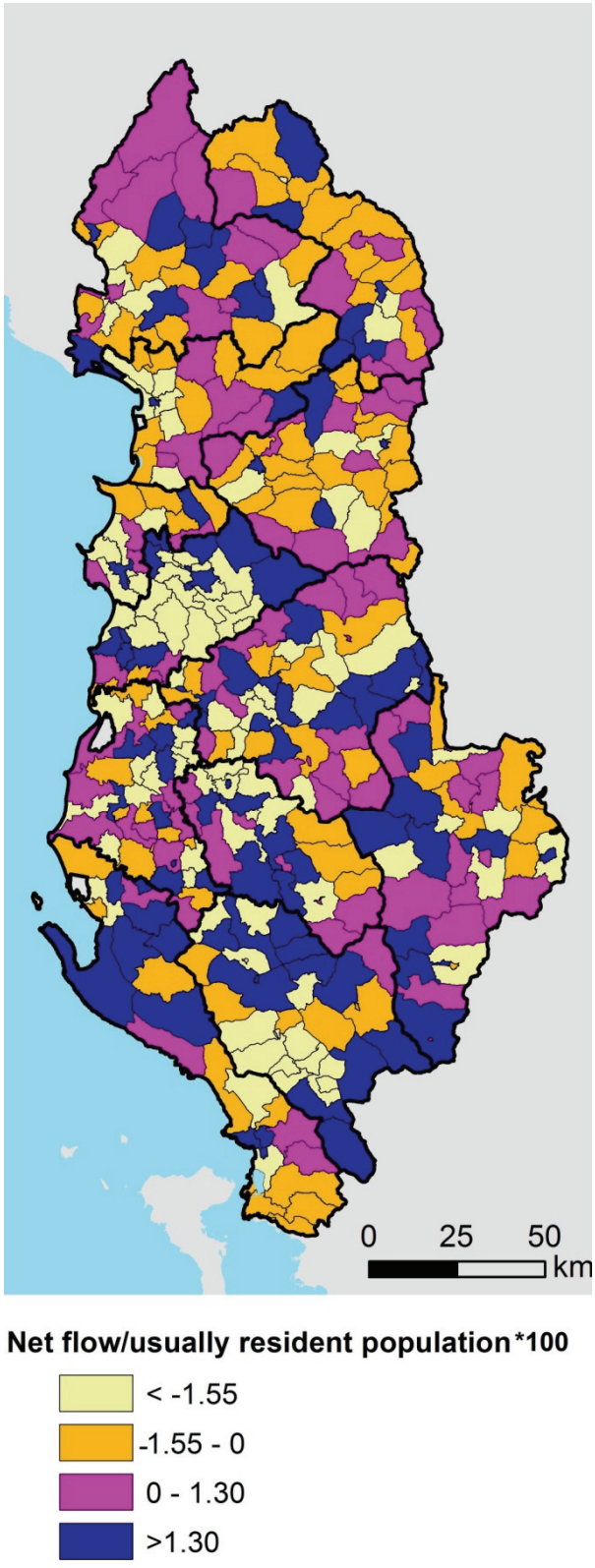
Using the two populations (usually-resident population and day-time population), we will compute an indicator that measures, for each municipality/commune, the impact of daily movements on the usually-resident population:

$(P_i^d - P_i) / P_i \times 100$ that is equal to $d_i^N / P_i \times 100$, where the numerator represents the difference between day-time population and usually-resident population and the denominator represents the usually-resident population.

The map shown in figure 38, confirms once again the preeminent role played by the largest Albanian municipalities in the system of daily spatial interactions. Indeed, comparatively high values of this indicator are registered for almost all of the big municipalities, while comparatively low values are recorded for their surroundings areas. A high value of this ratio is recorded also in the coastal area near the municipality of Vlorë.

Figure 38: Map of ratio between the daily net flow and the usually resident population. Albanian municipalities/communes

$$d_i^N / P_i \times 100$$



Some preliminary conclusions may be derived on the basis of this evidence. Spatial patterns have clearly emerged from the analysis of commuting flows at the municipality/commune level. First of all, we have observed a significant territorial differentiation within Albania with regard to daily spatial interactions. In some areas of the country the total flow volume is comparatively high (largest municipalities and surrounding areas, urban and coastal areas), in some others, it is quite scarce (internal, peripheral and rural areas). Some municipalities mainly attract commuting workers, others mainly push them out.

Secondly, this variability seems mainly related to the role played by the major conurbations as poles of attraction and redistribution of the labour force. In fact, they are characterized by comparatively high levels of inflow, functioning as destination areas for employed persons living in the surrounding areas.

Such role will be further explored in paragraph 3.5, while in the following paragraph we will look at the territorial differences concerning the use of means of transport to work.

3.4 Mode of transport from home to work

Obviously, the transport system (i.e. the availability of roads that allow use of private means of transport, of urban public transport, of railways and so on) plays a relevant role on the system of daily spatial interactions. Figures 39, 40, and 41, show the percentage distribution of daily commuters working in each municipality/commune[4] by the most used means of transport (i.e. used for the greatest part of the journey to work in terms of distance). Means of transport have been grouped into three main categories: private (use of cars as a driver and as a passenger, and motorcycles), public (bus, minibus, train) and others (on foot, bicycle, animal, tractor, and other). As for the use of private means of transport, the highest values are recorded for the coastal and northern mountainous areas, while the internal areas of the centre and southern regions (more rural/agricultural areas), and some of the bigger cities (such as Tirana) register values comparatively lower. On the contrary, for what concerns the use of public means of transport (figure 40), the highest percentages of use are registered in the largest urban areas (e.g. Durrës and Tirana and in the areas in between them) but also in medium urban areas of the south, such as Gjirokastër. Finally, figure 41 shows the areas where non-motorized means and/or rural means of transport are most used, i.e. rural areas, areas whose economic vocation is essentially agricultural, but also those urban areas with a significant proportion of workers covering short distances.

Furthermore, the map shown in figure 42 represents the ratio between the use of public and private means of transport. Red areas are those where commuters use more private than public means of transport; in the green areas, on the opposite, commuters use more public means of transport than privates ones. Finally, in the yellow areas there is a balance between the use of public and private means of transport.

Thanks to this visual representation, some spatial patterns underlying the relationship between commuting flows and mode of transport to work become clear:

- a sharp prevalence of red areas is observed, i.e. areas where commuters use more private means of transport, but where public means of transport are clearly the majority;
- the central part of Albania and especially the area of Tirana and its surroundings are the only green areas (with some minor exceptions regarding, for example the district of Pukë – except for the municipality of Pukë – and the districts of Gjirokastër and Përmet), i.e. areas where public means of transport are used more than private ones;
- finally, the areas where a balance is recorded between the use of private and public means of transport are located in the districts of Pogradec and Skrapar and in the areas around Berat.

4 This aggregate includes, besides daily commuters coming to the municipality/commune from other municipalities, also daily commuters residing in the municipality and commuting daily from home to work within its territory (i.e. people with a fixed workplace outside home within the same municipality of usual residence).

Figure 39: Percentage distribution of daily commuters travelling to work by private means of transport. Albanian municipalities/communes

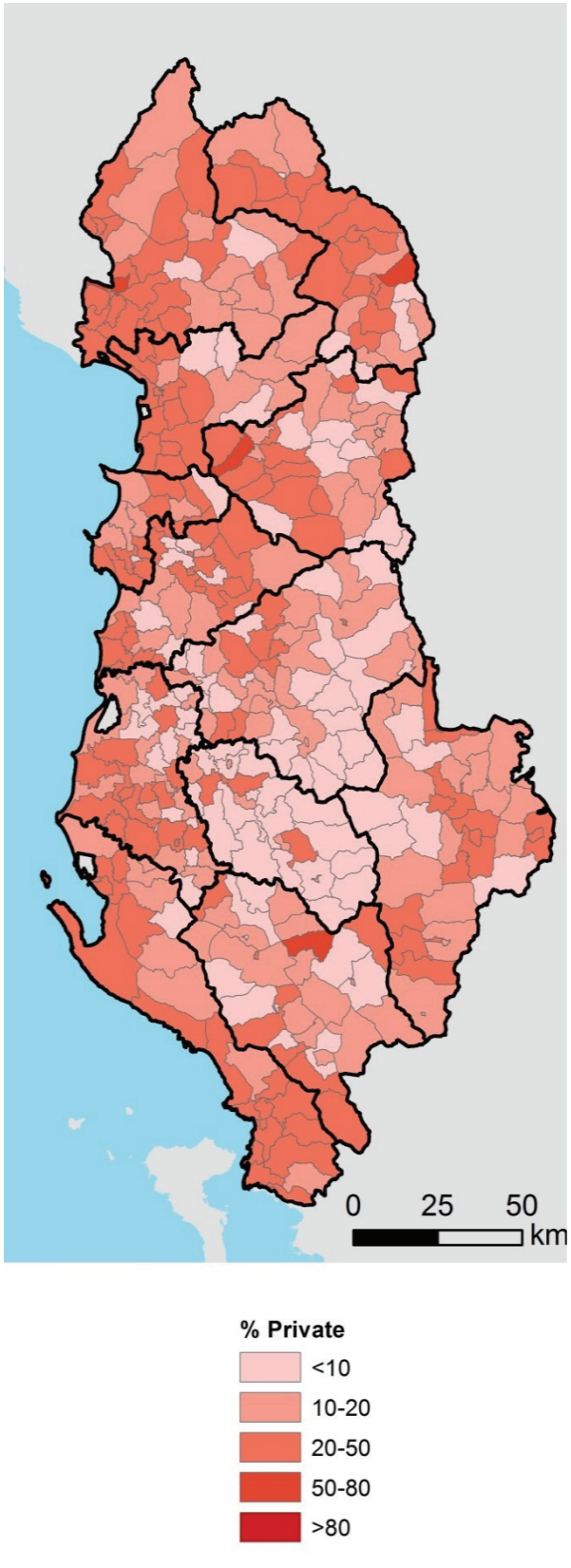


Figure 40: Percentage distribution of daily commuters travelling to work by public means of transport. Albanian municipalities/communes

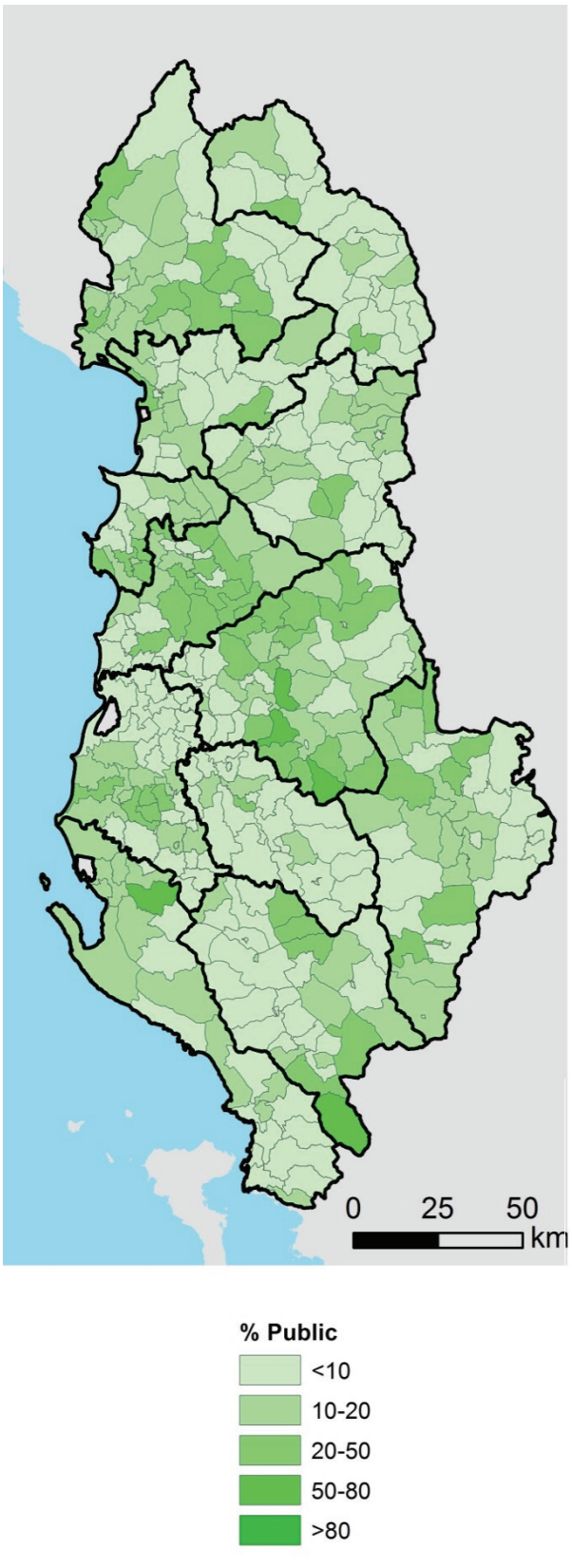


Figure 41: Percentage distribution of daily commuters travelling to work by other means of transport (on foot, bicycle, animal, tractor and other). Albanian municipalities/communes

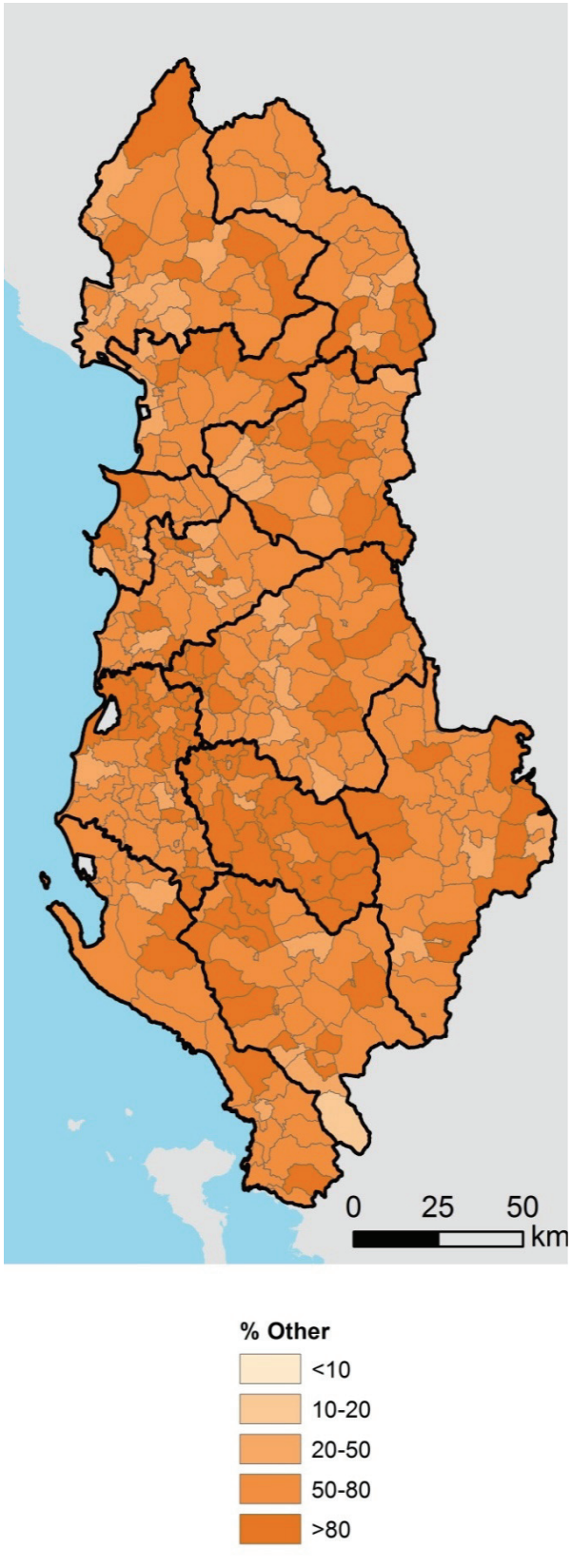
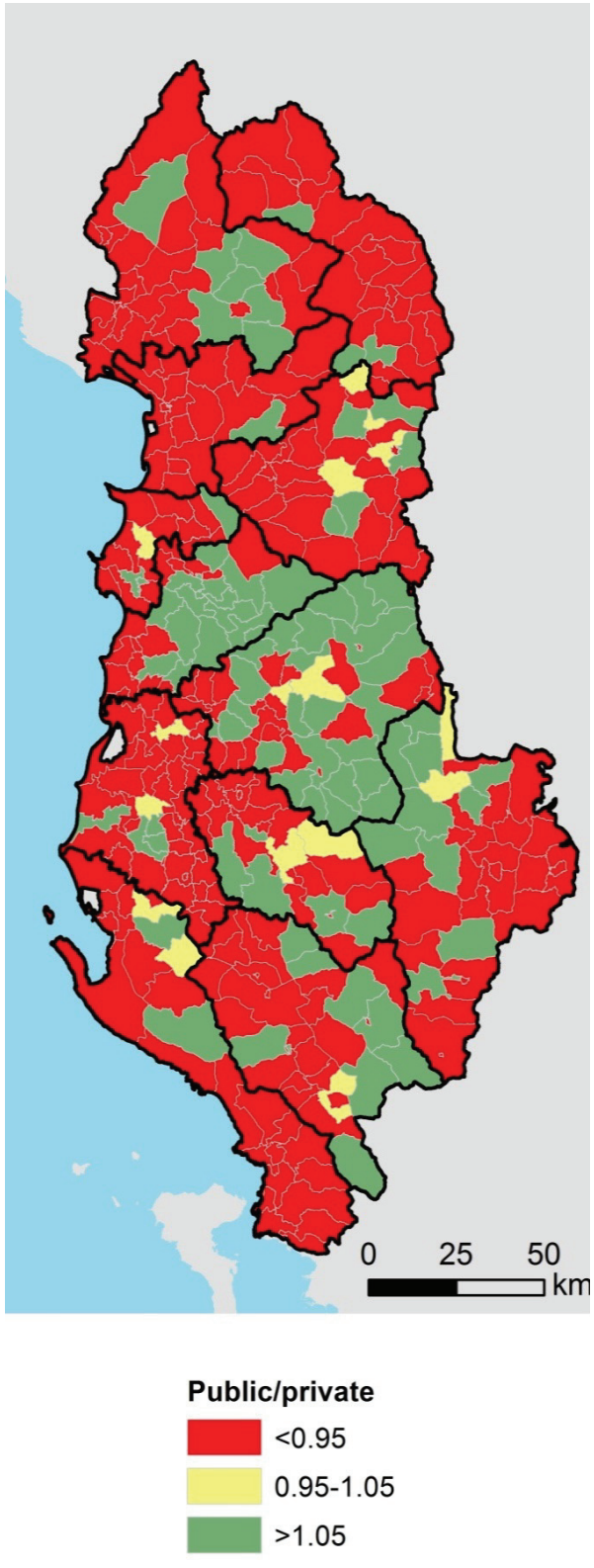


Figure 42: Percentage distribution of the ratio between daily commuters travelling to work by public means of transport and daily commuters travelling to work by private ones. Albanian municipalities/ communes



3.5 The role of big municipalities in the system of daily spatial interactions

3.5.1 Daily inflows and outflows

To better analyse, on one hand, the impact of daily spatial interactions on Albanian big municipalities and their surrounding areas and, on the other hand, the role played by big municipalities in the system of daily spatial interactions, we have selected the largest Albanian municipalities (i.e. the seven municipalities with at least 50,000 usual residents: Tirana, Durrës, Vlorë, Elbasan, Shkodër, Fier and Korçë)[5] as case studies.

We will first represent the daily inflow and daily outflow of these big municipalities and their surrounding areas, both in absolute and in relative terms (figures 43–49).

As shown by the maps, the following main results may be underlined[6] :

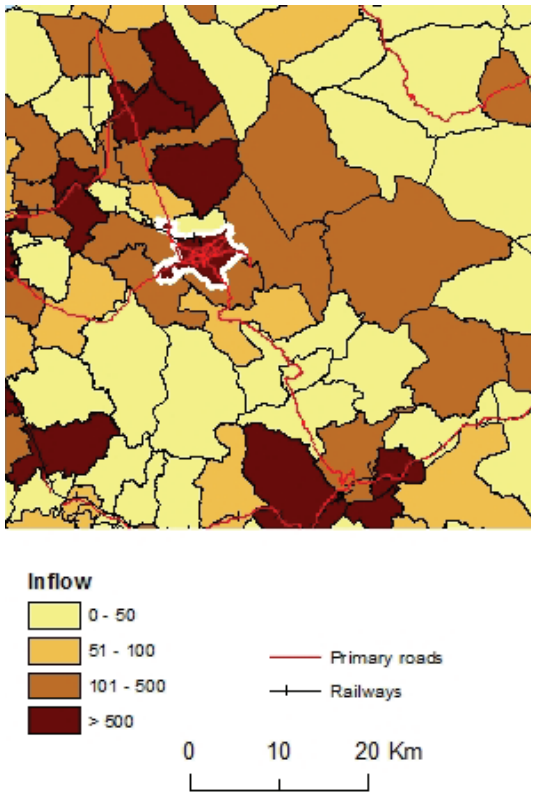
- the seven big municipalities which were analysed have similar profiles with regard to spatial daily interactions; they are generally characterized by a comparatively high volume of the total daily flow (daily inflow + daily outflow) and (with a few exceptions) by higher daily inflows than outflows. We may infer that they act both as attraction poles (they register higher daily inflows than outflows) and as poles from which a daily redistribution of commuting workers takes place (the total daily flows are comparatively high);
- almost all of the municipalities/communes localized in the surrounding areas of big municipalities have similar profiles. They are characterized by a total daily flow (daily inflow + daily outflow) lower than the one of big municipalities; the level of daily outflow is higher than the level of daily inflow. Therefore we may define these municipalities as the primary gravitational areas of big municipalities;
- big municipalities and municipalities in their surrounding areas form, altogether, complex systems of daily mobility; these systems (big municipality and surrounding areas), which in some cases are located far from each other in geometrical terms (linear distance centroid to centroid), are actually linked to each other in terms of daily spatial interactions (and, as we will see later, in some cases this link is even quite strong, see figure 61).

5 Kamëz, though being one of the seven largest Albanian municipalities, has not been considered, since from the analysis of its commuting flows it appears to be as a sort of big suburb of Tirana.

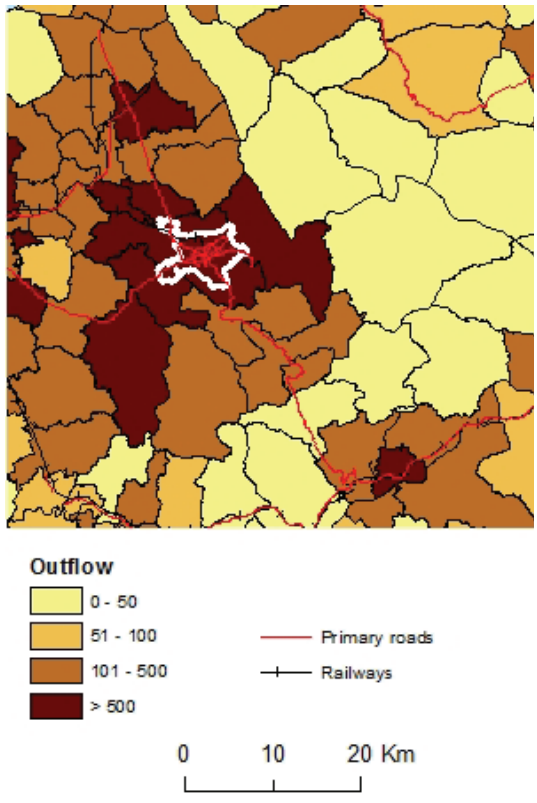
6 The shape files on primary roads and railways are downloaded by this open web system http://download.geofabrik.de/europe.html.

