

## IDENTIFYING SPATIAL LABOR MARKETS IN GREECE FROM THE 2001 TRAVEL-TO-WORK PATTERNS

PRODROMOS-IOANNIS K. PRODROMIDIS\*

Centre for Planning and Economic Research [KEPE]

### Abstract

The article examines inter-municipal commuting flows in Greece, collected via the 2001 Census, and delineates the country's labor market areas (LMAs). It finds that the LMAs of Athens (3.9 million inhabitants) and Thessaloniki (1.1 million) exceed the homonymous urban-planning complexes by 8 and 15 times, respectively. These LMAs, along with the LMAs of Patras (245 thousand) and Iraklion (233 thousand), host about half the country's population. Another thirty-eight clusters of municipalities and eight self-contained municipalities of 20-184 thousand inhabitants jointly host a quarter of the country's population. The picture is complemented by the presence of ten clusters of municipalities and 607 self-contained municipalities with smaller populations. Overall, the article advances our understanding of how the country functions at the sub-national level.

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**Key words:** Labor market areas. Functional economic areas. Commuting flows. Localities. Urban and micro-regional policy areas

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\* *Corresponding address:* KEPE, Amerikis 11, Athens 10672, Greece. e-mail: [pjprodr@kepe.gr](mailto:pjprodr@kepe.gr)

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## 1. Introduction

The purpose of this article is to delineate, for the first time, the Labor Market Areas (LMAs) of Greece by utilizing disaggregated travel-to-work data solicited in the 2001 Population Census. Thus, it enhances our understanding of how the economy operates at the sub-national level in a manner that may not be possible through the conventional territorial partitions (administrative regions or provinces; counties, districts or prefectures; etc.). This is especially true in cases where the aforementioned partitions represent a mixture of geographical factors, historical memories, relics of commercial life from previous centuries, administrative contingencies, political/electoral considerations, geometry or chance.

The stimulus was provided in conferences organized by the OECD and the EU, dealing with the issue. Indeed, a number of studies have already delineated and re-delineated the self-contained LMAs or basins (zones) of employment of Great Britain (Smart, 1974; Ball, 1980; Coombes and Openshaw, 1982; Coombes et al., 1986; Office for National Statistics and Coombes, 1998; Coombes et al., 2005), Italy (Istituto Nazionale di Statistica, 1997), Denmark (Kristensen, 1998), the Netherlands (van der Laan, 1991; van der Laan and Schalke, 2001), a number of French and Spanish regions (Schmitt and Henry, 2000; Casado-Díaz, 2000; Poper, 2005; Royuela and Vargas, 2007), New Zealand (Papps and Newell, 2002), and the travel-to-work areas of several national capitals (OECD, 2007).

For the most part, these approaches are based on an iterative process (algorithm) of grouping in a consistent manner contiguous or nearby localities, wards or municipalities, according to daily commuting flows from the place of residence to the place of work, and residence- and work-place-based self-containment criteria. Thus, unlike the conventional territorial partitions, the spatial formations recovered via this process display a good deal of the functional linkages between a 'core' area and its surrounding territories, and constitute territorial partitions on the basis of the economic interdependencies of localities. Consequently, they have gained considerable acceptance by the scientific community and governments as the appropriate territorial grid for diagnosing and analyzing regional disparities, engaging in policy interventions, relying on spillovers, etc. Indeed, in view of the complexity and continuing restructuring of modern economic reality, the determination and periodic revision of a country's functional areas are probably very much to be desired.

However, the instruments employed in these calculations, such as the definitions of cores and surrounding areas, commuting directions, and the criteria for attaching together or detaching areas, vary considerably from one case to another (Casado-Díaz and Coombes, 2005). A notable exception is provided by Eurostat, the EU's principal statistical agency, the staff of which studies sub-national development across countries in a uniform manner. Hence, a dataset consisting of the thirty biggest commuting outflows from each municipality (or LAU 1 level district, in terms of NUTS

typology)<sup>1</sup> is employed in order to identify, via an iterative process, the boundaries of the metropolitan and other main urban LMAs by attaching to city-cores the surrounding municipalities that exhibit substantial commuting flows to the city-core or to an iteratively enlarged core. In fact, the agency's statisticians have tested the use of a narrow commuting threshold of 20%, as well as a wider commuting threshold of 15%, which is more challenging to work with (Carlquist, 2006).<sup>2</sup> However, a growing recognition of the possibilities of LMA statistics in offering insights with regard to the performance of regions, prompted Eurostat, in late 2007, to invite the member states to report not only their main urban LMAs but all LMAs.

