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Cluster analysis of socio-economic data to inform place-based policy measures

by
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Abstract

The Italian Government launched the *Piano Casa Italia* immediately after the series of massive earthquakes that struck Central Italy in 2016, following the 2009 earthquake in L'Aquila and the one in 2012 in Emilia-Romagna. The cumulative impact of human losses and economic and social uncertainty produced by the last disaster in 2016 has spurred political decision-makers to advocate an ambitious long-term intervention, aimed at restructuring Italian public buildings and houses over the next decades. Italy has experienced only one other era of similar schemes with the controversial interventions lasting for more than thirty years of the *Cassa del Mezzogiorno*, which started in the 1950s to cope with the country's dual economic condition. Since then, no other long-term ambitious plan has been attempted in Italy and a similar planning perspective is nowadays far from the experience of most public managers, policy makers and even scholars of economics and development. The ongoing challenges that the *Piano Casa Italia* has to face are multifaceted: political, economic and social. Challenges pertaining to the agents asked to design the scheme, to implement it and to accept it. The overall perspective of structural change will mark its implementation.

This paper is a first contribution within a broader framework to outline the conditions characterizing those challenges and the paths of change that will be initiated by realizing the Plan. The paper suggests taking an analytical perspective to support informed policy measures, in four complementary domains: emergency (National Civil Protection), recovery (Struttura Commissariale), risk reduction (*Piano Casa Italia*), socio-economic development (National Strategy for Inner Areas). The present contribution starts with a preliminary step, in line with the Sendai Framework for disaster risk reduction (UNISDR 2015): a detailed analysis of the socio-economic, demographic and geographic conditions across Italian territorial areas, at a municipality level. This work explicitly aims to single out these features, by focusing both on seismic zones and on regions. The paper also returns the results of a cluster analysis performed at municipality level across Italy and concludes discussing some implications for place-based policy interventions.

Keywords: territorial resilience, process, social innovation, natural disasters, risk reduction, risk prevention, Piano Casa Italia, place-based policies, UNISDR Sendai Framework

Jel Codes: O35, R58, Q54

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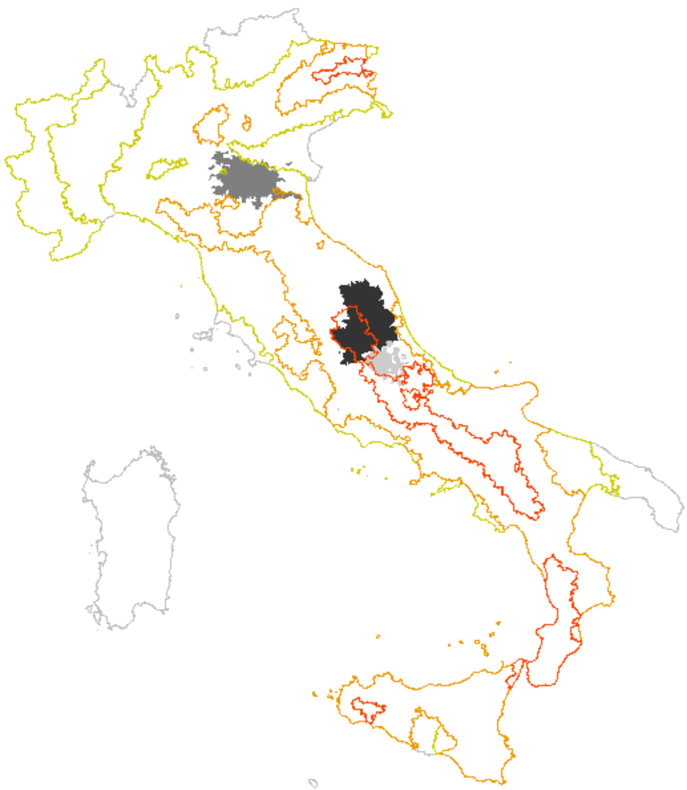
1. Introduction

Italy has a long history of earthquakes (Chubb, 2002; Guidoboni, 2012; 2014). In the last ten years, three major earthquakes have struck the country: L’Aquila (2009), Emilia (2012), and Central Italy (2016). Each of them had a wide impact on the country. As shown in Figure 1, they affected hundreds of municipalities and more than 15 thousand square kilometres in total (almost 5% of total national area), with a population of 2.4 million inhabitants and 0.8 million employees.

Figure 1 Latest earthquakes in Italy

Seismic zones	Latest earthquakes	No. Municipalities	Population (million)	Employment (million)
1	Central Italy (2016)	131	0.57	0.15
2	Emilia (2012)	109	1.71	0.59
3	L'Aquila (2009)	49	0.13	0.03
4		289	2.41	0.77



Source: authors’ elaboration on Civil Protection (2015) data

As known among experts and recently recognized also by the United Nation Office for Disaster Risk Reduction (UNISDR), "Italy sits on two fault lines, making it one of the most seismically active countries in Europe"[1]. In those conditions

[1] https://www.unisdr.org/archive/50085, (Geneva, 31 August 2016), last accessed 15th February 2017.

the Sendai framework for Disaster Risk Reduction 2015-2030 (UNISDR 2015)[2] provides insights for effective actions. The four priorities stated by the Sendai Framework embrace all the relevant dimensions to be considered in developing a plan for action at local, national and global level: understanding disaster risk; strengthening disaster risk governance to manage disaster risk; investing in disaster risk reduction for resilience; enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

The recent *Piano Casa Italia*, approved by the Italian Parliament, moves in that direction[3]. The Plan is conceived as a long-term intervention to bring about a significant turn in the negative effects that the present weaknesses produce in terms of human losses, not to mention the economic and social losses estimated to be several billions of euros, as potential economic damage. Launched by the Italian Government – with the support of all political parties – just after the series of massive earthquakes that struck Central Italy in 2016[4], the Plan is a comprehensive proposal, aimed at restructuring Italy's public buildings, houses and cultural sites, over the next decades (Sartori et al., mimeo); it has a long-term horizon that will encompass a wide territorial area with many specificities[5].

Italy has experienced only one other era of similar plans with the controversial interventions lasting for more than thirty years of the *Cassa del Mezzogiorno*, which started in the 1950s to cope with the country's dual economic condition. Since then, no other long-term ambitious plan has been attempted in Italy. Nowadays a similar planning perspective is far from the experience of public managers, policy makers and even scholars of economics and development, who are increasingly involved in theories, models and analyses of short-medium term policy programmes, such as the ones marking the EU programming policy with a five-year, and since 2000, seven-year horizon. The ongoing challenges that *Piano Casa Italia* has to face are multifaceted: political, economic and social challenges pertaining to the agents asked to design the plan, to implement it and to accept it. The overall perspective of structural socio-economic change will mark its implementation, requiring changes in culture, knowledge and practices on preparedness and responsiveness to support the Plan at all levels: from citizens and families to enterprises, from public administration to professionals.

[2] "The Sendai Framework for Disaster Risk Reduction 2015-2030 is the successor instrument to the Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters. It was adopted on March 18, 2015 at the World Conference on Disaster Risk Reduction held in Sendai, Japan, http://www.unisdr.org/who-we-are

[3] It has been promptly appreciated by UNISDR as Italy's commitment to long-term earthquake preparedness (https://www.unisdr.org/archive/50085 last accessed 15th February 2017).

[4] With a magnitude of 6.6, the earthquake on October 30, 2016 has been the largest in Italy, since the 1980 Irpinia earthquake. About 300 people died and severe material damage to buildings and material infrastructure has been reported, with entire towns being razed to the ground (such as Amatrice and Accumoli). In addition to the loss of human lives, widespread destruction of cultural heritage also occurred. In particular, in Norcia, the Basilica of St. Benedict was completely destroyed (Sartori *et al*., mimeo).

[5] The target of the plan is twofold: i) to set national "standard" rules for the construction of new buildings, according to anti-earthquake safety; and ii) to implement effective measures for private dwellings, often characterized by fragmented ownership, and for those public buildings of strategic importance (Sartori *et al*., mimeo). Moreover, the Plan includes four basic types of action: i) the "full implementation of the information on the country", including wide use of available big data; ii) the indication of "early intervention guidelines"; iii) funding and procedures; iv) strengthening of education, with the National School of Administration acting as a test subject. Information on the Plan is available at: http://www.governo.it/articolo/prevenzione-civile-dalle-emergenze-casa-italia-cos-lo-stato-volta-pagina/6184.

Any medium-long term complex plan, such as the *Piano Casa Italia*, needs to set priorities and to outline the most appropriate sequence of activities to support it from social, economic and political points of view. Although a consensus occurs on the need for that plan, so far information on its concrete implementation is not available.

Moreover, its development cannot be considered in isolation, as if it could be separated from other strategic actions: (a) the overlapping of the ongoing recovery from the last major earthquakes above mentioned: (b) the new nation-wide strategy on inner areas (Barca *et al*., 2014); (c) the urgent need to deeply revise the structure, means and role of the national and local emergency agency (whose competences and structure do not seem adequate to cope with the continuous challenges of many natural disasters). Although their general goals and contingent activities are different, all these strategic axes of national policies have to share many elements of local knowledge to implement tailor-made place-based policies, whose importance is generally acknowledged (Barca Report, 2009; Barca *et al.*, 2012; Camagni and Capello, 2013; Faludi, 2014).

Both challenges, the process to design and implement the Plan and its integration with other overlapping strategies, can be viewed within the Sendai Framework with regard to the priorities in improving communities' resilience to natural disasters.

Within this broad perspective, the paper suggests the need to support informed policy measures, in each of the relevant domains: emergency (National Civil Protection), recovery (Struttura Commissariale), risk reduction (*Piano Casa Italia*), socio-economic development (National Strategy for Inner Areas).

With regard to Italy, the territorial extension and distribution of the seismic zones (as shown in Figure 1) makes clear the importance of focusing on a systematic analysis of socio-economic data, covering the entire country at municipality level. These data represent just part of the relevant matrices of information that should be used: hydrogeological conditions, geomorphological characteristics, landscape, and environmental degradation, conditions of both physical infrastructures (transport, energy, communication) and social infrastructures (health, social and education services, communication, and the characteristics of public management at local level) play a crucial role in outlining a multidimensional mapping for informing policy measures. Although partial, a socio-economic analysis may significantly support the interpretation of the other layers of the aforementioned interconnected dimensions.

The aim of this paper is to return a comprehensive and detailed description of the socio-economic characteristics of the territories that the Plan should potentially target. Although there are no specific target areas, the Plan intends to start with some initial pilot interventions. By analysing a large set of socio-economic and other structural data at municipality level, the paper provides a detailed picture of seismic Italy: a contribution to ground the first priority of the Sendai framework, i.e. understanding disaster risk[6]. It paves the way to discussing the Plan’s potential impact, by considering the widest comprehensive number of Ital-

[6] "Policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be leveraged for the purpose of pre-disaster risk assessment, for prevention and mitigation and for the development and implementation of appropriate preparedness and effective response to disasters." Sendai Framework (UNISDR 2015, item 23)

ian municipalities that could be affected by earthquake hazard, even though the Plan will address also other kinds of natural hazards (e.g., landslides, floods, etc.).

In this paper, the description of socio-economic data will focus on seven main topics: geography and urban settlement, population and demography, employment rates and structure of the economy, agriculture and landscape, higher education institutions, daily commuting, age and type of residential buildings. Here, data at municipality level are generally grouped by seismic zone (as elaborated by the Italian Civil Protection according to the seismic hazard) and by region. In what follows, data for year 2011 are mostly considered. Main statistical sources are the 15th General Census of Population and Housing (Istat, 2011a), the 9th General Census of Industry and Services (Istat, 2011b), the 6th General Census of Agriculture (Istat, 2010), and the National Strategy for Inner Areas data (Barca *et al*., 2014).

The paper is structured as follows. Section 2 provides a general overview of Italian seismic zones, with data at municipality level. Section 3 discusses the main characteristics of the municipalities belonging to each seismic zone, by considering each of the aforementioned topics. Section 4 returns the main results of a cluster analysis, which aims to distinguish groups of municipalities according to their most important structural socio-economic characteristics. Section 5 concludes the paper and outlines the major implications for the Plan and for further research.

2. Italy's most seismic zones

2.1 Identification of Italian seismic zones

In order to reduce the impact of earthquake hazard, the Italian Civil Protection has provided a territorial classification for the whole country, which is based on past earthquakes' intensity and frequency. For each municipality, this classification returns the relative seismic hazard. On the basis of this, in each municipality specific anti-seismic regulations and technical norms for building construction apply (Civil Protection, 2015). Four different seismic zones (from #1 to #4) are identified, with zone #1 representing the most seismic, hence dangerous, one.

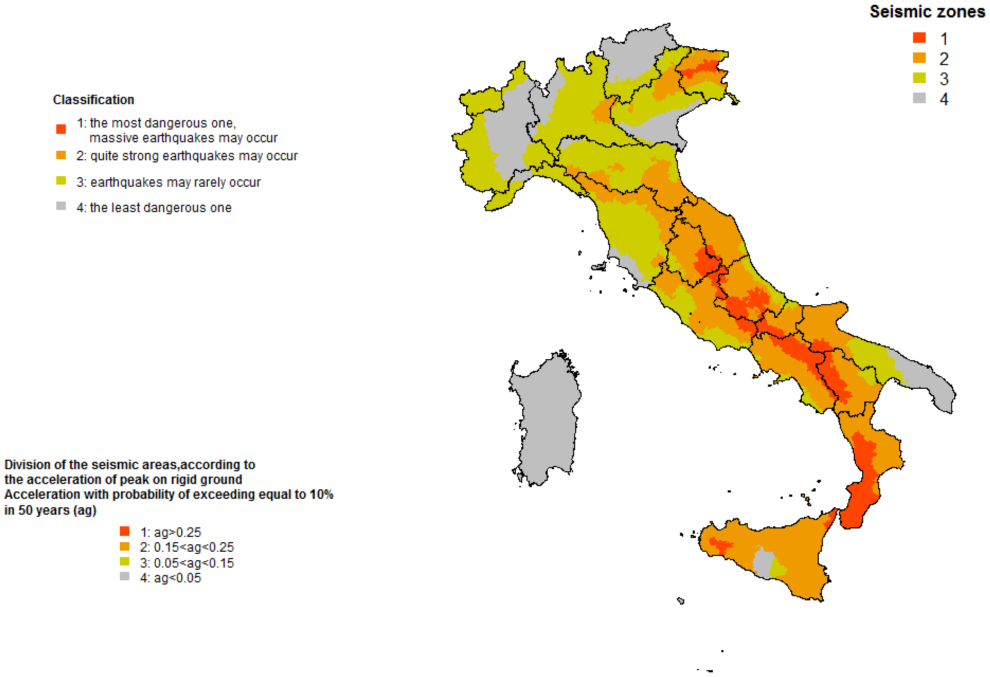
Moving from this taxonomy, Figure 2 returns such a classification at municipality level, taking into account two main treatments, which have been applied to the original data from Civil Protection, at a sub-municipality level[7].

As shown in Figure 2, seismic zones #1 and #2 mostly cover Central and Southern Italy. On the contrary, Northern regions largely comprise municipalities belonging to the seismic zones #3 and #4, with the only exception of Friuli-

[7] Following a precautionary principle, in our analysis municipalities characterised by the coexistence of more than one seismic zone have been assigned the highest seismic zone, with the only exception represented by the municipality of Rome. Indeed, Rome comprises 19 *municipi* (i.e. boroughs), with a total population of almost 3 million inhabitants. In this case, we have split Rome into two groups according the seismic zones of its respective boroughs: 11 belong to the seismic zone #3, whereas the remaining 8 belong to the seismic zone #2. The analysis of data has been carried out at a sub-municipality level aggregating data in those two groups.
A second treatment refers to the aggregation within seismic zone #3 of the municipalities classified by the National Civil Protection into the seismic zone #3s, a typology adopted within Piedmont and Liguria (in North Western Italy). Those municipalities represent a tiny share of the total. They are just 114 municipalities, with a total population of 385,514 inhabitants, equal to 0.65% of the national population.

Venezia Giulia (in the North-East). Table 1 returns the number of municipalities by seismic zone, per each region[8].

Figure 2 Italian municipalities by seismic zone



Source: authors' elaboration on Civil Protection (2015) data

Table 1 Number of municipalities, by region and by seismic zone, year 2011

	Seismic zones				
	1	2	3	4	Total
Italy	**705**	**2222**	**2912**	**2271**	**8110**
Piemonte	0	0	409	797	1206
Valle d'Aosta	0	0	74	0	74
Lombardia	0	57	1033	454	1544
Trentino Alto Adige	0	0	100	233	333
Veneto	0	89	327	165	581
Friuli-Venezia Giulia	32	108	78	0	218
Liguria	0	0	208	27	235
Emilia-Romagna	0	112	214	22	348
Toscana	0	95	168	24	287
Umbria	18	56	18	0	92
Marche	6	221	12	0	239
Lazio	43	266	87	0	396
Abruzzo	91	158	56	0	305
Molise	43	84	9	0	136
Campania	129	360	62	0	551
Puglia	10	58	47	143	258
Basilicata	45	81	5	0	131
Calabria	261	148	0	0	409
Sicilia	27	329	5	29	390
Sardegna	0	0	0	377	377

Source: authors' elaboration on Civil Protection (2015) data

8 The total number of 8110 municipalities is obtained by considering 8092 Italian municipalities (in 2011) plus the 19 *municipi* of Roma, which in fact replace the overall municipality.

As emerged from this classification, 36% of Italian municipalities belong to the highest seismic zones (i.e. zones #1 and #2). They are about three thousand municipalities; they host 38.9% of the Italian population, with about 31% of total employment. With regard to their territorial distribution, these municipalities are mostly located in the Southern part of the country. In most cases, they represent the ridge of the Apennines, a sort of a "backbone of Italy" (as defined by the Architect Renzo Piano).

2.2 An overview of population employment and remoteness

Before discussing the characteristics of the Italian municipalities by seismic zone and by region (Section 3), Census data on population, employment and remoteness make possible a comprehensive overview of seismic zones #1 and #2, at a national level.

Figure 3 returns the population at municipality level for both seismic zone #1 and seismic zone #2[9]. Within them, about 70% of municipalities have less than 5,000 inhabitants. Nevertheless, 4.5 million inhabitants out of 23 million total inhabitants live in municipalities with a population between 20,000 and 50,000 inhabitants. Furthermore, just 3 municipalities with a population larger than 250,000 inhabitants account for 1.9 million inhabitants.

When considering total employment in establishments, a large number of municipalities within both seismic zone #1 and seismic zone #2 are characterized by a small number of employees. Indeed, fewer than 200 municipalities have a number of local employees larger than 5,000. Despite their tiny share, they account for more than 60% of total employment in this area (Figure 4). Thus, when considering the municipalities that belong to seismic zones #1 and #2, employment appears to be much more spatially concentrated than population. Results are largely to be expected: just a small number of larger cities act as hubs for the local labour market.

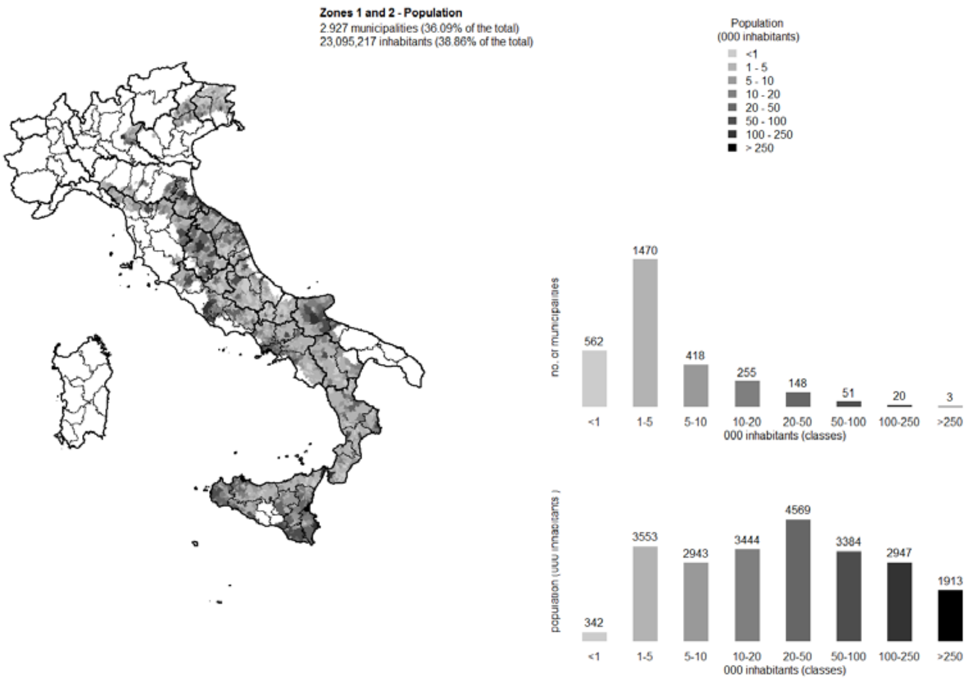
Such a spatial concentration of human activities within a relatively small number of settlements across seismic zones can be better appreciated by referring to the concept of "inner areas", as introduced and discussed by the Italian National Strategy for Inner Areas (Barca *et al.*, 2014). According to this framework, inner areas are defined as those municipalities that – suffering from geographical remoteness and affected by negative demographic trends – are now characterized by a significant deprivation of essential services, such as education, health and mobility. In their broadest definition, inner areas can be defined according to a concept of spatial accessibility. They are those municipalities that are located at more than 20 minutes from the nearest urban pole (i.e. a city providing the whole set of essential services under consideration). In the classification suggested by Barca *et al.* (2014), inner areas are "intermediate" municipalities, "peripheral" municipalities, and "ultra-peripheral" municipalities (refer to Annex 2 for further details).