Figure 43: Tirana and its surroundings

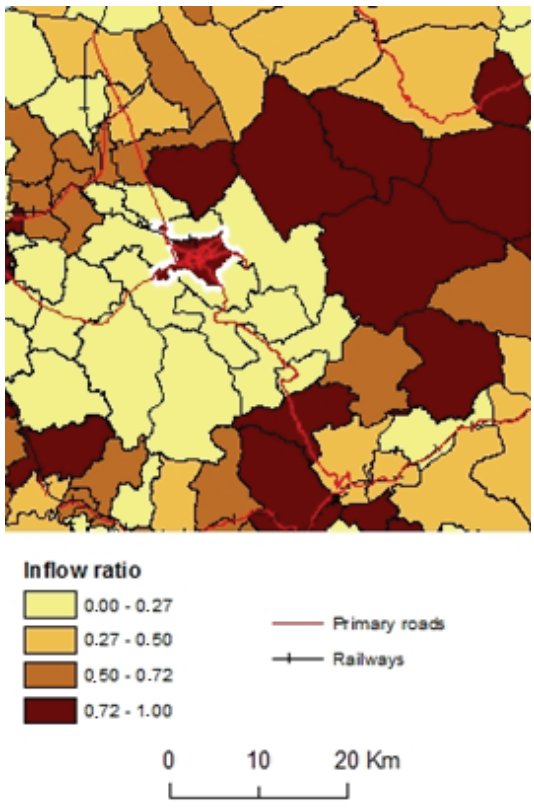
d_j^I



d_i^O



rd_j^I



rd_i^O

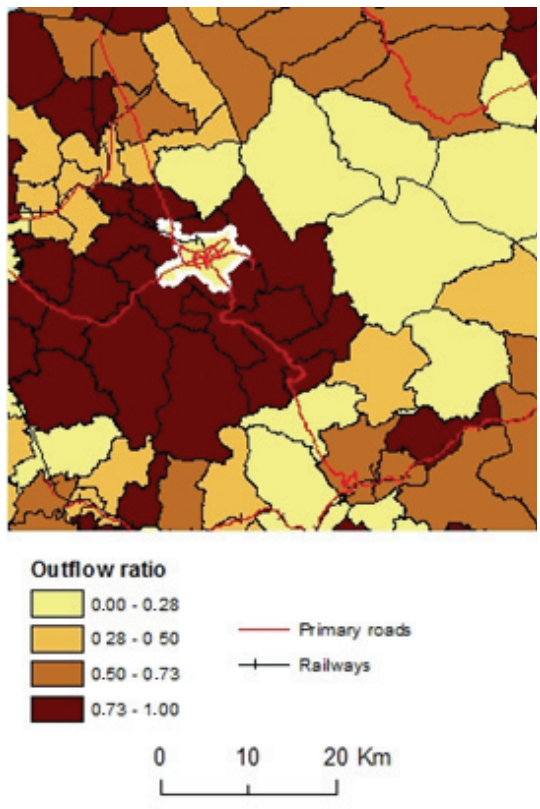
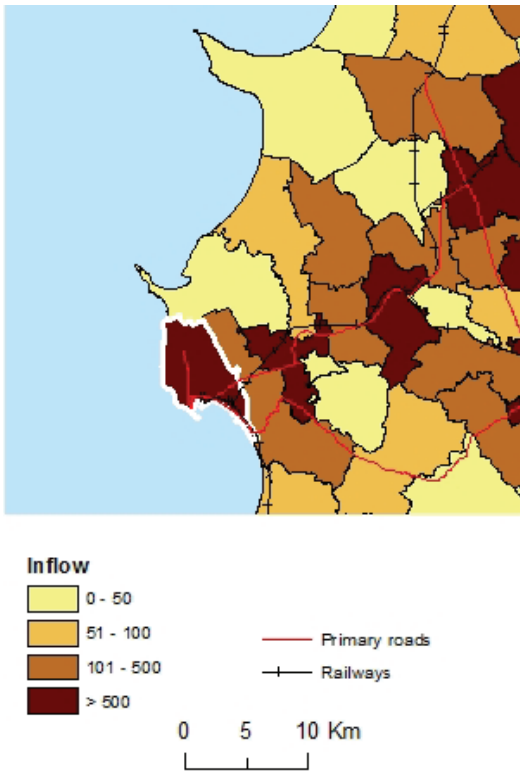
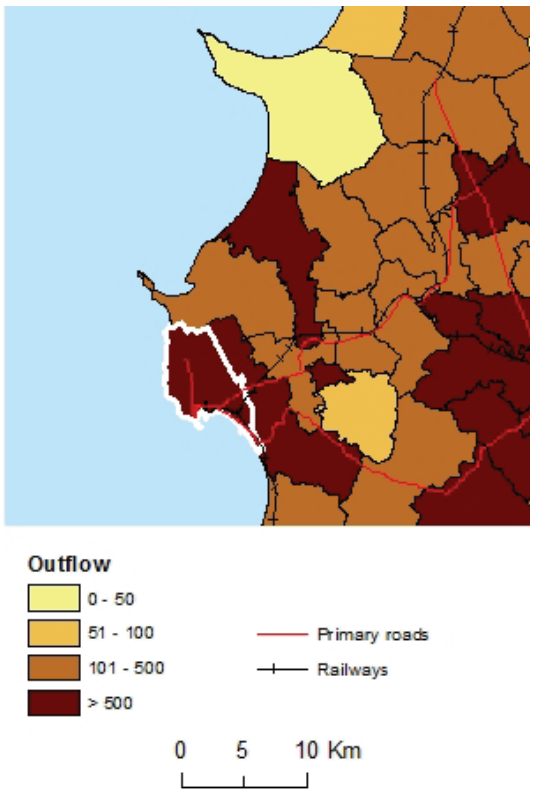


Figure 44: Durrës and its surroundings

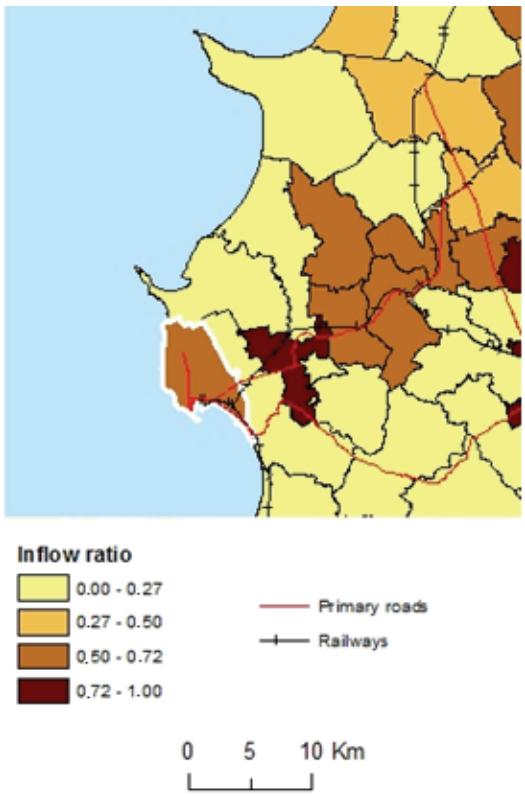
d_j^I



d_i^O



rd_j^I



rd_i^O

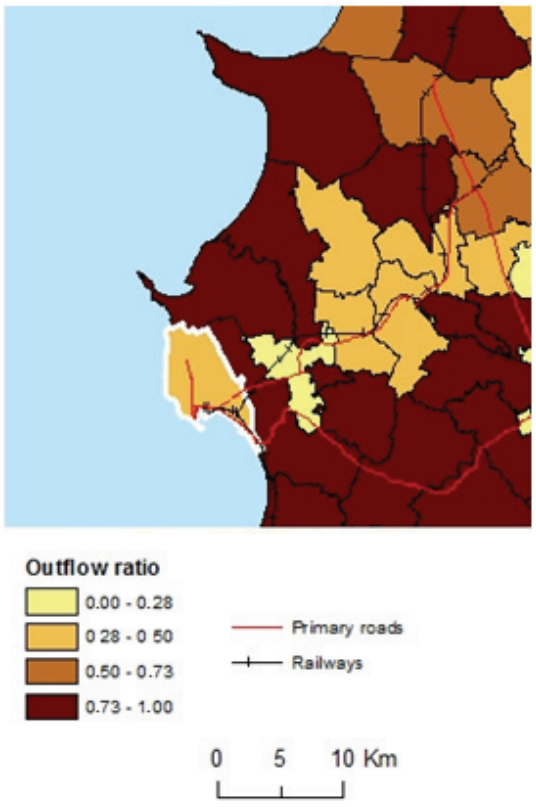
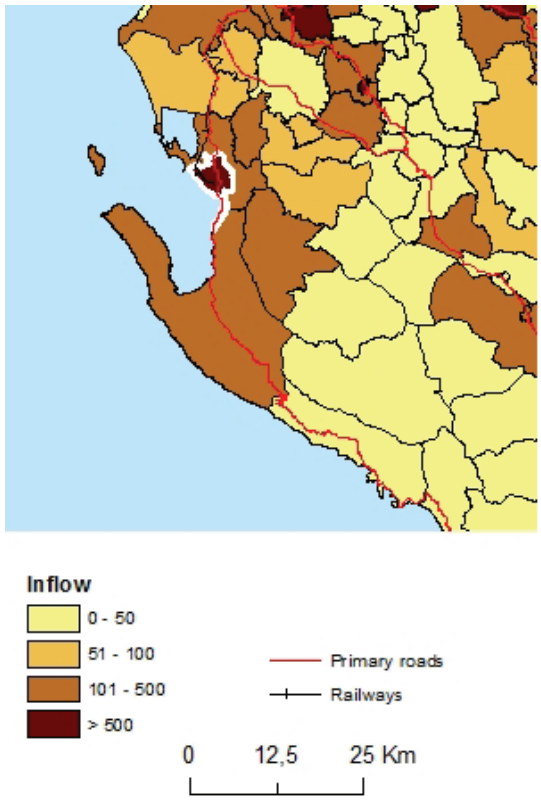
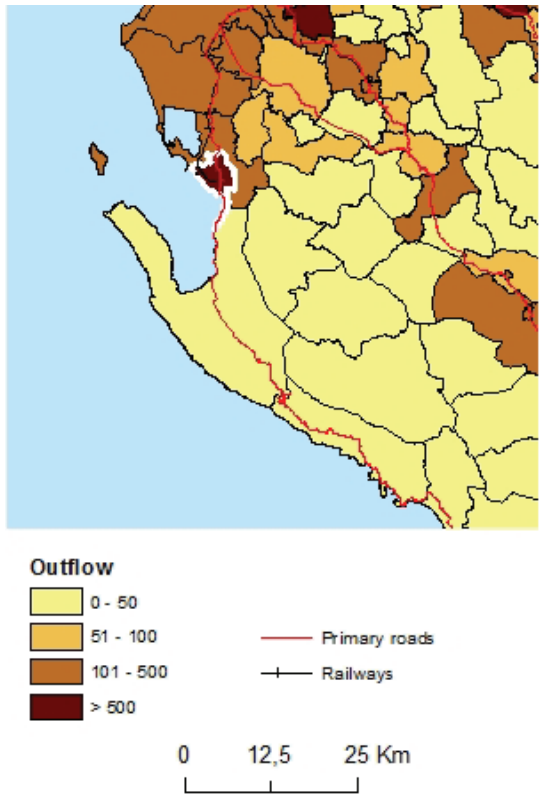


Figure 45: Vlorë and its surroundings

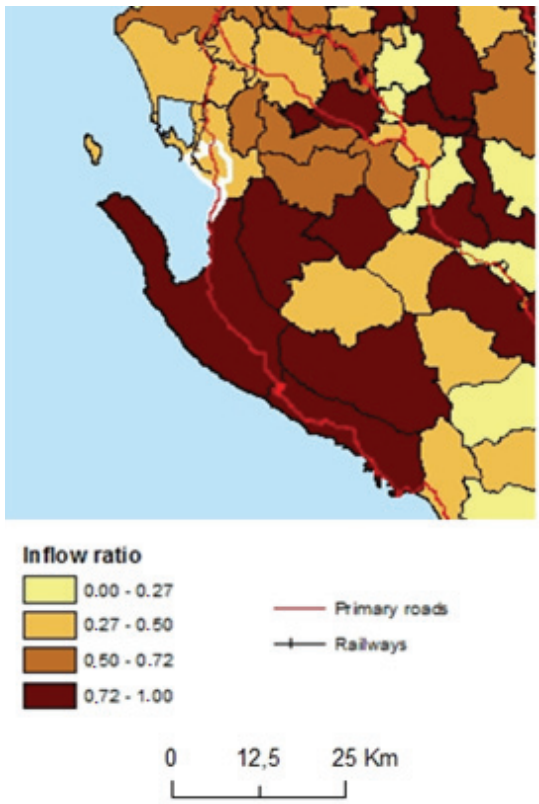
d_j^I



d_i^O



rd_j^I



rd_i^O

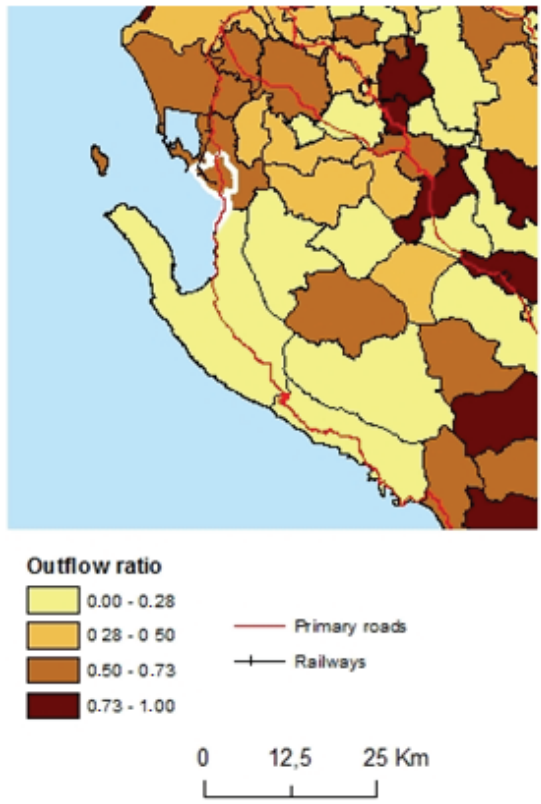
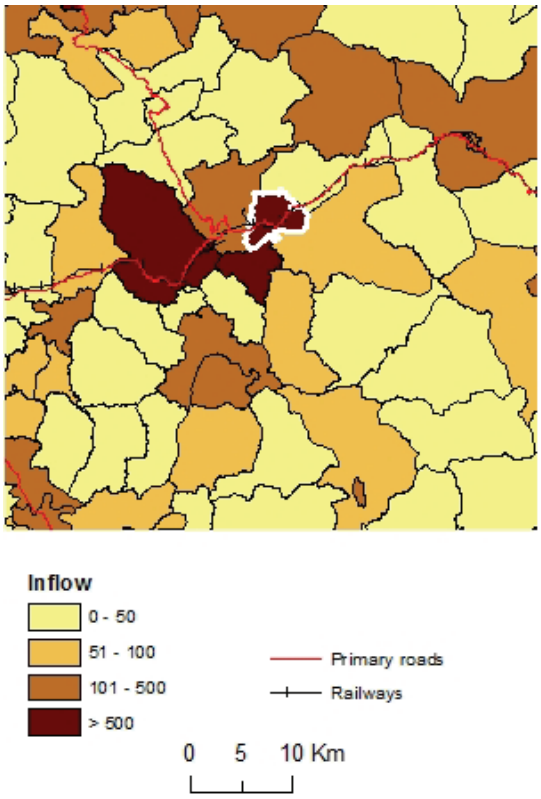
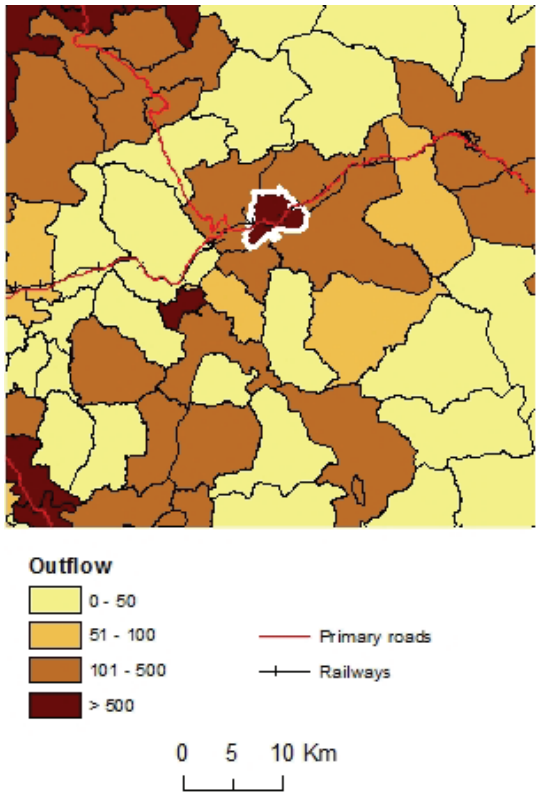


Figure 46: Elbasan and its surroundings

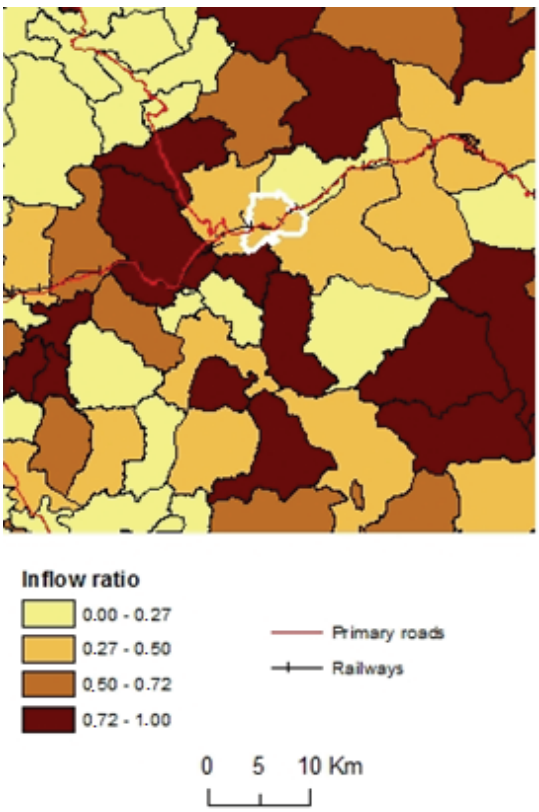
d_j^I



d_i^O



rd_j^I



rd_i^O

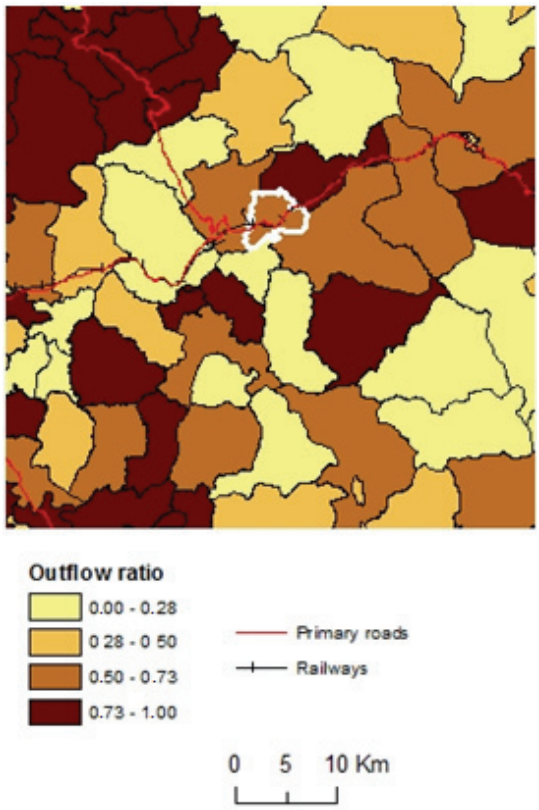
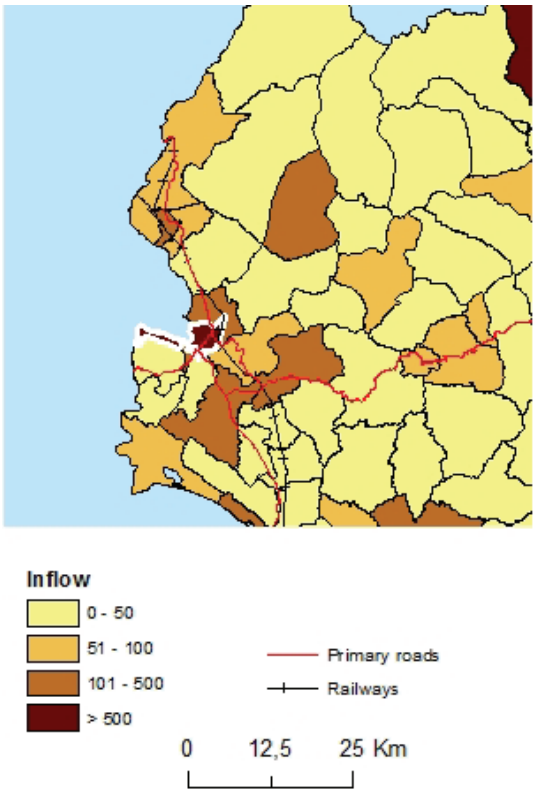
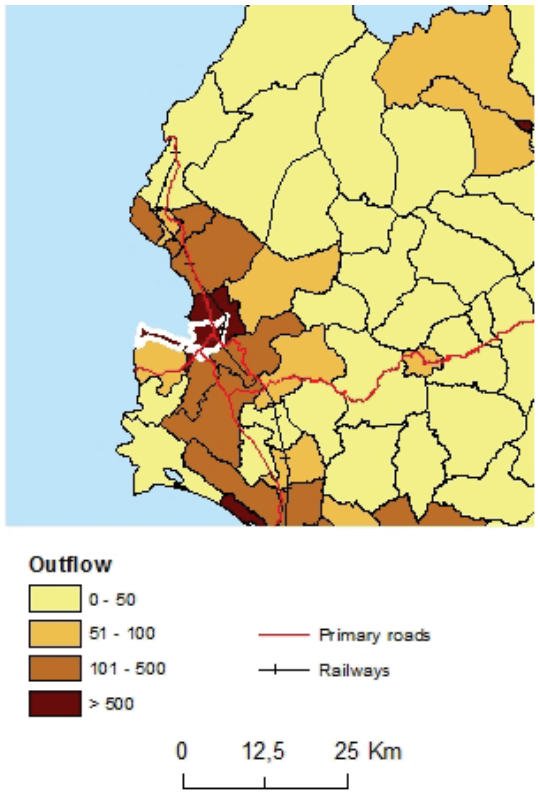


Figure 47: Shkodër and its surroundings

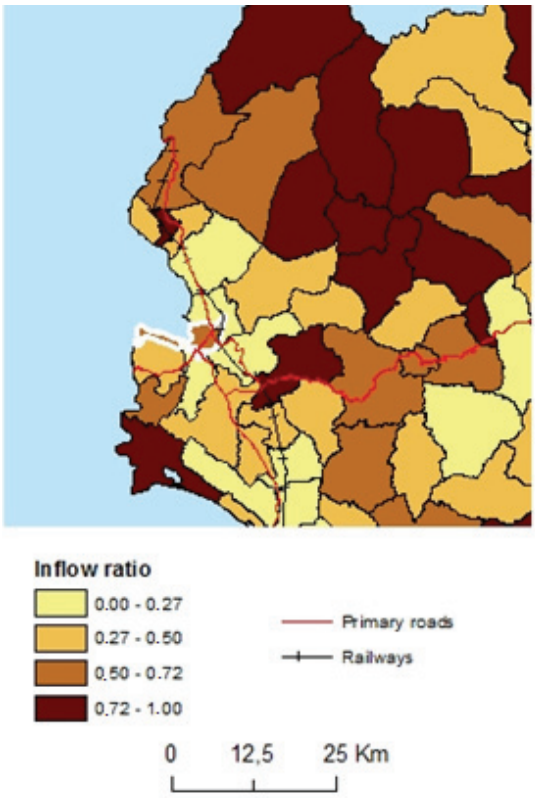
d_j^I



d_i^O



rd_j^I



rd_i^O

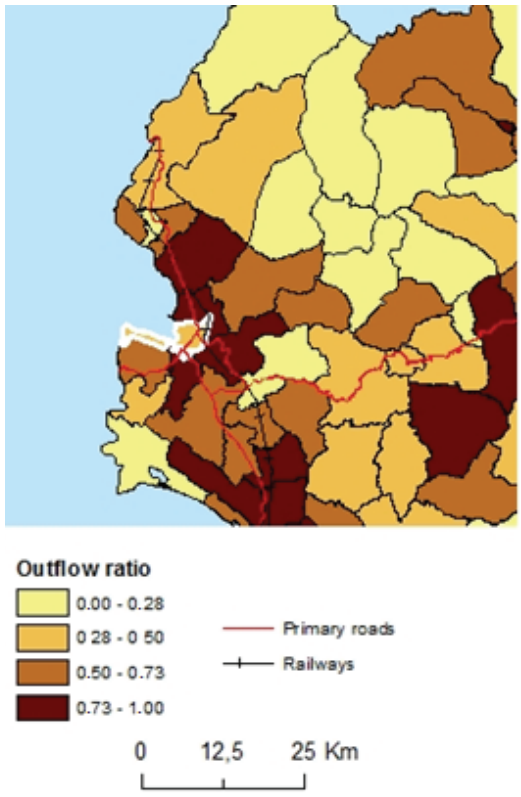
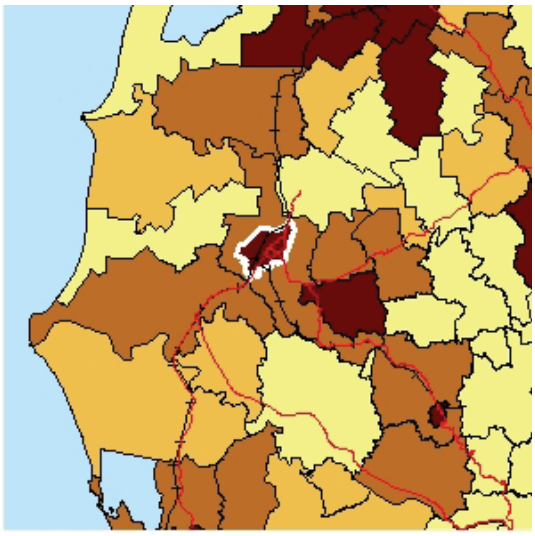
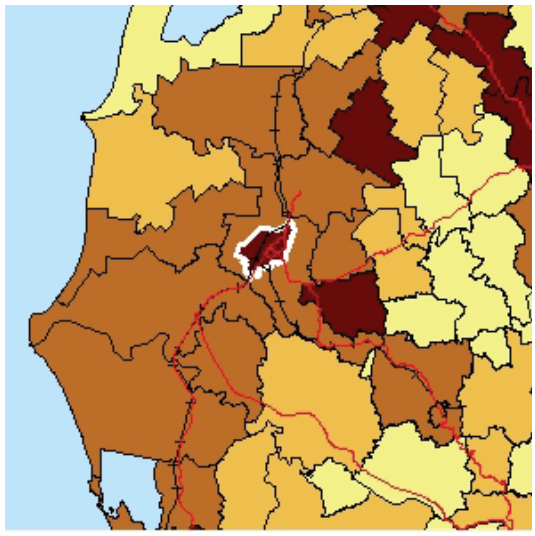