Among the member states, Greece is characterized by a very fragmented landscape. Located at the southern part of the Balkan peninsula (Figure 1) and inhabited by 10.934 million residents, the country covers an area of some 132 thousand square kilometers (2001 Census figures). The terrain is dominated by high mountain-chains (about 42.2% of the country's surface), small valleys traversed by rivers or inlaid with lakes, narrow coastal strips, a multitude of islands (about 35.1% of the country's surface), and a very jagged coastline, extending for 15 thousand kilometers of which 6.1 thousand kilometers are on the mainland and 8.9 on the islands. (To give a measure of comparison: Greece's coastline accounts for 13.6% of the EU-27 total, packed in a rather small area, about 3.1% of the EU landmass.) These natural features greatly fragment the country into a host of tiny districts. Obviously, the splintering impact of the landscape is, to some extent, tempered by the effectiveness of the transportation network linking these districts (coastal strips, plateaus, and islands). Yet, it might not come as a surprise, if a uniform set of criteria was applied across the EU, to see the number of the Greek functional economies per square kilometer exceed the EU average.

In Greece, the need to empirically determine the country's travel-to-work areas and delineate the labor markets areas within which policies may be most effective has been persuasively articulated by Efstratoglou (2006). However, up until early 2008,

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1. The *Nomenclature des Unités Territoriales Statistiques* (NUTS) is the five-tier hierarchical structure used in the EU to standardize territorial units. In Greece, the administrative regions (*periferies*) correspond to NUTS level 2 sized-districts; prefectures (*nomoi*) correspond to NUTS level 3 sized-districts; municipalities (*demoi* or *koinotites*) to upper level Local Administrative Units (LAU 1, formerly NUTS level 4), and their subdivisions or wards (e.g., *demotika diamerismata* or *koinotika diamerismata*) to lower level Local Administrative Units (LAU 2, occasionally still termed NUTS level 5).

2. In essence, if a relatively large share of a municipality's employed residents (say, 15% or more) commute to the city-core, then the municipality is considered as sufficiently integrated with the core and is treated as a part of its LMA. Moreover, if other municipalities exhibit similar commuting patterns vis-à-vis the city-core or the iteratively enlarged core then these municipalities are treated as parts of the particular LMA as well.

the detection of Greek LMAs could only be made by means of the thirty biggest commuting outflows from each municipality as solicited in the course of the 2001-Census, i.e., the dataset used by Eurostat. The recent availability of the complete set of commuting flows, in response to Eurostat's request for more sophisticated treatment and a thorough report, has enabled the production of a more accurate determination of the country's LMAs at both the 20% and the 15% incoming and outgoing commuting thresholds. The relevant calculations according to the former threshold bring the number of LMAs to 754 and according to the latter to 667.<sup>3</sup> Understandably, the employment of a lower threshold affects the aggregation of localities into broader formations on the basis of fewer commuters traversing the mountainous or other terrains. This yields a smaller number of rather larger LMAs, which, on average, include a number of less integrated communities compared to the formations drawn on the basis of a higher threshold. Considering that the 15% threshold employed hereinafter is also one of the lowest used by EU member states in their replies to Eurostat, the recovery in Greece of one of the largest number of LMAs across the EU is probably reflective of the country's idiosyncratically fragmented terrain.

The rest of the article is concerned with the inter-municipal commuting flows recorded in the 2001 Census in order to determine the LMAs of Greece at the 15% commuting threshold. Section 2 explains how the LMAs are determined, Section 3 supplies the results, and Section 4 concludes.

## 2. The methodology used in the delineation of the LMAs

As already mentioned, we use the same building blocks as Eurostat (namely, LAU 1 areas), and employ all incoming and outgoing commuting data. However, we enhance the method by considering two-way commuting flows, i.e., from the fringes to the core and vice-versa, which, despite increasing the project's complexity, provides a more complete picture of labor market linkages than one-way commuting. Indeed, two-way commuting is employed in both the UK self-containment algorithm and the North American labor market definitions. Additionally, we take the labor market delineation technique to the next logical step, and apply it throughout the country by examining not only the commuting patterns around the main urban centers, but across all 1,034 Greek municipalities. Thus, we codify the commuting origins and destinations in a non-symmetrical 1,034 by 1,034 interaction matrix, and proceed

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3. A comprehensive list of each LMA's constituent communities and of the communities that meet each threshold is provided in the discussion paper under the title *Deriving Labor Market Areas in Greece from Commuting Flows*, located at [http://www.kepe.gr/pdf/D.P/dp\\_99.pdf](http://www.kepe.gr/pdf/D.P/dp_99.pdf).

to cluster them without contiguity restrictions.<sup>4</sup> In effect, a municipality (or an iteratively enlarged LMA) will be grouped with another municipality or LMA if either (a) 15% or more of its employed residents commute to the other municipality or LMA, (b) 15% or more of all persons employed in the municipality commute from the other municipality or LMA, or both (a) and (b).<sup>5</sup>