Bertolini and Pagliacci (2016) have already claimed the existence of a general overlapping between inner (hence, remote) areas and rural areas, across Italy. Furthermore, it is easy to observe also an additional overlapping between inner areas and seismic zones #1 and #2 (Barca *et al.,* 2014). In fact, despite the presence of some major municipalities and in particular 91 major urban centres (classified as urban poles by the national strategy)[10], the vast majority of municipalities

[9] Annex 1 returns same information for just those municipalities within zone #1.
[10] Refer to Table A.1 (Annex 2) for a comprehensive and detailed list of these municipalities.

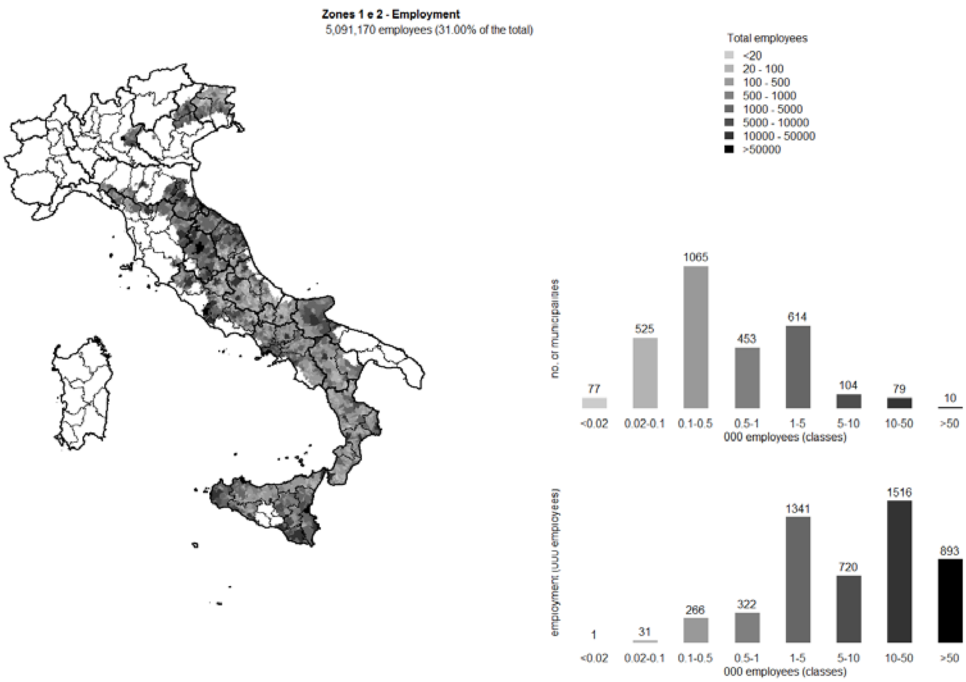
in this portion of the country represents inner areas. Intermediate, peripheral and ultra-peripheral municipalities also represent a non-negligible share of the total population that lives in these regions, especially in the Southern part of the country (Figure 5).

Figure 3 Resident population in municipalities belonging to seismic zones #1 and #2 (year 2011)



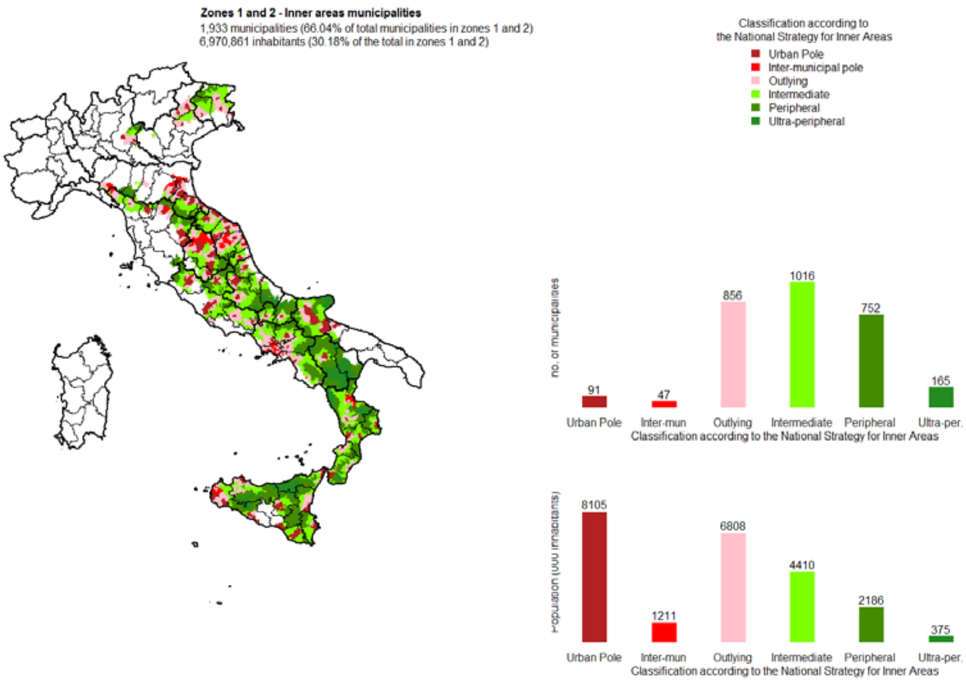
Source: authors' elaboration on General Census of Population and Housing (Istat, 2011a) data

Figure 4 Employees in establishments, in municipalities belonging to the seismic zones #1 and # (year 2011)



Source: authors' elaboration on General Census of Industry and Services (Istat, 2011b) data

Figure 5 Inner areas within the seismic zones #1 and # (year 2011)



Source: authors' elaboration on National Strategy for Inner Areas data

3. Municipality characteristics, by seismic zone and region

Moving from the general overview on seismic areas across Italy, a more detailed and comprehensive analysis is carried out in the following sub-sections that focus on geography and urban settlement, population and demography, employment rates and structure of the economy, agriculture and landscape, higher education institutions, daily commuting, age and type of residential buildings. For each of the variables considered in this analysis, boxplots of their distribution at municipality level, by region and seismic zones, are presented in Appendix 3.

3.1 Geography and urban settlement

A first important trait that characterises the municipalities with the highest seismic hazard in Italy regards geography.

Altitude. These municipalities are not only inner areas (as discussed in Section 2) but they actually have typical mountainous traits. As already underlined, most of them are located on the ridge of the Apennines. On average, municipalities within the seismic zone #1 and #2 are respectively 508m and 385m above sea level. These figures are definitely higher than the average values at national level. In addition, the median values – which are respectively 490m and 348m above sea level – suggest that a large share of these municipalities is actually mountainous. As expected, most mountainous municipalities across seismic zones #1 and #2 occur in Friuli-Venezia Giulia, the Marches, Abruzzo, Molise and Basilicata, whereas in Lazio, Campania and Apulia, just the municipalities in seismic zone #1 are mountainous, while municipalities in zone #2 mostly occur in flatlands or in hilly areas. On the contrary, across Sicily the municipalities that belong to seismic zone #1 are on average less mountainous than those in seismic zone #2.

Such a physical (hence, geographical) characteristic of seismic zone #1 clearly affects the overall urban settlement within these areas, and in particular: municipality size, and population density.

Size. With regard to municipality size, it is generally acknowledged that most Italian municipalities show a very small size (well below 10,000 inhabitants). Nevertheless, when considering specific seismic zones, municipalities in zone #1 are characterized by an even smaller average size. Despite general national trends, also regional comparisons are insightful. In Friuli-Venezia Giulia, the Marches, Umbria and Calabria, municipalities in seismic zone #1 are definitely smaller than the other municipalities in the same region. Conversely, when considering seismic zone #2, the municipalities of Abruzzo and Molise are smaller than the regional average. However, it can also be noticed that in some regions municipalities in zone #2 are larger than those in other zones. For instance, this is the case of Umbria and the Marches. In Emilia-Romagna, municipalities in zone #2 and zone #3 are almost the same average size.

In Section 2, the importance of inner areas across seismic zones #1 and #2 has been already acknowledged. Nevertheless, some urban poles in these areas occur, as well. Here, it can be observed that seismic zones #1 and #2 also host some large cities with more than 50,000 inhabitants: 7 of them occur in zone #1 (Messina and Reggio Calabria are the largest), while a further 67 municipalities occur in seismic zone #2. Among them, there are eight *municipi* of the city of Rome and a further six NUTS 2-level capital cities (Perugia, Ancona, L'Aquila, Naples, Catanzaro, and Palermo). The complete list of cities is returned in Annex 1.

Density of municipalities. Population density follows a similar, hence asymmetric, distribution when considering single seismic zones. At a national level, only a few municipalities show a population density larger than 2,000 persons per km^2. The presence of mountain chains across seismic zones #1 and #2 would suggest lower population density across these municipalities. In fact, municipalities in seismic zone #1 and municipalities in seismic zone #2 follow a different pattern. The former are affected by the lowest value (120.7 persons per km^2) among the four seismic zones under consideration, while the latter show the highest value (350.9 persons per km^2), on average. Nevertheless, some zone-1 municipalities – especially in Calabria – show high population density. Among municipalities within seismic zone #2, those across Campania and Sicily show the highest population density.

Adjusted density of urbanised areas. When considering population density, it could be misleading to compare municipalities with very different urban structures. For instance, two cities may share the same population density value, but the former is a tightly defined urban area, surrounded by mostly uninhabited rural areas (as often happens across Southern Italy), and the latter is characterised by a more scattered urban structure, where both a main urban area and low population-density rural areas in the surroundings coexist. Thus, an adjusted population density indicator is computed to disentangle each situation. Such an indicator returns population density just for those census tracts that Istat (2011a) classifies as urbanised. Figure 6 returns this indicator for municipalities within seismic zones #1 and #2, by group of regions (Northern Italy, Central Italy, Southern Italy). In most zone-1 municipalities, high-density municipalities when considering urbanised census tracts, are generally located at a lower altitude. A more scattered picture emerges when considering zone #2. In this case, municipalities tend to show greater adjusted population densities, especially in the South (as expected). However, when considering Sicily, the negative relationship between altitude and adjusted population density no longer holds true.

3.2 Population and demography

Besides data on overall population and its settlement across the country, even its composition by age classes (0-14 years, 15-64 years, 65+ years) would suggest insightful considerations (Figure 7).

Young population. People of a young age are under-represented in both seismic zones #1 and #2. The average ratio of persons under age 15 to the total population is below the national average: it is equal to 12.4% and 13.0% in municipalities of the seismic zones #1 and #2, respectively (Figure 7). In particular, in Friuli-Venezia Giulia, the Marches, Lazio and Campania, the average ratio of younger dependents is significantly lower in municipalities in zone #1 than in municipalities in other zones. Conversely, some Southern regions (e.g. Molise, Basilicata and Calabria) show an above-average percentage of young people in zone #1.

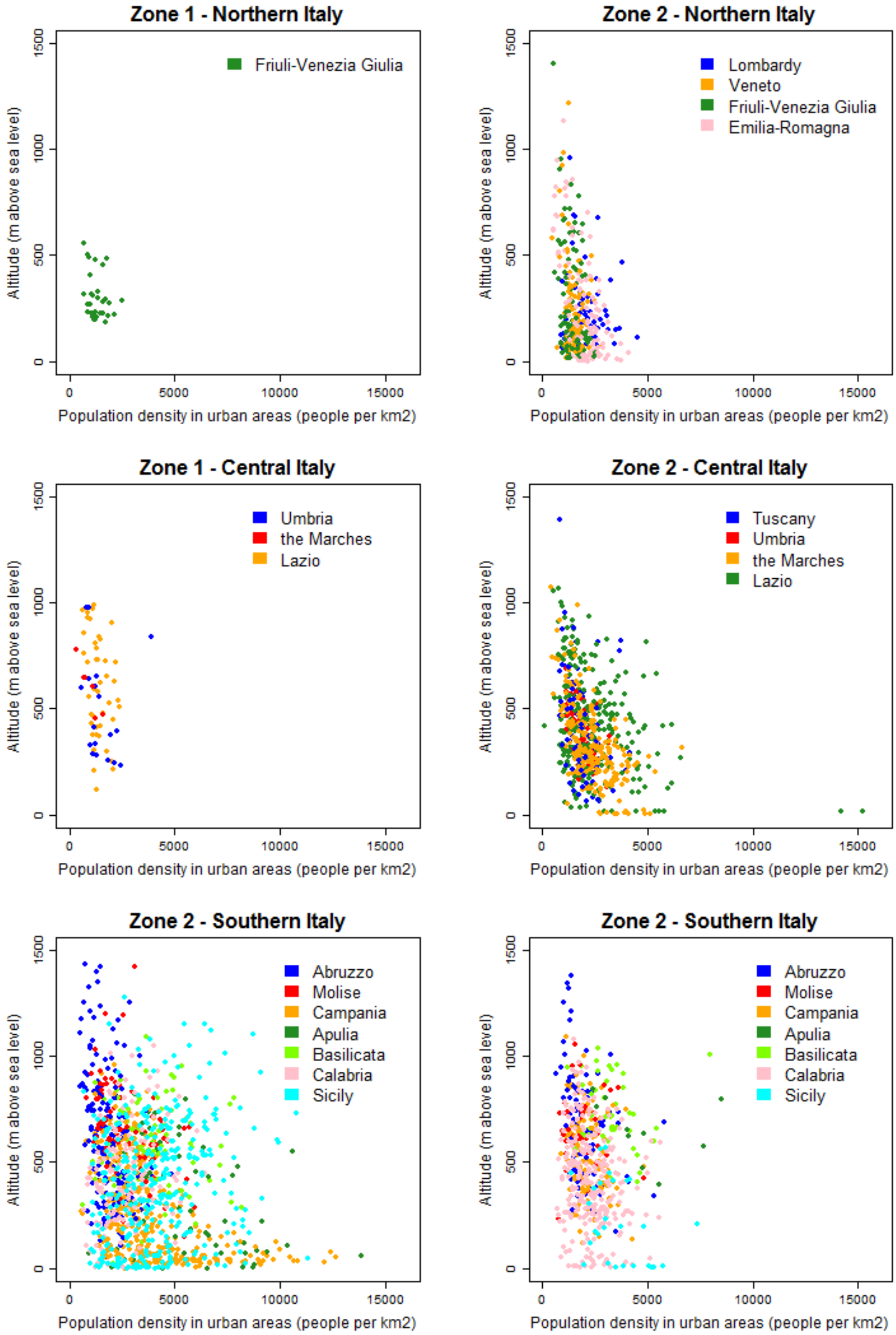
Working-age population. With regard to the share of the population in their working age (15-64 years), no significant differences can be appreciated when considering alternative seismic zones, at national level. A small number of regions show a more scattered pattern, with a low share of working-age people in the municipalities of the seismic zone #1 in Umbria, Lazio, and Apulia.

Elderly people. Data on the ratio of people aged 65+ to the total population are much more interesting, suggesting major differences among seismic zones. Indeed, this ratio is higher in seismic zones #1 and #2 (23.4% and 22.9%, respectively) than in seismic zones #3 and #4 (22.3% and 22.8%, respectively). Compared to the respective regional average values, such a ratio is particularly high in the municipalities of the seismic zone #1 across Friuli-Venezia Giulia, Umbria, the Marches, Lazio, Campania and Apulia. The opposite holds true in Calabria, where the percentage of elderly population is higher in the municipalities of seismic zone #2 than in those in seismic zone #1 (this is due to the fact that large urban areas occur in the latter).

Foreigners. An ageing population is not the only issue across seismic zones #1 and #2. These municipalities are also characterised by a limited number of foreigners. In 2011, foreigners represented – on average – 3.7% of the population of seismic zone #1: this figure was lower than that observed in zone #2 (5.3%), zone #3 (8.6%) and zone #4 (6.3%). When considering regional values, this phenomenon is particularly clear across the municipalities of Umbria, Lazio, and Apulia. Conversely, zone-1 municipalities in Friuli-Venezia Giulia represent an exception, being characterised by almost the same average share of foreigners that is observed across the other seismic areas in the region. Conversely, when considering municipalities in seismic zone #2, they tend to show larger shares of foreign population out of the total. For instance, in Umbria, Lazio and the Marches these municipalities tend to show values higher than the respective regional averages.

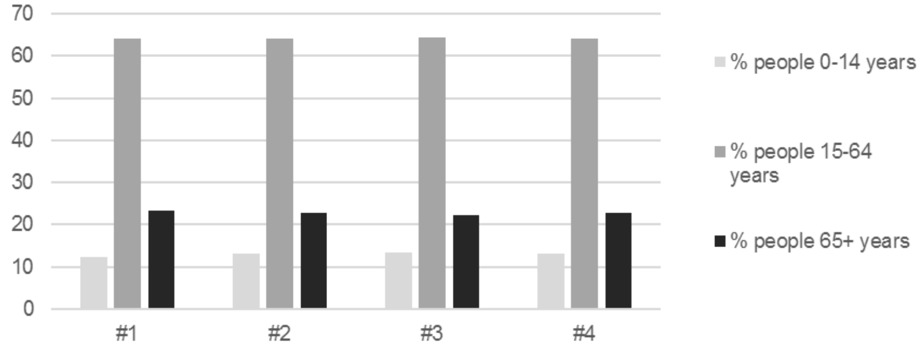
Household components. Moreover, household composition greatly differs among seismic zones in Italy. In seismic zones #1 and #2, households show a larger number of components (2.49 and 2.54, respectively) than the national average (2.41 individuals per family). Although this pattern occurs at national level, some regions experience an opposite situation: in Friuli-Venezia Giulia, Umbria, the Marches, Campania, Apulia and Sicily, the number of members per household is lower in seismic zones #1 and #2 than the respective regional average.

Figure 6 Adjusted population density of urbanised areas and altitude, by seismic zone and group or regions (year 2011)



Source: authors' elaboration on Istat data

Figure 7 Population by age class (%) and by seismic zone, on a national basis



Source: authors' elaboration on Istat data

Tenure status. Data from the general census also provide information about families' tenure status. On average, municipalities in seismic zones #1 and #2 are usually characterized by a lower percentage of owner-occupancy. Such a share is particularly low in zone-1 municipalities across Umbria, Molise and Calabria. On the contrary, higher shares of owner-occupancy are observed in Lazio and Campania, compared to their respective average values. Similarly, when considering tenancy, municipalities in seismic zones #1 and #2 are characterized by lower figures than the national average. With regard to seismic zone #1, this trend affects almost all regions except Friuli-Venezia Giulia, Abruzzo and Calabria. These data suggest that municipalities in seismic zones #1 and #2 are affected by a larger share of households living in properties neither as owner-occupiers nor as tenants, but with other forms of tenure status.

3.3 Employment rates and structure of the economy

It is well acknowledged that economic activities are not evenly distributed across Italy. Italian regions in fact show large differences both in terms of employment structure and in terms of industrial composition of their economies. Thus, also seismic zones tend to show large differences between each other.

Employment rate. In seismic zones #1 and #2, municipalities show low employment rates, expressed as employed persons aged 15 and over – over the number of persons aged 15+. Data are generally below the national average, suggesting the existence of poor labour markets across these areas. With regard to single regions, similar patterns (i.e. lower values in zones #1 and #2 than the regional average) are observed in Friuli-Venezia Giulia, the Marches and Lazio. Conversely, smaller Southern regions (e.g. Molise and Basilicata) show greater employment rates in municipalities in seismic zone #1 than in the rest of the region.

Activity rate Distribution of economic activity rates across Italy largely confirm these results. At national level, the municipalities that belong to seismic zones #1 and #2 show larger shares of people who are not in the labour force. In particular, in Friuli-Venezia Giulia, the Marches and Lazio, figures for those municipalities that belong to seismic zone #1 are significantly higher. By contrast, regions across Southern Italy do not show significant differences among different seismic zones.

Unemployment rate. Similarly, also unemployment rates show similar patterns. In general terms, municipalities across the seismic zones #1 shows a higher share of people aged 15 and over in search of employment. According to the traditional North-South differences, significantly higher unemployment rates occur in municipalities of seismic zone #1 in Umbria, Abruzzo, Calabria, and Sicily. High unemployment rates also occur across municipalities in seismic zone #2 across Campania.