Figure 48: Fier and its surroundings

d_j^I



d_i^O



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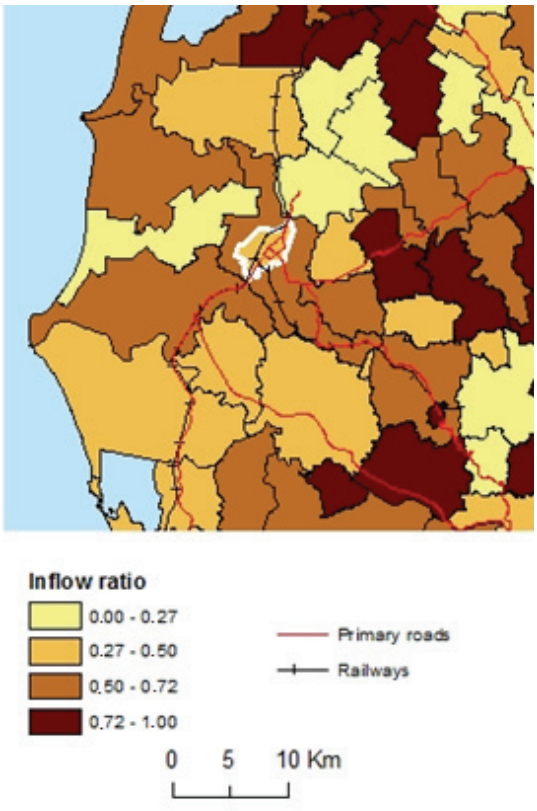


rd_i^O

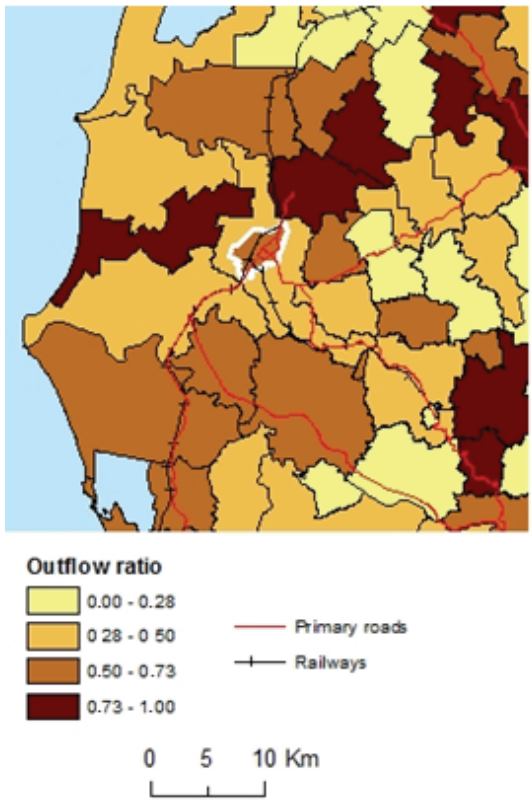
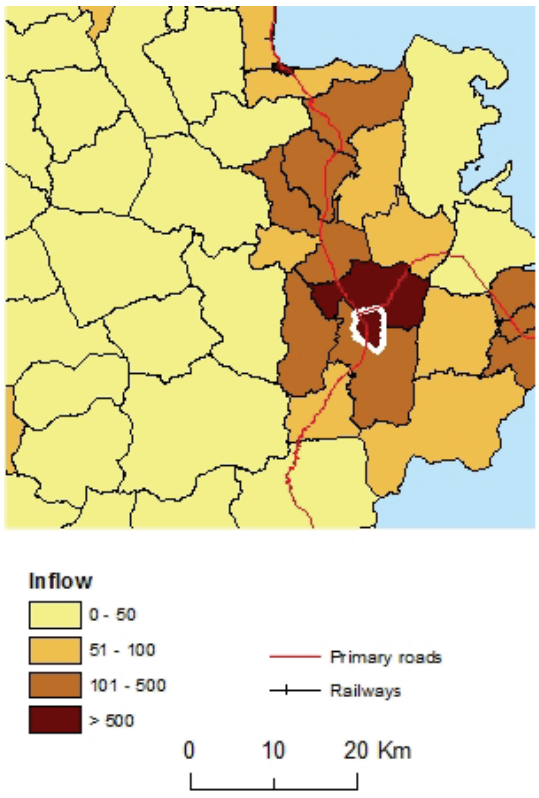
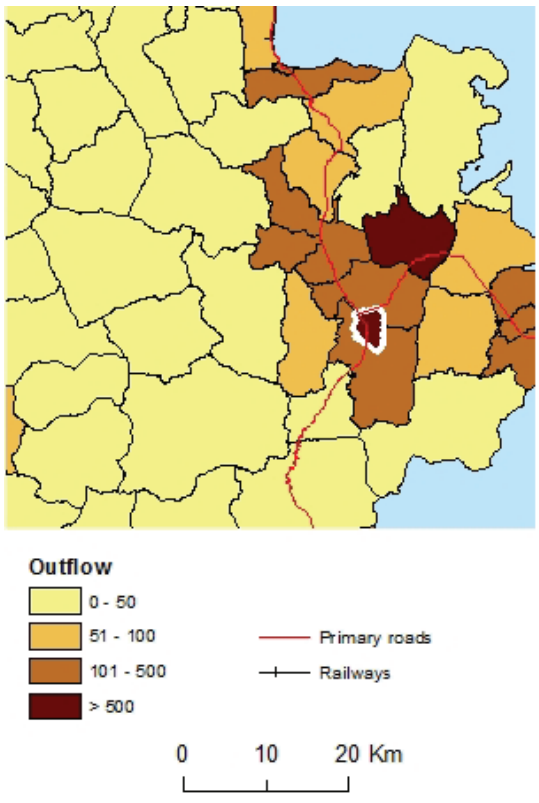


Figure 49: Korçë and its surroundings

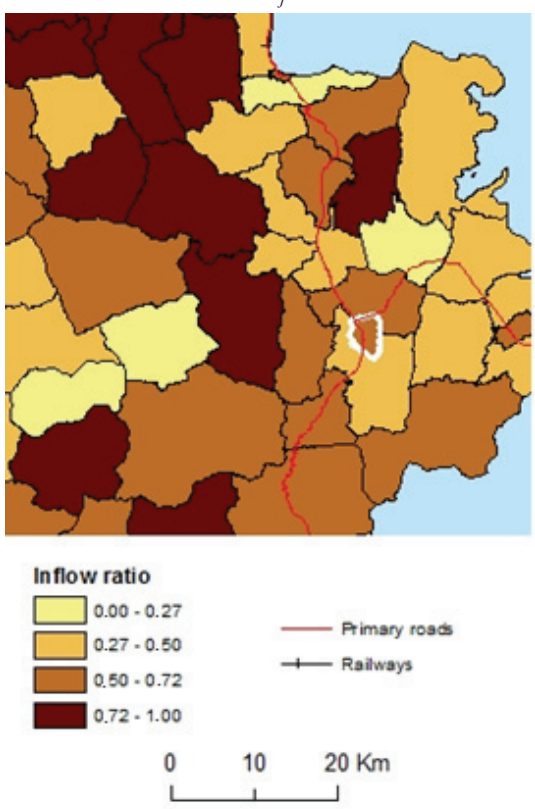
d_j^I



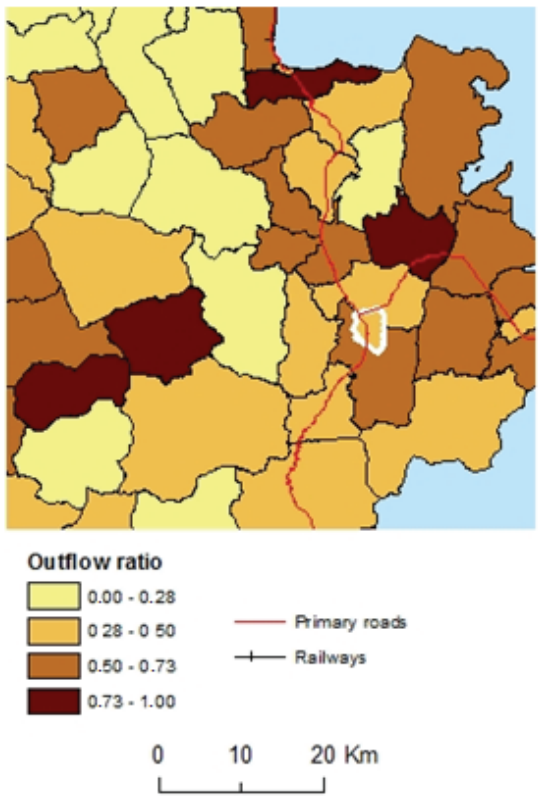
d_i^O



rd_j^I



rd_i^O



3.5.2 Usually resident population and day-time population

We will now analyse the impact of daily interactions on the usually resident population of each big municipality. Of course, their population might grow or decrease in function of the net flow (daily inflow-daily outflow). Municipalities that attract commuters more than they push away will see their usually resident population growing during the day-time; while, on the contrary, municipalities that attract less commuters than they push away will see their usually resident population declining.

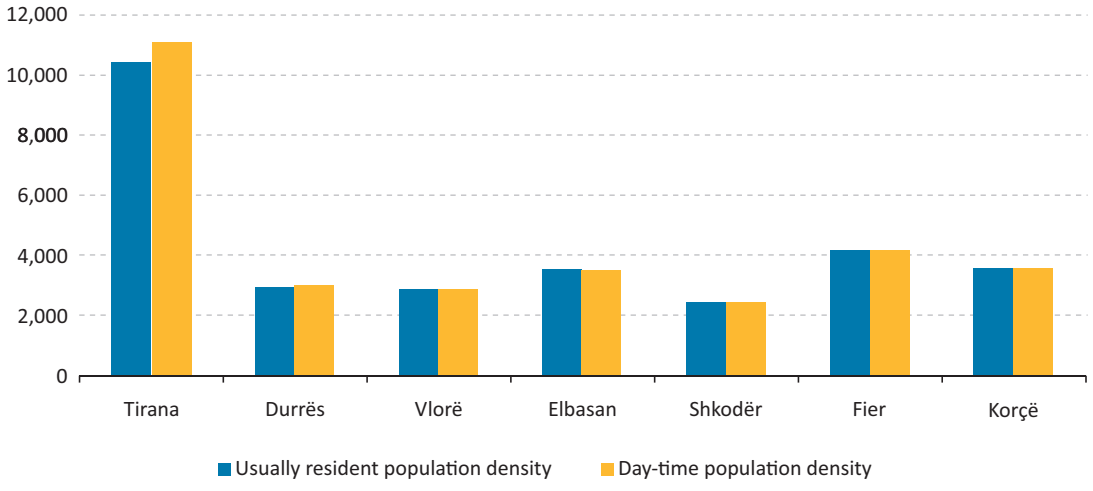
Looking at the difference between usually resident population and day-time population, we observe a significant difference for the municipality of Tirana, where the difference between commuters coming to and commuters going out of Tirana results in a positive net flow of about 25 thousand people (table 6), i.e. a net increase of 6% (figure 51). The day-time population is also higher for the municipalities of Durrës, Shkodër and Korçë (though the impact on the usually resident population is of only 1.2%, 0.8% and 0.6%, respectively), while the net flow is slightly negative for Elbasan, Fier and Vlorë. According to the daily net flow [7], the population density will also increase or decrease during the day.

As we may see (figure 50), the day-time population density is quite higher than the usually resident population for the municipality of Tirana, somewhat higher for the municipalities of Durrës and Shkodër and slightly higher for the municipality of Korçë, while it is almost the same for the others.

Table 6: Usually resident population, day-time population, absolute variations in the largest Albanian municipalities

Municipality	Usually resident population	Day-time population	Absolute variations
	(A)	(B)	(B) - (A)
Tirana	418,495	443,636	25,141
Durrës	113,249	114,656	1,407
Vlorë	79,513	79,439	-74
Elbasan	78,703	78,489	-214
Shkodër	77,075	77,549	474
Fier	55,845	55,702	-143
Korçë	51,152	51,573	421

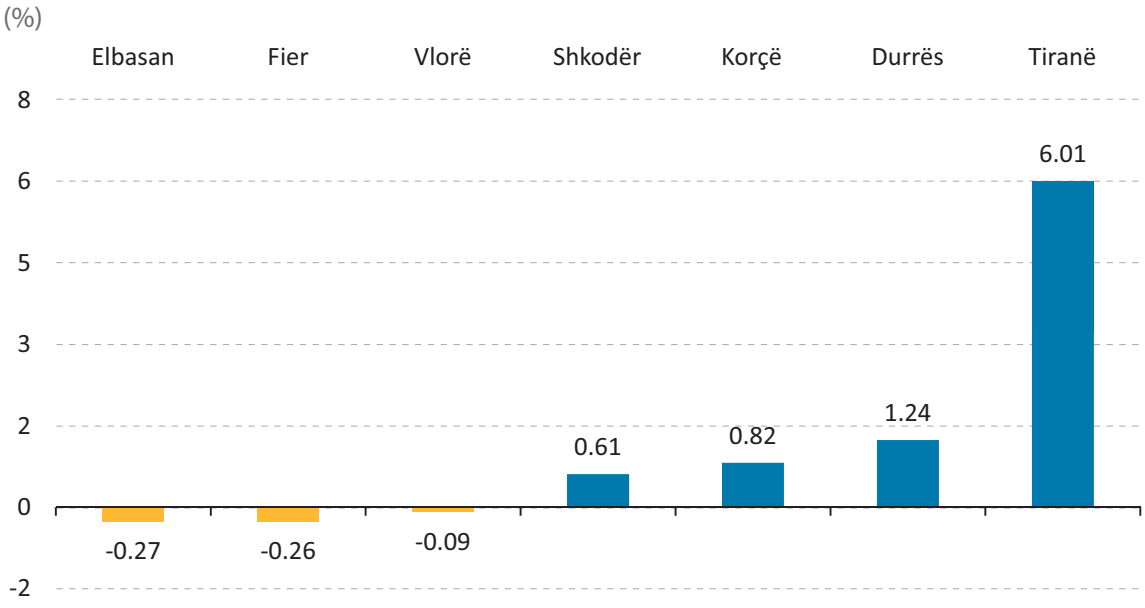
Figure 50: Usually resident population density and day-time population density in the largest Albanian municipalities



7 As known, population density is calculated as the ratio between the population and the surface (area) on which it insists, here expressed in Km2. In our case we have therefore two measures of the population density for each municipality (i); one refers to the usually resident population, and the second one refers to the daily population.

The impact of the daily spatial interactions on the usually resident population of each municipality is represented in figure 51, where the proportion of the daily net flow on the usually resident population, $d_i^N / P_i \times 100$, is shown.

Figure 51: Percentage of daily net flow on the usually resident population in the largest Albanian municipalities



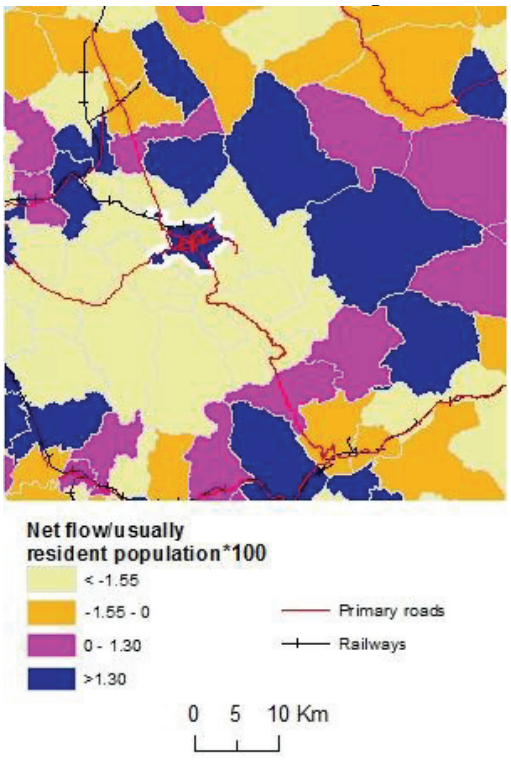
A peculiar role is therefore played by the municipality of Tirana, acting mainly as an attraction pole (with a positive net flow between day-time population and usually resident population), while the other big municipalities appear mainly as redistribution poles, being characterized by inflows as high or just slightly higher than outflows.

This dynamic is further confirmed by the representation on a map of the proportion of the daily net flow on the usually resident population of each of the seven selected municipalities, considered together with their surrounding areas (figure 52).

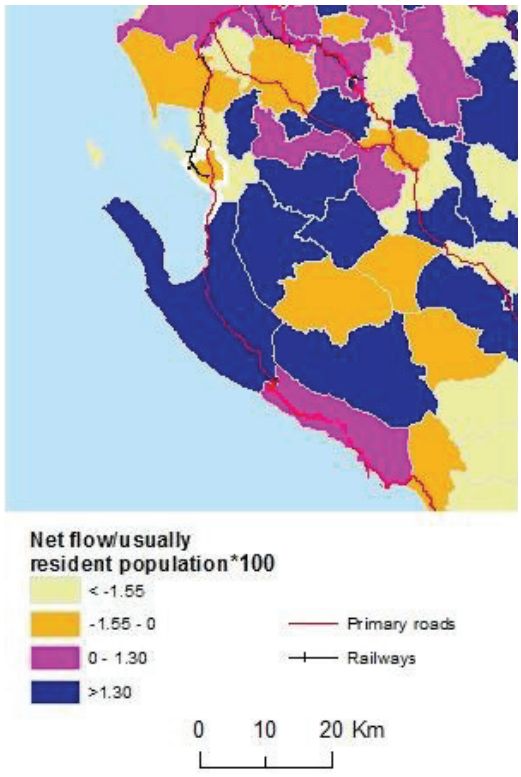
The role played by big municipalities as poles of attraction of daily spatial inflows is clearly evident. However, as we know, they are also poles of redistribution of daily spatial outflows, as highlighted by the analysis of daily inflow and outflow ratios (figures 43-49).

Figure 52: Percentage of daily net flow on the usually resident population in the largest Albanian municipalities and surroundings

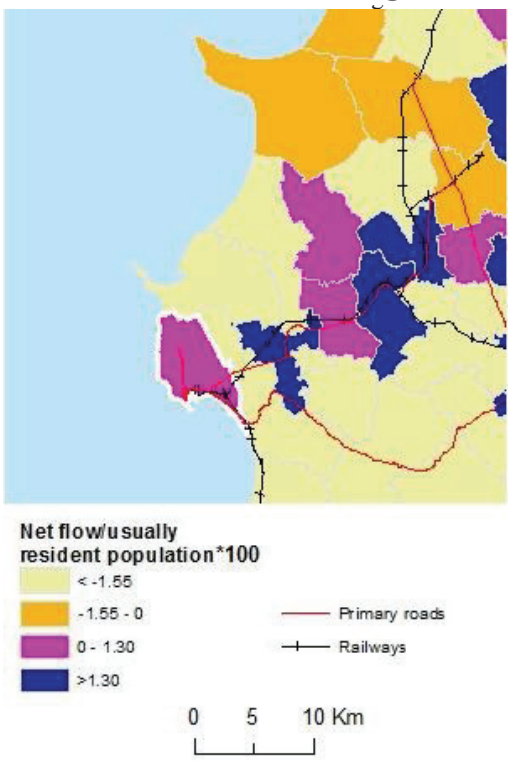
Tirana and its surroundings



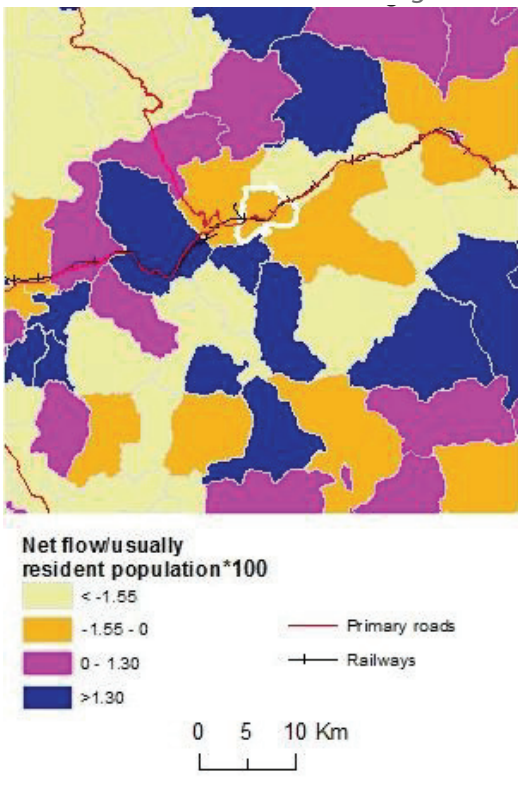
Vlorë and its surroundings



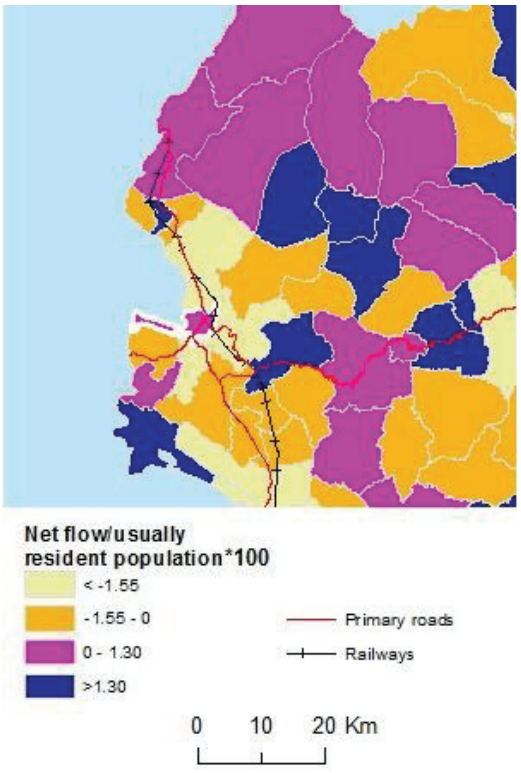
Durrës and its surroundings



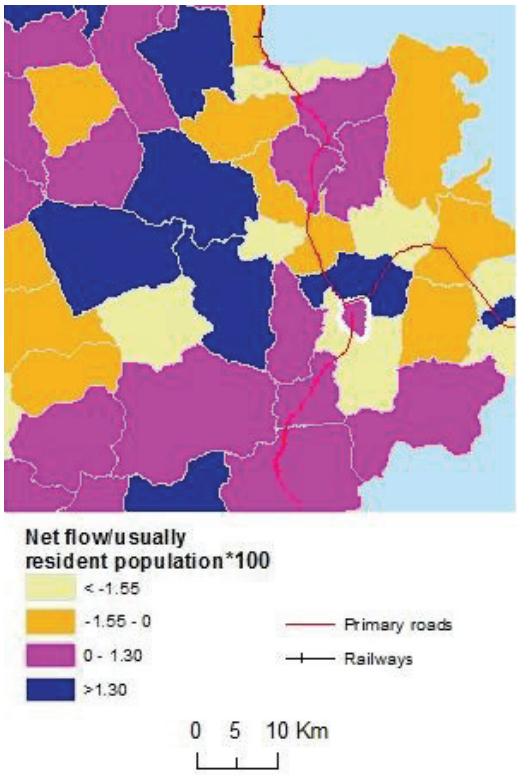
Elbasan and its surroundings



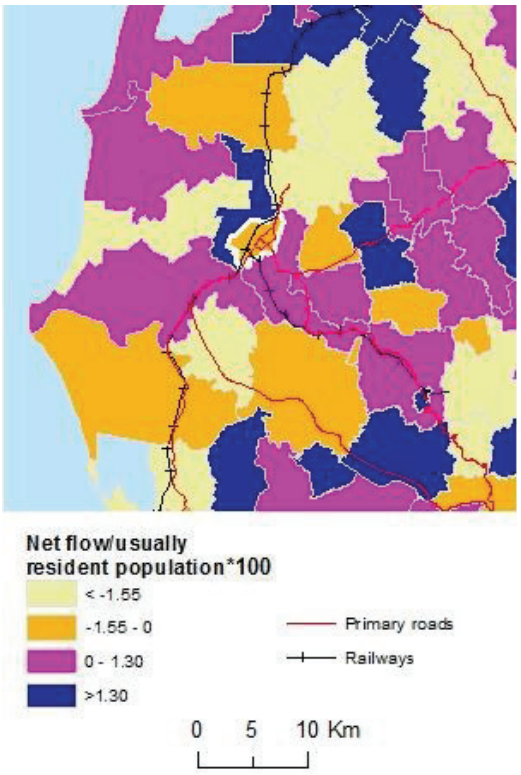
Shkodër and its surroundings



Korçë and its surroundings



Fier and its surroundings



3.5.3 Daily inflows by distance and areas of influence of big municipalities

As it is known, the distance between the place of residence (i) and the place of work (j) acts as a friction to the daily spatial interactions. Usually, as the distance increases, the volume of the daily inflows tends to decrease. Obviously, this relation may change depending on other variables, such as transport network or a given function exerted by the municipality of destination (e.g. availability of certain services). We will test this assumption considering the seven selected municipalities. In particular, we have analysed the inflow volume to these municipalities by distance of the place of origin. The distance is expressed in km and it refers to the distance between the centroid of the municipality/communes of residence (i) and the centroid of the municipality/commune of work (j). As we may see in figure 53, the inverse relation between distance and volume of inflow seems to be valid also in the case of the seven municipalities under observation. However, we may note some differential aspects among the seven municipalities. These differential aspects refer not only to the absolute volume of inflows but also to the profile of the curves and to some descriptive statistics (weighted distance mean, maximum distance, modal distance)[8] .