We illustrate this with an example which makes use of the travel-to-work flows displayed by the employed residents in the town of Kozani (pop. 49,812 in West Macedonia) and its environs (Table 1). Apparently, Kozani attracts 25% of the employed persons residing in the municipality of Dimitrios Ipsilantis (pop. 2,861), 23% of the employed persons residing in the municipality of Elimia (pop. 6,320) and 23% of the employed persons residing in the municipality of Eani (pop. 3,746).<sup>6</sup> At the same time, commuters from the town of Kozani make up 23% of all who are employed in the municipalities of Ellispontos (pop. 7,481) and Dimitrios Ipsilantis.<sup>7</sup> As all five localities meet or exceed either the incoming or the outgoing commuting threshold of 20%, they are taken to comprise a functional area at the particular threshold. Collectively, they attract 19% of the employed residents in neighboring Velvendos (pop. 3,549),<sup>8</sup> while commuters from them make up 1.9% of all persons employed in Velvendos.<sup>9</sup> As neither of the two commuting ratios meets the 20% threshold, Velvendos is left outside the functional area formed by the other five localities at the 20% incom-

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4. Hypothetically speaking, the imposition of such restrictions, while allowing the consideration of adjacent localities that may not be well linked (as contiguity does not necessarily translate to actual rail/motorway or direct and steady ferry connectivity), may prevent the consideration of detached or somewhat distant continental localities that are well linked and may exhibit substantial travel flows through the transportation network. Additionally, it is at variance with the commitment to exclusively rely on (and map) economic interactions. At any rate, only three non-contiguities are detected, involving localities attached to the Thessaloniki, Patras and Serre LMAs.

5. The prevailing view is that LMAs are not supposed to overlap. In our case, only two municipalities raise any concern regarding the broader travel-to-work area to which they ought to be attached: Avlis (to the LMA of Athens or to the LMA of Halkis) and Dimitrios Ipsilantis (to the LMA of Kozani or to the LMA of Ptolemais). The issue is resolved in favor of their incorporation into the Athens and Kozani zones, respectively, on the basis of both (a) the relative sizes of the flows (for they join the Athens and Kozani LMAs on the basis of the 20% rather than the 15% threshold), and (b) the similarities displayed in terms of their male and female employment, unemployment, and non-participation patterns (i.e., better t-statistics and fits in a number of regressions).

6. I.e., 209 out of the 831 employed persons residing in Dimitrios Ipsilantis, 244 out of the 1,062 employed persons residing in Eani, 482 out of the 2,070 employed persons residing in Elimia.

7. I.e., 615 out of 2,711 in the case of the former, and 225 out of 998 in the case of the latter.

8. In particular, 155 of the municipality's 1,183 employed residents commute to Kozani, 27 to Ellispontos, 3 to Eani, 1 to Dimitrios Ipsilantis.

9. Involving 16 residents from Kozani, and 1 from each Elimia and Ellispontos out of the 942 people employed in Velvendos.

ing or outgoing threshold, but it is included in the enlarged LMA formed at the lower threshold of 15%. It follows that LMA sizes may change as commuting thresholds are modified. Having shown how an LMA is formed, we turn to the results obtained across the country, at the lower of the two thresholds.

### 3. The LMAs

We find that the largest LMAs are located around Athens, Thessaloniki, and the urban centers of Patras, Iraklion, Larisa, Volos, and Ioannina (Table 2). All encompass a number of urban and rural municipalities, which are denoted in Figure 2 with black and dark gray, respectively. In particular:

- The Athens LMA seems to consist of 120 municipalities, the majority of which are situated in the region of Attiki and five in the prefecture of Boeotia (in Central Greece). The LMA occupies a surface of 3,609 square kilometers (2.7% of the country's land-surface)<sup>10</sup> and, at the time of the Census hosted a population of 3.887 million inhabitants (35.6% of the country's population); i.e., 600 thousand more residents and about eight times more than the area of the homonymous urban-planning complex. This corresponds to 79.7% and 3.7% of the overall surface of the administrative regions of Attiki and Central Greece-Euboea, respectively, and 99.1% and 5.2% of the corresponding regional populations.<sup>11</sup>
- The Thessaloniki LMA spans 45 municipalities situated in the homonymous prefecture and the neighboring prefectures of Halkidiki and Kilkis. It occupies a total surface of 3,718 square kilometers (2.8% of the country's surface)<sup>12</sup> and, at the time of the Census, hosted a population of 1.090 million inhabitants (10.0% of the country's population); i.e., 312 thousand more residents and 15-times more than the area of the homonymous urban-planning complex. This corresponds to 19.8% of Central Macedonia's surface and 58.1% of the region's population.
- The LMA of Patras (12 municipalities) hosted 245 thousand people, and those of Iraklion (17 municipalities) 233 thousand, Larisa (11 municipalities) 184 thousand, Volos (11 municipalities) 154 thousand, and Ioannina (17 municipalities) 131 thousand. Taken together, these areas accounted for 8.7% of the country's population and occupied 5.4% of the land.

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10. The minor divergence from the figure provided in Table 2 is accounted by inland water-covered surfaces, such as lake Marathon.

11. The figures relate to the continental part of Attiki and the island of Salamis, thus leaving out a number of islands and a small slice of the east Peloponnesian coast that form part of the administration of Attiki.