Sectoral composition. Referring to the major differences in terms of industrial composition, they can be appreciated by considering data on employees in establishments, as disentangled by sections, according to the Nace Rev.2 classification (Table 2). In seismic zone #1, more than 500,000 people are employed in local establishments. Among them, 24.8% of the total workforce is employed in the wholesale and retail trade sector, while 18.9% is employed in the manufacturing sector. In seismic zone #2 more than 4.5 million people are employed, but the two aforementioned sectors (manufacturing and trade) cover almost the same share of employees (22% of the total). Thus, sector composition is particularly heterogeneous among different seismic zones.

As suggested by these general data, it is useful to focus on some given sectors and on the ratios to the total number of employees by seismic zone (Figure 8).

Manufacturing. When considering the employment in manufacturing activities, at national level, municipalities of seismic zones #1 and #2 are less manufacturing than the average. The ratio of the employees in manufacturing establishments to the total number of employees is 18.9% in zone #1 and 22.0% in zone #2, whereas it is above 24% in both the remaining seismic zones. The same pattern occurs at regional level: in Abruzzo and Apulia, municipalities in zone #1 are definitely less manufacturing than the rest of their regions. On the contrary, Lazio, Molise, Campania and Calabria show an opposite trend, with seismic zone #1 quite manufacturing. With regard to zone #2, higher values are observed across Umbria and the Marches.

Construction. At a national level, employment in the construction section (F) is around 10% of the total. Data do not significantly differ among seismic zones, although zone #1 is above the national average (11.4% of the total employment). Differences are more pronounced when considering specific regions. In Friuli-Venezia Giulia and the Marches, municipalities across seismic zone #1 show higher construction employment ratios than the rest of the region. Conversely, in Abruzzo, Campania and Sicily, the highest ratios for the construction industry employment are observed across seismic zone #2.

Wholesale and retail trade; repair of motor vehicles and motorcycles. When considering trade, at a national level, the ratio of the employment in this Nace section (G) out of the total is equal to 21%. Figures are higher in seismic zone #1 (24.8%) and seismic zone #2 (22.8%). Quite large ratios are observed in Abruzzo and Calabria, for seismic zone #1, and in Molise, Campania and Basilicata, for seismic zone #2. Conversely, in some regions, the ratio of the employment in the trade sector is below the regional average when considering seismic zone #1. This holds true in Friuli-Venezia Giulia, the Marche and Lazio.

Financial and insurance activities. While trade represents a kind of traditional service, other Nace sections may represent more innovative services. This is the case of financial and insurance activities (K). As expected, employment in this section is definitely lower in zone #1 than in other zones. At national level, the ratio is equal to 2.8% in zone #1, while the national average is equal to 3.6%. At regional level, just a few exceptions occur: for instance, in Umbria and Abruzzo, seismic zone #1 shows a greater-than-expected ratio of employees in the financial and insurance activities.

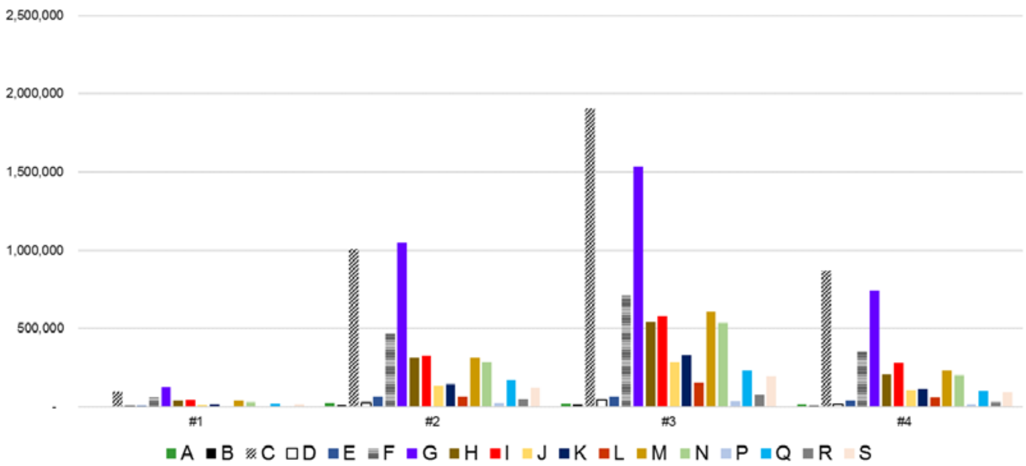
Table 2 Employees by Nace Rev.2 section and by seismic zone, year 2011

		Seismic zones				
		#1	#2	#3	#4	Italy
Agriculture, forestry and fishing	A	2,682	25,447	20,049	16,369	**64,547**
Mining and quarrying	B	1,138	9,534	16,537	5,914	**33,123**
Manufacturing	C	97,234	1,008,574	1,906,474	868,769	**3,881,051**
Electricity, gas, steam and air conditioning supply	D	2,509	23,654	41,032	17,860	**85,055**
Water supply, sewerage, waste management and remediation activities	E	7,434	63,013	65,831	37,610	**173,888**
Construction	F	58,634	468,937	717,348	351,403	**1,596,322**
Wholesale and retail trade; repair of motor vehicles and motorcycles	G	127,304	1,044,358	1,535,187	741,172	**3,448,021**
Transportation and storage	H	38,828	310,492	538,383	206,962	**1,094,665**
Accommodation and food service activities	I	40,296	324,071	579,525	278,997	**1,222,889**
Information and communication	J	11,036	133,466	286,527	106,127	**537,156**
Financial and insurance activities	K	14,252	142,721	326,948	113,243	**597,164**
Real estate activities	L	3,673	65,395	151,198	61,150	**281,416**
Professional, scientific and technical activities	M	37,420	309,990	606,258	231,145	**1,184,813**
Administrative and support service activities	N	29,002	284,642	534,884	199,637	**1,048,165**
Education	P	2,384	25,922	32,868	13,975	**75,149**
Human health and social work activities	Q	21,043	168,286	233,779	98,234	**521,342**
Arts, entertainment and recreation	R	3,974	46,074	77,697	29,368	**157,113**
Other service actitivities	S	14,776	122,975	194,355	90,101	**422,207**
Total		513,619	4,577,551	7,864,880	3,468,036	**16,424,086**

Source: authors' elaboration on Istat data

Human health and social work activities. Lastly, health services and social assistance (Q) can represent a key section for the local economy, although employment is generally low at national level (3.2% of total employment, on average). However, seismic zones #1 and #2 show a ratio of employees in health care and social assistance that is above the national average: 4.1% and 3.7% of total employment, respectively. The same pattern occurs also at a regional level, where seismic zones #1 and #2 tend to show higher values for employment in this section.

Figure 8 Employment out of the total (%), by Nace Rev. 2 section and by seismic zone, year 2011



Source: authors' elaboration on Istat data

Industrial districts. Italy is traditionally known for its industrial districts (see, among others, Becattini, 1990; Sforzi, 2002, Brusco, 1982), which account for a significant part of economic activity. In 2011, Istat identified 141 industrial districts across Italy. They comprise 2,121 municipalities (26.2% of the total), which host both 13.3 million inhabitants and 4.2 million employees in local establishments (25.7% of the total). These districts are mostly located in the Northern part of the country and in the Third Italy (Bagnasco, 1977)[11].

Given their traditional location throughout the country, Figure 9 clearly shows how they are distributed among different seismic areas. Actually, most of them occur across seismic zone #3.

However, considering data at municipality level, within industrial districts, zone #1 and zone #2 jointly account for 23.1% of the total number of municipalities (489 municipalities out of 2,121), 26.6% of total population (3.5 million people out of 13.3 million) and 25.5% of total employment (1.1 million employees out of 4.2 million) (Table 3). Moreover, Figure 10 returns the allocation of employment in industrial districts, by region and by seismic areas.

When considering the country as a whole, municipalities in industrial districts within seismic zones #1 and #2 represent 6% of the total number of municipalities, 6% of total population and 6.5% of total employment (Table 4). However, these figures are not evenly distributed across the Italian regions. Indeed, most of these municipalities that belong to the industrial districts, within seismic zones #1 and #2, are mostly located across Central Italy, and some of them were severely hit by the earthquake in 2016. In fact, in Umbria, the Marches and Campania, almost all the industrial districts are comprised within the seismic zones #1 and #2. However, in the Marches, these industrial districts account for 70% of the regional total. Besides the Marches, when considering industrial districts in seismic zones #1 and #2, also in Tuscany, Umbria and Abruzzo more than 10% of total employment occurs in the municipalities of the industrial districts within seismic zones #1 and #2. Across the Northern part of the country, higher figures are also observed in Veneto and Emilia-Romagna (Table 4).

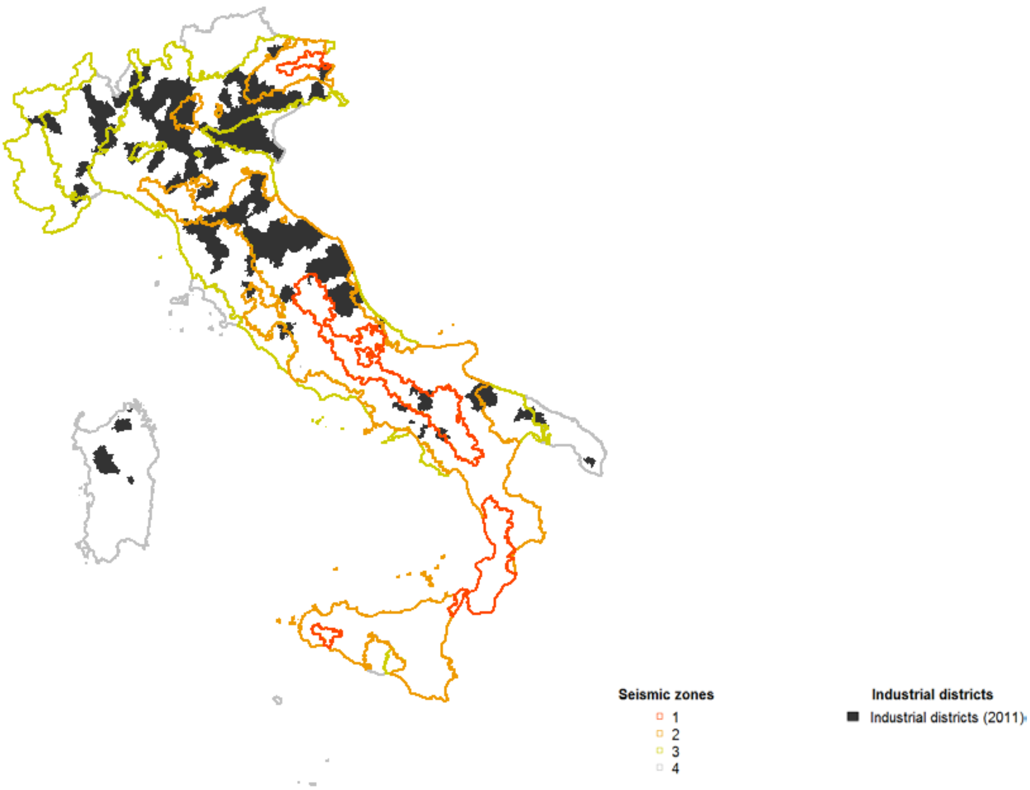
Table 3 Industrial districts by region and by seismic zone, year 2011

NUTS 2 region	Number of Municipalities (by seismic zone)					Population (by seismic zone)					Employment (by seismic zone)				
	Total	#1	#2	#3	#4	Total	#1	#2	#3	#4	Total	#1	#2	#3	#4
Piedmont	195			8	187	555,047			4,766	550,281	162,371			712	161,659
Lombardy	841		50	571	220	4,251,961		501,608	2,453,129	1,297,224	1,392,612		182,936	802,339	407,337
Trentino-South Tyrol	32			32		44,730			44,730		12,114			12,114	
Veneto	416		56	210	150	3,216,775		364,282	1,739,449	1,113,044	1,106,868		122,553	615,997	368,318
Friuli-Venezia Giulia	42	2	15	25		134,411	1,515	43,896	89,000		38,588	131	14,654	23,803	
Liguria	18			5	13	39,979			4,317	35,662	12,258			735	11,523
Emilia-Romagna	111		36	65	10	1,187,412		412,972	722,616	51,824	390,796		128,927	247,504	14,365
Tuscany	99		45	54		1,326,429		411,135	915,294		431,013		126,126	304,887	
Umbria	14		14			114,255		114,255			32,478		32,478		
the Marches	172	2	165	5		1,086,677	2,014	1,074,927	9,736		343,301	524	340,325	2,452	
Lazio	16		6	10		68,759		28,603	40,156		13,793		6,767	7,026	
Abruzzo	45		31	14		291,215		134,747	156,468		81,385		36,259	45,126	
Campania	62	33	29			305,930	105,635	200,295			56,135	18,620	37,515		
Apulia	24		5	8	11	631,850		152,942	310,600	168,308	127,923		27,808	62,804	37,311
Sardinia	34				34	70,890				70,890	12,735				12,735
Italian Industrial districts	2121	37	452	1007	625	13,326,320	109,164	3,439,662	6,490,261	3,287,233	4,214,370	19,275	1,056,348	2,125,499	1,013,248
Italy total	8110	705	2222	2912	2271	59,433,744	2,878,920	20,216,297	23,930,880	12,407,647	16,424,086	513,619	4,577,551	7,864,880	3,468,036

Data just for those NUTS 2 regions that comprise at least one municipality in industrial districts
Source: authors' elaboration on Istat data

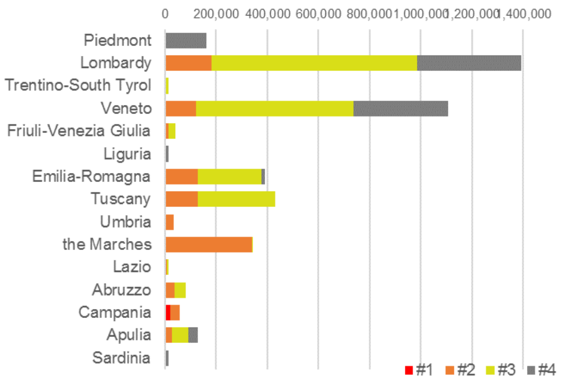
11 Annex 4 returns the comprehensive list of the Italian industrial districts, by returning name, industrial specialisation and composition by seismic zone, for each of them.

Figure 9 Industrial districts across seismic areas, year 2011



Source: authors' elaboration on Istat data

Figure 10 Employment in industrial districts by region and by seismic areas, year 2011



Data just for those NUTS 2 regions that comprise at least one municipality in industrial districts
Source: authors' elaboration on Istat data

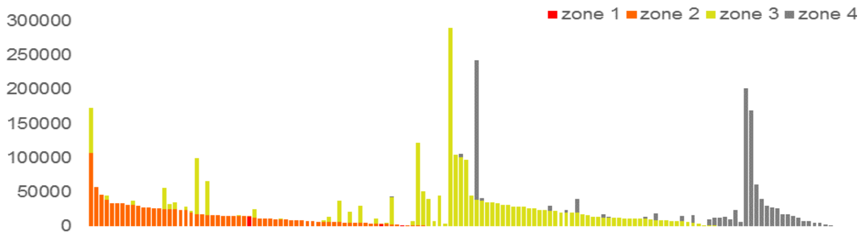
Table 4 Municipalities of industrial districts, in seismic zones #1 and #2: relevance by region

NUTS 2 region	Industrial districts in #1 and #2 out of Industrial districts			Industrial districts in #1 and #2 out of the region		
	Number of Municipalities	Population	Employment	Number of Municipalities	Population	Employment
Piedmont	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Lombardy	5.9%	11.8%	13.1%	3.2%	5.2%	5.2%
Trentino-South Tyrol	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Veneto	13.5%	11.3%	11.1%	9.6%	7.5%	7.3%
Friuli-Venezia Giulia	40.5%	33.8%	38.3%	7.8%	3.7%	3.9%
Liguria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Emilia-Romagna	32.4%	34.8%	33.0%	10.3%	9.5%	8.5%
Tuscany	45.5%	31.0%	29.3%	15.7%	11.2%	10.9%
Umbria	100.0%	100.0%	100.0%	15.2%	12.9%	13.0%
the Marches	97.1%	99.1%	99.3%	69.9%	69.9%	70.3%
Lazio	37.5%	41.6%	49.1%	1.5%	0.5%	0.4%
Abruzzo	68.9%	46.3%	44.6%	10.2%	10.3%	10.6%
Campania	100.0%	100.0%	100.0%	11.3%	5.3%	5.5%
Apulia	20.8%	24.2%	21.7%	1.9%	3.8%	3.6%
Sardinia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Italy	23.1%	26.6%	25.5%	6.0%	6.0%	6.5%

Data just for those NUTS 2 regions that comprise at least one municipality in industrial districts
Source: authors' elaboration on Istat data

When considering just the 68 industrial districts that comprise at least one municipality in seismic zones #1 and #2, their total employment is equal to 1.76 million employees (41.7% of total employment in industrial districts). Among them, 1.08 million employees just occur within municipalities in zones #1 and #2 (namely, 61.2% of the total employment in the aforementioned 68 industrial districts).

Figure 11 Employment in industrial districts, by the seismic zone of their municipalities, year 2011



Decreasing order by total employment in municipalities in seismic zones #1 and #2; by employment in municipalities in seismic zones #3; by employment in municipalities in seismic zones #4
Source: authors' elaboration on Istat data

When considering the industrial specialization of Italian industrial districts, insightful results are returned. 'Mechanicals' and 'textile & clothing' represent the most important specialization across Italy, for they jointly account for about 65% of the total employment within industrial districts. However, they are not located in the most seismic areas of the country. In fact, these districts mostly comprise municipalities that are located across seismic zones #3 and #4. Conversely, other specializations seem to be in the greatest danger: in particular, industrial districts specializing in household goods and leather & footwear mainly comprise municipalities (and employment) that are located within seismic zones #1 and #2 (Table 5).

Table 5 Municipalities of industrial districts by specialisation

Specialisation	Number of Municipalities (by seismic zone)					Population (by seismic zone)					Employment (by seismic zone)				
	Total	#1	#2	#3	#4	Total	#1	#2	#3	#4	Total	#1	#2	#3	#4
Mechanicals	821		101	431	289	4,758,375		844,564	2,708,662	1,205,149	1,619,956		290,167	931,300	398,489
Textile & clothing	459	7	110	142	200	3,670,354	13,613	814,377	1,403,979	1,438,385	1,102,464	2,422	206,311	449,040	444,691
Household goods	281	2	98	154	27	1,508,490	1,515	668,977	691,462	146,536	476,530	131	220,474	214,779	41,146
Leather & foot-wear	159		79	48	32	1,203,304		556,402	483,403	163,499	375,380		178,781	160,666	35,933
Food Industry	173	28	32	90	23	823,325	94,036	202,134	474,113	53,042	205,985	16,722	53,335	123,737	12,191
Jewellery & musical instruments	50		11	31	8	506,726		188,745	288,264	29,717	180,729		65,846	104,585	10,298
Chemicals & plastics	103		5	59	39	473,198		85,743	168,193	219,262	134,139		17,235	54,921	61,983
Paper & Polygraphs	9		5	4		204,876		59,720	145,156		67,458		17,244	50,214	
Metallurgy	66		11	48	7	177,672		19,000	127,029	31,643	51,729		6,955	36,257	8,517
Italian Industrial districts	2121	37	452	1007	625	13,326,320	109,164	3,439,662	6,490,261	3,287,233	4,214,370	19,275	1,056,348	2,125,499	1,013,248
Italy total	8110	705	2222	2912	2271	59,433,744	2,878,920	20,216,297	23,930,880	12,407,647	16,424,086	513,619	4,577,551	7,864,880	3,468,036

Source: authors' elaboration on Istat data

3.4 Agriculture and Landscape

When considering agricultural activities throughout the country, one of the most important indicators is represented by utilized agricultural areas (UAA). On a national basis, no significant differences are observed among different seismic zones, although municipalities within seismic zone #1 show a share of UAA over total land area which is just slightly below the national average. Conversely, insightful results arise when taking regional differences into account. For instance, in many Italian regions (e.g. Friuli-Venezia Giulia, the Marches, Lazio, Molise, and Calabria) municipalities in zone #1 show a lower share of UAA than municipalities in other seismic zones. However, in Campania, the ratio of UAA to land area in seismic zone #1 is the region's highest. Different trends are observed in other regions. For instance, in Umbria, the ratio of UAA to land area in seismic zone #2 is the highest, as it is in Basilicata and Sicily. Similar findings emerge when considering total agricultural areas, which also include forests which are not directly managed by agricultural holdings.