As an example, Tirana, which attracts many daily commuters, seems to have a quite large gravitational basin in general terms (the maximum distance to Tirana is the third highest distance), even though the vast majority of daily commuters live in adjacent areas or however very close to the capital. This is shown by the fact that 71.5% of the commuters going daily to Tirana fall within the first class of distances (<= 10 km).

In the case of Durrës, the volume of flows tends to decrease as the distance increases, but beginning only from the second class (10-20km), where fall more than half of the commuters going daily to Durrës.

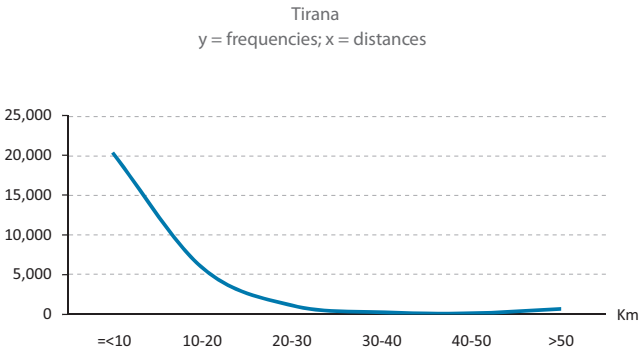
Vlorë records the highest maximum distance (about 194 km) and also the highest average one (22,4 km). In this case, the flows coming from municipalities which are more distant than 40 km appear to be relevant.

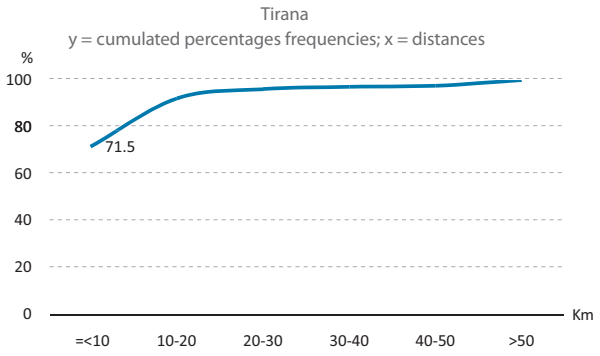
In the case of Elbasan, the modal distance is quite short (a bit more than 6 km) as the maximum distance is also comparatively short, even though in order to exceed the 50% of incoming commuters.

Shkodër, Fier and Korçë may be treated as one group (though with some differences among them). As for Elbasan, we have to refer to the second class of distances (10-20 km) in order to exceed the 50% of incoming commuters. The modal distances are quite short (especially for Fier and Korçë) while the average ones vary from 14.8 km for Korçë to 17.7 km for Fier. What appears as relevant in all of the three municipalities is the final part of the curve which increases in the last class.

8 The Weighted distance mean is the average distance travelled by daily commuters obtained as the average of the distances travelled by those entering the municipality weighted by their number (how many people enter). The Max distance is the maximum distance of the distribution of distances travelled by daily commuters. The Modal distance is the distance that records the highest frequency (i.e. the distance which originates the highest number of commuters).

Figure 53: Distance and commuting inflows in the largest Albanian municipalities

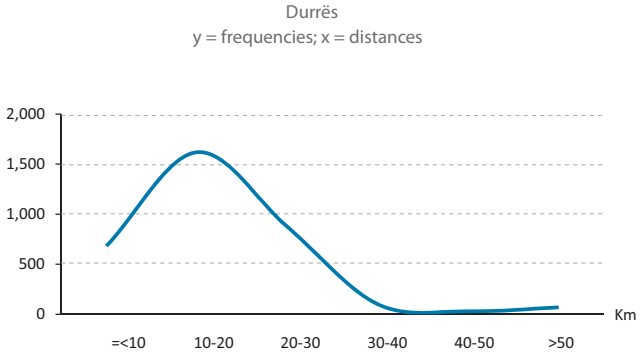


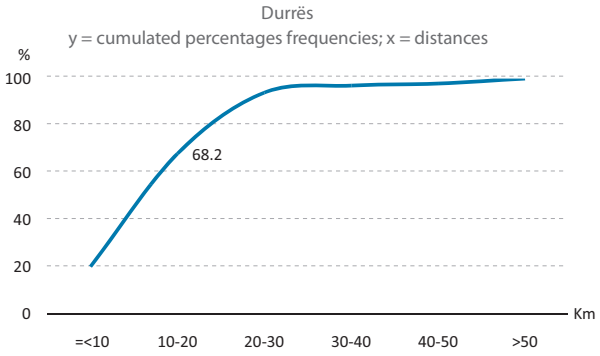


Weighted distance mean = 11.3 km

Max distance = 186.1 km

Modal distance = 8.3 km

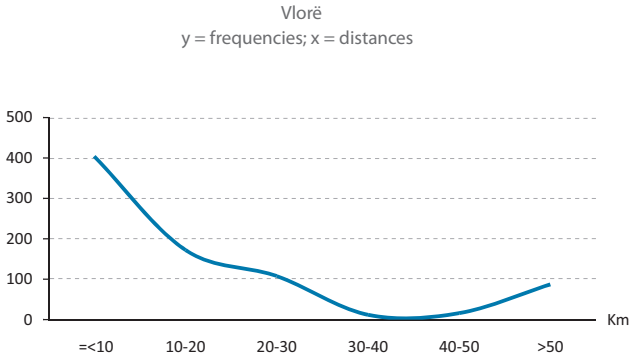


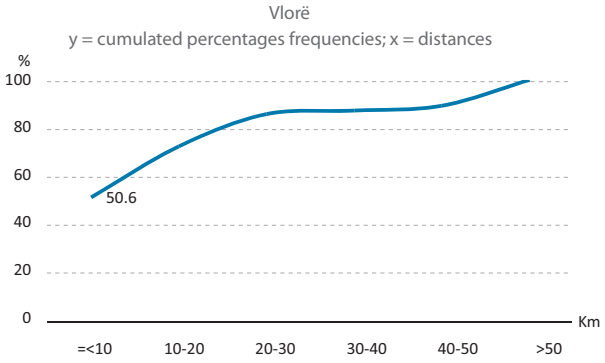


Weighted distance mean = 18.0 Km

Max distance = 143.5 km

Modal distance = 11.6 km



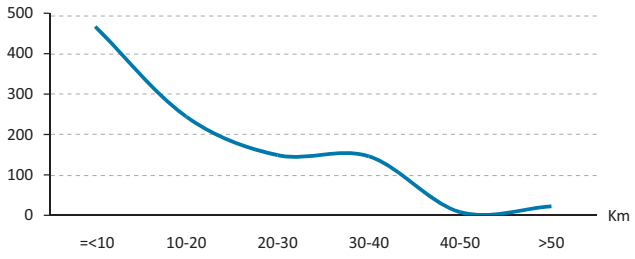


Weighted distance mean = 22.42 km

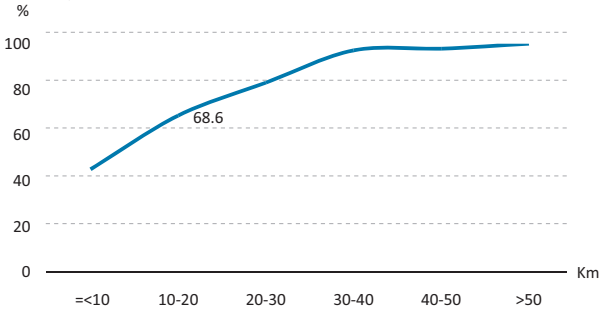
Max distance = 193.8 km

Modal distance = 6.5 km

Elbasan
y = frequencies; x = distances



Elbasan
y = cumulated percentages frequencies; x = distances

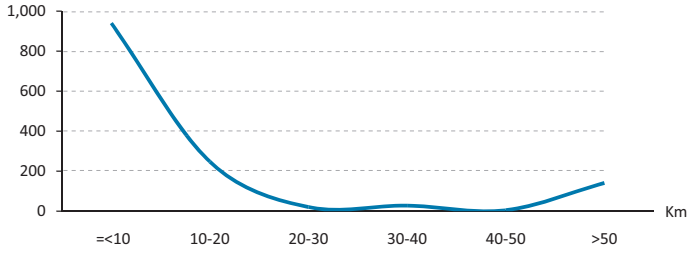


Weighted distance mean = 16.3 km

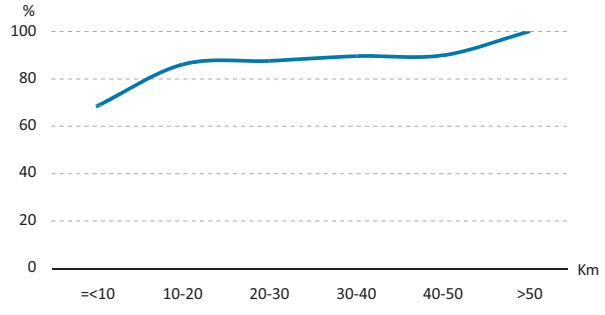
Max distance = 136.1 km

Modal distance = 6.3 km

Shkodër
y = frequencies; x = distances



Shkodër
y = cumulated percentages frequencies; x = distances

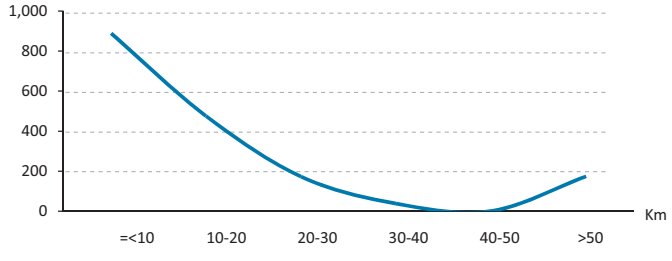


Weighted distance mean = 16.6 km

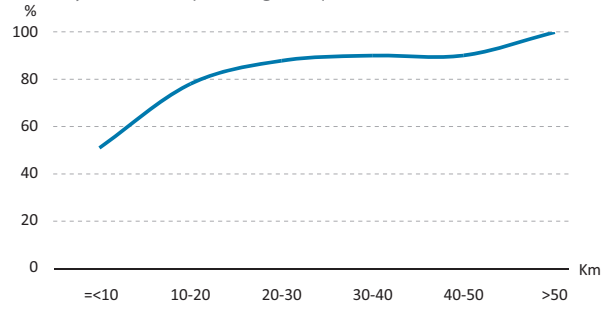
Max distance = 148.2 km

Modal distance = 5.3 km

Fier
y = frequencies; x = distances



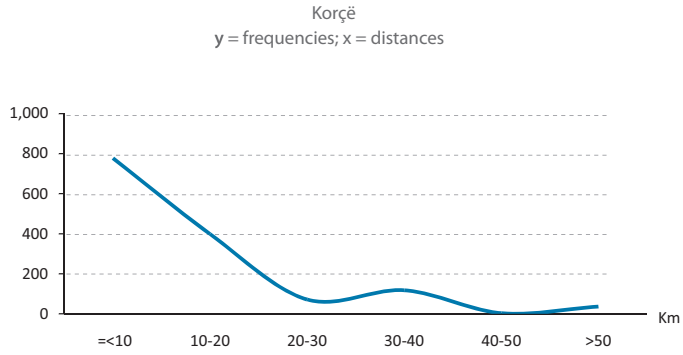
Fier
y = cumulated percentages frequencies; x = distances

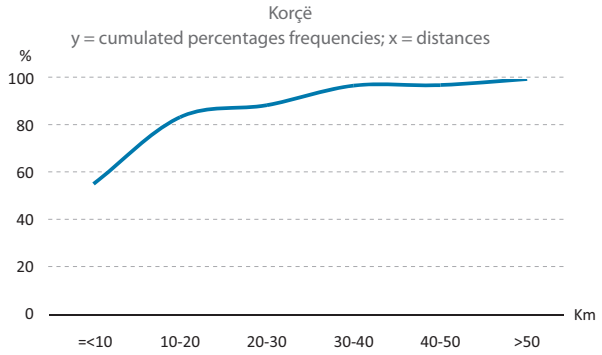


Weighted distance mean = 17.7 km

Max distance = 183.4 km

Modal distance = 8.7 km





Weighted distance mean = 14.8 km

Max distance = 192.7 km

Modal distance = 5.1 km

If it is true that the distance acts as a friction to daily spatial interactions (under equal conditions), it is also true that it represents a variable of study that might provide useful information, at least indirectly, on the functions exerted by the municipalities under analysis.

In this perspective, it is interesting to study from a geographical point of view the system of daily spatial interactions of each of the seven considered municipalities. Figures 54 to 60 represent (one per municipality) the percentage distribution of daily commuters working in each municipality by municipality/commune of residence. We have to recall that this aggregate includes daily commuters who reside in the municipality and commute daily from home to work within its territory (i.e. people with a fixed workplace outside home within the same municipality of usual residence) and who, in fact, usually represent the majority of the daily commuters of a given municipality.

From the maps we can clearly see that some municipalities attract daily commuters from a wide range of municipalities and are characterized by a gravitational area that covers a large surface (Tirana, Durrës and, partially, Vlora). Some others, on the contrary, are characterized by a gravitational area less extended and geographically circumscribed (Elbasan, Shkodër, Fier and Korçë). Nevertheless, what once again emerges clearly is the strong link between big municipalities and their surrounding areas in terms daily spatially interactions.

Figure 54: Percentage distribution of daily commuters working in Tirana by municipality/ commune of residence

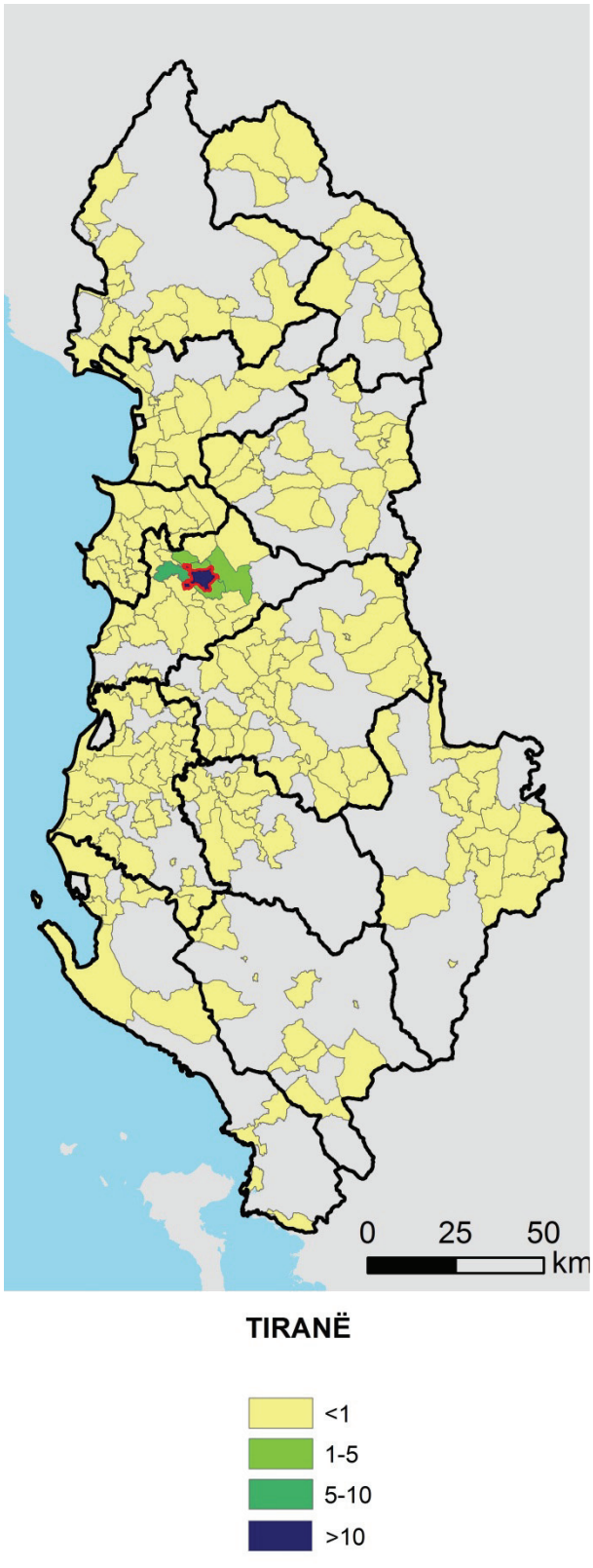


Figure 55: Percentage distribution of daily commuters working in Durrës by municipality / commune of residence

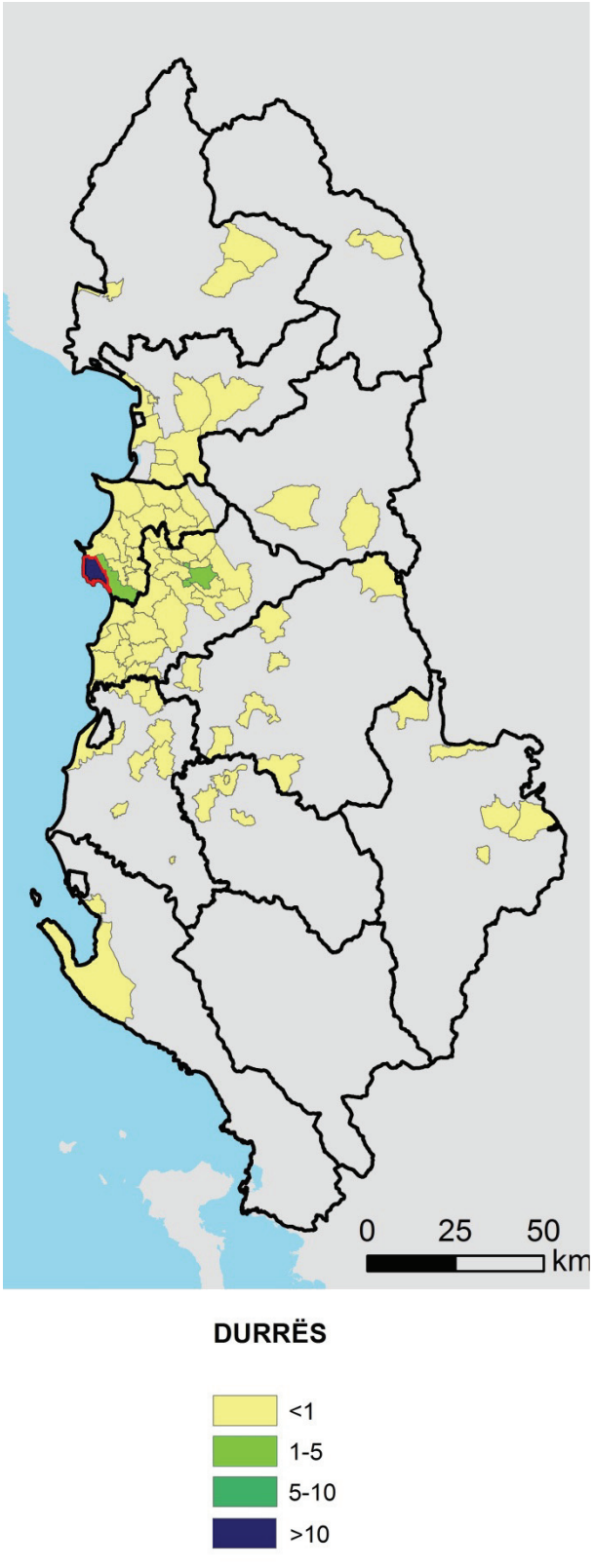


Figure 56: Percentage distribution of daily commuters working in Vlorë by municipality/ commune of residence

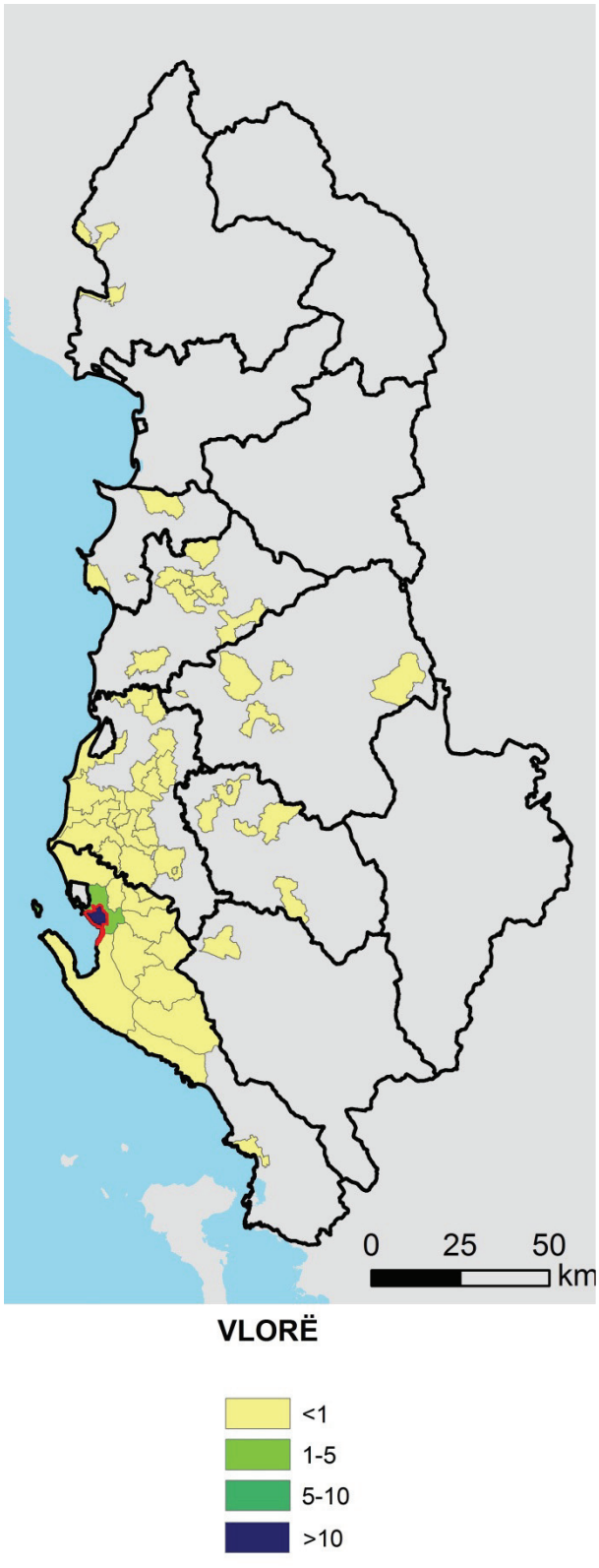


Figure 57: Percentage distribution of daily commuters working in Elbasan by municipality/ commune of residence