12. This corresponds to 3,649 square kilometers if inland water-covered areas are excluded (see Table 2).

Thirty-five LMAs and eight self-contained municipalities host populations ranging from 21 to 115 thousand inhabitants. They are indicated in Figure 2 with black and standard gray, which denote the urban and rural municipalities, respectively. (Their population, land-surface (water-covered areas excluded) and altitude figures are provided in Table 3). These are:

- The LMAs of Hania (115 thousand people), Rhodes (109 thousand), Halkis (98 thousand), Trikala, Kalamata, Serre (80-82 thousand), Kavala, Kerkira, Kozani, Lamia, Corinth, Agrinion (70-74 thousand), Komotini, Xanthi, Drama, Katerini, Veria (61-69 thousand), Alexandroupolis, Karditsa, Tripolis, Kastoria (50-56 thousand), Rethimnon, Arta, Ptolemais, Hios, Mitilini (41-48 thousand), the island of Zakynthos (39 thousand), and the LMAs of Egion (35 thousand), Kilkis, Thebes, Sparta, Levadia, Kos, Florina, Nafpaktos (21-29 thousand people).
- The individual municipalities of Pírgos (36 thousands), Giannitsa, Amalias, Argos (30-32 thousand), Edessa, Ierapetra, Naousa, Orestias (22-26 thousand). These exhibit rather low commuting ratios to/from the surrounding communities, i.e., they appear to be self-contained.

The majority of local authority units (indicated in Figure 2 with light gray) are quite small in terms of population size.

- (a) A small number of these units form ten inter-municipal LMAs, namely the island of Siros and the travel-to-work areas of Aliverion, Grevena, Argostolion, Hrisoupolis, Igoumenitsa, Amfissa, Lefkas (14-20 thousand), Distomon, Tinos (8-9 thousand).
- (b) The rest exhibit low inward and outward commuting ratios. This suggests that the majority of these (mainly rural) municipalities are rather self-contained. In particular:
  - 190 municipalities host populations ranging from 5 to slightly less than 20 thousand inhabitants. They collectively account for 14.9% of the country's population and 30.3% of the land.
  - 417 municipalities have fewer inhabitants. They collectively account for 9.0% of the country's population and 38.3% of the land. A good number of them are insular communities or communities that lie along the Pindos mountain-range and its Peloponnesian extensions that splits the mainland into east and west.

A brief summary of the population and land-surface features of the above clusters of municipalities and self-contained municipalities under (a) and (b), is provided in Tables 4 and 5. Considering that, on average, the smallest of these in terms of:

- acreage (less than 115 km<sup>2</sup>) are situated on the insular Ionian, South and North Aegean regions and the insular sub-region of Attiki; and

- population size (about 3,050 inhabitants) are situated on the mountainous regions of Epiros and West Macedonia (at average altitudes of 566 and 820 meters, respectively: the highest in the country);

it appears that the feature of economic fragmentation, relative seclusion and low labor market integration/interdependency may be associated with the country's fragmented terrain (i.e., with the existence of many islands or mountains). Table 6 probes the issue by considering the correlations (i) between population size and both land surface and population density across all LMAs, and (ii) among land-surface, population density, and altitude across the three types of LMAs.<sup>13</sup> According to the estimates with absolute values in excess of 65%, the most populous LMAs are generally more extensive in terms of surface and also more crowded (column 1). Additionally, of the seven largest LMAs, those that are more extensive in terms of surface are generally more densely populated as well. By contrast, those of the small LMAs that are more extensive are by-and-large thinly populated (column 2), and those that are thinly populated are generally situated at higher altitudes (column 4).

Indeed, as the cost of energy in traversing mountainous formations is higher, it is reasonable to assume that highland communities may be seen by many as less attractive domiciles and workplaces to commute to/from. Accordingly, labor market integration is more likely to occur along transport corridors, such as the small valleys and narrow coastal strips, where the cost of moving or hauling is lower. In an interesting departure from J.H. von Thünen's theory of concentric rings of settlements formed on flat homogeneous land around a central city, or as a paradigm of LMA adjustment to a distinctively idiosyncratic terrain,<sup>14</sup> a good number of large and modestly-sized Greek LMAs appear to follow the mountainous contours and to have assumed stripe-form shapes that have little or no interaction with the surrounding areas lying further away.<sup>15</sup> Likewise, coastal localities separated by long inlets of water, and islands constitute separate economic spaces.

Obviously, spatial seclusion may have important implications regarding the degree of attractiveness of these localities to a number of industries, as well as the effectiveness and spillover-potential of regional development policies. Hence, it draws attention to the importance of the transportation network in facilitating traveling be-

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13. I.e., (a) the seven largest LMAs, (b) the forty-three medium-size LMAs with populations ranging between 21 and 115 thousand, and (c) the thirteen regional types of smaller LMAs with less than 20 thousand inhabitants.

14. It is this very environment that gave rise to the diverse patchwork of city-states and tribes in classical antiquity.