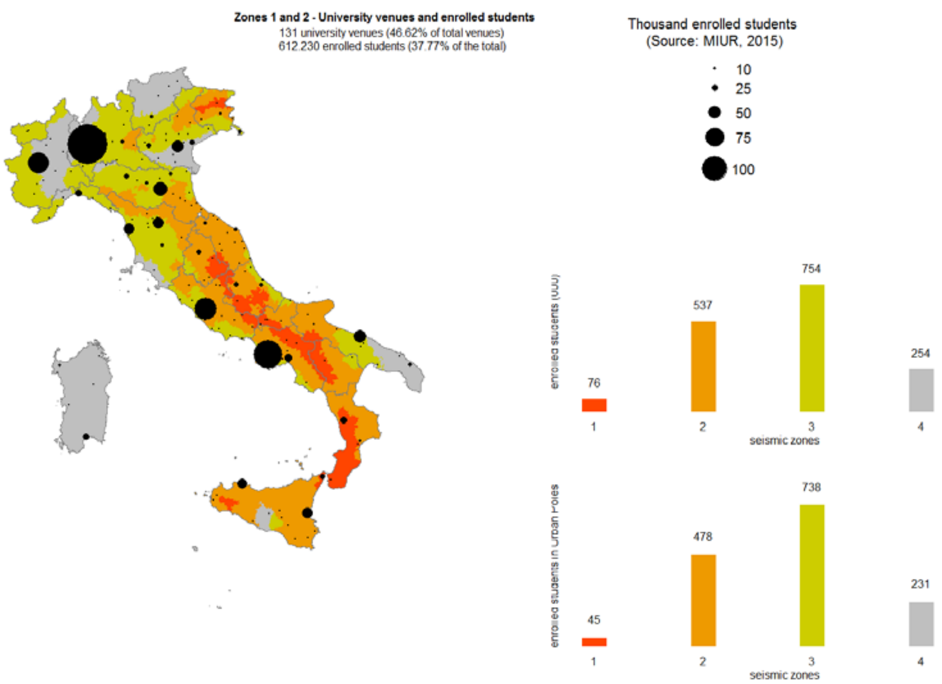
Lastly, when considering woodland areas separately, municipalities in seismic zone #1 tend to show values which are above the national average (given the fact that they mostly cover mountainous areas). In particular, on a regional basis, the share of woodlands over total land area is significantly higher in seismic zone #1 than the regional average in Umbria, the Marches, Lazio, Abruzzo and Molise. Conversely, when considering Campania, this share is higher in seismic zone #2 than in the rest of the region. Finally, Basilicata and Calabria do not show substantial differences among different seismic zones.

An additional dimension that is expected to vary largely when considering different seismic zones across the country is livestock breeding. Both the number of agricultural holdings involved in breeding and the heads of cattle differ considerably at municipality level, when moving from the flatland areas in the Northern part of the country to the mountain areas of Central and Southern Italy. Unfortunately, no detailed data can be presented here. However, animal breeding represents a key economic activity, especially across mountain and inner areas. In those municipalities it is crucial for various reasons, from land management to cultural heritage promotion and safeguarding. Most Italian quality food products (such as PDO, protected designation of origin, and PGI, protected geographical indication, products) are closely connected to local quality breeding.

3.5 Higher education institutions

Although there is a partial overlap between seismic zones #1 and #2 and inner areas, the lack of education service is not so generalized among these municipalities. Indeed, some of them (and especially urban poles) play a key role in providing education services to the surrounding rural population, even across seismic zones #1 and #2. This is also true when taking higher education institutions (HEIs) into account. A significant share of public universities are located within seismic zones #1 and #2: HEIs' venues in municipalities in the seismic zones #1 and #2 are 131 (i.e. 46.6% of total venues). Moreover, in 2015, nearly 38% of Italian college students were enrolled in these venues: 5% of them enrolled in municipalities of seismic zone #1 and 33% enrolled in the seismic zone #2, respectively. In particular, within seismic zones #2, the municipalities hosting the largest number of students are Rome and Naples (Figure 12).

Figure 12 Students enrolled in municipalities, by seismic zone (academic year 2014-2015)



Source: authors’ elaboration on MIUR data

3.6 Daily commuting

The aforementioned features of Italian municipalities (population and demography together with the structure of the economy and the location of HEIs) also affect daily commuting patterns (for working and studying). Seismic zones #1 and #2 on average show a lower mobility of their citizens outside their own city limits than the rest of the country. In particular, when considering municipalities within seismic area #1, figures are considerably lower in the Marches and Apulia. In particular, in Apulia, municipalities of seismic zones #1 and #2 show a lower daily commuting mobility than the regional average. In Calabria, however, the same figures for the municipalities across seismic zone #1 are higher than those observed across seismic zone #2. In Umbria, the municipalities in seismic zone #1 have a high degree of variability with regard to daily commuting.

3.7 Age and types of residential buildings

Census data return detailed information about residential buildings, which are 12.19 million in Italy. Among them, 42% are constructed in seismic zones #1 and #2 (0.91 million and 4.26 million, respectively). These buildings are the ones that the *Piano Casa Italia* is expected to target first. Indeed, they are not just located in the municipalities with the highest seismic hazard; in most cases, they are particularly old, as well. When considering the age of their construction, the 2011 Census disentangles the following nine periods of time: before 1919, 1919-1945, 1946-1960, 1961-1970, 1971-1980, 1981-1990, 1991-2000, 2001-2005, 2006 onwards. At the national level, residential buildings are not particularly new: 56.7% of the total buildings were constructed before 1970 (thus not following any anti-seismic regulation[12]), while just 6.8% of the total were constructed after 2000. Moreover, data at municipality level by seismic zone confirm the fact that zones #1 and #2 show older buildings than the rest of the country.

Buildings before 1919. When considering most old buildings, municipalities of seismic zones #1 and #2 show a share out of the total that is just below the national average (15%). In fact, the largest share (17.5%) occurs in municipalities belonging to seismic zone #3. On a regional basis, differences are more blurred: before 1919, a small share of buildings was erected in municipalities in zone #1 in Friuli-Venezia Giulia, Umbria, the Marches and Sicily. Conversely, in Lazio and in Abruzzo, municipalities of seismic zone #1 show a share of residential buildings built before 1919 that is higher than other zones.

Buildings 1919-1945. Buildings of the interwar period are just 10% of the total at national level, but in the municipalities of seismic zone #1 they account for 14.2% of the total. However, in some regions this share with regard to zone #1 is lower than the regional average: this is the case of Friuli-Venezia Giulia, Umbria, the Marches and Basilicata. Conversely, the share is larger in Lazio and Abruzzo.

Buildings 1946-1960. Buildings erected in the immediate post-war period are about 14% of the total and no significant differences are found among seismic zones. However, greater differences emerge when taking into account single regions. For instance, in Friuli-Venezia Giulia, Umbria, the Marches, Basilicata and Sicily, the share of buildings erected in years 1946-1960 in municipalities of seismic area #1 is considerably smaller than the share in other areas. Conversely, municipalities of the same area in Abruzzo, Molise and Calabria show larger values than the respective regional average.

Buildings 1961-1970. In the 1960s, a large number of buildings was erected (16.9% of the total), but this urbanization process affected seismic zones #2 to #4 more than zone #1, where the share of 1960s buildings is just 14.8%. Such a tendency is observed at a regional level, in Friuli-Venezia Giulia, Umbria, the Marches and Lazio but not in Campania and Calabria.

Buildings 1971-1980. The urbanization process kept going during the 1970s, when more than 17% of the total of Italian residential buildings were constructed. Once again, municipalities in seismic zone #1 show a lower share of erected buildings in the period (only 15.2% of the total). Here, a significant exception is represented by Friuli-Venezia Giulia: after the massive earthquake in 1976,

[12] In Italy, the first law providing anti-seismic regulations for new buildings was passed in 1974 (L. 64/1974).

a large reconstruction process started occurring precisely within municipalities of the seismic area #1.

Buildings 1981-1990. When considering the 1980s, the share of buildings erected in seismic zone #1 (15.2%) and in seismic zone #2 (12.9%) are above the national average (12%). This is particularly true in Friuli-Venezia Giulia – where the reconstruction after the 1976 earthquake continued, in Umbria – hit by a large earthquake in 1979, and in Campania and Basilicata – largely destroyed by the massive 1980 earthquake of Irpinia.

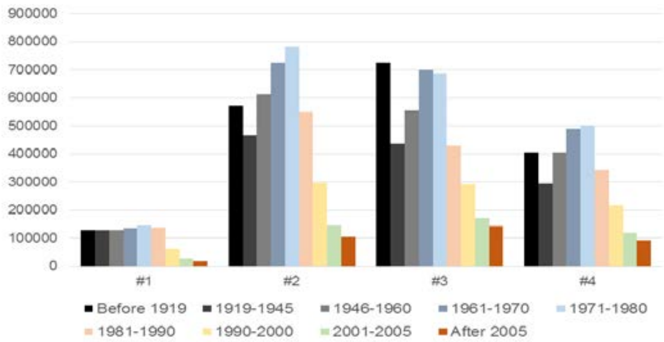
Buildings 1991-2000. In the following decade (1991-2000), the share of newly constructed buildings sharply declined (7.1% on a national basis). In this case, the share of new buildings in both seismic zones #1 and #2 are below the national average, although figures are higher in the aforementioned regions of Umbria, Campania, and Basilicata.

Buildings 2000-2005. When considering years 2000-2005 and seismic zones #1 and #2, less than 4% of total buildings were constructed. Data are lower than the national average, and the same holds true also on a regional basis when considering Friuli-Venezia Giulia, Umbria and Abruzzo. On the contrary, in Molise, Basilicata and Calabria, municipalities of seismic zone #1 still show an above-the-average share of newly constructed buildings.

Buildings after 2005. Lastly, when considering the period after 2006, new buildings represent less than 3% of total buildings in seismic zones #1 and #2. On a regional basis, this holds true in Friuli-Venezia Giulia, Umbria and the Marches. These data clearly suggest that new buildings are not so common in most seismic zones of Central Italy.

According to the overall data about the total number of buildings erected in each period, seismic zone #1 not only shows older buildings, with a smaller number of buildings erected since 1990. It also seems that the large urbanization process that took place in the rest of the country between 1961 and 1980 did not affect it. However, in Figure 13 it is easy to notice that, since 2000, the process of construction of new buildings has substantially slowed down in all seismic zones, although this has occurred at a slower pace in seismic zone #3.

Figure 13 Buildings by age (%) and by seismic zone



Source: authors' elaboration on Istat data

Buildings by number of dwellings. Census data also classify building according to the number of dwellings. Table 6 shows that buildings in seismic zones #1 and #2 seem to be not particularly large: more than 50% of them are represented by single-detached houses (namely, buildings with just one dwelling), while larger buildings with more than 9 dwellings each represent a tiny minority.

Table 6 Buildings by number of dwellings and by seismic zone, year 2011

Seismic zones	Number of buildings	Buildings by number of dwellings (%) 1	2	3-4	5-8	9-15	>16	Total
#1	914,795	61.1%	21.2%	10.9%	4.4%	1.6%	0.7%	100.0%
#2	4,256,795	51.6%	23.6%	14.0%	6.5%	2.6%	1.6%	100.0%
#3	4,145,644	45.6%	24.3%	14.8%	8.3%	4.1%	2.9%	100.0%
#4	2,870,464	57.6%	21.9%	10.9%	5.4%	2.6%	1.7%	100.0%
Italy	**100.0%**	**51.7%**	**23.3%**	**13.3%**	**6.7%**	**3.0%**	**2.0%**	**100.0%**

Source: authors' elaboration on Istat data

4. A cluster analysis: data by seismic zone

The previous sections have highlighted the heterogeneity among seismic zones in Italy. Nevertheless, heterogeneity may also occur within each single seismic area. A useful way to assess it is considering the results of a cluster analysis conducted on ten demographic and economic variables, available at municipality level across Italy[13]. Among the aforementioned variables, the selected ones can be grouped into the following four thematic areas:

- Population: number of inhabitants and share of foreigners out of the total;
- Land use: population density and share of UAA out of municipality land area;
- Industrial sectoral employment: share of employment in manufacturing, share of manufacturing employment in SMEs, share of employment in the textile industry, in mechanics, in the electro-med industry[14];
- Remoteness: distance from the closest urban pole.

Cluster analysis returns nineteen groups of municipalities, besides the group of NUTS 3-level capital cities. These capital cities have been excluded from the cluster analysis, because of their peculiar heterogeneity, due to their different sizes and roles in governance. The differences among the nineteen clusters mostly refer to three major dimensions: population size, role of manufacturing activities (and economic specialisation) and share of foreigners out of the total. Indeed, among the nineteen clusters, four of them comprise relatively large cities, seven include medium-sized cities (some of them with manufacturing activities, showing different specialisations), seven comprise small cities and one cluster includes micro-villages.

The list of nineteen clusters, besides NUTS 3-level capital cities, is returned in Table 7. The same table also returns insightful results when considering the output of the cluster analysis in the light of the four seismic zones. Different typologies of municipalities actually coexist within each seismic zone. Indeed, both seismic zone #1 and seismic zone #2 cover almost all clusters, with the only exception of four clusters, which are not covered by seismic zone #1[15]. As expected, each zone shows a different cluster composition, both in terms of number of municipalities and in terms of resident population. For instance, seismic zone #1 comprises a large number of small towns in mountain areas (285 municipalities,

[13] Here, the methodology already suggested by Pagliacci and Russo (2016) is followed: cluster analysis is performed by means of a hierarchical approach, adopting the Euclidean distance to compute dissimilarity matrix, and Ward's method to assess distances between clusters. However, while Pagliacci and Russo (2016) just considered the municipalities in Emilia-Romagna region, here the whole country is considered.

[14] The selection of those divisions of economic activity reflects the need to take into account the industrial structure configuration in the area of Emilia-Romagna hit by the 2012 earthquake.

[15] The clusters that are not included in seismic zone #1 are: densely-populated urban areas, medium-sized manufacturing towns with +mechanics and +foreigners, remote medium-sized towns and small manufacturing towns, with a lot of electro-med employment.

with more than 600,000 inhabitants). Conversely, with regard to seismic zone #2, a more complex pattern emerges, with the coexistence of both large cities and smaller towns.

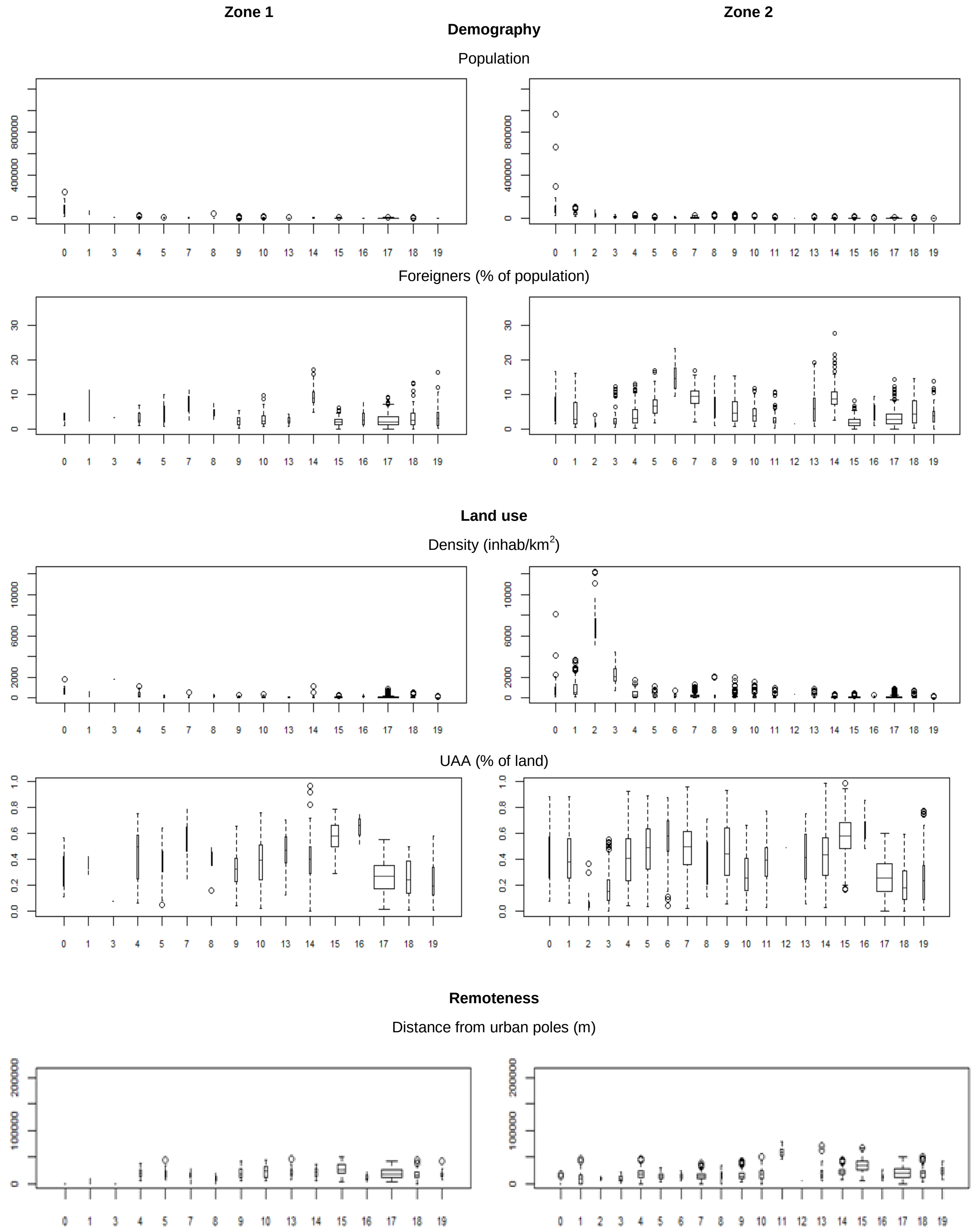
Table 7 clusters and composition by seismic zone

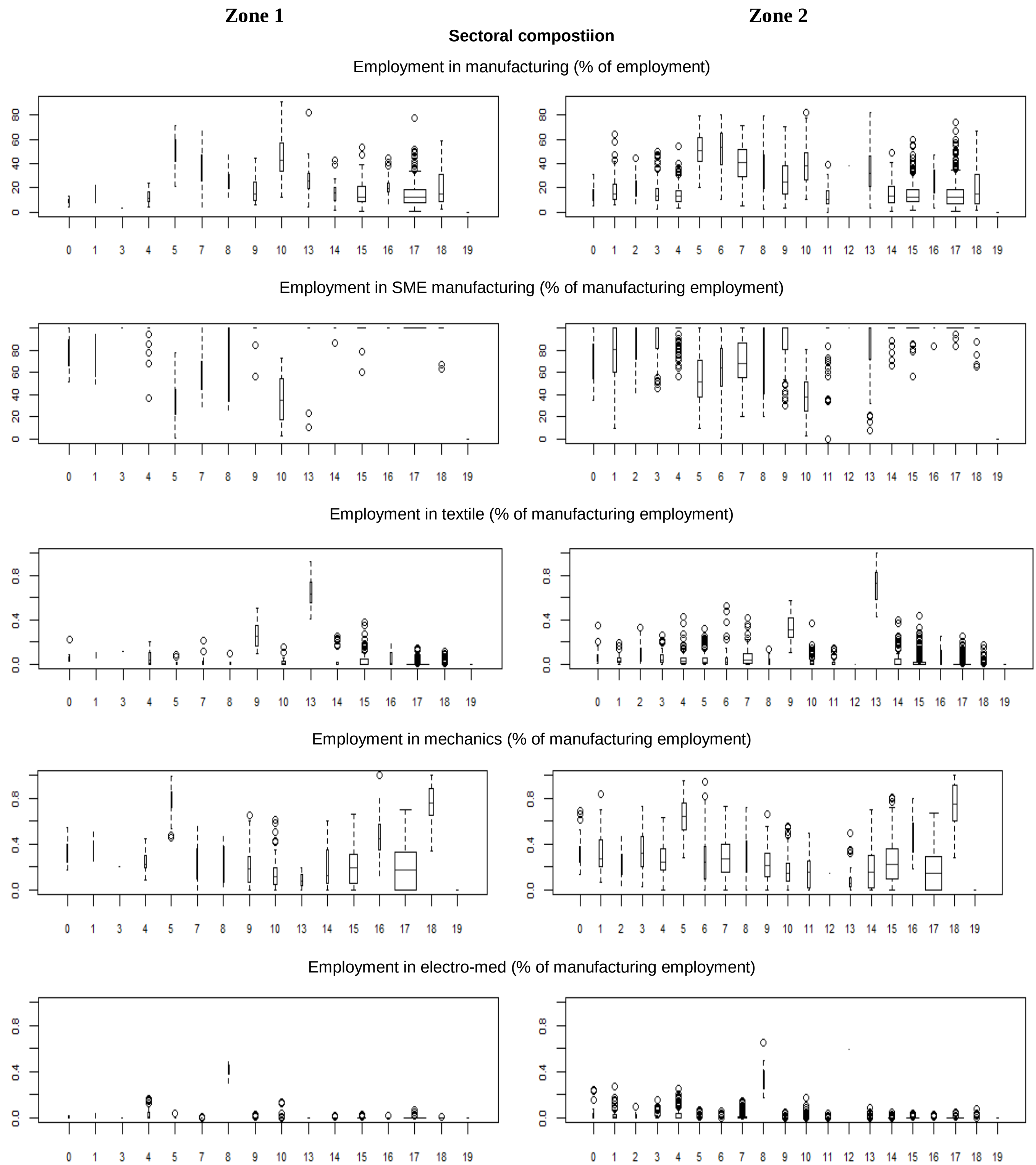
		No. Municipalities					Total Population				
	Name of the cluster	Italy	Zone 1	Zone 2	Zone 3	Zone 4	Italy	Zone 1	Zone 2	Zone 3	Zone 4
	Rome	19	0	8	11	0	2,617,175	0	1,198,468	1,418,707	0
	NUTS-3 level capital cities (excluding Rome)	109	7	38	38	26	14,707,213.0	677,211.0	4,734,851.0	6,415,596.0	2,879,555.0
cities	major urban poles	198	4	81	71	42	8,466,844	198,365	3,680,199	2,936,888	1,651,392
cities	densely-populated urban areas	27	0	18	6	3	967,327	0	629,108	262,247	75,972
cities	urban areas with mechanics	230	1	74	100	55	2,965,419	6,555	1,027,158	1,102,885	828,821
cities	with no foreigners/little manufacturing	381	31	157	111	82	4,288,607	359,155	1,836,880	1,182,177	910,395
medium towns	++manufacturing_++mechanics	671	20	103	344	204	2,700,958	60,078	442,857	1,538,964	659,059
medium towns	manufacturing_+mechanics +foreigners	290	0	54	200	36	1,384,109	0	282,626	957,098	144,385
medium towns	manufacturing_mechanics and foreigners	889	13	220	440	216	7,026,011	63,402	1,811,077	3,802,709	1,348,823
medium towns	manufacturing_ electromed & mechanics	107	6	30	41	30	659,117	53,220	197,711	265,242	142,944
medium towns	manufacturing_textile	515	34	130	159	192	2,617,701	93,726	724,003	903,985	895,987
medium towns	large entreprises manufacturing_other specialization	362	42	98	120	102	1,827,060	154,336	544,487	689,063	439,174
medium towns	remote	147	0	74	12	61	570,651	0	319,315	25,131	226,205
small towns	manufacturing_ +++electromed	11	0	1	7	3	32,967	0	1,548	28,668	2,751
small towns	manufacturing_textile	227	20	49	61	97	668,750	41,918	206,966	183,009	236,857
small towns	+foreigners	527	31	152	226	118	1,218,055	79,370	407,772	556,589	174,324
small towns	--foreigners	815	112	305	75	323	2,219,551	282,420	912,313	163,114	861,704
small towns	rural & close to urban poles	291	18	24	158	91	594,096	41,565	51,511	347,511	153,509
small towns	mountain areas	1,464	285	448	430	301	2,811,403	642,412	976,527	708,276	484,188
small towns	SMEs manufacturing_+mechanics	540	58	113	184	185	1,002,794	111,036	213,354	416,797	261,607
	micro villages	290	23	45	118	104	87,936	14,151	17,566	26,224	29,995