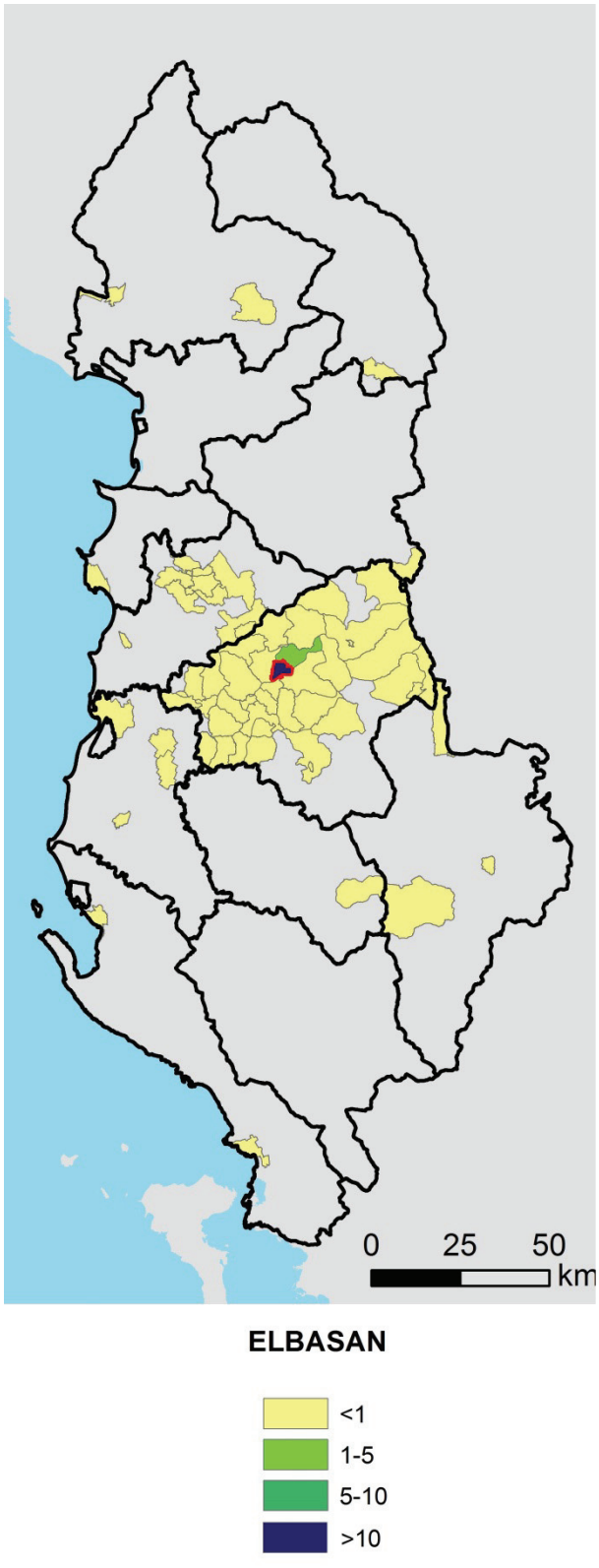


Figure 58: Percentage distribution of daily commuters working in Shkodër by municipality/ commune of residence

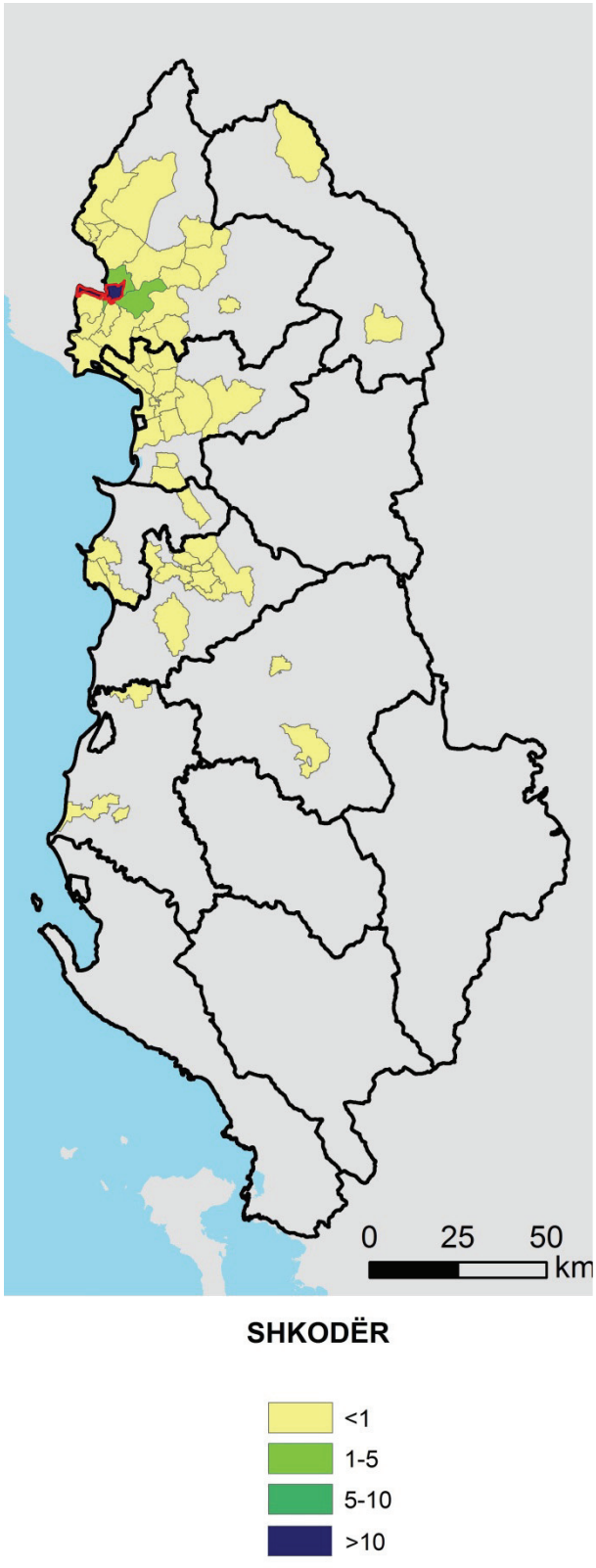


Figure 59: Percentage distribution of daily commuters working in Fier by municipality / commune of residence

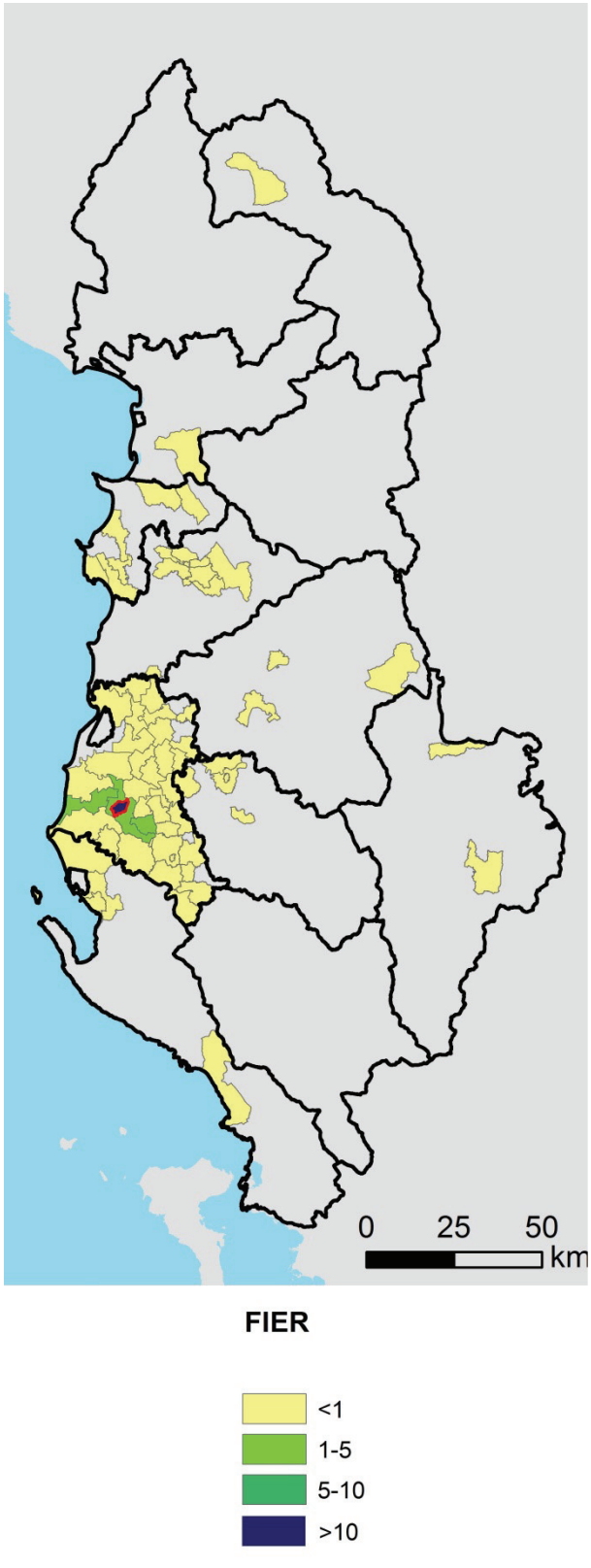
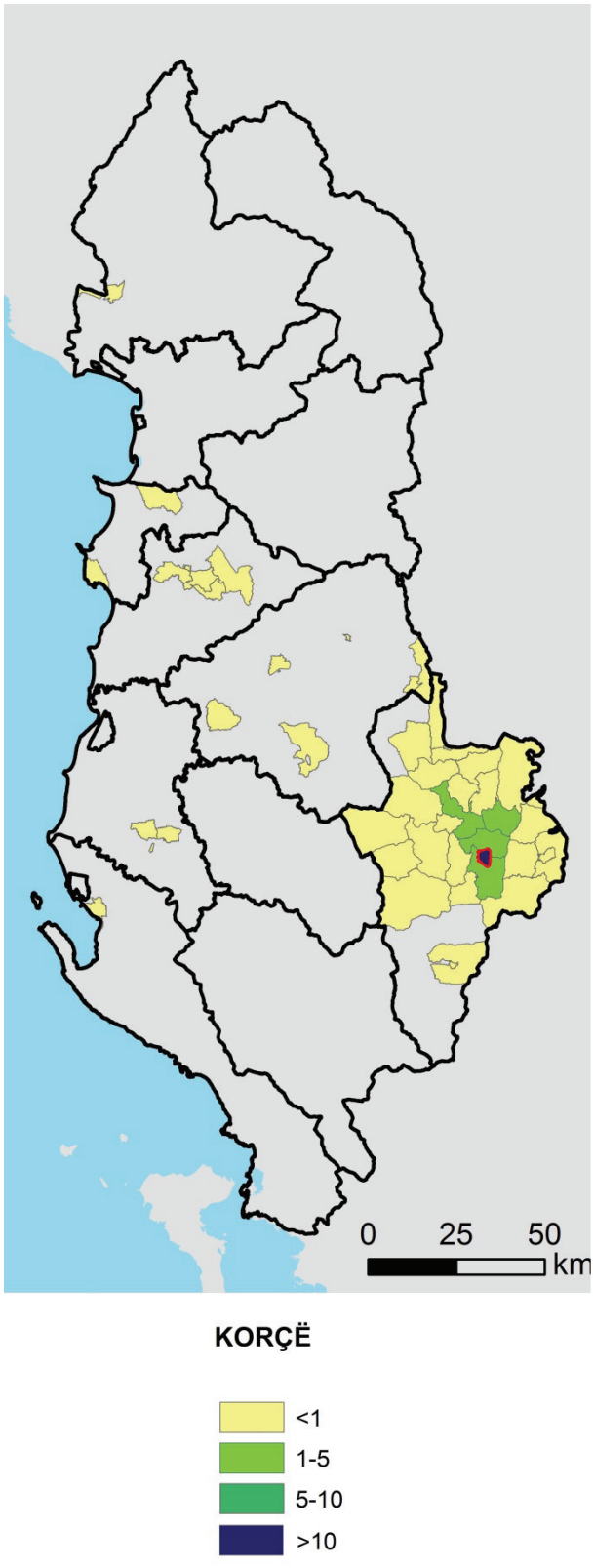


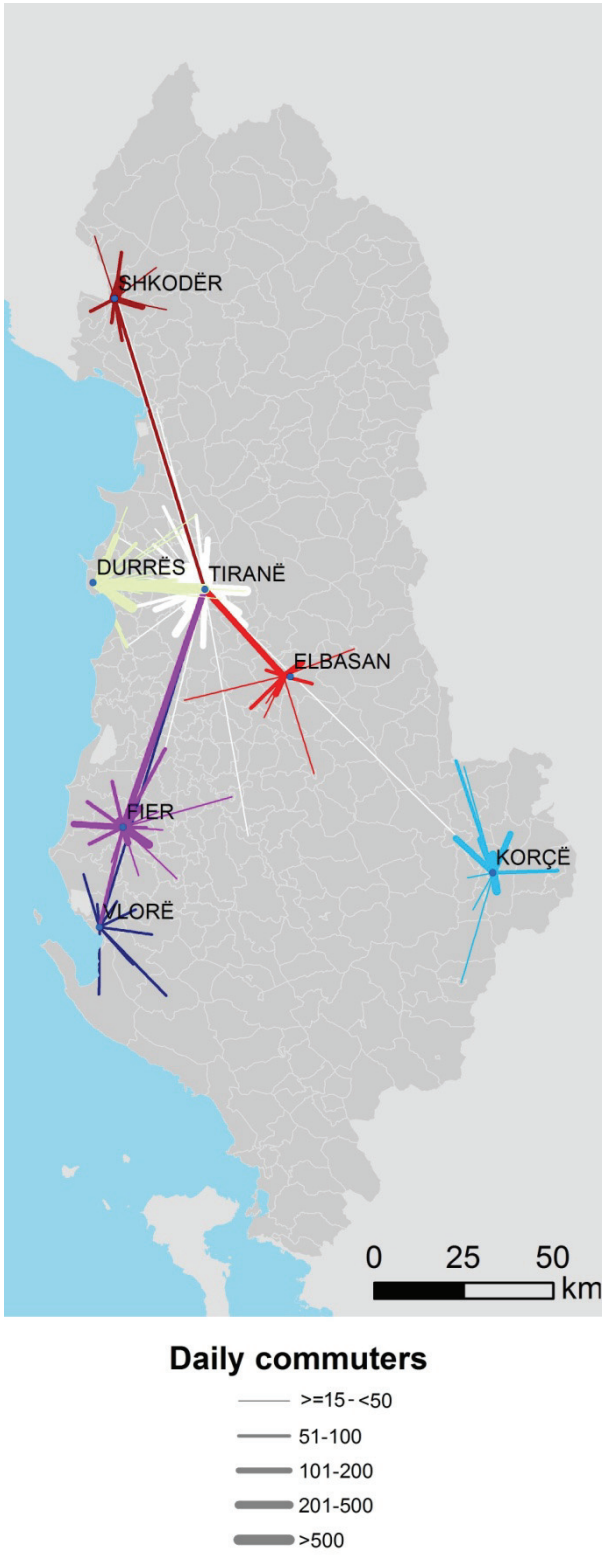
Figure 60: Percentage distribution of daily commuters working in Korçë by municipality/ commune of residence



We will now try to understand whether these seven systems are related to each other. In figure 61 we have represented, by a geographical approach, the distribution (in absolute values) of daily commuters by municipality/commune of residence for each of the seven municipalities. Namely, the daily inflow to each of the seven selected municipalities and coming from one of them has been represented by a centroid to centroid vector, whose thickness is proportional to the intensity of the flow. In order to get a more comprehensible representation and to represent flows actually significant in relation to the structure of the daily interactions system, daily inflows <=15 units have not been represented[9] .

This representation further enhances our understanding of the spatial patterns that characterize commuting in Albania. In fact, on one hand, each municipality's gravitational area becomes better defined and, on the other hand, it clearly emerges that these seven systems of daily mobility are linked to each other and, in some cases, such as for the flows Tirana/Durrës, Tirana/Elbasan, Tirana/Fier, the link is even quite strong (figure 61).

Figure 61: The system of daily spatial interactions among the seven largest Albanian municipalities



9 As an example, the flow going from Lumas (district of Berat) to Tirana has not been represented (frequency = 1 person) as it is for the flow going daily from Rrapë in the district of Pukë to Elbasan (frequency = 1 person).

4 MULTIVARIATE SPATIAL ANALYSIS OF DAILY COMMUTING FLOWS IN ALBANIA

4.1 Introduction

The purpose of this chapter is to study and identify patterns underlying daily spatial interactions data (i.e. daily commuting flows) among Albanian municipalities/communes through a multivariate spatial analysis, in order to propose an alternative classification to the traditional administrative and geographical ones (prefectures and districts).

Traditional flow-mapping approaches are unsatisfactory to this aim because, as mentioned by Guo (2009a):

- they are only effective in portraying small datasets and will quickly become cluttered as the dataset size increases;
- they often use the default geographic units of the observational data (e.g. countries or municipalities), which may not be the best to represent and uncover underlying patterns due to the existing significant differences (e.g. in terms of population and size) among the units. In fact, one can easily imagine that, if locations are grouped into different regions, different flow patterns may emerge;
- finally, traditional flow-mapping approaches cannot visualize multivariate information simultaneously with flow patterns.

For the aforementioned reasons we have decided to apply a method, named Flow Map – Flow Mapping with Graph Partitioning and Regionalization, recently proposed by Guo (Guo, 2009a; Guo, 2010a). This method is applied by the use of integrated software designed to explore flow patterns in large spatial interaction data. In particular, it involves two major steps:

a. using spatially constrained graph partitioning to find a hierarchy of regions defined by spatial interactions, the so called natural (or derived) regions;

b. representing a flow map based on natural (or derived) regions and their attributes.

The first step (a) will be based on the results of a spatial clustering and regionalization carried on through another software package recently developed by Guo (2010b), named GraphRECAP – Graph Regionalization with Clustering and Partitioning[1]. We will first analyse the results of a spatial clustering carried on without imposing any spatial constraining strategy (paragraph 4.2), and then, through the imposition of a set of constraining parameters (paragraph 4.3), we will finalize the regionalization process which will be the input of the flow mapping tools (paragraph 4.4).

4.2 Spatial clustering with a non-spatial constraining strategy

As input variables of the spatial clustering process we have selected ten indicators (computed for each municipality/commune of Albania) plus the spatial attributes of each municipality/commune. The indicators are:

1. surface (in mt2)
2. daily outflow degree: the number of destinations that have daily flows from each municipality/commune
3. daily outflow: the total daily volume (i.e. the total daily commuters) going outside each municipality/commune
4. adjusted daily outflow ratio, i.e. the ratio between the daily outflow and the usually resident population
5. adjusted daily net flow ratio, i.e. the ratio between the net flow (daily inflow – daily outflow) and the usually resident population

1 GraphRECAP is a toolkit for partitioning spatially embedded graphs (such as county to county migrations or commuting flows) and deriving spatially contiguous regions based on graph connections (Guo, 2010b). Readers are referred to Guo's publication for computational, technical and methodological details (Guo, 2008, 2009a, 2009b, 2010a, 2010b).

6. adjusted daily inflow ratio, i.e. the ratio between the daily inflow and the usually resident population
7. daily inflow degree: the number of destinations that have daily flows to each municipality/commune
8. usually resident population
9. daily inflow: the total daily volume (i.e. the total daily commuters) coming to each municipality/commune
10. daily net flow (daily inflow – daily outflow).

On the basis of the input variables, after standardizing them, GraphRECAP identified 16 clusters (i.e. groups) of municipalities/commune. This number is due to the dimension of the SOM (Self Organizing Map) which was chosen out of the various alternatives, since it proved to ensure the best results in terms of cluster differentiation (each cluster has the highest possible inner homogeneity while heterogeneity among clusters is the highest possible).

Each SOM node (cluster) is represented by a circle, whose size (area) represents the number of units (municipalities in our case) that it contains. SOM uses the Euclidean distance to assess the multivariate similarity between spatial objects. Therefore, nearby clusters are more similar to each other than those far away.

Behind the nodes (circles) there is the U-Matrix layer, where hexagons are shaded to show the multivariate dissimilarity between neighbouring nodes, with darker tones representing greater dissimilarity (Guo, 2010a)[2].

Furthermore, a Parallel Coordinate Plot (PCP) is used to reveal the meaning of each municipality assigned to each cluster by SOM, since on this plot we may observe the clusters' profile and their level of similarity. Finally, the results are related to each other and visualized on an interactive map.

In figure 62 we may observe the general results of this first step of analysis. In the multivariate mapping (a) municipalities with the same colours belong to the same clusters while, in the clustering with SOM (b), node hexagons (clusters of municipalities) with similar colours present a lower level of dissimilarity. This difference can also be seen in the PCP (c), where lines of colours very different among each other refer to clusters that present divergent values of the input indicators (that is to say a divergent "profile"). It should be noted that the thickness of the lines in (c), as the circumference of the node hexagons in (b), is proportional to the size of clusters.

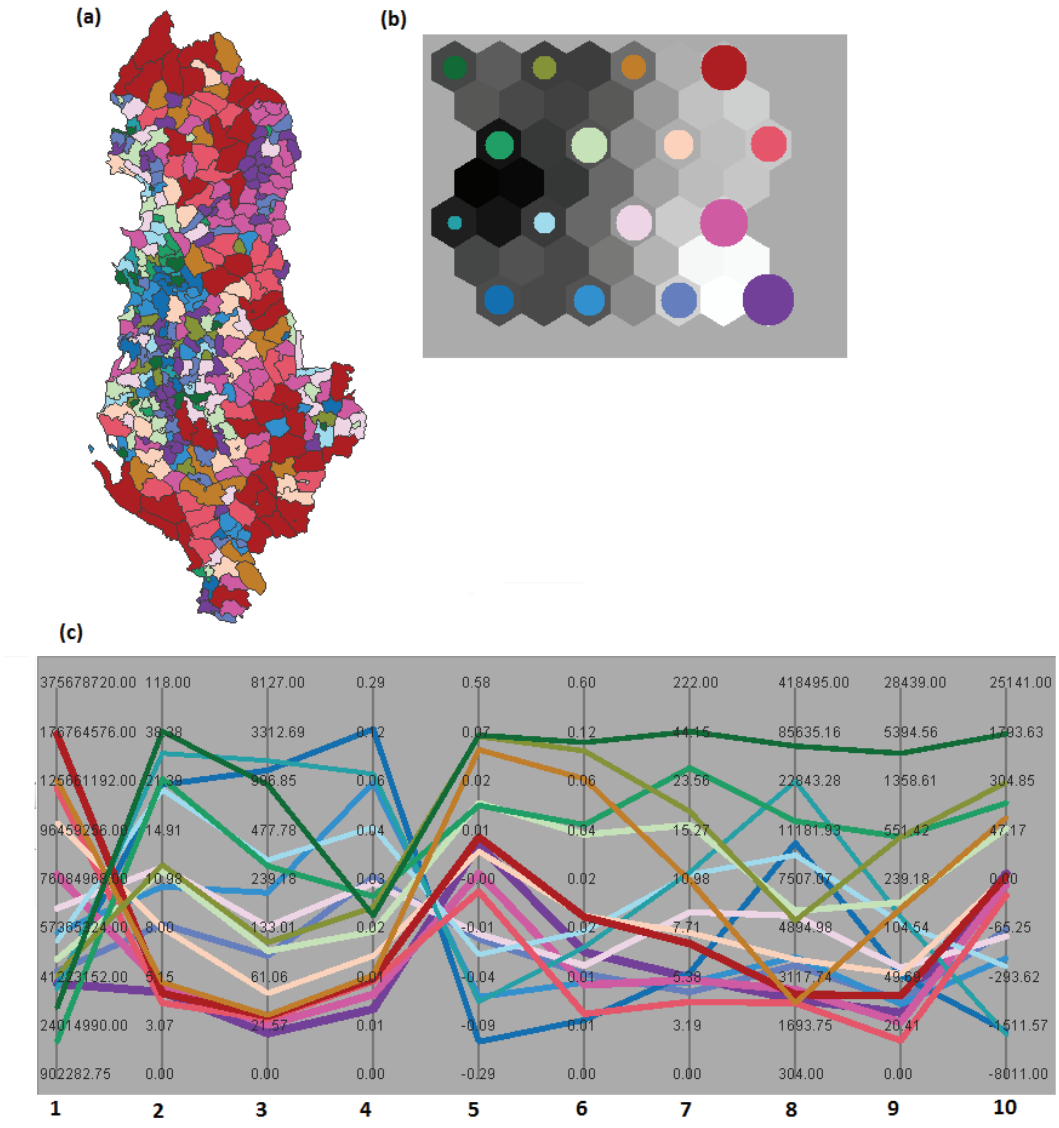
PCP is made up of as many axes as the indicators used in the analysis. Every axe is scaled using the nested means method, which puts the mean value at the centre of each axis and thus makes axes defined by different units and data ranges comparable (Guo, 2010a)[3].

Figure 62 shows that a certain degree of variability exists in terms of daily spatial interactions flows (c) and that this variability appears to follow particular spatial patterns, at least in a certain number of cases. Actually, a fairly large number of municipalities with similar profiles, and therefore belonging to the same cluster or to clusters with a low level of dissimilarity, quite often prove to be contiguous in terms of spatial location (figure 62.a).

2 Detailed explanation about SOM can be found in relevant publications (Guo, Gahegan et al. 2005, Kohonen, 1995).

3 This method can alleviate overlapping problems in PCP for skewed data distributions. Specifically, nested means method is a non-linear scaling that recursively calculates a number of mean values (and sub means) and uses these values as break points to divide each axis into equal-length segments.