15. I am indebted to Prof. Helmut Maier of the Berlin School of Economics for bringing it to my attention.



tween localities and effecting the economic unification of neighboring communities, and – by extension – the country.

In closing, we note that there is not much evidence of labor market integration between major cities other than Athens and Piraeus (the port of Athens) or of transnational commuting. The lack of transnational commuting is not surprising given that the statistics date from a period when Greece did not share common borders with other EU member-states. In short, the country's national borders were also EU borders, with all the limitations in trans-border commuting flows this entails.

#### **4. Conclusions**

The daily commuting information obtained from employed persons permits the determination of the labor markets of Greece across the country's 1,034 municipalities, in a manner that was not previously possible. We analyze all two-way inter-municipal commuting flows at the 15% threshold, which is used in Eurostat's pilot study regarding national capitals and major urban centers. The iterative computation process used suggests that Greece contains 667 distinct LMAs. The largest ones are situated around the cities of Athens, Thessaloniki, Patras and Iraklion, which taken together host 49.9% of the country's total population. There also exist thirty-eight smaller clusters of municipalities and eight self-contained municipalities hosting populations ranging from 21 to 185 thousand inhabitants, which jointly host 25.0% of the country's population. The remaining LMAs and self-contained municipalities are smaller.

The exercise has allowed us to take a fresh look at the economy as it truly is (i.e., a collection of clusters and communities) without preconceptions that localities or economic sub-spaces must fit into the inherited regional administrative framework. Indeed, the visual representation of these micro-regional formations on a map challenges the conventional perception of how modern-day Greece is organized and functions. It recalls the geographic relief of the country (e.g., a good number of small self-contained localities is situated along the Pindos mountain-range), but bears little resemblance to the patchwork of the NUTS levels 2 and 3 administrative divisions (i.e., the 13 regions and 54 prefectures) employed by the national and the EU authorities to design the country's regional development. This suggests that economic life may not (a) correspond to the presumed 13 or 54 labor markets or territorial units of policy intervention of Greece or (b) run along the urban/rural divide. As a result, the survey areas for soliciting a good number of economic and social statistics may have to be re-drawn; and the spatial dimension of employment, unemployment or other policy-initiatives (pertaining to social cohesion, transportation, the environment, the spread of epidemics, the attraction of foreign investment etc.) to be accordingly re-

focused.<sup>16</sup> In this context, it might make sense if a number of such issues were assigned to authorities operating at the LMA level, even if the constituent localities belong to different administrative districts for historical, electoral or other reasons. For instance, the Thessaloniki LMA stretches beyond the homonymous urban-planning complex, over the western part of the Thessaloniki prefecture, as well as parts of the neighbouring Halkidiki and Kilkis prefectures. It seems that the localities forming an LMA ought to enjoy/engage in a uniform treatment of, say, labor-related issues on which they are highly interdependent. Understandably, a prescription that meets their needs may not be as suitable for the localities in another LMA, the authorities of which may have to work out what is appropriate in their case. In contrast, in the case of an LMA that cuts across administrative lines, reliance on the coordination of two authorities set up in different administrative districts (with each of these authorities adopting different policies in the different territories (other LMAs) under its purview) appears to be more cumbersome.

Last but not least, this first snapshot of the country's LMAs is quite relevant to discussions taking place in Greece regarding mergers of municipalities. Rezoning municipalities is expected to (a) generate economies of scale in terms of staffing and policy coordination, as well as (b) align the average size of local authorities with the average size encountered in a number of EU countries. However, our findings suggest that it might be unwise to reduce the number of micro-regional areas in which economic initiatives can be planned/combined (i) below the figure of 667, (ii) before fresh results are obtained via the forthcoming Census. The next Census is scheduled to take place in 2011 and supply commuting data at an even more disaggregated level (LAU 2). This will facilitate the production of a more thorough map of LMAs. On the other hand, if the existing municipalities are merged into a considerably smaller number of larger formations (say 300 to 400), presumably on the basis of a lower commuting threshold or other criteria (historical, political etc.), then there is a good chance that many of the new, enlarged authorities will constitute little more than amalgamations of poorly integrated areas. This may seriously compromise the assumption of suitable place-based policies across large tracts of the country.

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16. For example, in building a case for attracting private investment to a place, it is probably wiser to factor in the age and skill profile of the resident workforce or other assets at the LMA level, as opposed to the age and skill profile of inhabitants or the other assets to be found in the individual community where the plant is to be located.

**Table 1: In- and out-commuting flows observed at the town of Kozani and its environs (in West Macedonia)**

Residents	Employed							Sum of employed residents
(a) in the municipality of	(i) in the municipalities of						(ii) elsewhere	
	Kozani	D. Ipsilantis	Eani	Elimia	Ellipsontos	Velvendos		
• Kozani	14,329	225	40	69	615	16	1,760	17,054
• D. Ipsilantis	209	482		1	12		127	831
• Eani	244	11	609	5	44		149	1,062
• Elimia	482	10	4	1,322	70	1	181	2,070
• Ellipsontos	302	71		2	1,704	1	180	2,260
• Velvendos	155	1	3		27	892	105	1,183
(b) in other places	1,150	198	24	18	239	32		
Sum of residents and commuters employed in a place	16,871	998	680	1,417	2,711	942		

Source: Own calculations based on the National Statistical Service of Greece (NSSG), the 2001 Population Census figures.