Source: authors' elaboration

In more general terms, when enlarging the focus on the single specific variables used for the cluster analysis (e.g. share of foreigners, presence of manufacturing activities, industrial specialization, land use and remoteness), clear spatially mixed patterns emerge, even within each seismic zone. These findings are graphically displayed by means of boxplots in Figure 14.

Figure 14 – Clusters profile: distribution of variables by seismic zone and cluster





The width of each boxplot is proportional to the number of municipalities in each cluster
Cluster #0 is the set of NUTS 3 level capital cities, which have not been considered in the cluster analysis.

Source: authors' elaboration

5. Conclusions

In Italy, 36% of Italian municipalities are classified with the highest seismic risk (zones #1 and #2). They are about three thousand municipalities, with 39% of the Italian population and 31% of total employment. These figures provide an idea of the social and economic burden of seismic hazard for the entire country and of the urgency of interventions to reduce that risk.

The recently approved *Piano Casa Italia*, as a comprehensive proposal aimed at restructuring Italian public buildings and houses over the next decades, will be confronted not only with the impressive magnitude of the interventions needed, but also with its very long-term horizon and with the big differences across Italian municipalities.

The detailed analysis proposed in this paper provides brand-new knowledge about those specific socio-economic differences, in particular considering the interactions between four complementary domains: after shock emergency, recovery of areas hit by recent earthquakes, risk reduction, socio-economic development, coordinated respectively by National Civil Protection, Struttura Commissariale, *Piano Casa Italia*, National Strategy for Inner Areas.

Most of the municipalities in seismic zones #1 and #2 show a weak socio-economic condition, in that they are affected by an ageing population, lower presence of manufacturing activities and geographical remoteness – hence, a substantial overlapping with inner areas, as defined by the National Strategy (Barca *et al.*, 2014). All these findings emerge also as the outcome of a cluster analysis, performed at municipality level across Italy.

A proper knowledge of these characteristics also represents a key issue in the critical implementation of place-based policies (Barca Report, 2009; Barca *et al.*, 2012) like the *Piano Casa Italia*, as well as emergency interventions and reconstruction. Indeed, from a policy perspective, what is clear is the urgency of a comprehensive intervention at a national level that could contribute to a new path of development of those municipalities.

Which topics must be addressed in the policy interventions of *Piano Casa Italia*? And why?

First of all, geography and demography are expected to matter significantly. Most seismic zones in Italy are characterized by lower population density and size, as most of them belong to mountain areas (especially throughout the Apennines). These features could make the implementation of the first steps of the Plan more difficult, both in terms of available competences and high-skilled workers at local level, because of a generalized lack of larger cities. In addition, population size and distribution by age are important. Demographic features of seismic zones #1 and #2 are expected to increase the vulnerability of these regions[16]. In particu-

[16] As stressed in the Sendai Framework (UNISDR, 2015: pp. 9-10), "The Hyogo Framework for Action defines vulnerability as: The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards… [and] hazard is defined as a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydro meteorological and biological) or induced by human processes (environmental degradation and technological hazards)."

lar, a larger share of elderly people together with a lower share of owner-occupancy may play a negative role, which makes a rapid implementation of the *Piano Casa Italia* even more important.

Secondly, local economies of seismic municipalities show specific features. In most cases, they are weaker than the economy in the rest of the country, especially in terms of lower employment rates and higher unemployment rates. Thus, these municipalities are expected to show a smaller amount of local wealth, which could have a negative impact on the implementation of the Plan. Moreover, their economies mostly comprise manufacturing and construction establishments. About 25% of total industrial districts occur in seismic zones #1 and #2 and they are actually specialized in footwear and clothing, heavily exposed to international competition.

Thirdly, higher education institutions matter. They have a relevant presence in seismic zone 2, both in terms of locations and number of students enrolled. This fact could play a significant role in enhancing place-based changes supporting the implementation of the Plan: a big change in mind-set and a capillary and diffuse seismic-risk knowledge will be necessary. According to UNISDR (2015), this includes "disaster prevention, mitigation, preparedness, response, recovery and rehabilitation, in formal and non-formal education, as well as in civic education at all levels, as well as in professional education and training". This knowledge must be fostered across individuals and families, in the business sectors, in the public sector (from teachers to civil servants and administrators at municipality and regional level) and in the NGOs operating in civil society. HEIs can support the creation and diffusion of specific knowledge to support the local needs in the next decades. The small size of most of these universities could be supported by incentives to create networks of collaboration, both in teaching (e.g., definition of the syllabus on topics on recovery, emergence…) and research projects.

Fourthly, age and type of buildings matter. Older buildings (i.e. the ones that were constructed before 1970) in seismic zones #1 and #2 represent the primary target of the Plan, as they are the ones deserving immediate attention for a restructuring that would also take into account anti-seismic regulations. As claimed by the Plan itself, in its political intentions, a crucial step in the Plan is the assessment of the actual state of preservation of buildings especially in seismic zones #1 and #2 where buildings are composed by a few dwellings each. This aspect seems to play a positive role when considering the total amount of time needed to assess the current state of the building: the smaller the building, the less the time to certification. However, a fragmented ownership may slow down the overall process of interventions. Appropriate economic incentives could enhance the speed of such a process by fostering local interventions by a network of professional experts. Here, clear and transparent procedures will play a major role in ensuring responsibility and ethical behaviour to reduce the medium-long term tragic effects experienced in many past disasters in Italy. The Plan will both support the bottom-up ability of local communities to innovate and promote higher building standards across Italy. Its success will critically depend on ethical and legal training and will also be dependent on other changes in the Property Register and in the digitalisation of the procedures for building permits.

Although all the above-mentioned items constitute relevant indications in designing the Plan, there is an aspect that deserves special attention: governance of the Plan at national and local level. The number of municipalities involved will require coordination of all the many specific features and peculiarities of the municipalities in question. To not address this issue could become the Achilles' heel of the Plan. Considering the Plan only as a top-down process might not be effective, but also considering it as a bottom-up procedure it might be hard to produce effective results, given the lack of local competences and the need for adopting the most effective technical standards and best-practice techniques.

Discussing this issue is the next step in the ongoing research that we are carrying out to support a collective discussion on the Plan and possibly a more effective decision-making process to implement it. Another strand of complementary action-research would be needed to assess the vulnerability of physical infrastructures as well as of social infrastructures (health services, social services, education, communication), and of public management at a local level, all of which have effects at a local level in enhancing preparedness. This action-research must be a pillar for making the local process effective in understanding and mastering the long-term implications of the Plan.

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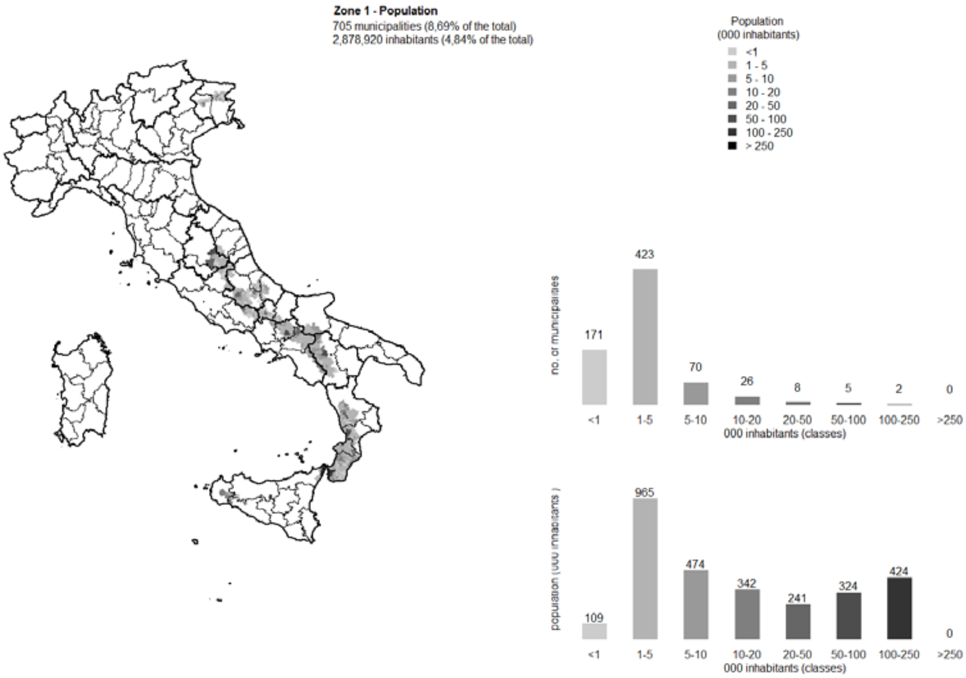
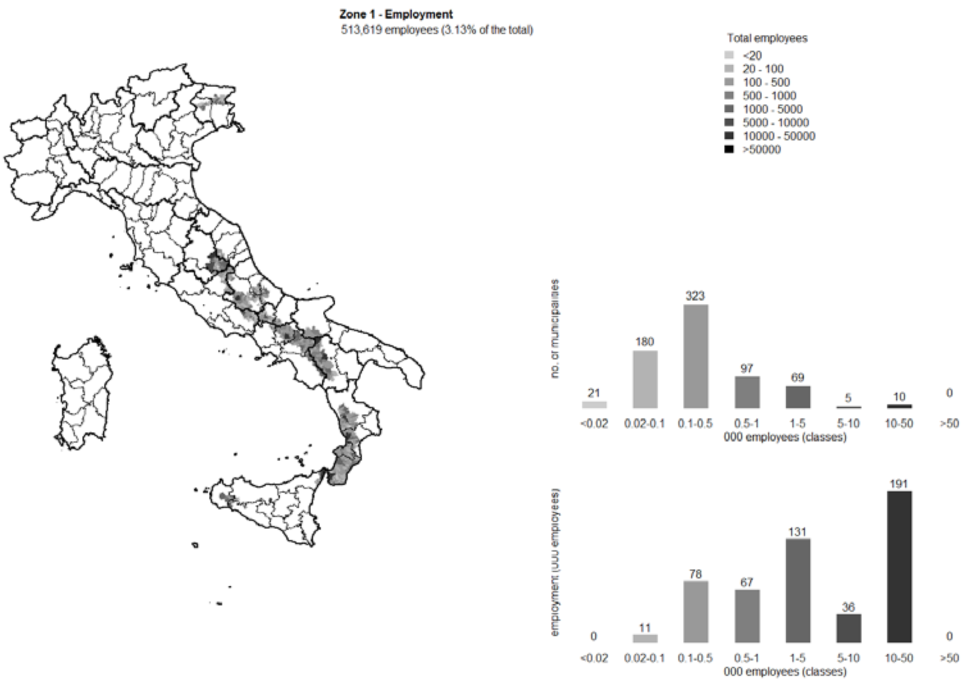
Annex 1: A general overlook on the seismic zone #1

Figure A.1 Resident population in municipalities belonging to the seismic zones #1 (year 2011)



Source: authors' elaboration on General Census of Population and Housing (Istat, 2011a)

Figure A.2 Employees in establishments, in municipalities belonging to the seismic zone #1 (year 2011)



Source: authors' elaboration on General Census of Industry and Services (Istat, 2011b)

Annex 2: Classification of inner areas and urban poles in seismic zones #1 and #2

The National Strategy for Inner Areas classifies Italian municipalities into six different groups, according to their service endowments (considering health service, secondary education and railway infrastructures) or the time needed to reach the closest urban centre, able to provide the aforementioned set of services. Overall classification is as follows (Barca et al., 2014):

A. Urban Poles of attraction: municipalities providing the whole range of services;
B. Inter-municipal poles of attraction: groups of neighbouring municipalities that jointly provide the whole range of services;
C. Outlying areas: municipalities at less than 20 minutes from the closest urban poles;
D. Intermediate areas: municipalities at less than 40 minutes from the closest urban poles;
E. Peripheral areas: municipalities at less than 75 minutes from the closest urban poles;
F. Ultra-peripheral areas: municipalities at more than 75 minutes from the closest urban poles.

In their broadest definition, inner areas include all municipalities classified as D, E and F.

Considering only municipalities classified as urban poles (A), just 14 municipalities are located in seismic zone #1, whereas additional 77 municipalities occur in the seismic zone #2. Most of them are in Lazio, Campania, Calabria and Sicily (Table A.1).

Table A.1 Employees in establishments, in municipalities belonging to the seismic zone #1 (year 2011)

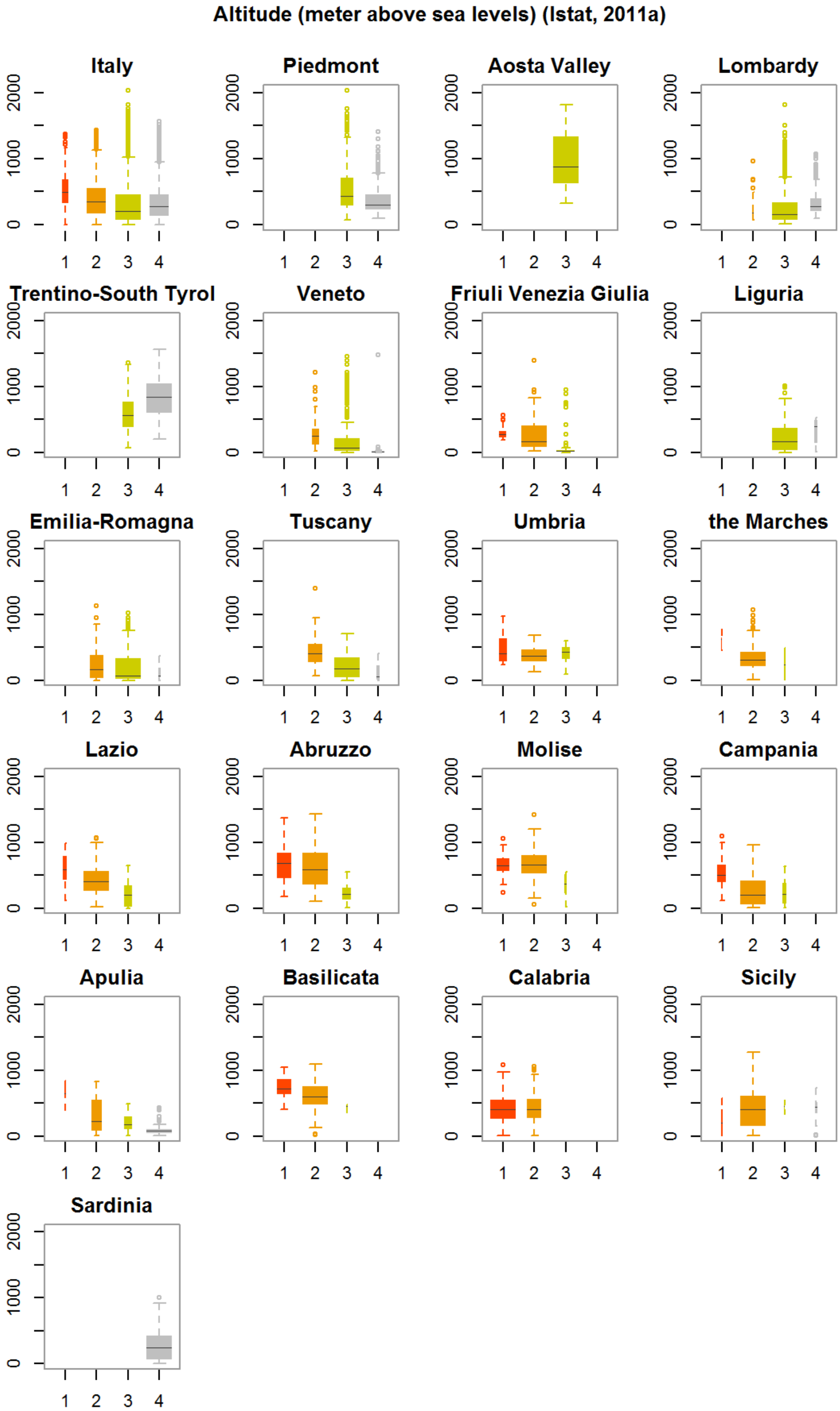
NUTS 2 region	Seismic zone 1 Name	Seismic zone 1 Inhabitants	Seismic zone 2 Name	Seismic zone 2 Inhabitants
Lombardia			Brescia	189,902
			Desenzano del Garda	26,793
Veneto			Belluno	35,591
			Montebelluna	30,765
			Feltre	20,525
Friuli-Venezia Giulia	Gemona del Friuli	11,141	Udine	98,287
			Pordenone	50,583
			Gorizia	35,212
Emilia-Romagna			Rimini	139,601
			Forlì	116,434
			Cesena	95,990
			Imola	67,892
			Faenza	57,748
			Riccione	34,536
			Lugo	32,062
Toscana			Arezzo	98,144
			Pistoia	89,101
			Cortona	22,495
			Borgo San Lorenzo	17,854
			Castelnuovo di Garfagnana	6,059
Umbria	Foligno	56,045	Perugia	162,449
	Spoleto	38,429	Terni	109,193
Marche			Ancona	100,497
			Pesaro	94,237
			Fano	62,901
			Ascoli Piceno	49,958
			Senigallia	44,361
			Macerata	42,019
			Jesi	40,303
			Civitanova Marche	40,217
			Fabriano	31,020
			Urbino	15,501
Lazio			Roma - VIII Municipio	226,338
			Roma - X Municipio	174,086
			Roma - V Municipio	167,822
			Roma - XII Municipio	163,180
			Roma - XI Municipio	124,392
			Roma - IX Municipio	116,330
			Roma - VI Municipio	113,221
			Roma - VII Municipio	113,099
			Viterbo	63,209
			Tivoli	52,910
			Frosinone	46,649
			Rieti	46,187
			Cassino	33,658
Abruzzo	Avezzano	40,744	L'Aquila	66,964
			Teramo	54,294
			Chieti	51,484
Molise	Isernia	22,025	Campobasso	48,747
			Venafro	11,236
Campania	Benevento	61,489	Napoli	962,003
			Salerno	132,608
			Pozzuoli	80,357
			Caserta	75,640
			Avellino	54,222
			Battipaglia	50,464
			Scafati	50,013
			Nocera Inferiore	46,563
			Nola	33,979
			Sarno	31,030
			Mercato San Severino	22,036
			Sapri	6,809
Puglia			Foggia	147,036
			Barletta	94,239
			Cerignola	56,653
			San Severo	54,906
Basilicata	Potenza	66,777		
Calabria	Cosenza	69,484	Catanzaro	89,364
	Lamezia Terme	70,336	Crotone	58,881
	Locri	12,459		
	Reggio di Calabria	180,817		
	Tropea	6,555		
	Vibo Valentia	33,357		
Sicilia	Messina	243,262	Agrigento	58,323
			Gela	75,668
			Enna	27,894
			Catania	293,902
			Ragusa	69,794
			Siracusa	118,385
			Marsala	80,218
			Palermo	657,561
			Castelvetrano	31,824