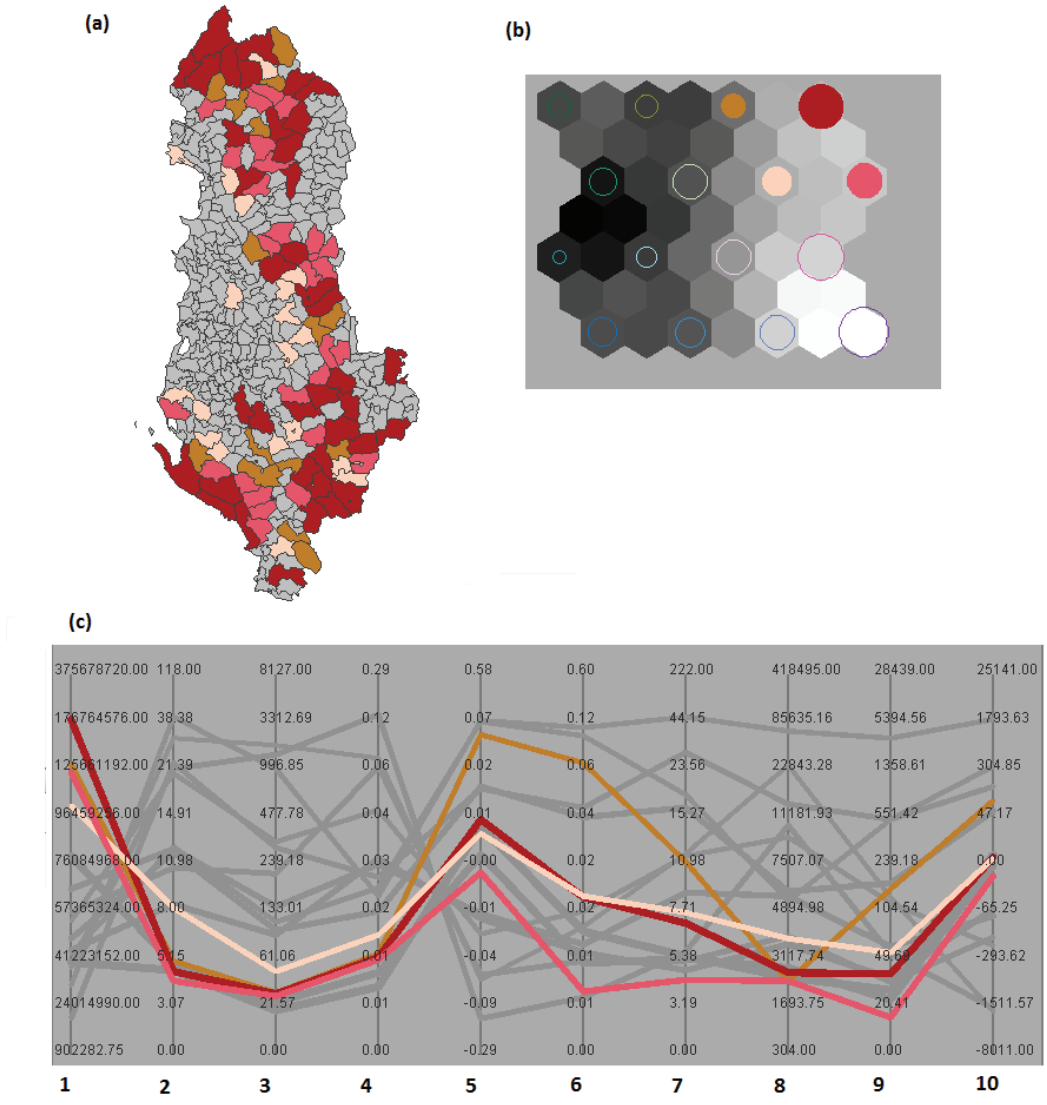
Figure 62: General results. (a) Multivariate mapping. (b) Clustering with SOM. (c) Multivariate visualization of clusters (Parallel Coordinate Plot)



An exploratory analysis was carried out on the basis of these results, with the aim of obtaining further classification of the 16 clusters in order to identify 6 primary groups. Based on the properties of SOM (i.e. clusters with similar colours present low levels of dissimilarity among each other) the 16 clusters have therefore been further grouped into 6 groups. We will now describe and discuss the main features of each of them.

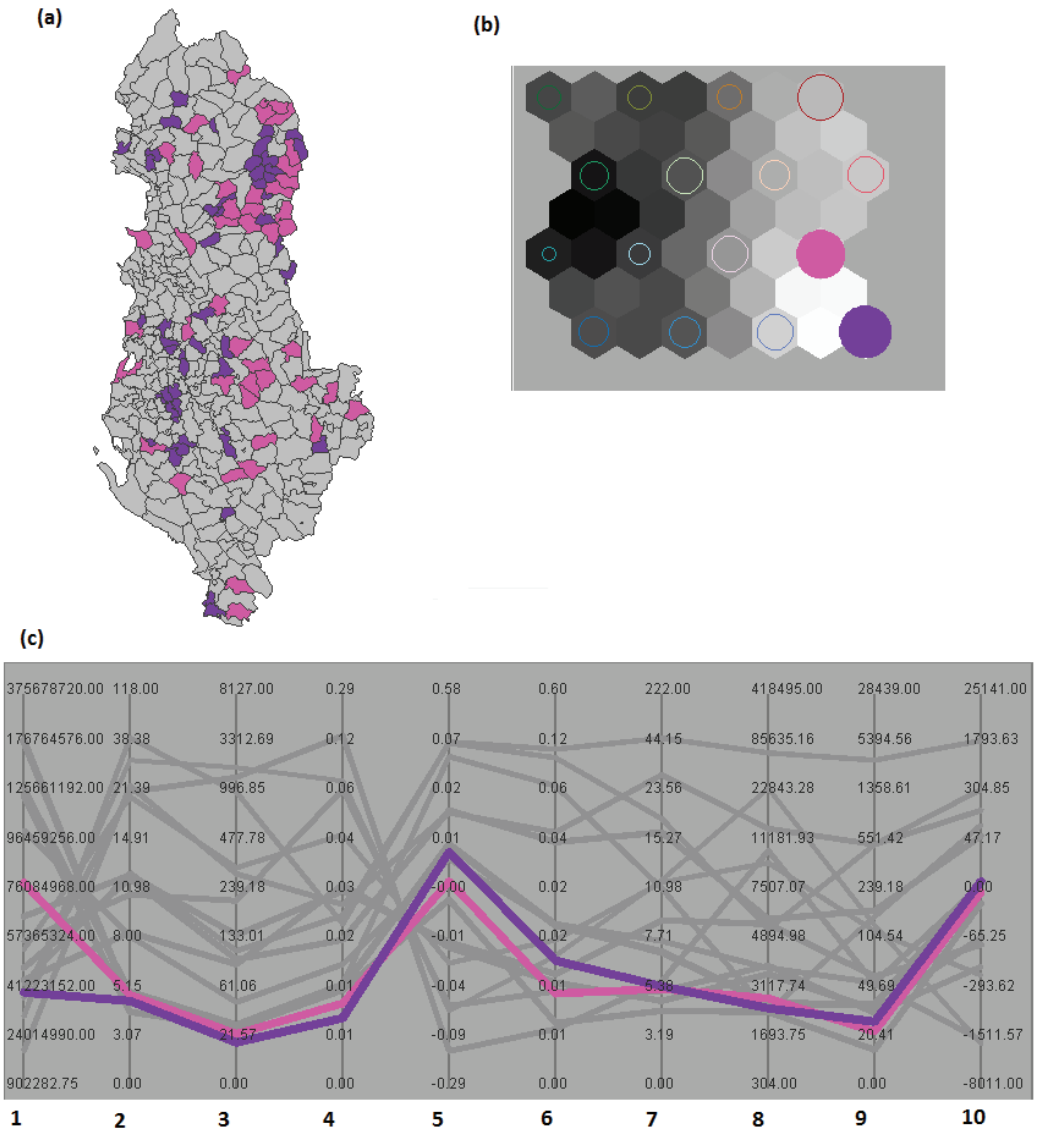
The first, Group 1, is characterized by clusters of municipalities with a comparatively high value of indicator 1; low values of indicators 2, 3, 4, 8, and 9; medium values (except for the brown cluster) of indicators 5, 6 and 10. This group is therefore composed by clusters of municipalities/communes with a large territory and a small usually resident population, and characterized by a low level of daily spatial interactions (the levels of daily inflow and daily outflow are comparatively low). Looking at the spatial distribution of the municipalities/communes belonging to this first group, we may clearly see that almost all of them are located in the rural and mountain areas of Albania and on the coastal areas of the southern- west part of the country. It should be noted that the municipalities/communes belonging to this group are often territorially contiguous, thus showing the existence of spatial patterns. We may define this group as "Big/Peripheral" because it is composed by clusters of municipalities/communes, which are big in terms of surface, yet peripheral with regard to their territorial location but also with regard to the role played in the daily interactions spatial system of Albania (figure 63).

Figure 63: Group 1, "Big/Peripheral". (a) Multivariate mapping (b) Clustering with SOM (c) Multivariate visualization of clusters (Parallel Coordinate Plot)



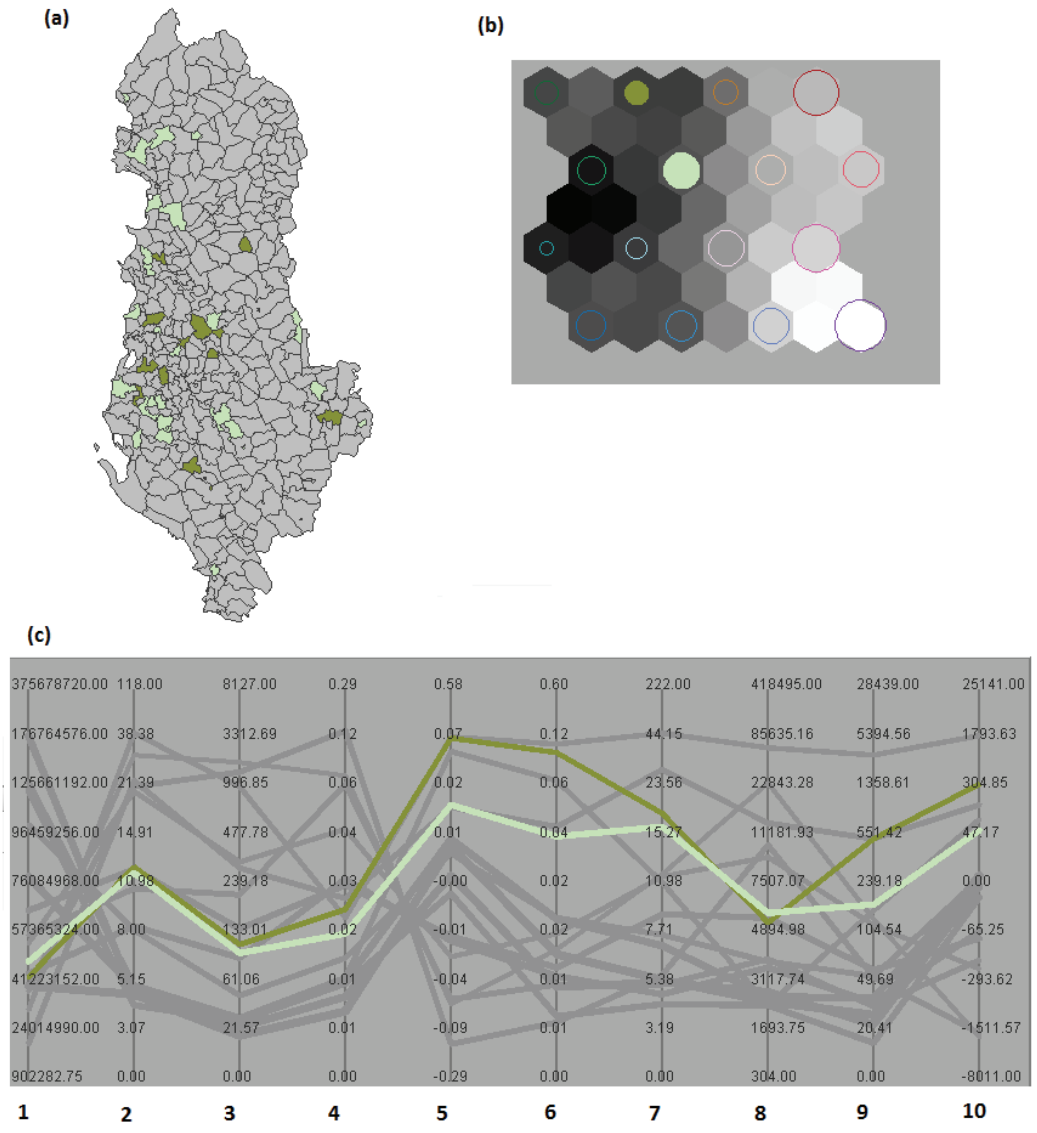
The second group, Group 2, is quite similar to the first one with the exception of indicator 1 (surface). Municipalities/communes belonging to this second group are characterized by a small territorial area, by comparatively low level of indicators 2, 3, 4, 6, 7, 8, and 9, and by medium values of indicators 5 and 10. We may define this group as "Small/Peripheral" since it is composed by municipalities/communes with a low level of daily spatial interactions, and which are comparatively small in terms of their usually resident population and territory. The level of spatial contiguity among municipalities/communes belonging to this group is lower compared to that of municipalities/communes belonging to group 1, but even in this group some municipalities/communes are territorially contiguous (namely, municipalities/communes located in the north-eastern part of the country). In terms of localization, this group may be divided in two categories; the first category is composed by municipalities/communes located in the north-eastern part of the country, with a certain level of spatial concentration and spatial contiguity among them. The second category, on the contrary, is composed by municipalities and communes, which are quite scattered and located mainly in the central and in the southern part of the country (figure 64).

Figure 64: Group 2, "Small/Peripheral" (a) Multivariate mapping (b) Clustering with SOM (c) Multivariate visualization of clusters (Parallel Coordinate Plot)



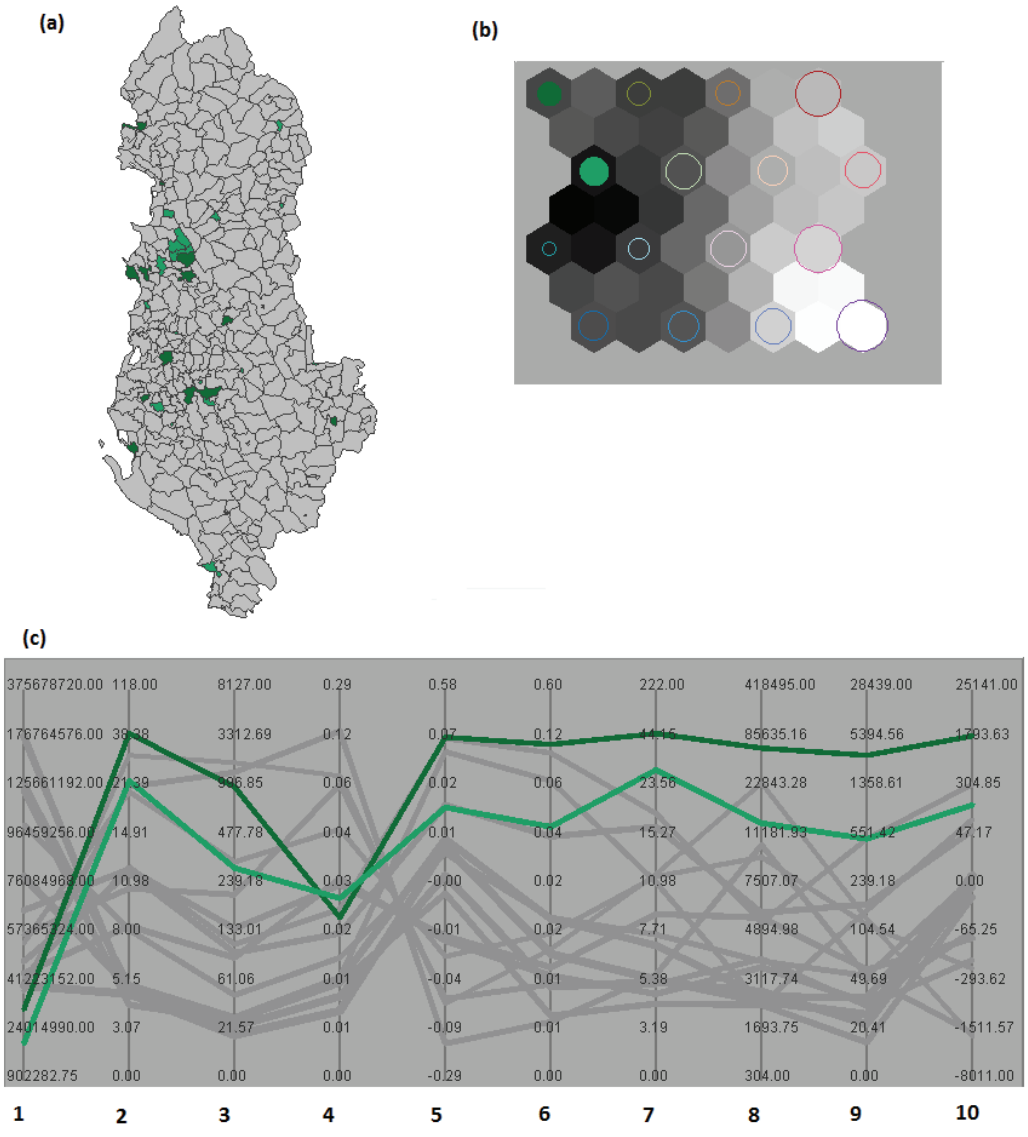
The third group, Group 3, is quite different from groups 1 and 2. We have defined this group as "Medium/Semi Central" since the municipalities/communes that belong to this group are characterized by almost medium values of indicators 1 and 3, medium values of indicators 2, 4 and 8, and by comparatively high values of indicators 5, 6, 7, 9 and 10. In other words, the municipalities/communes that belong to this group are characterized by a system of spatial daily interactions where the level of daily inflows is higher than the level of daily outflows (and for this reason the values of daily net flow and adjusted net flow ratio are quite high). The number of municipalities/communes from where these flows originate is quite high, while almost all other indicators reveal a medium situation, especially in terms of surface and usually resident population. The municipalities/communes of this group are therefore medium in terms of these two dimensions (surface and usually resident population) and play a semi central role in the system of spatial daily interactions of Albania (figure 65).

Figure 65: Group 3, "Medium/Semi central" (a) Multivariate mapping (b) Clustering with SOM (c) Multivariate visualization of clusters (Parallel Coordinate Plot)



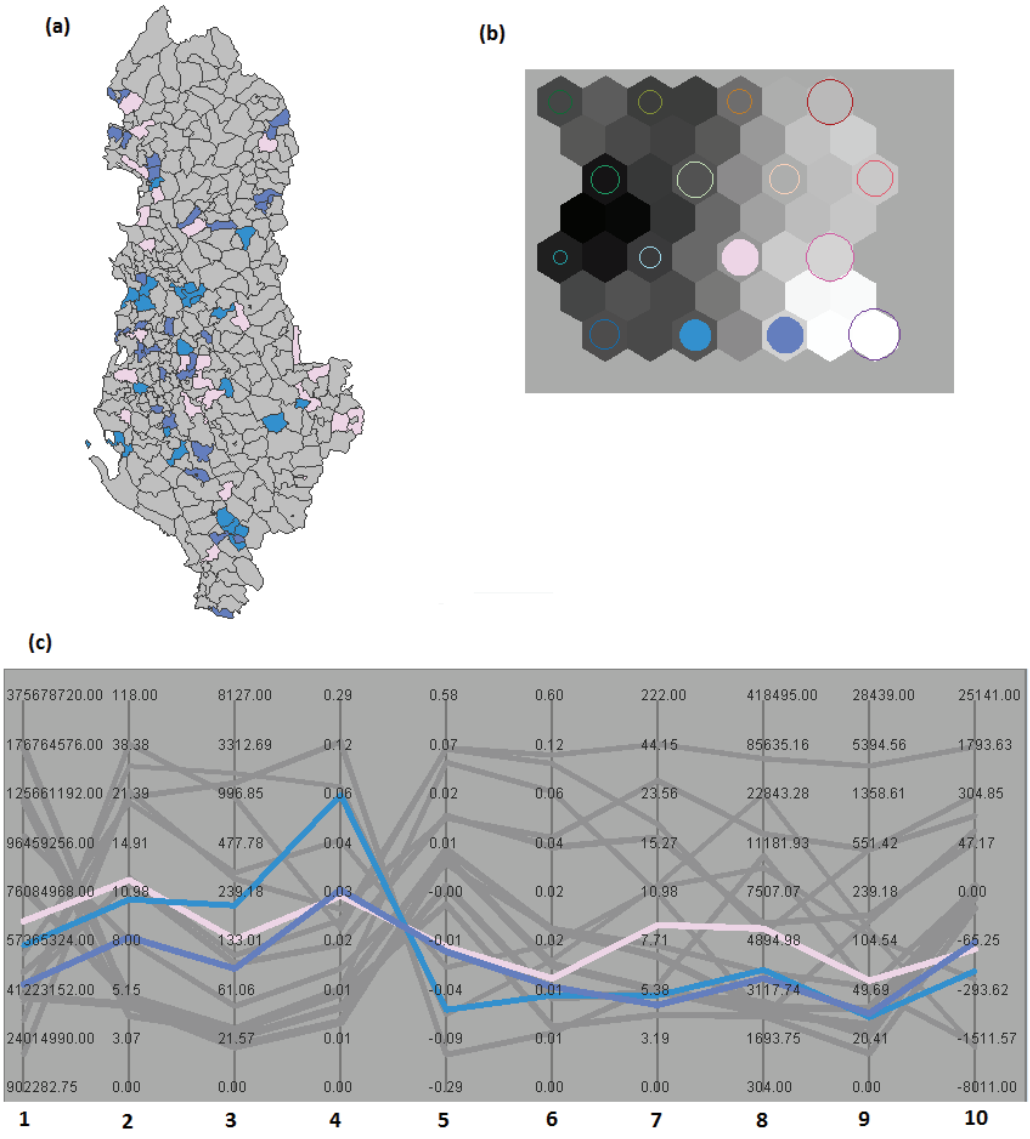
Group 4 is very different from the ones described till now. It is composed by municipalities/communes with a very low level of indicator 1, a medium value of indicator 4, and very high levels of indicators 2, 3, 5, 6, 7, 8, 9 and 10. The municipalities/communes belonging to this group are therefore characterized by a very dynamic system of daily spatial interactions, where the level of daily inflow is higher than the level of daily outflow. The number of municipalities/communes of origin and of destination of daily movements is very high, as well as the size of the usually resident population. On the contrary, the municipalities of this group are very small in terms of surface. We have defined this group as "Small/Central (Prey)". The municipalities of this group are, in fact, small in terms of surface, but play a crucial central role in the system of daily spatial interactions of Albania. The term "prey" is adopted taking into account in a broad sense the logic and definitions of the prey-predator model elaborated by Lotka and Volterra (Lotka, 1925; Volterra 1926). This is because the municipalities/communes of this group (as we will see when describing the profile and characteristics of the next two groups) are predated by a number of other municipalities/communes that are very close to them in terms of spatial location, and they present divergent profiles compared to the one of this group. In terms of spatial location we can clearly see that in this case the condition of spatial contiguity is not confirmed. Municipalities belonging to this group are quite scattered in terms of spatial location; finally, it should be noted that the main municipalities (Tirana, Durrës, Vlorë, Elbasan and Shkodër) belong to this group (figure 66).

Figure 66: Group 4, "Small/Central (Prey)" (a) Multivariate mapping (b) Clustering with SOM (c) Multivariate visualization of clusters (Parallel Coordinate Plot)



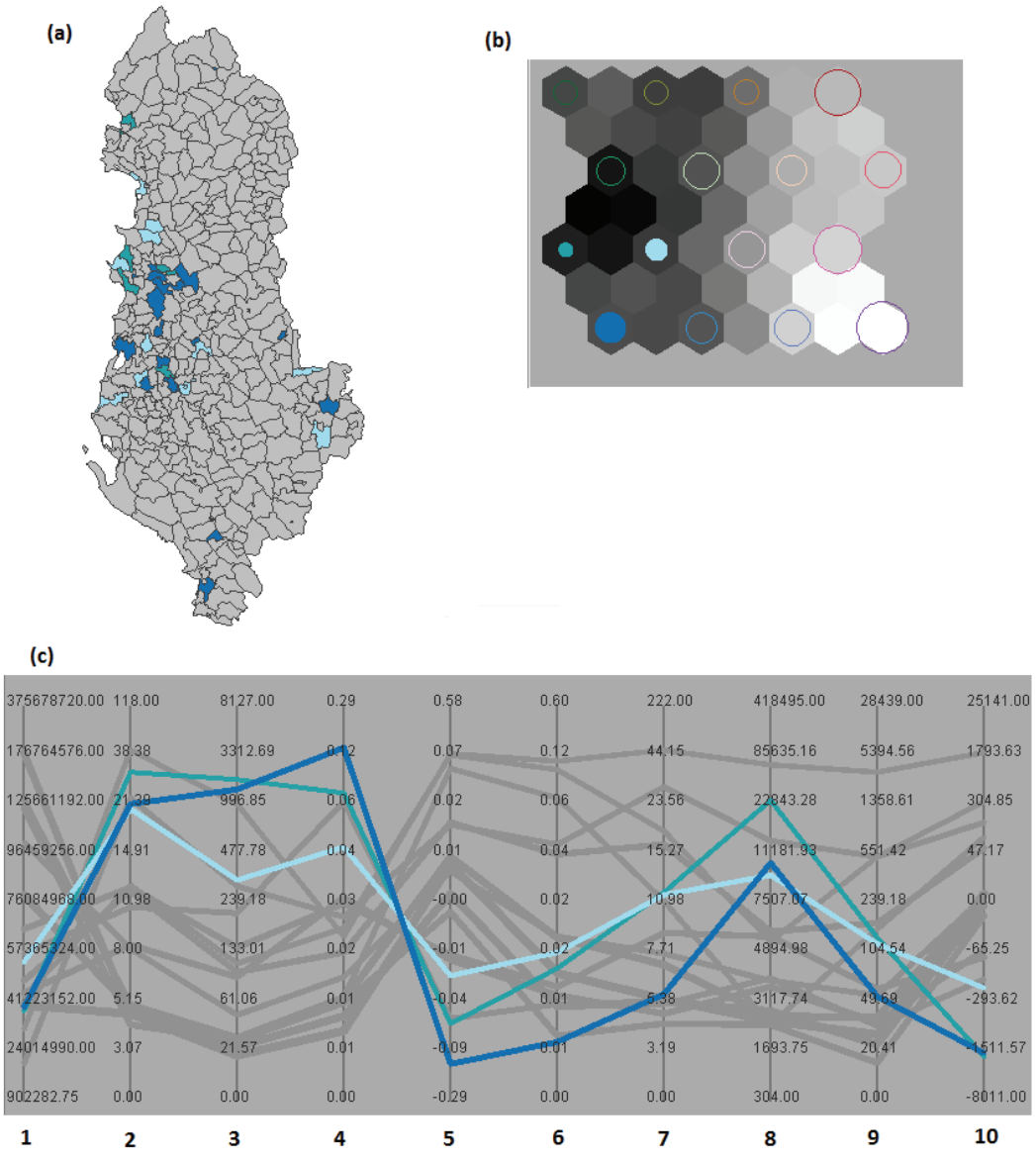
Group 5, "Medium/Central (semi predators)", is composed by municipalities/communes that have medium values of the indicators 1, 2; medium/high values of the indicators 3 and 4 and, finally, comparatively low values of indicators 5, 6, 7, 8, 9 and 10 (with the exceptions in some cases of the pink cluster of municipalities/communes). That is to say that this group is characterized by a low level of daily inflow and comparatively high level of daily outflow. This is also the reason why the level of daily net flow and adjusted daily net flow ratio is comparatively low. Looking at the spatial location of the municipalities/communes that belong to this group we can see from the map that they are often close to the municipalities belonging to group 4 (prey). These are the reasons why we defined this group as "Medium-low/Central (semi predators)". The municipalities belonging to this group have a medium-small dimension in terms of usually resident population and in terms of surface. They play a central role in the Albanian system of daily spatial interactions. A role that can be define as "semi-predators" because they present a quite low level of daily inflows and a relatively high level of outflows together with a spatial distribution that underlines that they are usually not so far from the prey (figure 67).