**Table 2: The seven largest LMAs of Greece on the basis of the 15% in- and out-commuting ratios**

	Population		Land surface (excl. water)		Average altitude (meters)		Number of municipalities
	In thousands	In urban wards	Km <sup>2</sup>	In urban wards	Total	Of the urban wards	
1 Athens-Piraeus	3,887	97%	3,607	38%	175	110	115 in Attiki, 5 in Central Greece
2 Thessaloniki	1,090	86%	3,649	13%	259	93	45 in Central Macedonia
3 Patras	245	86%	1,251	11%	306	27	12 in Western Greece
4 Iraklion	233	75%	1,202	13%	316	98	17 in Crete
5 Larisa	184	78%	1,660	9%	173	70	11 in Thessaly
6 Volos	154	84%	825	8%	187	38	11 in Thessaly
7 Ioannina	131	70%	1,882	5%	671	499	17 in Epiros

Source: See Table 1.

**Table 3: The forty-three medium-size LMAs of Greece on the basis of the 15% in- and out-commuting ratios**

	Population		Land surface (excl. water)		Average altitude (meters)		Number of municipalities
	In thousands	In urban wards	Km <sup>2</sup>	In urban wards	Total	Of the urban wards	
1 Hania	115	82%	794	17%	259	56	12 in Crete
2 Rhodes	109	73%	787	12%	146	27	8 in South Aegean Isl.
3 Halkis	98	82%	749	14%	204	17	6 in C. Greece-Euboea
4 Trikala	82	71%	561	12%	171	115	8 in Thessaly
5 Kalamata	81	81%	524	16%	314	32	5 in Peloponnesos
6 Serre	80	70%	669	14%	166	53	5 in Central Macedonia
7 Kavala	74	82%	351	11%	256	53	2 in East Macedonia
8 Kerkira	74	80%	283	39%	139	70	7 in Ionian Islands
9 Kozani	74	58%	1,180	5%	713	669	6 in West Macedonia
10 Lamia	73	72%	772	9%	290	98	3 in Central Greece
11 Corinth	71	59%	557	10%	127	22	5 in Peloponnesos
12 Agrinion	70	80%	274	37%	105	85	3 in West Greece
13 Komotini	69	69%	927	7%	84	44	4 in Thrace
14 Xanthi	67	69%	445	7%	51	80	3 in Thrace
15 Drama	67	67%	1,930	3%	498	115	5 in East Macedonia
16 Katerini	63	98%	118	82%	41	31	2 in Central Macedonia
17 Veria	61	81%	526	14%	534	99	3 in Central Macedonia
18 Alexandroupolis	56	89%	804	19%	183	10	2 in Thrace
19 Karditsa	54	66%	491	7%	379	105	4 in Thessaly
20 Tripolis	54	67%	1,583	3%	732	582	8 in Peloponnesos
21 Kastoria	50	58%	1,262	7%	895	679	11 in West Macedonia
22 Rethimnon	48	73%	497	10%	356	45	4 in Crete
23 Arta	48	55%	426	9%	234	26	6 in Epiros
24 Ptolemais	47	64%	709	8%	750	600	5 in West Macedonia
25 Hios	46	62%	472	7%	216	28	6 in North Aegean Isl.
26 Mitilini	41	77%	187	10%	83	19	2 in North Aegean Isl.
27 Zakynthos Isl.	39	58%	405	15%	230	53	6 in Ionian Islands
28 Pargos	36	73%	169	31%	47	16	1 in Peloponnesos
29 Egion	35	84%	237	19%	372	44	2 in Western Greece
30 Giannitsa	32	93%	208	90%	51	45	1 in Central Macedonia
31 Amalias	32	71%	247	31%	105	42	1 in Peloponnesos
32 Argos	30	87%	138	38%	118	40	1 in Peloponnesos
33 Kilkis	29	66%	478	23%	197	274	2 in Central Macedonia
34 Thebes	29	77%	482	29%	246	180	2 in Central Greece
35 Edessa	26	74%	321	12%	444	320	1 in Central Macedonia
36 Sparta	26	72%	518	5%	589	217	3 in Peloponnesos
37 Levidia	24	89%	278	50%	180	204	2 in Central Greece

38	Kos	24	75%	130	52%	33	15	2 in South Aegean Isl.
39	Ierapetra	24	66%	395	18%	232	18	1 in Crete
40	Florina	23	67%	362	7%	851	663	2 in West Macedonia
41	Naousa	22	0%	301		383		1 in Central Macedonia
42	Orestias	22	79%	255	41%	73	31	1 in Thrace
43	Nafpaktos	21	78%	211	13%	249	20	2 in Western Greece

Source: See Table 1.