Source: authors' elaboration on General Census of Industry and Services (Istat, 2011b)

Annex 3: Boxplot

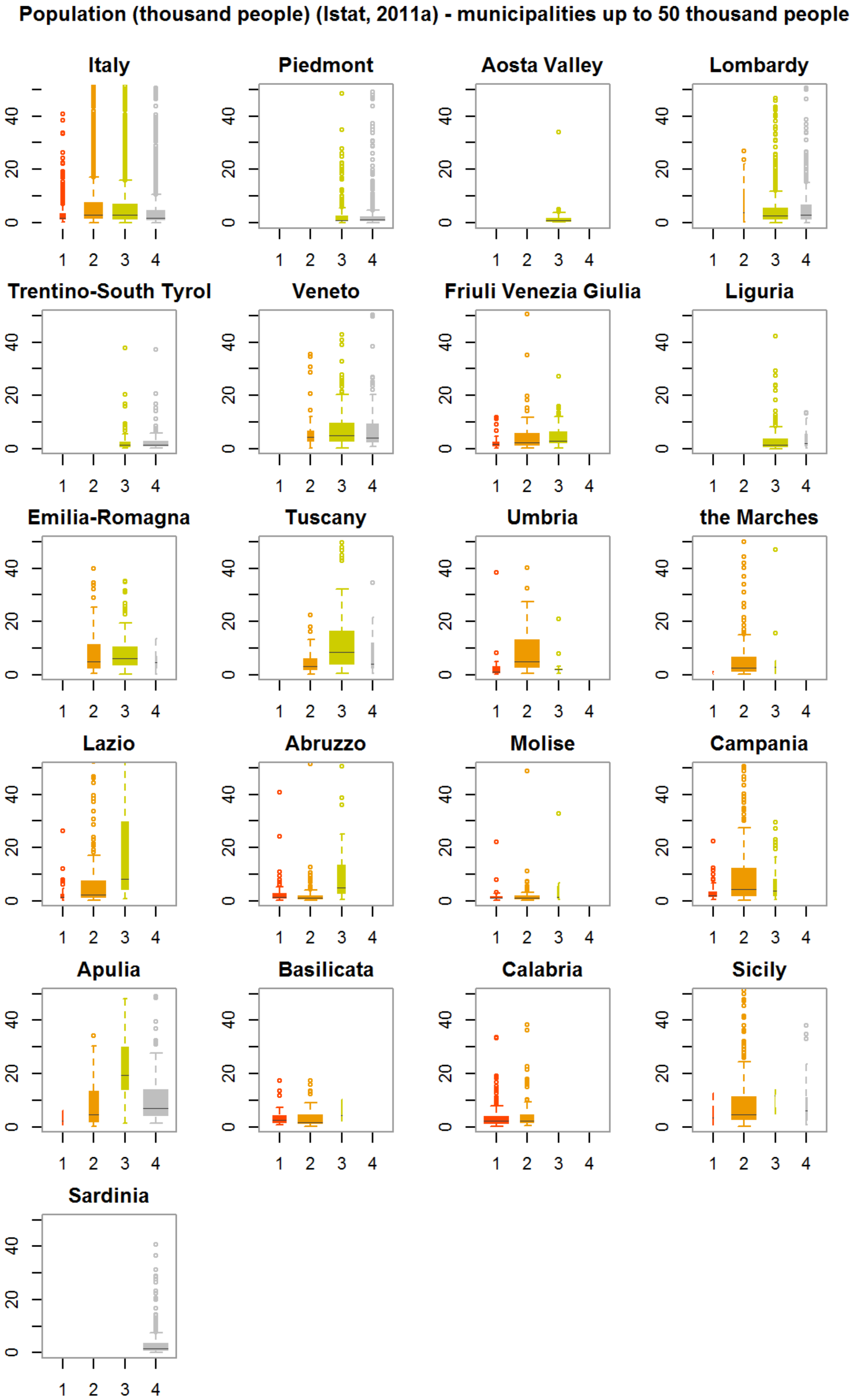
In each of the following boxplots, widths are proportional to the number of municipalities.

Figure A.3 Altitude above sea level at municipality level, by region and by seismic zone



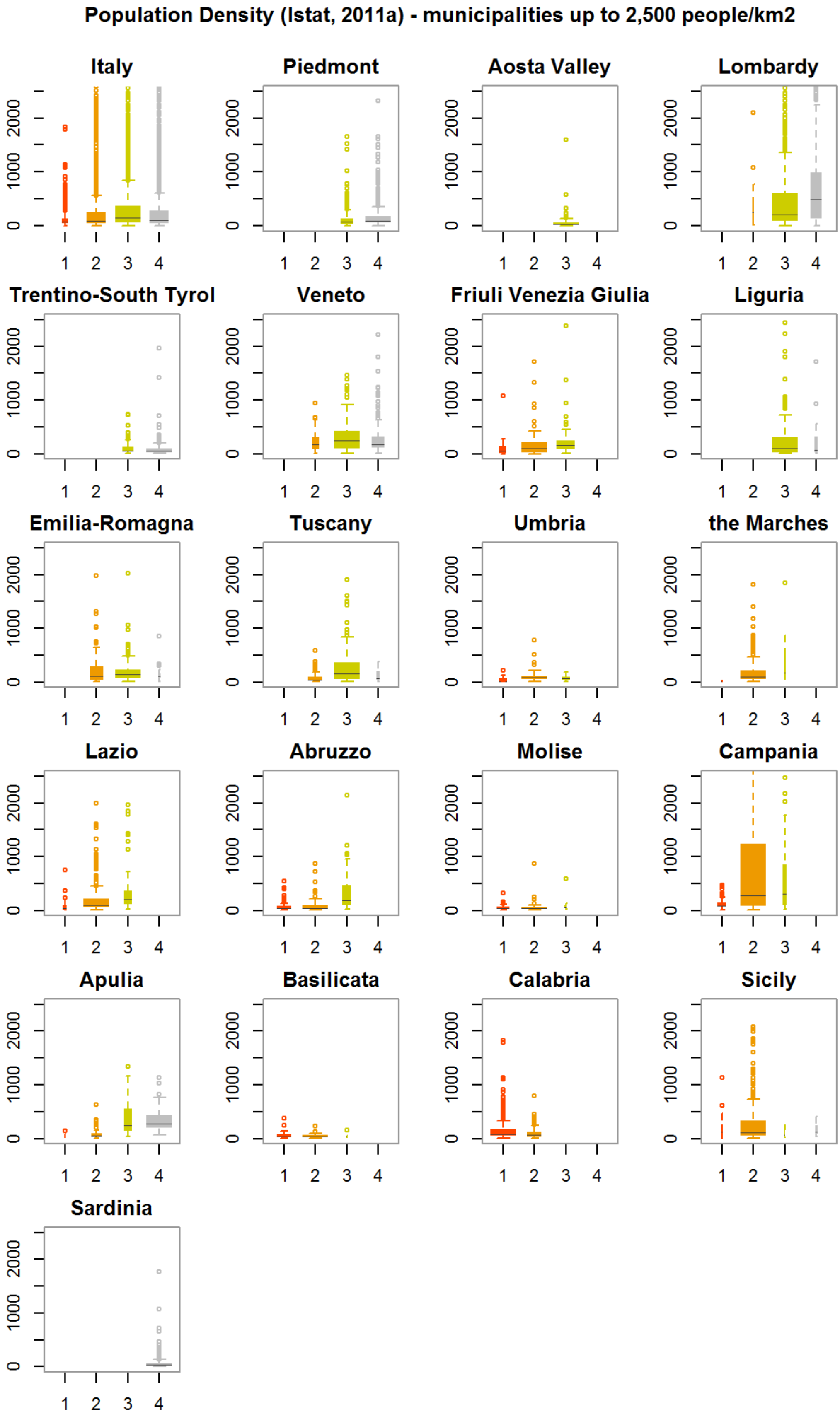
Source: authors' elaboration on Istat (2011a) data

Figure A.4 Population at municipality level, by region and by seismic zone (year 2011)



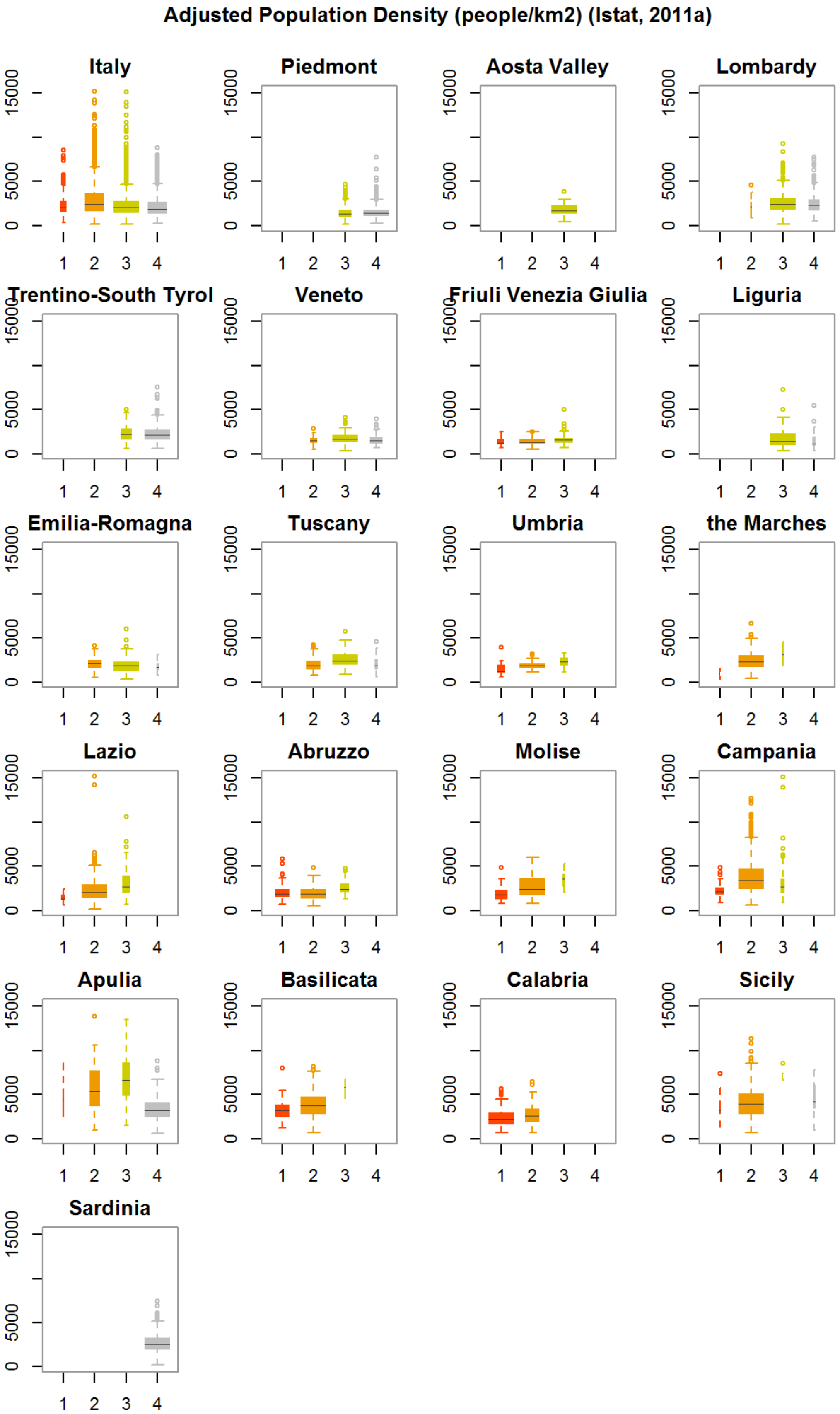
Source: authors' elaboration on Istat (2011a) data

Figure A.5 Population density at municipality level, by region and by seismic zone (year 2011)



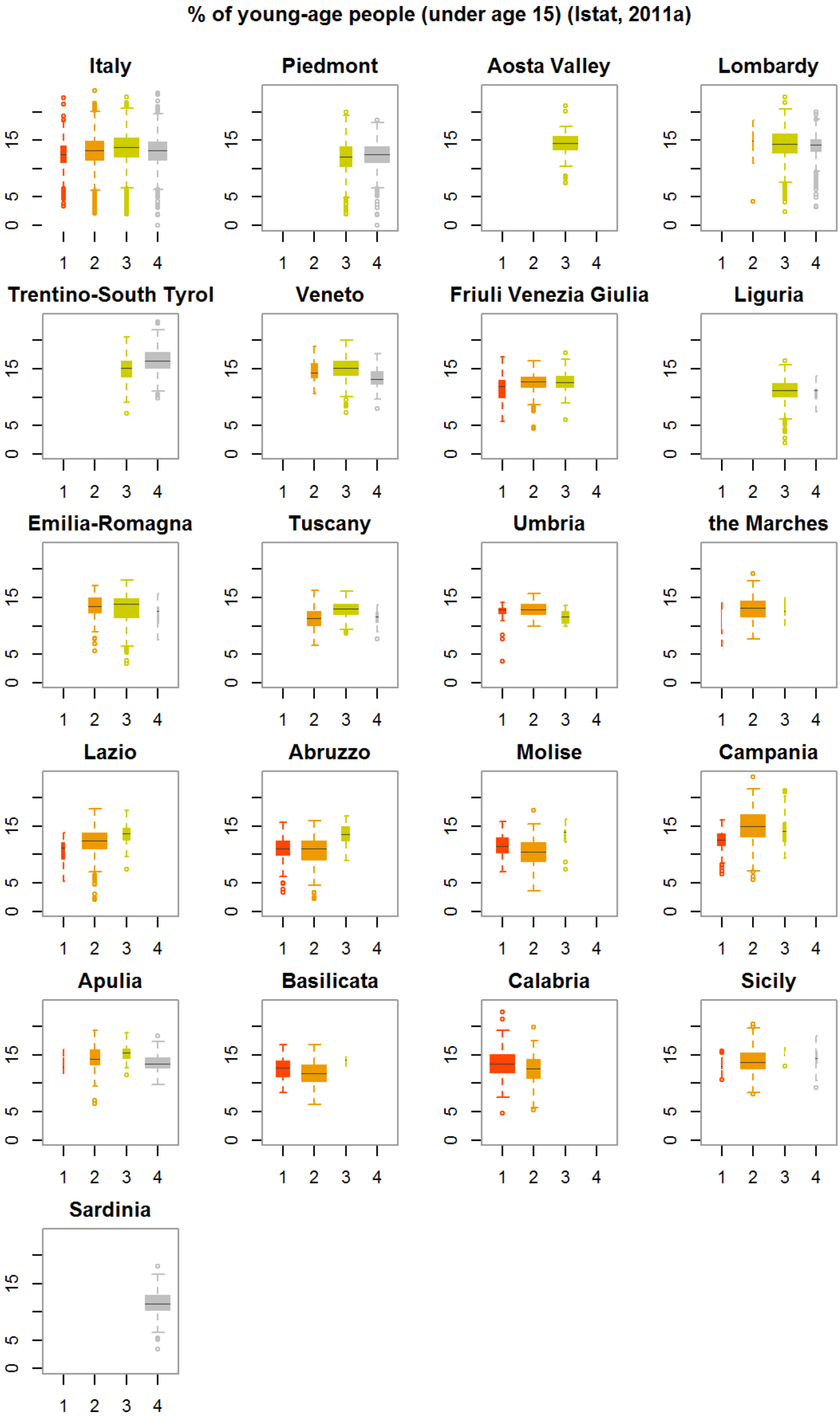
Source: authors' elaboration on Istat (2011a) data

Figure A.6 Adjusted Population density at municipality level, by region and by seismic zone (year 2011)



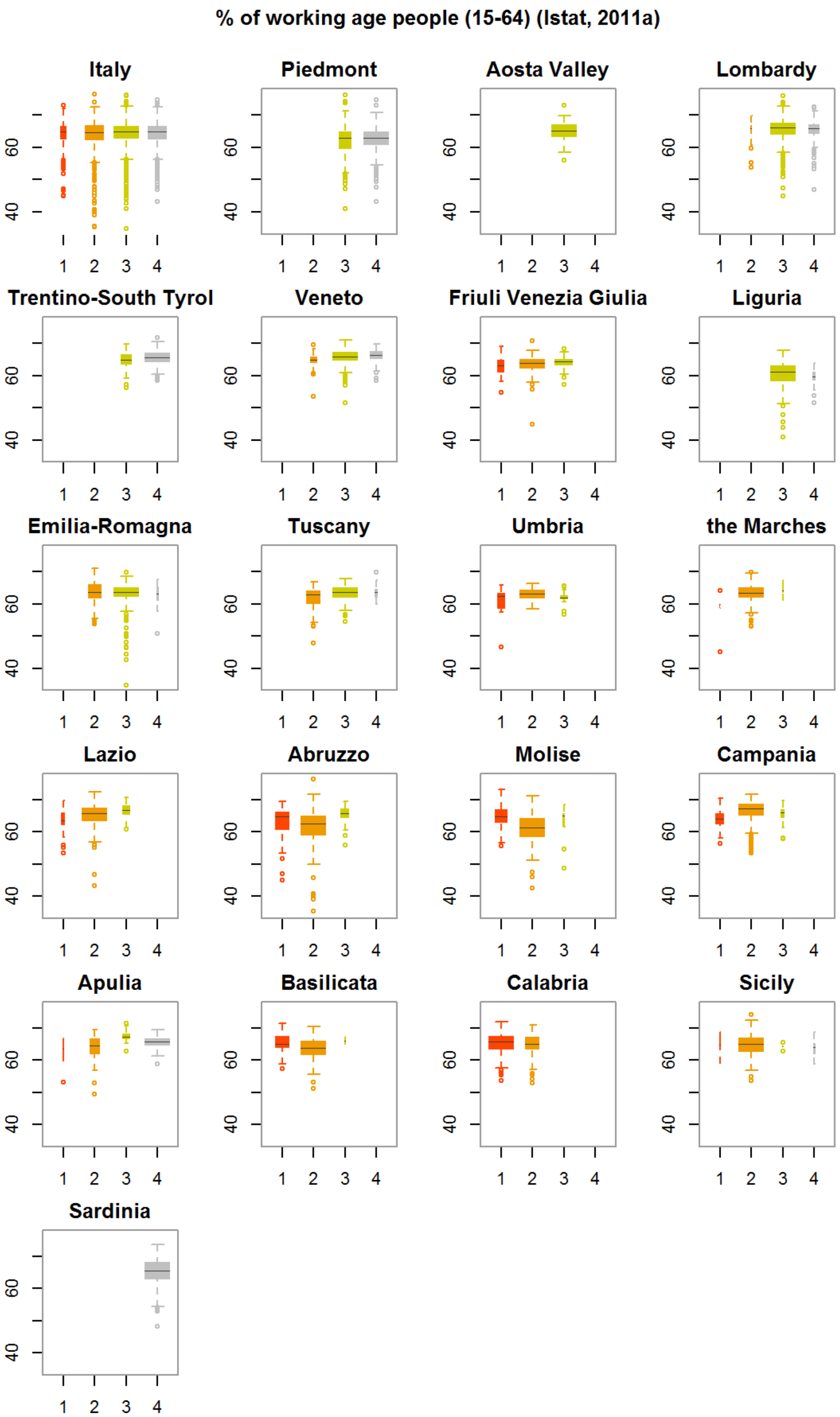
Source: authors' elaboration on Istat (2011a) data

Figure A.7 Share of people under age 15 out of the total (year 2011)