Figure 67: Group 5, "Medium/Central (semi predators)" (a) Multivariate mapping (b) Clustering with SOM (c) Multivariate visualization of clusters (Parallel Coordinate Plot)



The last group, "Small/Central (predators)", clarifies the above mentioned concepts of prey and predators. This group is characterized by very high levels of indicators 2, 3, 4 and 8; by low levels of indicators 1, 5, 6, 9, 10, and by medium/low levels of indicator 7. That is to say that, in the municipalities belonging to the clusters that constitute this group, the level of daily total flow (daily inflow + daily outflow) is relatively high, but with a clear prevalence of daily outflows. The level of inflow is in fact lower compared to the level of outflow. The municipalities of this group are relatively big in terms of usually resident population and relatively small in terms of territory. Looking at the spatial location of the municipalities belonging to this group, we may clearly see that they are mainly located close to the prey municipalities with a high level of spatial contiguity, especially in the case of Durrës, Tirana and Shkodër (figure 68).

Figure 68: Group 6, "Small/Central (predators)" (a) Multivariate mapping (b) Clustering with SOM (c) Multivariate visualization of clusters (Parallel Coordinate Plot)



To better analyse and understand patterns of daily spatial interactions that link together (reciprocally) prey and predators, we have focused our analysis on the cases of Tirana, Durrës and Shkodër and their surroundings (figure 69).

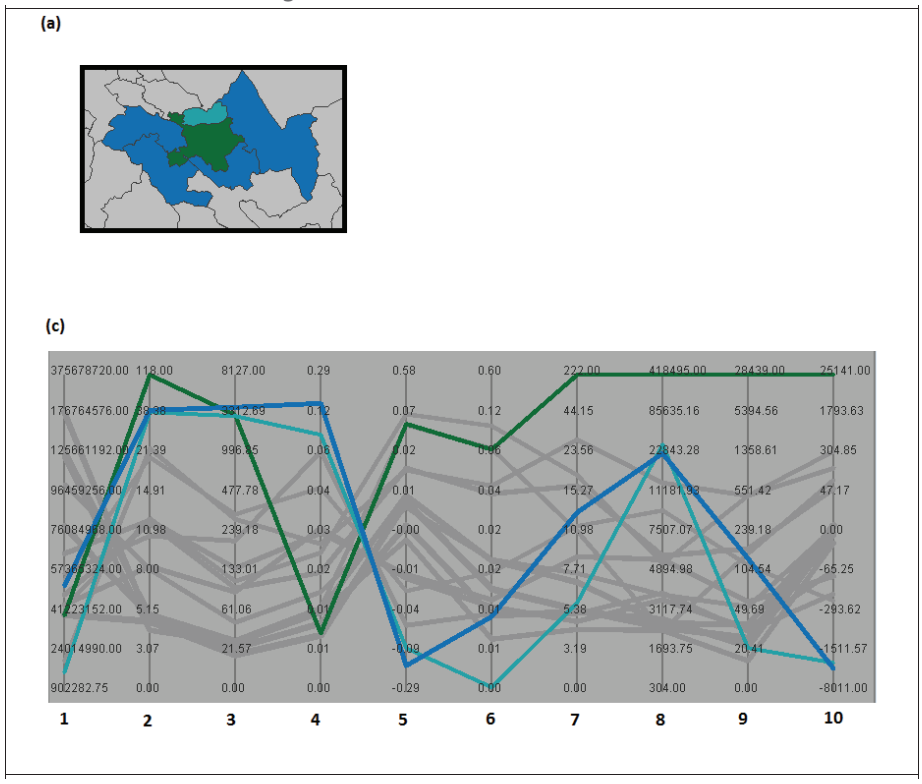
Tirana, Durrës and Shkodër belong to the same cluster (green) while the municipalities/communes of their surrounding areas belong mainly to clusters that have a low level of dissimilarity among each other (figure 69.a).

Looking at the PCPs of each of these municipalities (core and first ring) we may clearly see that prey and predators are characterized by divergent profiles in terms of the indicators used in the analysis (figure 69.c).

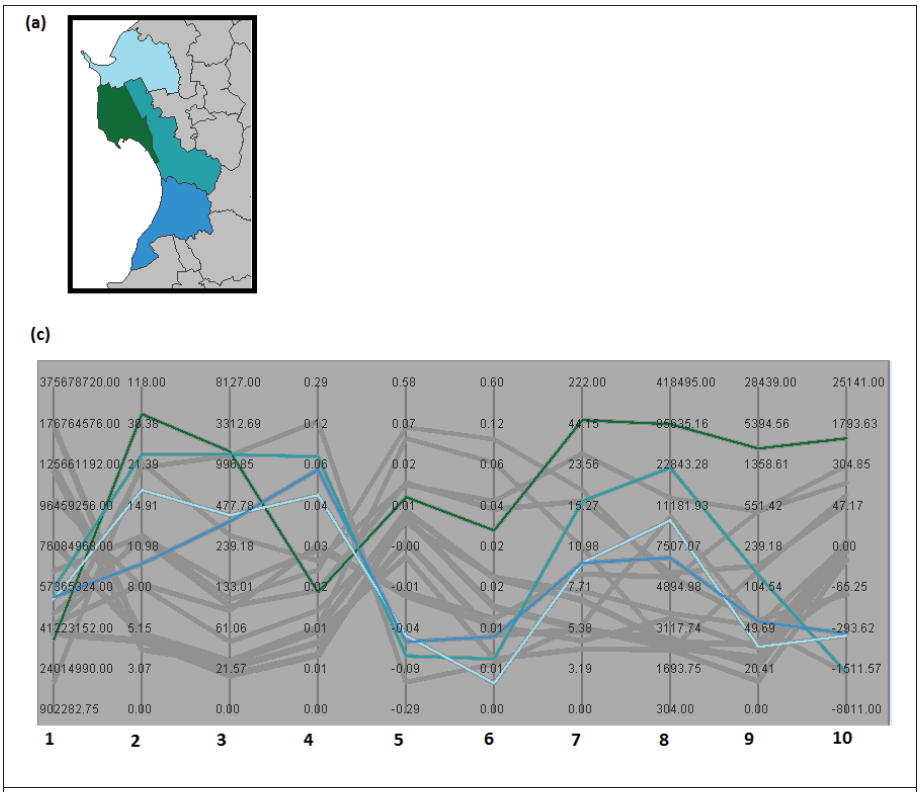
Tirana, Durrës and Shkodër (cores) have comparatively high levels of indicators 2, 3, 5, 6, 7, 8, 9 and 10, while the municipalities/communes of their rings (municipalities contiguous to the core) have almost all comparatively low levels of indicators 5, 6, 9 and 10. Combining this information to that of the spatial location of prey and predators we may infer that predators represent the prey's gravitational areas. In this sense, the use of the terms prey and predator becomes evident. Indeed, the population of the rings preys on that of the core municipalities in the sense that it uses the same space and benefits from the services offered by the core municipalities though not contributing directly to financing them (e.g. by payment of taxes).

Figure 69: Durrës, Tirana and Shkodër, Prey and predators profiles (a) Multivariate mapping (c) Multivariate visualization of clusters (Parallel Coordinate Plot)

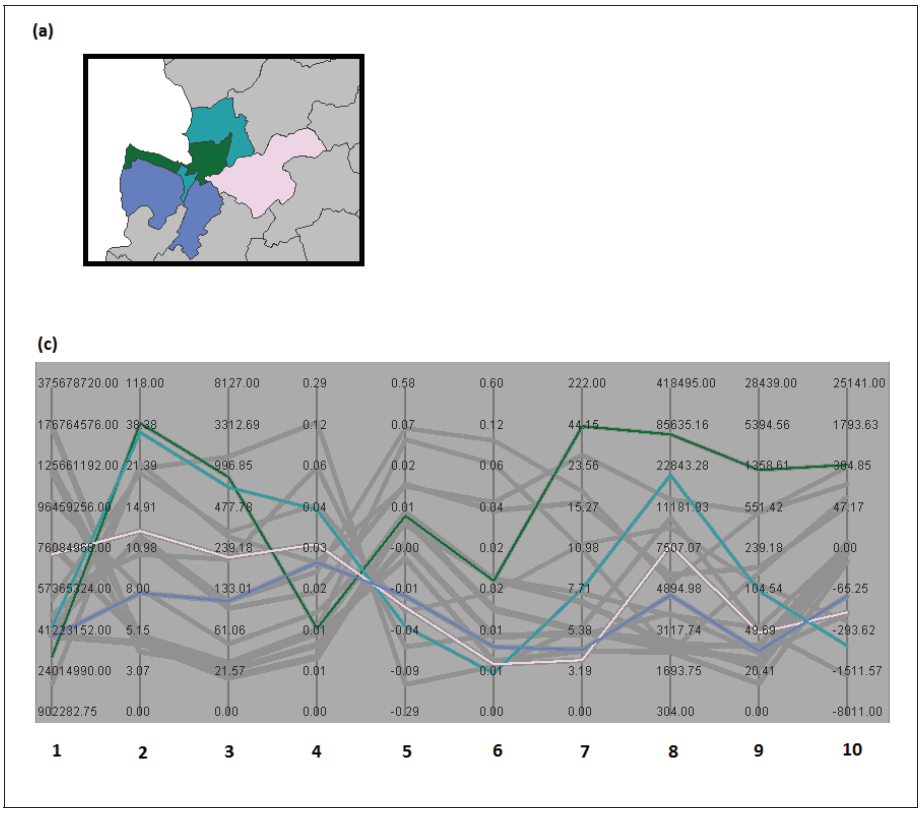
Tirana and its surroundings



Durrës and its surroundings



Shkodër and its surroundings



4.3 Regionalization (spatial clustering with a spatial constraining strategy)

In this second step of our analysis we will be using a spatially constrained graph partitioning technique (using GraphRECAP) to identify a hierarchy of natural regions defined by spatial interactions. The natural (derived) regions so identified, under a set of constrained parameters, are composed by clusters of municipalities that are both homogenous in terms of the characteristics of their daily spatial interactions and spatially contiguous. In terms of territorial level, the natural regions are intermediate areas between the local level (municipalities/communes) and the national one.

This kind of spatial statistical analysis belongs to the class of regionalization methods. As defined by Guo (2008), regionalization is a process that divides a large set of spatial objects into a number of spatially contiguous regions, while optimizing an objective function, typically a homogeneity (or heterogeneity) measure of the identified regions. Regionalization is therefore a special kind of spatial clustering where the condition of spatial contiguity between spatial objects plays a key role[1].

The starting point is that, following Guo (2010a), spatial interactions naturally form a network/graph, where each node is a location (or area) and each link is an interaction between two nodes (location). Such spatial interaction networks (e.g. municipalities/communes to municipalities/communes daily commuting flows) normally consist of: S, a set of locations (nodes), in our case municipalities/communes of Albania; F, a set of flows (links) among locations, in our case daily spatial commuting flows (direct); and V_f, a set of variables of each flow[2]. In this perspective, regionalization can reduce spurious data variations caused by uneven sizes or small base populations, and generalize (i.e. find general rules in) large spatial

1 As recalled by Bernetti et al. (2001), regionalization processes play an important part in many sectors of research, finding application in areas like climatic zoning (Fovell and Fovell, 1993; Gin and Guo, 2009; Wang et al., 2010), environmental analysis (Henderson, 2006; Romano et al., 2010), the analysis of landscape (Long et al., 2010), the interpretation and organization of census data (Openshaw and Rao, 1995) and public health data (Haining et al., 1994; Osnes, 1999), the analysis of socio-economic phenomena (Assuncão et al., 2006; Benassi and Ferrara, 2010; Benassi et al., 2010), the analysis and interpretation of demographic and urban/regional dynamics (Behnisch and Ultsch, 2010; Benassi et al., 2013; Benassi and Naccarato, forthcoming) and the analysis of migration flows (Guo, 2010a). The concept of regionalization hypothesized and applied to socio-economic entities by Openshaw (1977) results in the creation of geographic objects formed by combining contiguous elements sharing one or more characteristics and is closely connected with spatial statistics (Bernetti et al., 2011).

2 In our case we have just a set of locations (nodes) and a set of flows (links) among locations.

interaction data to discover general flow patterns. The key requirement is that the regionalization process should allow preserving major patterns in the network while suppressing details (Guo, 2010a).

Coming back to our study, our aim is to identify *n* spatial areas (natural regions) intermediate between the local and the national level that, under a constrained strategy, will minimize inner heterogeneity (within regions) and maximize external heterogeneity (between regions) with regard to daily spatial interactions. The key challenge of this operation is to identify regions based on commuting flows (this is why we call them "natural" or derived regions) instead of using pre-defined political or administrative boundaries. After computing a contiguity matrix, which specifies which items (municipalities/communes) are neighbours in space, in order to complete the regionalization process we should define a constraining strategy and a set of parameters. Referring to the works of Guo for in depth methodological details (2008, 2010a, 2010b), we will now describe the constraining strategy and parameters adopted. As regionalization method we have chosen the Full Order-ALK method, which is a combination between the agglomerative clustering method named ALK (Average Linkage Clustering) and the spatial constraining strategy named Full Order. The ALK method derives natural regions in two steps. It first constructs a hierarchy of clusters from the bottom by iteratively merging the most connected clusters. Therefore, the method needs a contiguity matrix as input. The output is a spatially contiguous tree, where each edge connects two geographic neighbours and the entire tree is consistent with the cluster hierarchy. Second, the spatially contiguous tree is partitioned from the top, by finding the best edge to remove. By repeating this step for each new region, a hierarchy of regions is constructed. During this partitioning process, additional constraints may be enforced, for example, we may want to impose a minimum population size for each region (Guo, 2010a). Guo proves in his work (2008) that this method derives regions of significantly better quality (in terms of the objective function value) than other existing methods. As flow expectation model we chose the Expectation SI_FLOW; this model calculates an expected flow value for each pair of spatial objects based on the total in and out flows of each object (in our case the total in and out daily flows of each Albanian municipality/commune). Finally, to derive regions from the spatial interactions flows, a measure of similarity or of the strength of connection has to be defined for each pair of locations (or regions). Following the work of Guo (2010a), in this research we adopt the concept of modularity measure, which is defined in the following equation:

$$Modularity = Actual\ Flows - Expected\ Flows$$

Different statistical models can be used to calculate the expectation flows. In this paper, the simplest model is used, which assumes that interactions among locations are random and proportional to the origin and destination population (Guo, 2010a). For example, in the commuting flow data, we assume that each individual has the same probability to commute and the choice of destination is proportional to the population of the destination:

$$Expected\ Flows\ (A, B) = P_A P_B F / P_S^2$$

where P_S is the total population for all locations S, P_A is the population of the region $A \subseteq S$, P_B is the population of $B \subseteq S$, $A \cap S = \varnothing$, and F is the total flow among all locations (including flows within the same location). In this way, we ensure that the total expected flows are the same as the total actual flows (Guo, 2010a).

In addition to these parameters we impose two additional constraints during the partitioning process. Namely, we have tried two different regionalizations. In the first regionalization we have fixed a maximum number of regions equal to 12 (the actual number of Albanian prefectures) and a minimum size of the usually resident population per region equal to 150,000 units. With these parameters we have identified 12 natural regions (figure 70, 70.a). In the second regionalization we have fixed a maximum number of regions equal to 36 (the actual number of Albanian districts) and a minimum size of the usually resident population per region equal to 30,000 units. With these parameters we have identified 36 natural regions (figures 71, 71.a).

Figure 70: Natural (derived) regions (12)

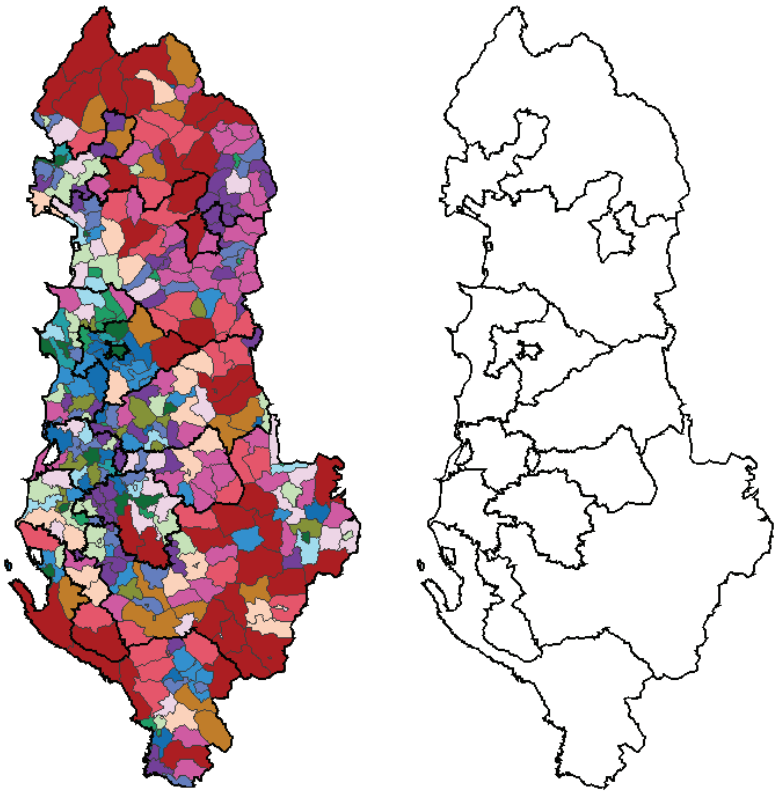


Figure 70.a: Natural (derived) regions and "traditional" Albanian prefectures

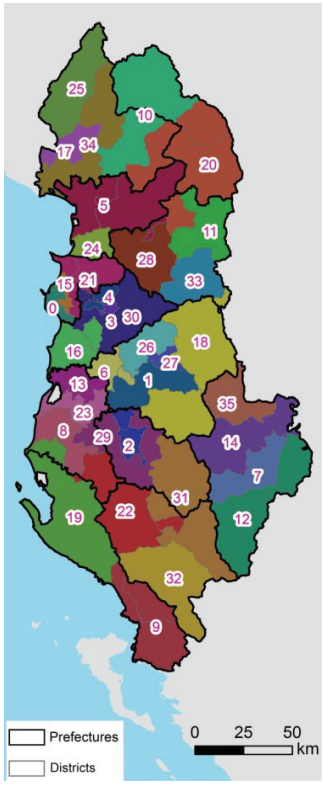


Figure 71: Natural (derived) regions (36)

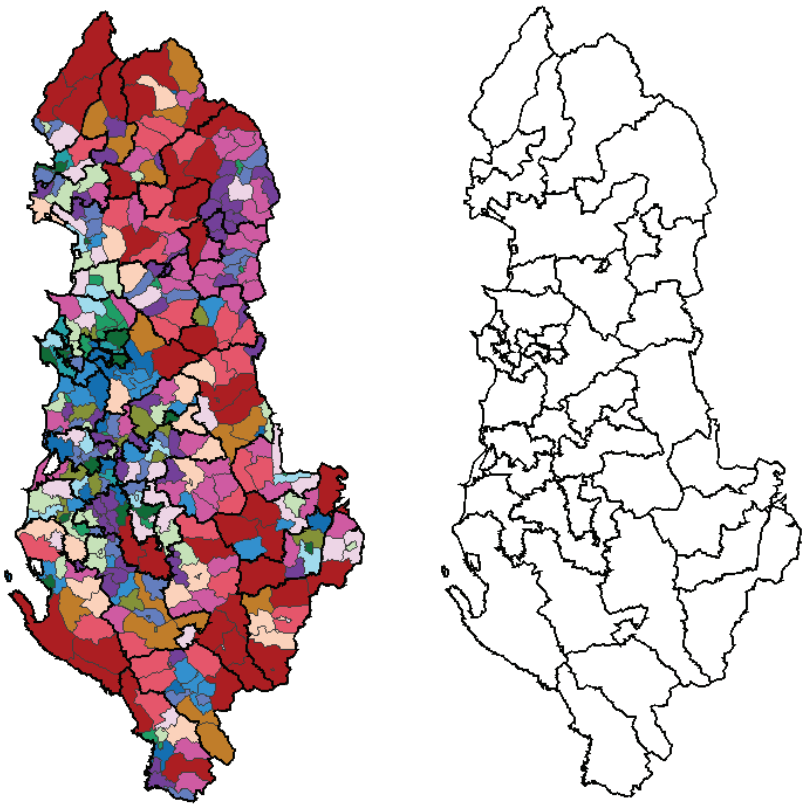
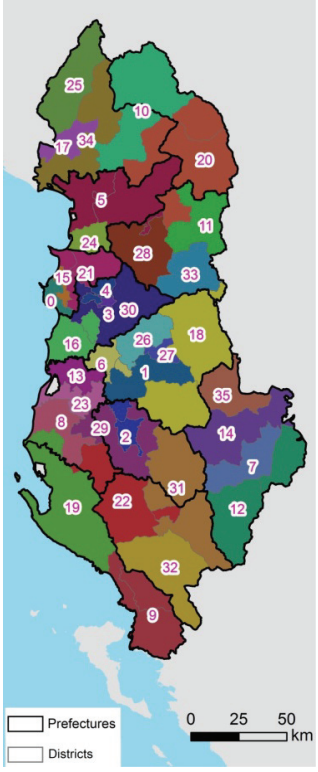


Figure 71.a: Natural (derived) regions and "traditional" Albanian prefectures and districts



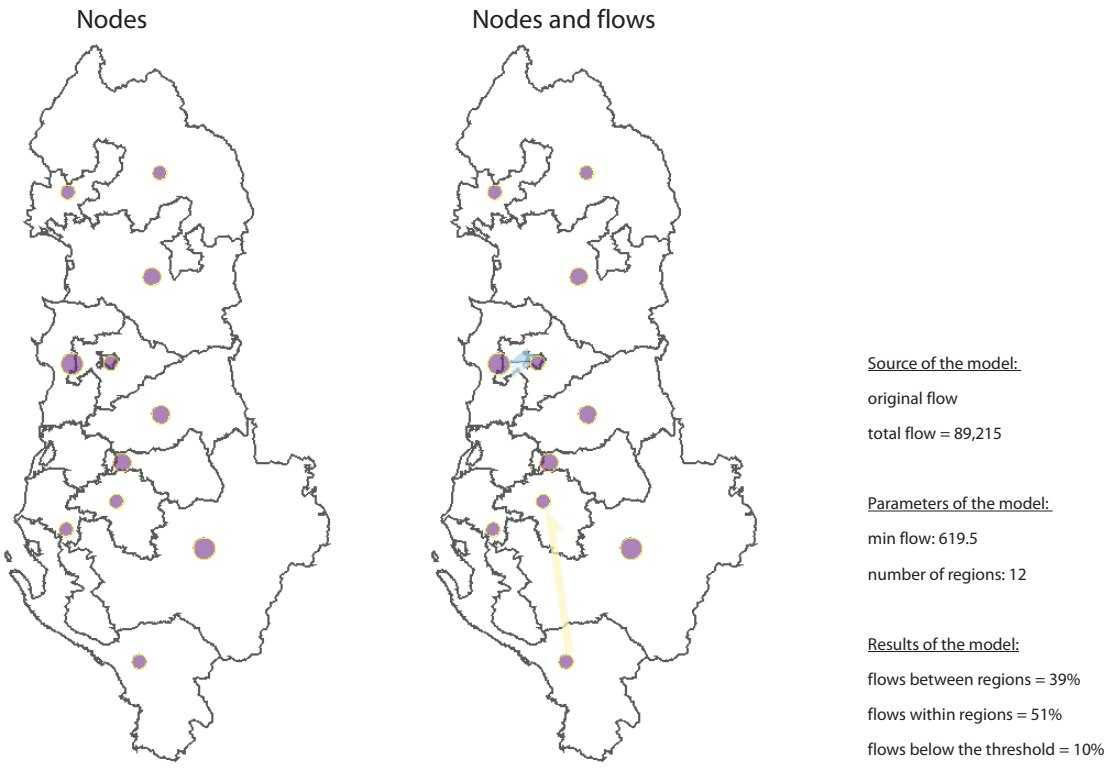
4.4 Flow mapping and multivariate visualization of daily spatial interactions in Albania

Flow maps display region-to-region flows and within-region flows considering the natural derived regions obtained in the previous step. Region-to-region flows are represented with lines while within-region flows with nodes. Nodes are represented by circle symbols placed at the centroid of each region. The width of flow lines and the radius of nodes are proportional to flow measures formulated with flow strength/volumes. The flow lines that share the same colour are shaded based on the flow values between regions (Guo, 2010a).