**Table 4: The regional distribution of the small LMAs of Greece (with less than 20 thousand inhabitants) on the basis of the 15% in- and out-commuting ratios**

	Population		Land surface (excl. water)		Average alti- tude (meters)		Number of LMAs involved	
	In thousands	In urban wards	Km <sup>2</sup>	In urban wards	Total	Of the urban wards		
1	Central Macedonia	473	12%	12,616	2%	238	27	75
2	Peloponnesos	337	19%	12,154	1%	425	29	85
3	Central Greece-Euboea	305	6%	12,571	1%	435	83	72
4	Western Greece	284	13%	8,678	2%	399	43	53
5	Thessaly	266	13%	10,467	2%	429	154	70
6	East Macedonia-Thrace	251	8%	9,351	1%	240	23	37
7	Crete	175	24%	5,448	2%	333	108	36
8	South Aegean Isl.	165	23%	4,369	2%	165	76	45
9	Epiros	158	25%	6,776	2%	566	18	52
10	North Aegean Isl.	118	20%	3,164	2%	165	32	28
11	West Macedonia	101	17%	5,746	2%	820	541	33
12	Ionian Isl.	97	42%	1,611	9%	210	49	22
13	Attiki	36	29%	782	7%	139	31	9

Source: See Table 1.

**Table 5: Average population and land-surface figures of the small LMAs of Greece (with less than 20 thousand inhabitants), by region**

<i>Population (in thousands)</i>		<i>Land surface excluding water (in km<sup>2</sup>)</i>		
1	Epiros	3,033	1 Ionian Isl.	73
2	W. Macedonia	3,065	2 Attiki	87
3	S. Aegean Isl.	3,668	3 S. Aegean Isl.	97
4	Thessaly	3,802	4 N. Aegean Isl.	113
5	Peloponnesos	3,966	5 Epiros	130
6	Attiki	4,013	6 Peloponnesos	143
7	N. Aegean Isl.	4,213	7 Thessaly	150
8	C. Greece-Euboea	4,240	8 Crete	151
9	Ionian Isl.	4,404	9 W. Greece	164
10	Crete	4,851	10 C. Macedonia	168
11	W. Greece	5,358	11 W. Macedonia	174
12	C. Macedonia	6,309	12 C. Greece-Euboea	175
13	E. Macedonia-Thrace	6,789	13 E. Macedonia-Thrace	253

Source: See Table 1.

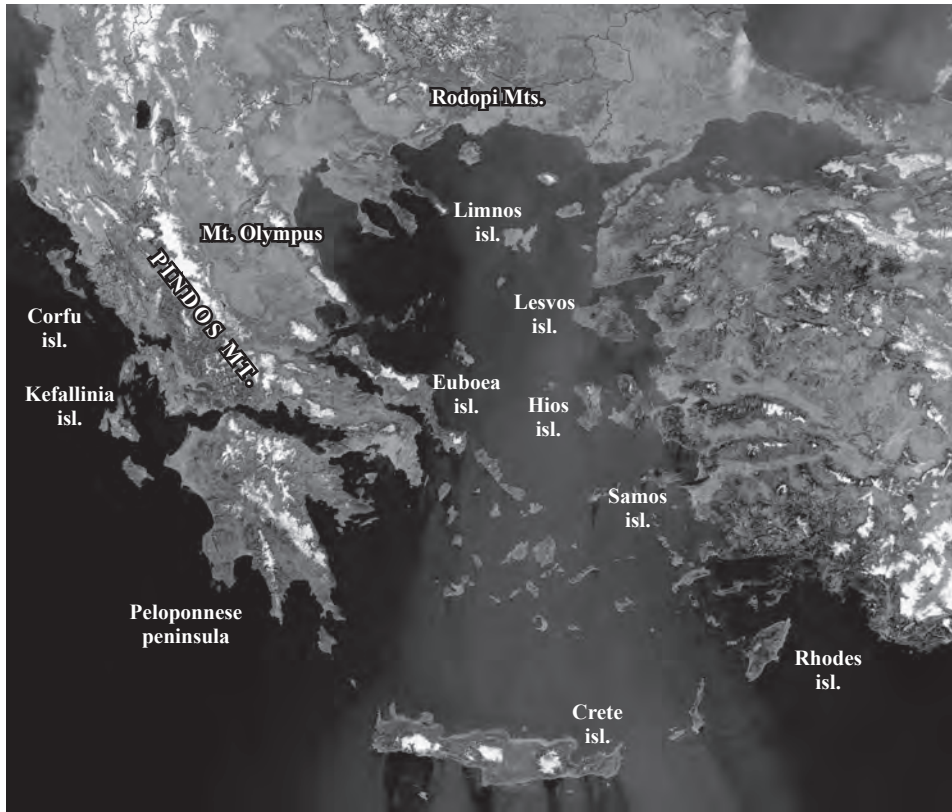
**Table 6: Correlations across the features of the seven large LMAs, the forty-three medium-size LMAs and the thirteen regional types of small LMAs**