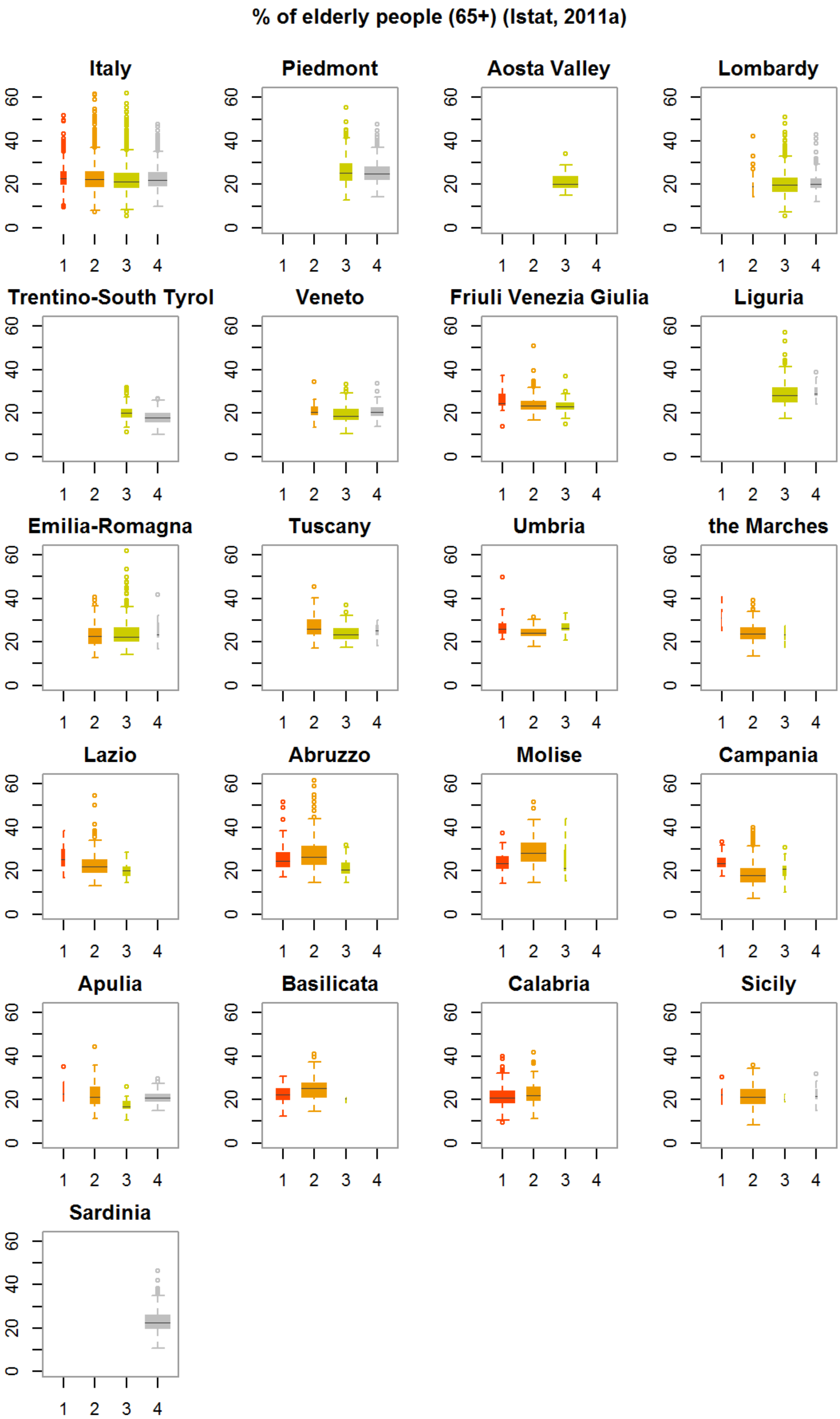
Source: authors' elaboration on Istat (2011a) data

Figure A.8 Share of people aged 15-64 out of the total (year 2011)



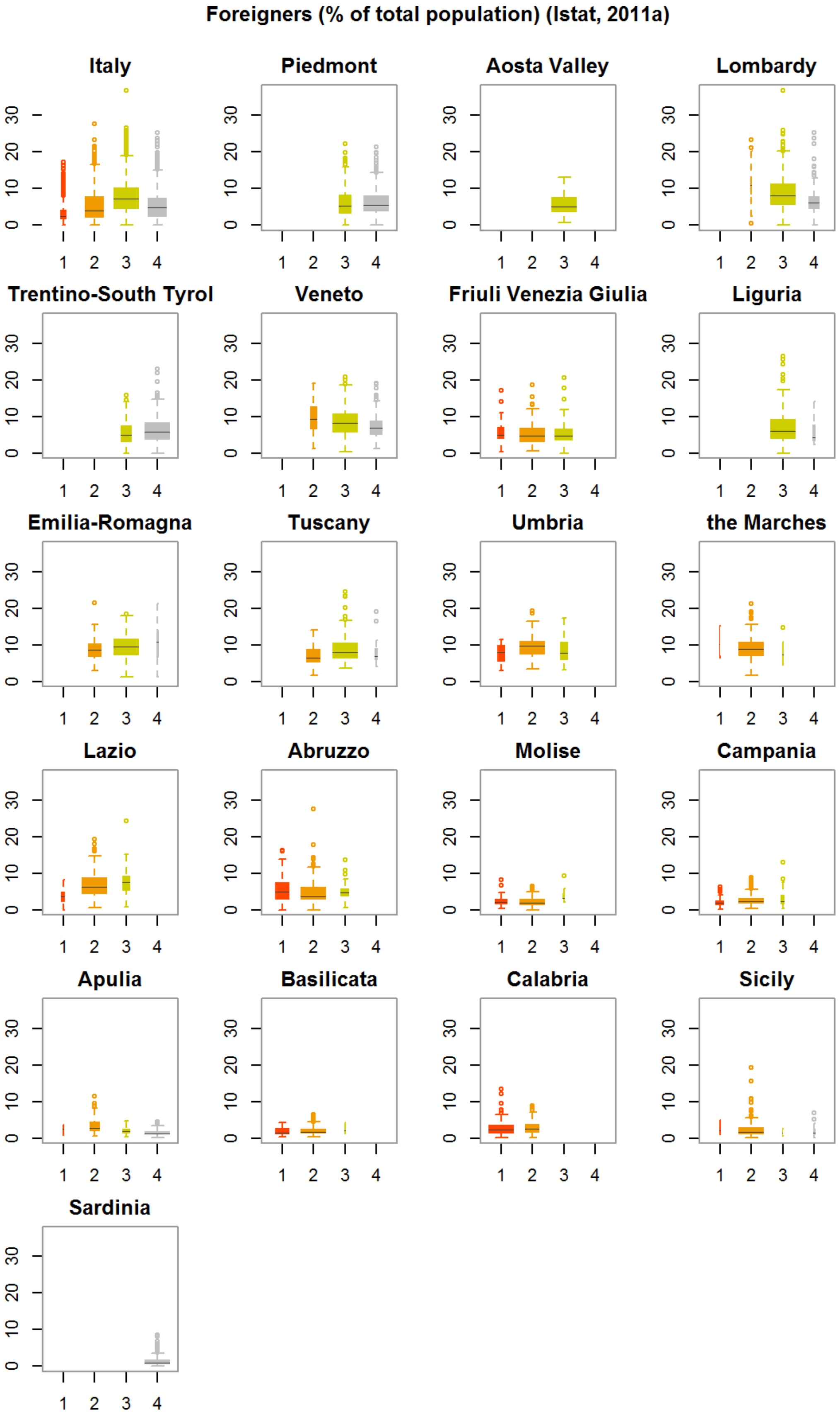
Source: authors' elaboration on Istat (2011a) data

Figure A.9 Share of people 64 and over out of the total (year 2011)



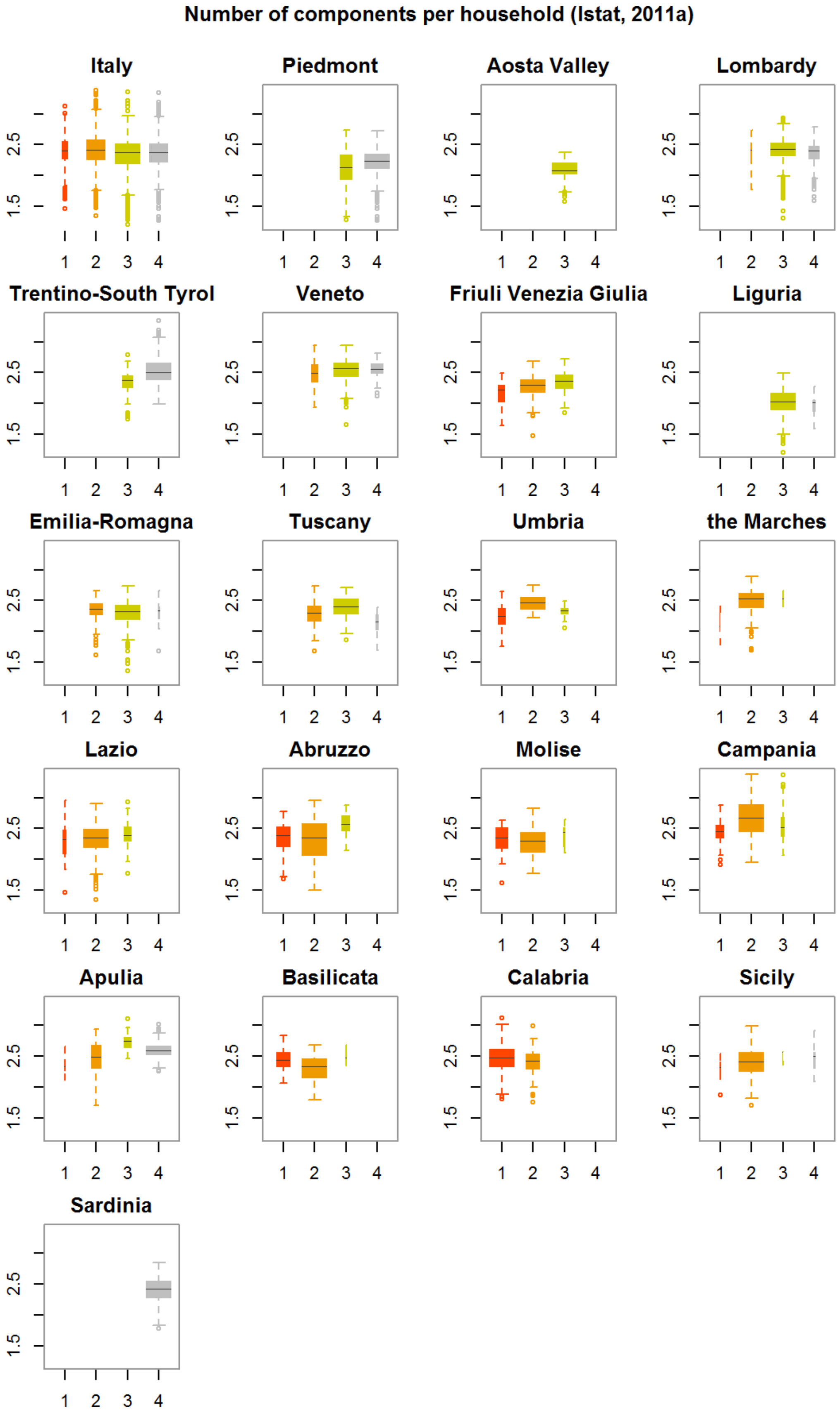
Source: authors' elaboration on Istat (2011a) data

Figure A.10 Share of foreigners (% of total population) (year 2011)



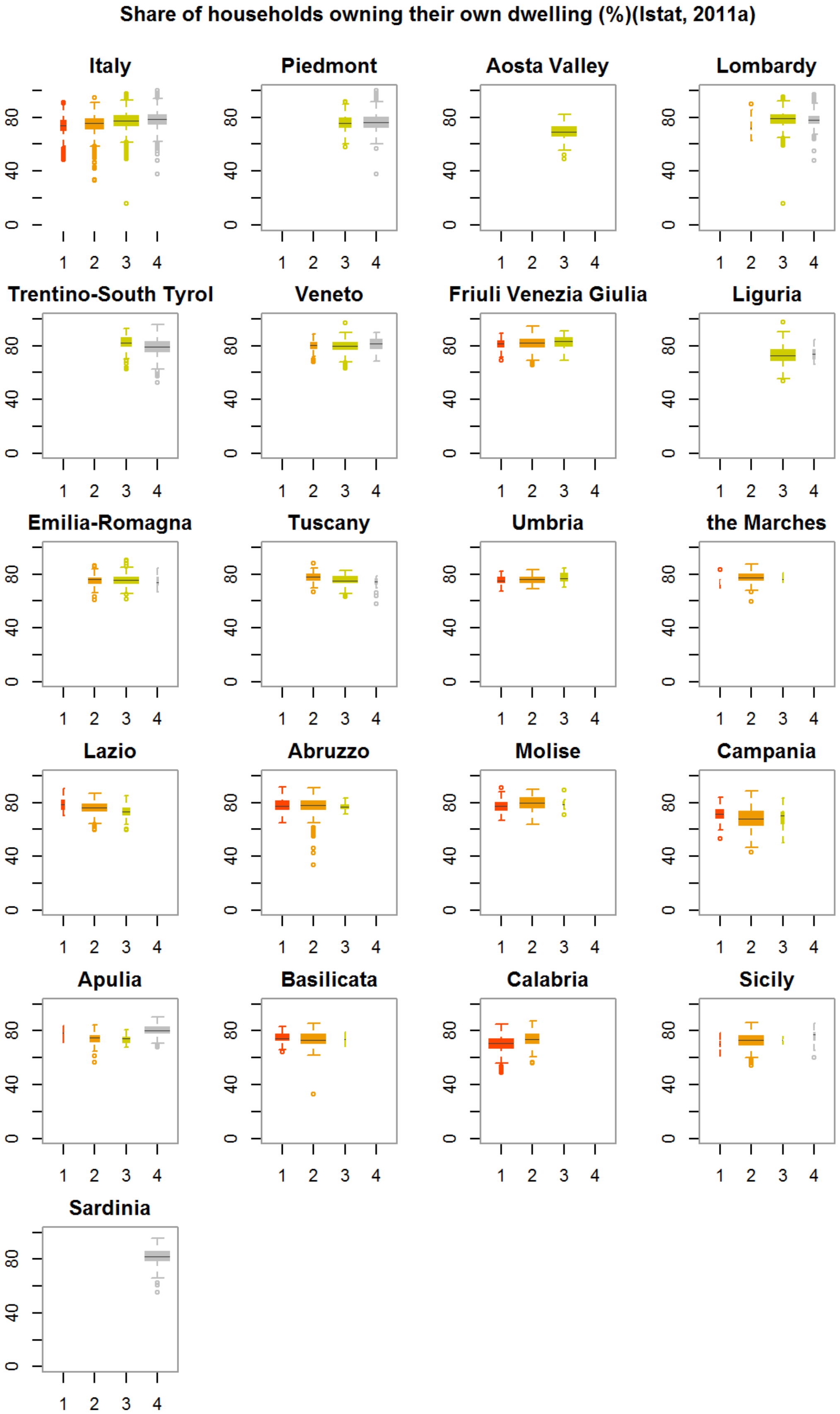
Source: authors' elaboration on Istat (2011a) data

Figure A.11 Households components (year 2011)



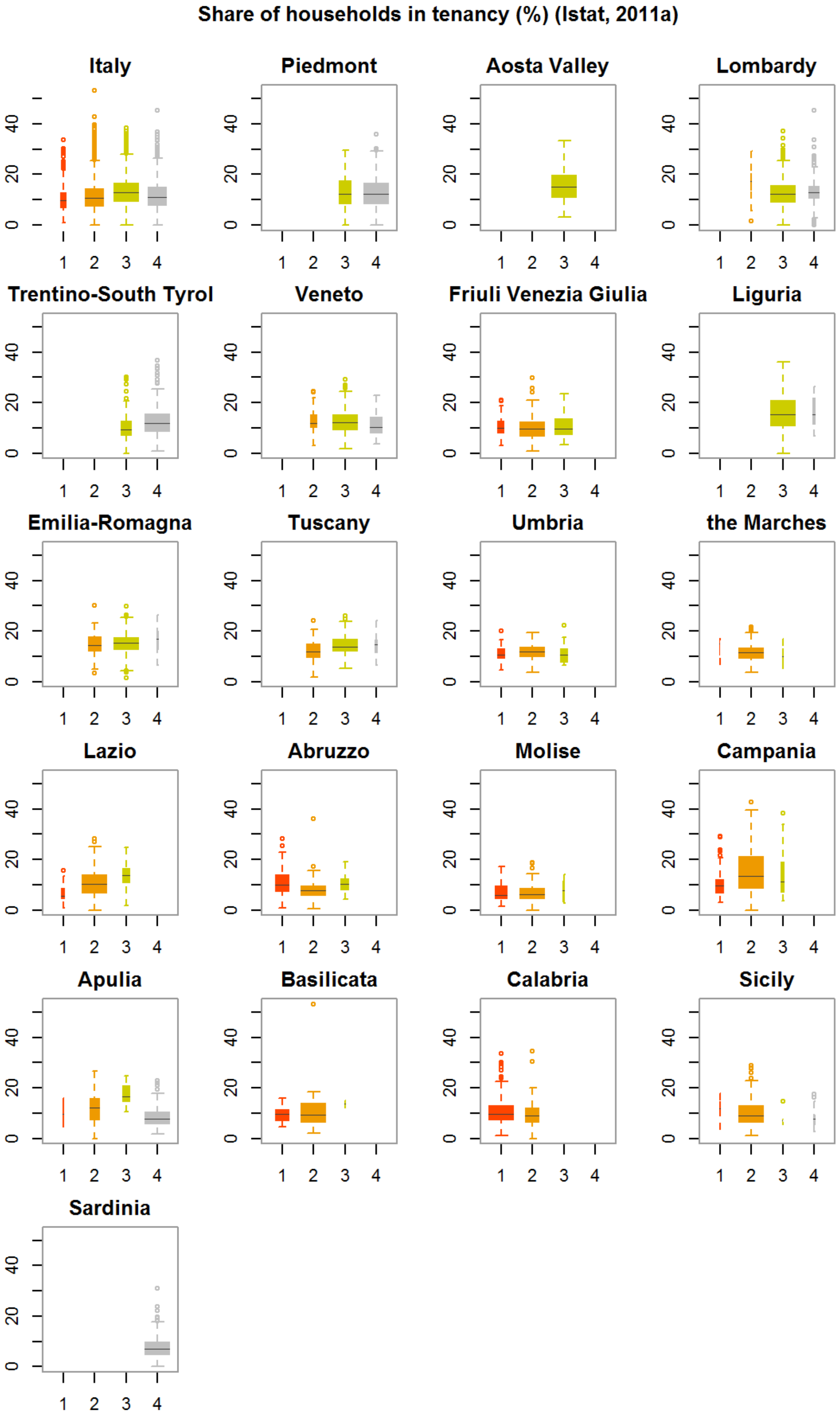
Source: authors' elaboration on Istat (2011a) data

Figure A.12 Owner-occupancy (%) (year 2011)



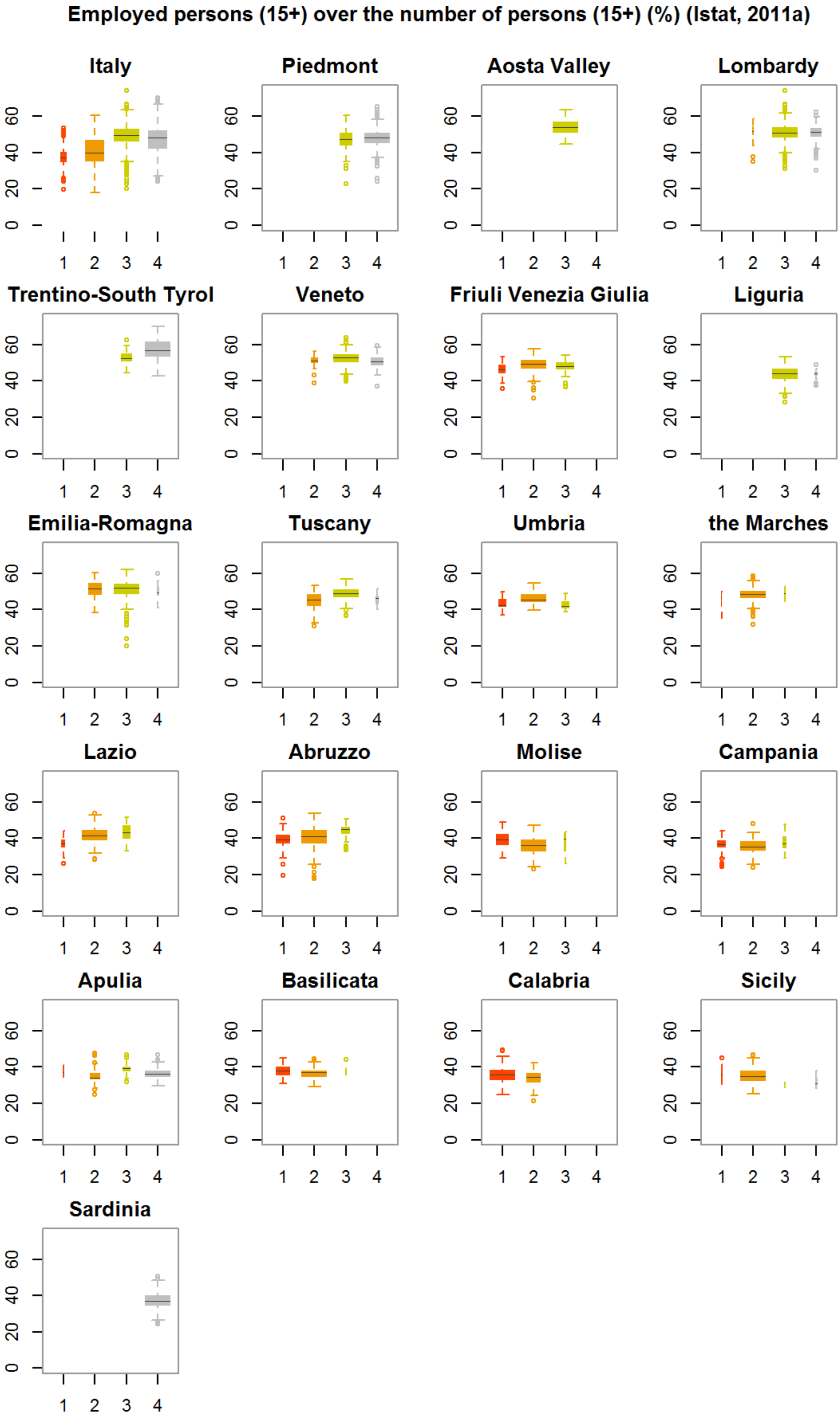
Source: authors' elaboration on Istat (2011a) data