In the case of the first regionalization, we consider first the original flows, with a fixed flow threshold equal to 619.5 that is to say the average of all region-to-region flows (figure 72), and we analyse the 12 naturally derived regions. As we may see, the level of self-containment of each of the 12 derived regions is quite high, since 51% of the total amount of daily flows is within the derived regions (while the remaining 10% of the flows are below the fixed threshold). Indeed, there are only two daily spatial interactions between derived regions, although they cover 39% of the total amount of daily flows. The first one is bidirectional and links reciprocally the region of Tirana to that of Durrës. The second one is unidirectional and links the southern part of the country (origin of the commuting flow) with Berat area.

Secondly (figure 72.a), we consider, instead of the original flow, the modularity flow as the source of the model (see paragraph 4.3). In this case, region-to-region flows are displayed by subtracting the actual flows from the expected ones, and the fixed flow threshold is equal to 0.08. As a result, the flows between regions become 45% of the total flows, while the flows within regions constitute 51% of the total flows (and the remaining 4% of the flows are below the fixed threshold). What we may deduce from figure 72.a is that the level of daily spatial interactions between the 12 natural derived regions grows not only with regard to the total flow volume, but especially in terms of multiplication of the places of origin and destination. In other words, when the modularity measure is applied (figure 72.a), replacing the original flows with the ones which we assume could be effective if commuting would only be determined by the size of the population, we observe a significant spatial enlargement of the Albanian daily spatial interactions system, compared to the previous one (figure 72).

Figure 72: Nodes and commuting flows (original) of the 12 derived regions



The same methodology has been applied to the 36 natural derived regions of the second regionalization, therefore taking into account both the original (figure 73) and the modularity flow (figure 73.a).

The results are quite similar to the ones observed for the 12 natural derived regions. Considering the original flow (figure 73), we may see that 53% of the total flow volume is between regions, while 40% is within regions. Considering the modularity flow (figure 73.a), the proportions of within-flows and between-flows remain the same, but with a multiplication of the origin and destination points and, again, a significant spatial enlargement of the daily spatial interactions system.

It is worth noting that the derived regions (12 and 36) present a good level of self-containment of the daily spatial interactions both in terms of original flows and modularity flows. This means that they represent, in an efficient way, a possible statistical subdivision of Albanian territory, alternative to the traditional administrative and geographical ones. This alternative regionalization could be used as a first step towards the identification of local labour systems in order to become useful for regional development planning and more generally for the country socio-economic development.

Figure 72.a: Nodes and commuting flows (modularity) of the 12 derived regions

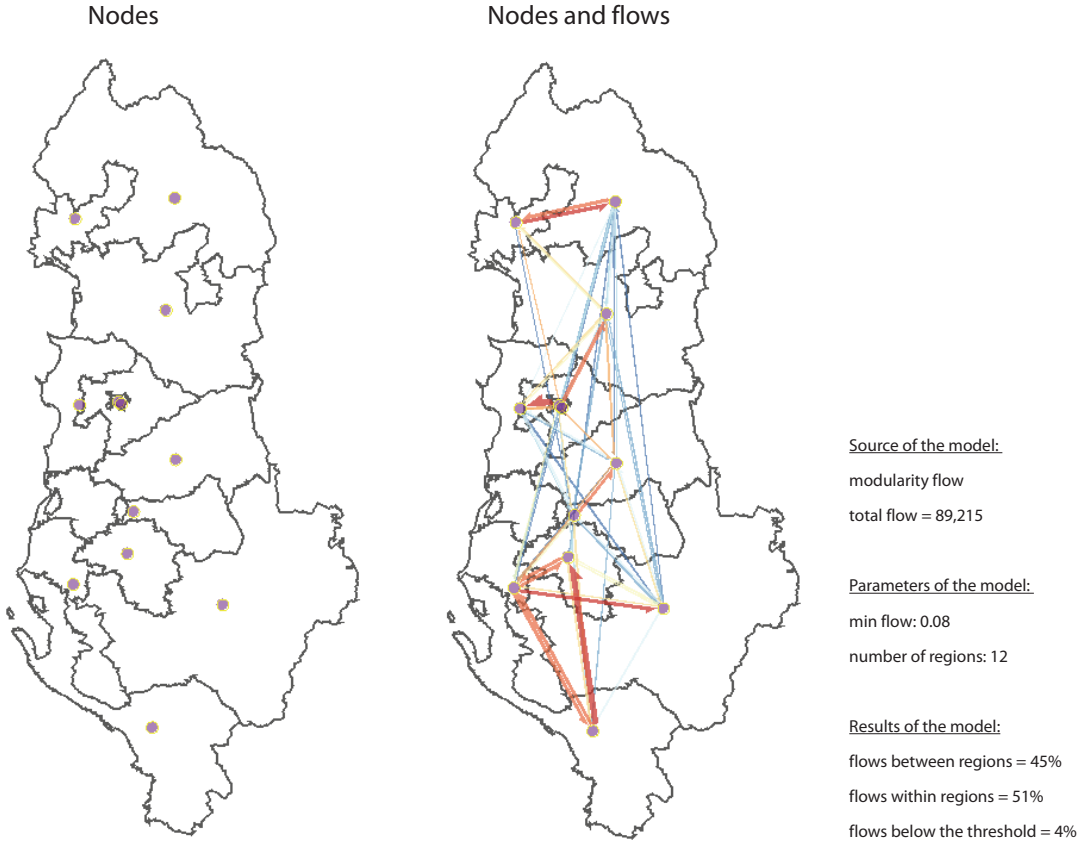
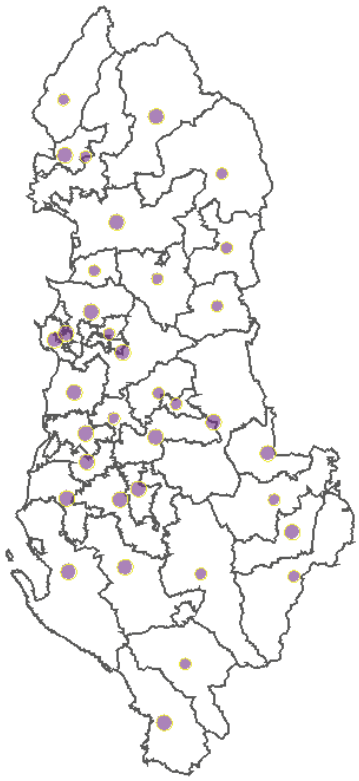
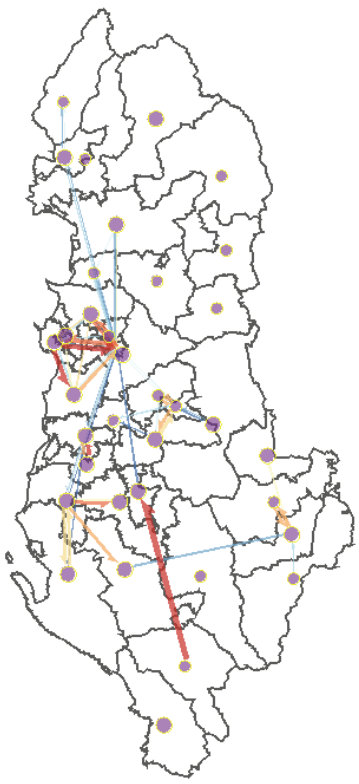


Figure 73: Nodes and commuting flows (original) of the 36 derived regions

Nodes



Nodes and flows



Source of the model:

original flow

total flow = 89,215

Parameters of the model:

min flow: 68.84

number of regions: 36

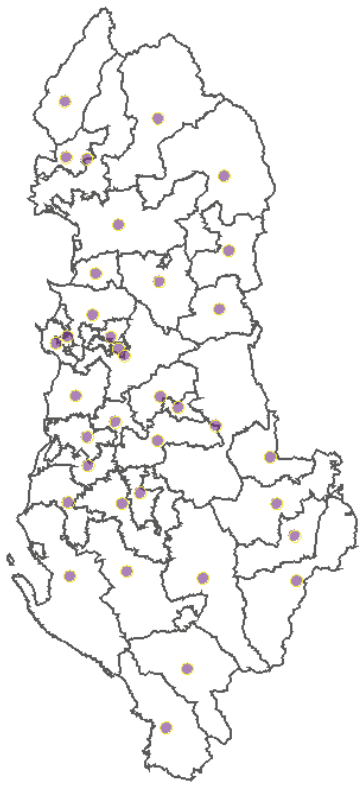
Results of the model:

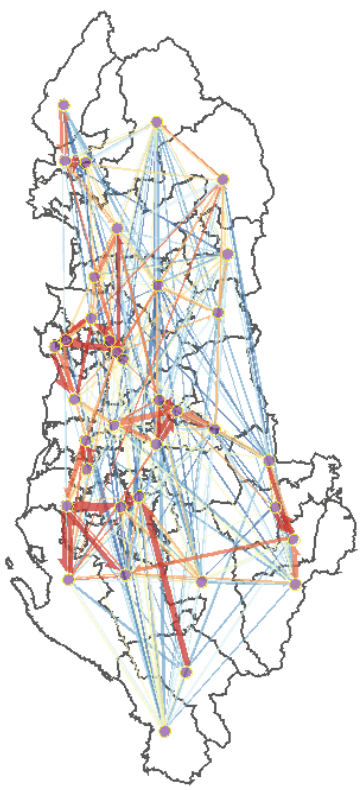
flows between regions = 53%

flows within regions = 40%

flows below the threshold = 7%

Figure 73.a: Nodes and commuting flows (modularity) of the 36 derived regions





Source of the model:

modularity flow

total flow = 89,215

Parameters of the model:

min flow: 0.03

number of regions: 36

Results of the model:

flows between regions = 53%

flows within regions = 40%

flows below the threshold = 7%

5 MAIN FINDINGS AND CONCLUDING REMARKS

Generally speaking, commuters are all employed persons who have a fixed workplace outside home, though the destination of the journey from home to work may vary from being within the same town/village of the usual residence to being in a different country. In this broad sense, 3 out of 4 employed persons in Albania may be defined as commuters (including both employed persons with a fixed workplace outside home in Albania and those working abroad). The remaining quarter is composed almost equally of home-based workers (13% of the overall employed population) and of workers with no fixed place of work (11.9% of the total employed population).

The distribution by type of place of work is quite different from 2001, when the percentage of workers with a fixed place of work away from home was just 40.7 and almost half of the overall employed population declared to be working at home in a farm (with just a slight percentage of home-based workers whose home was not a farm). These differences are in line with the growth of urban population, which between the two censuses has outgrown the population living in rural areas, and reflect the different employment structure (people employed in agriculture accounted for half of the total in 2001 while now they constitute just 27.1% of the total employed population).

Home-based workers are about 86 thousands (13% of the total employed population). One in every five of them lives (and works) in the prefecture of Elbasan (21.1%), and especially in the district of Elbasan (12.4% of the total home-based workers in Albania), while the highest percentage of home-based workers, out of the total employed population, is recorded in the prefecture of Dibër, where home-based workers constitute more than one third of the total employed persons. Elbasan, Shkodër, Lezhë, Korçë, Kukës all record a higher percentage than the Albanian average value (12.7%); while the lowest one is observed in the prefecture of Tirana (5.8%). Home working in Albania is essentially a rural phenomenon. 80.3% of home-based workers live in rural areas, and 80.2% of them work in agriculture.

Workers with no fixed place of work are about 78 thousands (11.9% of the total employed population). 20.8% of them live in the prefecture of Tirana (and mostly in the district of Tirana, accounting for 5% of the total number of workers with no fixed place of work), followed by Elbasan (14.9%), Fier (12%) and Korçë (10.2%). The highest percentage, out of the total employed population is instead recorded in the prefecture of Elbasan (15.8%), followed by the prefectures of Korçë, Berat, Shkodër, Vlorë, Gjirokastër, Durrës and Lezhë, all with a proportion above the average country value (11.6%). Workers with no fixed place of work are a diverse group, which may be depicted as a mix of "mobile" and occasional workers, such as agriculture day labourers, construction workers, ambulant vendors and precarious service workers.

Workers abroad constitute just 1% of the total employed population. Greece is their main country of destination (almost 80% of the cases). The highest percentage of workers abroad, out of the total employed population, is obviously recorded in municipalities close to the border, such as Pogon, where workers abroad account for more than one third of the total employed population (33.8%); Dropull i Poshtëm, where a quarter of the employed population work abroad; Trebisht, with almost one worker abroad every five employed persons (19.2%). The vast majority of abroad commuters come from rural areas (90.6%). They are mainly construction (40.2%) and agriculture workers (37.7%).

Inner work commuters i.e. employed with a fixed place of work outside home in Albania are almost 490 thousands and they are the large majority of the employed population. More than one third of inner work commuters live in the district of Tirana (34%), where indeed 28.5% of the total employed persons of Albania reside, followed at quite a distance by Durrës (7.2%), Lushnje (6.7%), Elbasan (5%), Vlorë (4.8%), Fier (4.7%), Korçë (4.5%), Shkodër and Berat (both with 4.1%). Though, if we look at the percentage of inner work commuters, out of the total employed population, we find a quite different ranking, with the district of Kuçovë (89.5%) in the first place, followed by Tirana (87.6%), Skrapar (84.7%), Tropojë (82.6%), Lushnje (82.3%), Sarandë (81%), Gjirokastër (79.4%), Peqin (78.5%), Tepelenë and Vlorë (both with 77.2%), Lezhë (75.3%), and Kukës (74.4%), which all stand above the Albanian average value of 74.1%. At the opposite end of the distribution we find, with values well below the average country value, and all less than half of the total employed population, the district of Malësi e Madhe (41.1%), the district of Librazhd (45.2%), the district of Dibër (45.3%), the district of Mat (47.9%), and the

district of Gramsh (48.7% of inner commuters). These data contribute to outline the distinction between districts with a strong agricultural vocation and districts with a more urban socio-economic character.

The vast majority of inner commuters are mainly daily commuters (91.2%); while periodic commuting consists mainly of people travelling 1-4 times a week (7.9%) and only 0.9% travel to work less than once a week.

As to the mode of transport, half of them walk to work (50.2%), more than a fifth of them use cars (22.7%) – either as a driver (16.8%) or as a passenger (5.9%), 18.7% use the bus, while all the percentages of other means are quite low. As expected, we can observe a quite different distribution by means of transport according to the urban/rural character of the place of usual residence. Namely, rural areas register, as obvious, a higher percentage of workers going to work by typically rural means of transport i.e. animal and tractor (3.6% versus 0.2%), an almost double share of people using a motorcycle (3.6% versus 1.5%) and a higher percentage of people going from home to work on foot (though even among people living in urban areas this share is quite high - 57.3% versus 46.9%). Private means (putting together private non-motorized and private motorized means they amount to 75% of the total) prevail, while public means of transport are used only by a fifth of work commuters. Though, the most important feature of the distribution by means of transport is the large use of non-motorized means and especially the large number of commuters going to work on foot. This is explained both by the fact that the vast majority of work commuting flows take place within the same municipality/commune of the usual residence (as we will see in chapter 3) and by the rural character of many areas of the country (though, as already mentioned, the share of commuters going to work on foot is quite high even among those living in urban areas – see table 2).

If we group the means of transport according to their public/private character, we can observe that more than half of the inner work commuters go to work on foot or by bicycle (private non-motorized), a quarter of them use private motorized means of transport (car and motorcycle), and that public means of transport (bus, minibus, taxi and train) are used by 20%, while rural means of transport are used by 1.3%. The large number of commuters going to work on foot is explained mainly by the fact that the vast majority of work commuting flows take place within the same municipality/commune of the usual residence and, partly, by the rural character of many areas of the country (though, as already mentioned, the share of commuters going to work on foot is quite high even among those living in urban areas).

The agricultural or tertiary characterization of each prefecture clearly emerges from the analysis of the proportion of use of each of the above mentioned categories of means of transport:

- almost three quarters of commuters living in Berat (72.3%) go to work on foot or by bicycle, while the lowest percentage (37%), though still quite high, is recorded in the prefecture of Tirana;
- Tirana (34%) is instead the prefecture with the highest use of motorized public means of transport, while the lowest percentage of use is recorded in Kukës (6.4%);
- Lezhë (31.1%) is the prefecture with the highest use of motorized private means of transport and Berat the one with the lowest use (12.3%);
- animal / tractors are the means most used in the prefecture of Korçë (7.4%) while they are used only by 0.2% of commuters leaving in Tirana.

Daily commuters to work are about 432 thousands. Of course, the volume of movements increases as we go down the geographical scale. Indeed, the majority of daily commuters work within the same municipality/commune of their usual residence (79%).

Commuters working outside their municipality/commune of usual residence constitute therefore 21% of daily commuters (about 89 thousand people). Some of them are at the same time commuters at the district level, i.e. people moving between municipalities belonging to different districts (about 14 thousand people, accounting for 3.1% of daily inner work commuters and for 15.2% of the total flows between municipalities/communes), while some others (a smaller part) are also commuters at the prefecture level, i.e. people travelling between municipalities belonging to different

prefectures (about 10 thousand people, amounting to 2.4% of the total daily commuters and 11.5% of the total flows between municipalities/communes).

Already at the prefecture and district levels of analysis, we observe a quite relevant spatial heterogeneity with regard to daily commuting interactions. Namely, there are prefectures (Kukës, Dibër and Gjirokastër) and districts (Pukë, Kukës, Dibër, Bulqizë, Kavajë, Peqin, Mallakastër, Tepelenë, Skrapar) where the imbalance between inflows and outflows is positive, and prefectures (Durrës, Lezhë and Korçë) and districts (Kurbin, Durrës, Lushnje, Librazhd, Kuçovë, Pogradec and Kolonjë) where, on the contrary, such an imbalance is negative. Though, the territorial division chosen for the analysis might affect the results, as it is shown, for example Tirana, where the net flow recorded at the district level actually disguises relevant profits in terms of population commuting to the municipality of Tirana.

Going down to the municipality level of analysis, we may observe a significant territorial differentiation with regard to daily spatial interactions. In some areas of the country the total flow volume is comparatively high (largest municipalities and surrounding areas, urban and coastal areas), in some others it is quite scarce (internal, peripheral and rural areas). Some municipalities mainly attract commuting workers, others mainly push them out. This variability seems mainly related to the role played by the major conurbations as poles of attraction and redistribution of the labour force. In fact, they are characterized by comparatively high levels of inflow, functioning as destination areas for employed persons living in the surrounding areas.

The focus on the seven largest municipalities (Tirana, Durrës, Vlorë, Elbasan, Shkodër, Fier, Korçë) confirms that they act both as attraction poles and as poles from which a daily redistribution of commuting workers takes place. The same is for municipalities/communes located in their surrounding areas, which appear as the primary gravitational areas of big municipalities. Altogether, big municipalities and municipalities in their surrounding areas form complex systems of daily mobility, which in some cases are also linked to each other (Tirana/Durrës, Tirana/Elbasan, and Tirana/Fier).

The measure of the impact of daily flows on the usually resident population confirms the preeminent role played by the largest Albanian municipalities in the system of daily spatial interactions. The difference between usually resident population and day-time population is especially relevant for the municipality of Tirana, resulting in a positive net flow of about 25 thousand people. The day-time population is also higher for the municipalities of Durrës, Shkodër and Korçë, while the net flow is slightly negative for Elbasan, Fier and Vlorë. The day-time population density is quite higher than the usually resident population for the municipalities of Tirana, somewhat higher for the municipalities of Durrës and Shkodër and slightly higher for the municipality of Korçë.

As to the gravitational areas of each municipality, generally the volume of flows tends to decrease as the distance increases, though with some differential aspects among the seven municipalities. For example, the vast majority of daily commuters to Tirana live close to the capital (71.5% of the daily commuters to Tirana travel a maximum of 10 km), while in the case of Durrës more than half of commuters come from distances between 10 and 20 km, and in the case of Vlorë, flows coming from municipalities which are more distant than 40 km also appear to be relevant.

Looking at the percentage distribution of daily commuters working in each municipality by municipality/commune of residence, we observe that Tirana, Durrës and, partially, Vlorë attract daily commuters from a wide range of municipalities and are characterized by a broad gravitational area; while Elbasan, Shkodër, Fier and Korçë have a less extended and geographically circumscribed gravitational area. We also notice that these systems of daily mobility are linked to each other, and in some cases, as it is for the flows Tirana/Durrës, Tirana/Elbasan, Tirana/Fier, the link is quite strong.

The leading role of big municipalities is confirmed and further clarified by the results of the multivariate spatial analysis of daily commuting flows. More precisely, they appear as playing a crucial central role, but also as "preys" predated by a number of other municipalities/communes (that we could name "predators") that are very close to them in terms of spatial location and that present quite divergent profiles in terms of the indicators chosen for the analysis (e.g. they are characterized by a low level of daily inflow and by a comparatively high level of daily outflow, and they have a medium-small size in terms of usually resident population and in terms of surface).

The study carried on the census data on commuting from home to work has allowed us to:

- identify the socio-demographic profiles of commuters and of non-commuters and to verify that there are significant differences between these two groups and among the various groups of non-commuters;
- identify the patterns underlying the spatial structure of daily work commuting system, and especially to highlight the fundamental role played by big municipalities as poles of attraction of commuters coming from other municipalities, but also as poles of re-distribution of employed persons (commuters outflow originating from these municipalities are also quite significant);
- analyse the difference between the usually resident population and the day-time population of big municipalities and to confirm the peculiar role of the municipality of Tirana, the one for which the more significant impact of the day-time population on the usually resident population is recorded;
- identify and qualify their gravitational areas in terms of distance travelled by commuters to get to them and in terms of the municipalities contributing most to their commuting inflows;
- discover that big municipalities are not only linked to their surroundings but also to the other centres or, more precisely, that each core-rings system is linked to the others.

Thanks to GIS tools and techniques and to the use of advanced spatial analysis methodology, territory has played a key role in this study (differently from traditional analyses based just on non-spatial attributes of data). Furthermore, the multivariate spatial analysis has allowed us to propose an alternative classification of Albanian territories to the traditional administrative ones. Indeed, the derived regions obtained through the regionalization (i.e. spatially constrained clustering) could be considered a first step towards the identification of local labour systems (Istat, 1997; Istat, 2005) to be used as the basis of regional development planning.

The picture that we get of the daily spatial interactions in Albania is that of a country with a number of dynamic centres, which can be seen both as hierarchically higher with respect to their surrounding areas, due to the complex functions that they exert (e.g. their institutional role, the diverse services that they offer), and as preys, which are used by predators who don't belong to their usually resident population but who exploit their territory and more precisely their services. This opens a debate about the challenges that this represents for the local authorities, and about the financial resources required for coping with it, in order not to suffer the impact of these dynamics. The leading role in this picture is played by the municipality of Tirana, to which go the honour and the burden of being the key player.

If commuting flows to and from big municipalities occupy the foreground of the picture, the background is that of internal, peripheral and rural areas where the volume of commuting flows is quite scarce. From the point of view of commuting flows, these areas appear as self-contained. Therefore, it should be analysed whether this scarce mobility of workers might be explained as an effect of a rural or less developed economy, or whether this has to do with the (lack of) availability of means of transport, i.e. with the cost, monetary and non-monetary, of mobility.

In this regard, very interesting is the key role played in work-related commuting by non-motorized means of transport (which in other contexts would be defined as ecological means), in view of the strengthening of the system of public transports, based on the current habits of the employed population.

Therefore, in order to further enhance our knowledge of the Albanian system of mobility, commuting flows should be looked at together with transport networks. Furthermore, the study of commuting should be carried on together with that of internal migration flows, given that, as it is well known, the two phenomena are strictly connected.

The collection of a larger set of variables in future censuses (such as time taken to get to work) would allow the study of the mobility costs (monetary and non-monetary).

Finally, the use of sample survey for collecting information on mobility biographies should be taken into consideration in order to analyse the complex system of relationships that link territory, migration and commuting.

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