All LMAs (1)		LMAs	<i>Land surface and pop. density (2)</i>	<i>Land surface and altitude (3)</i>	<i>Altitude and pop. density (4)</i>
	<i>Population</i>	Large	0.6765	-0.1264	-0.4043
<i>Land surface</i>	0.7089	Medium-size	-0.4867	0.5383	-0.5145
<i>Pop. density</i>	0.8472	Small	-0.6731	0.3375	-0.7394

Notes: In columns (2)-(4) the correlation coefficients are calculated for each group of LMAs separately. The population size of the large, the medium-size and the regional representatives of small-size LMAs is above 131 thousand, between 21-115 thousand, and less than 20 thousand inhabitants, respectively.

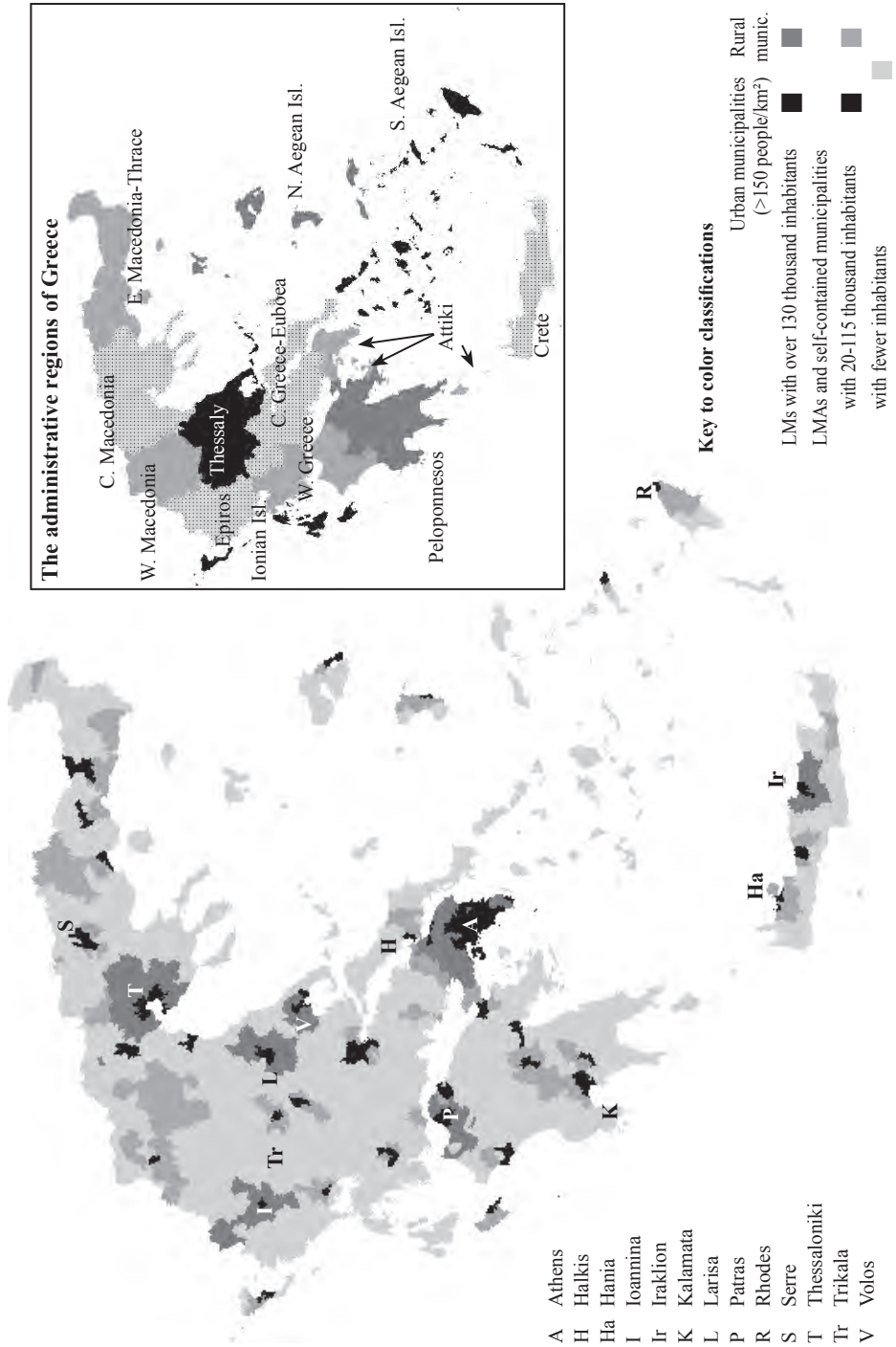
Source: See Table 1.

**Figure 1: The terrain of Greece and neighboring regions**



*Source: NASA/GSFC (2003)*

Figure 2: The country's LMAs on the basis of the 15% in- and out-commuting ratios of those employed in 2001





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