Figure A.13 Tenancy (%) (year 2011)



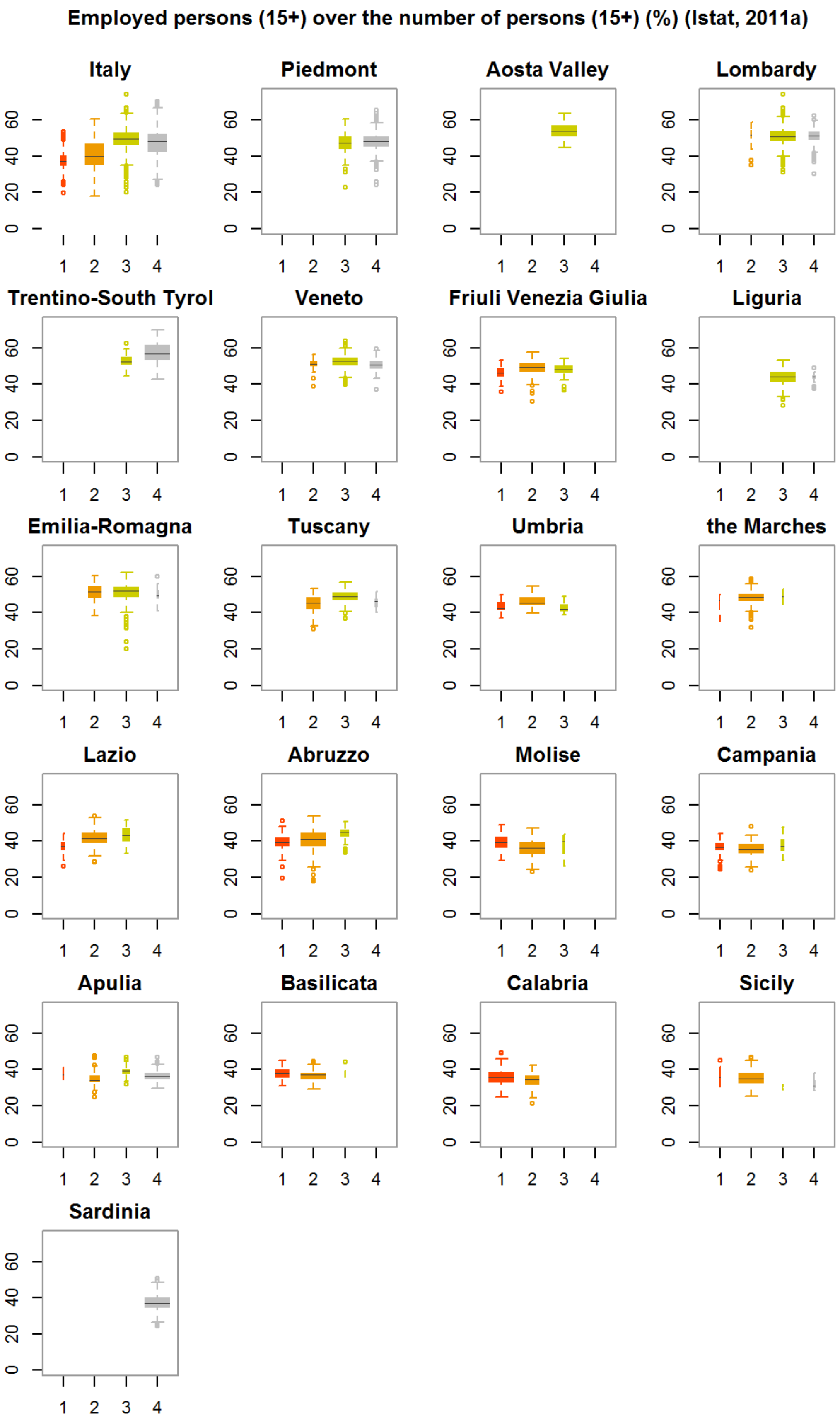
Source: authors' elaboration on Istat (2011a) data

Figure A.14 Employment rate (%) (year 2011)



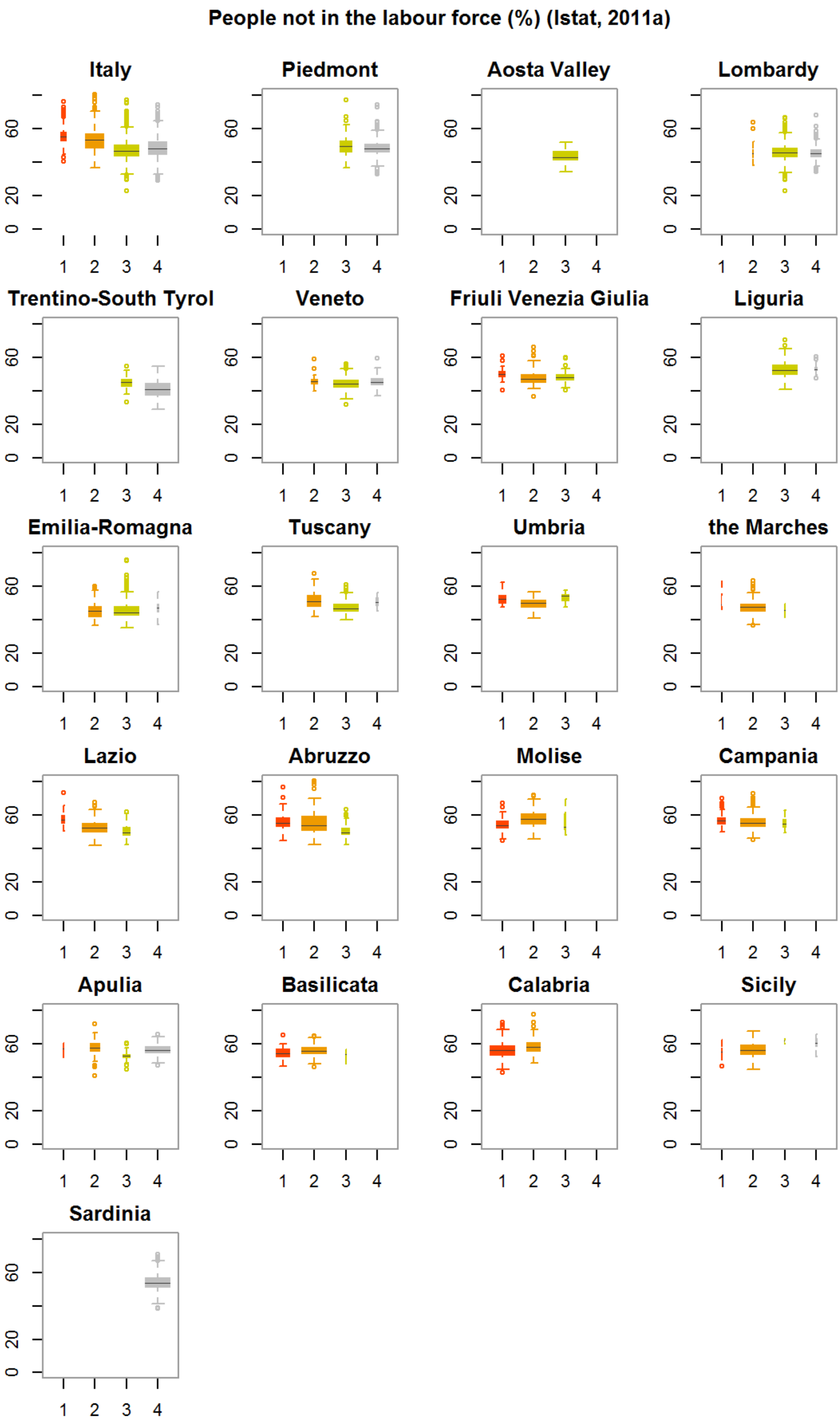
Source: authors' elaboration on Istat (2011a) data

Figure A.15 Employment rate (%) (year 2011)



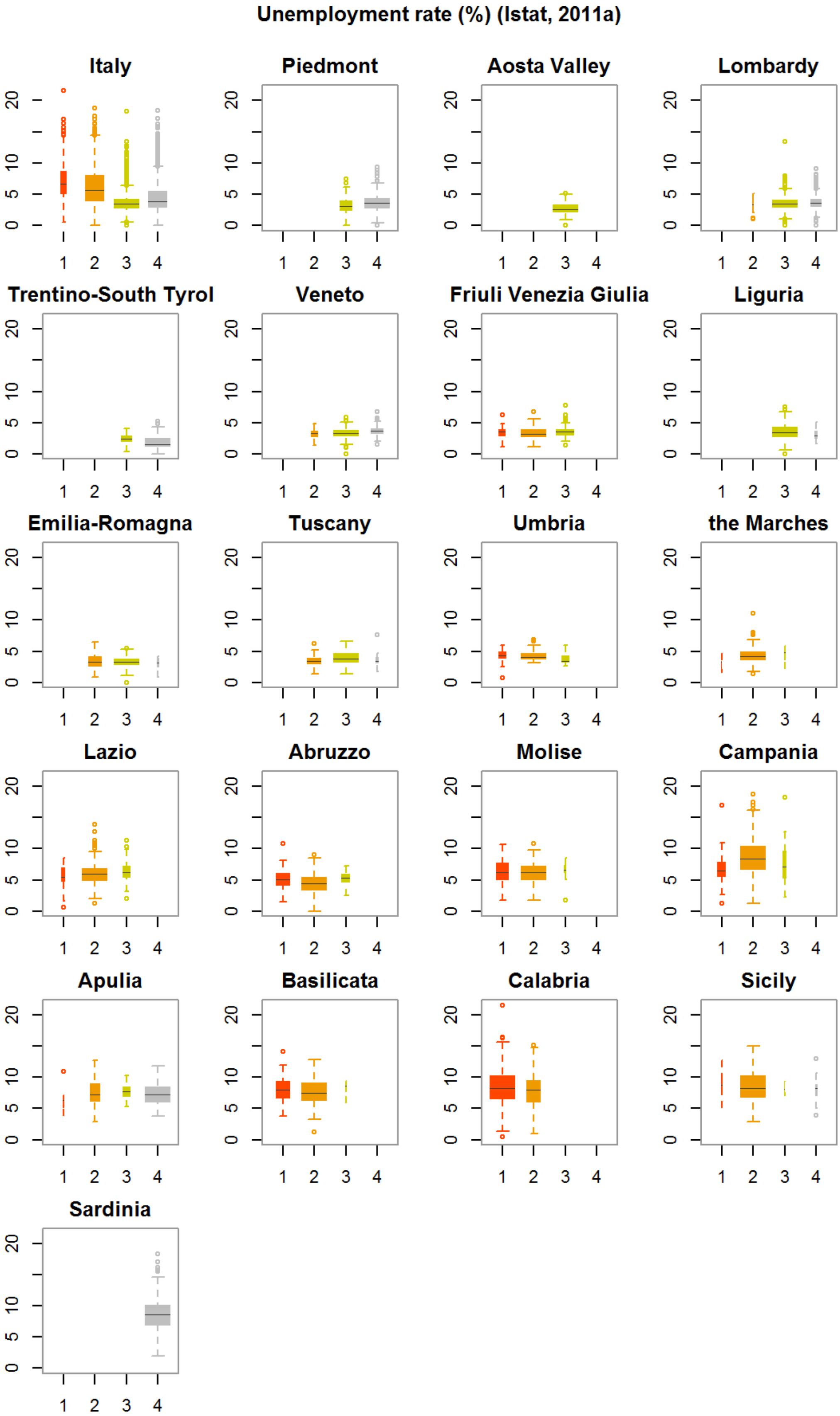
Source: authors' elaboration on Istat (2011a) data

Figure A.16 People not in the labour force (%) (year 2011)



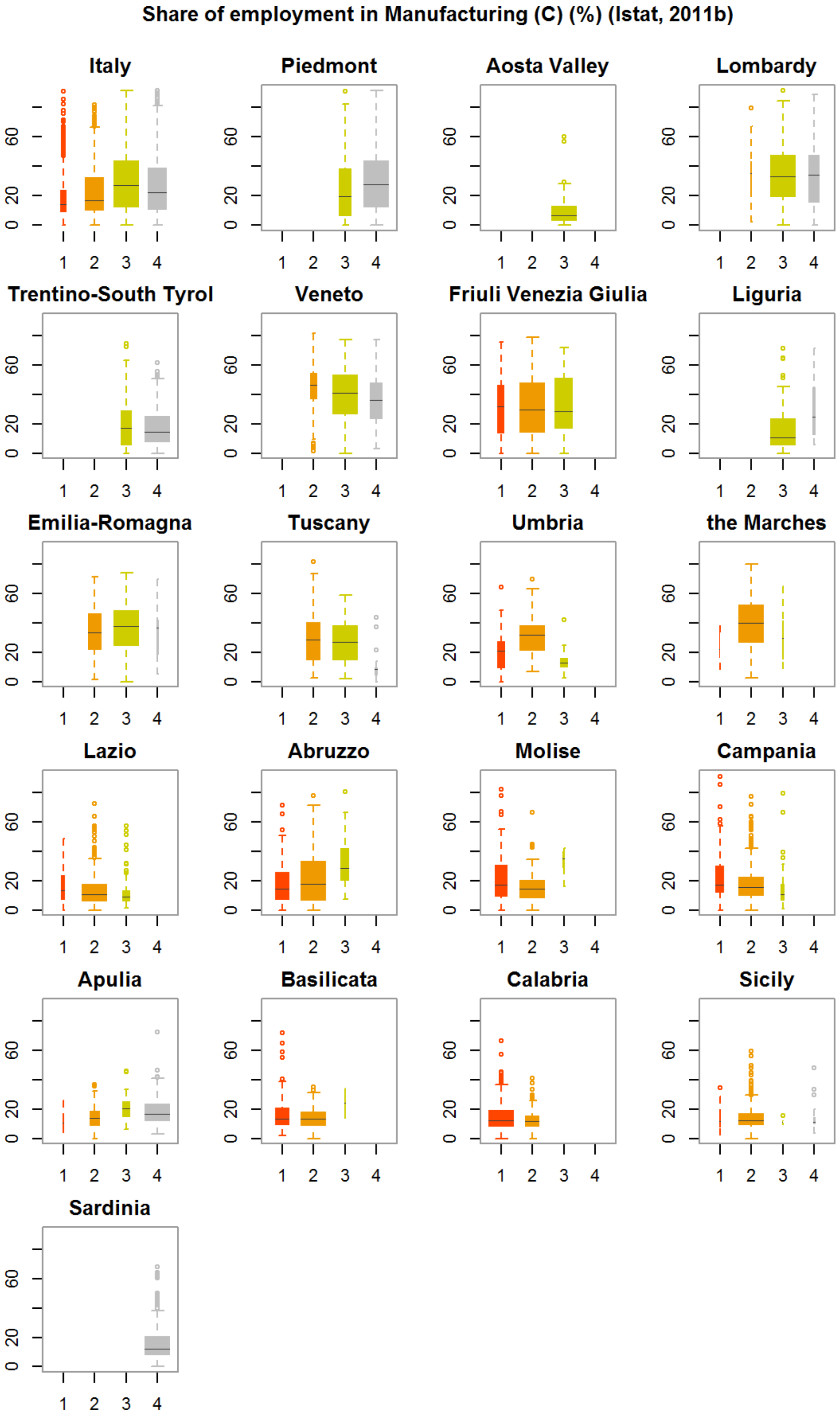
Source: authors' elaboration on Istat (2011a) data

Figure A.17 Unemployment rate (%) (year 2011)



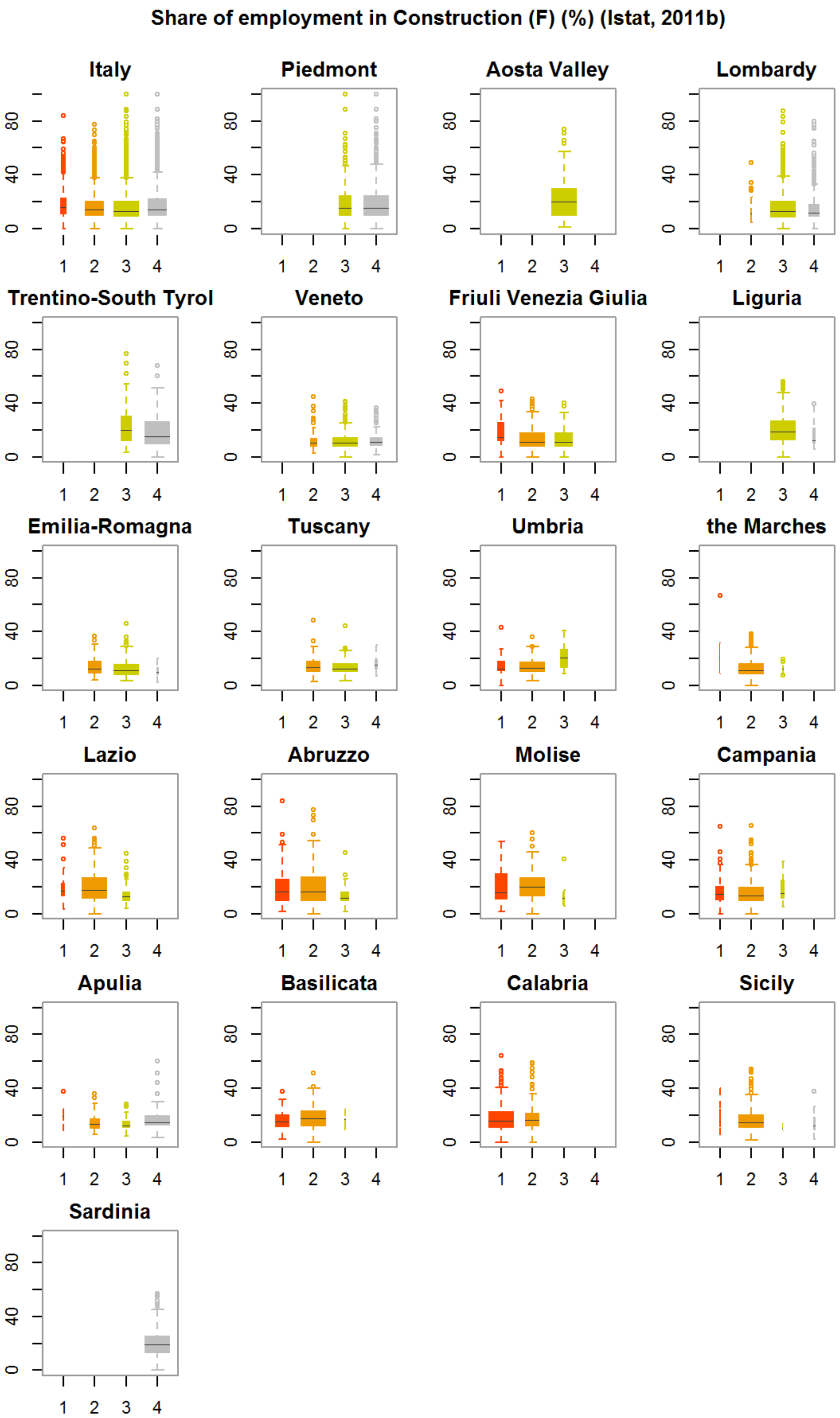
Source: authors' elaboration on Istat (2011a) data

Figure A.18 Share of employment in manufacturing activities (division C) (%) (year 2011)



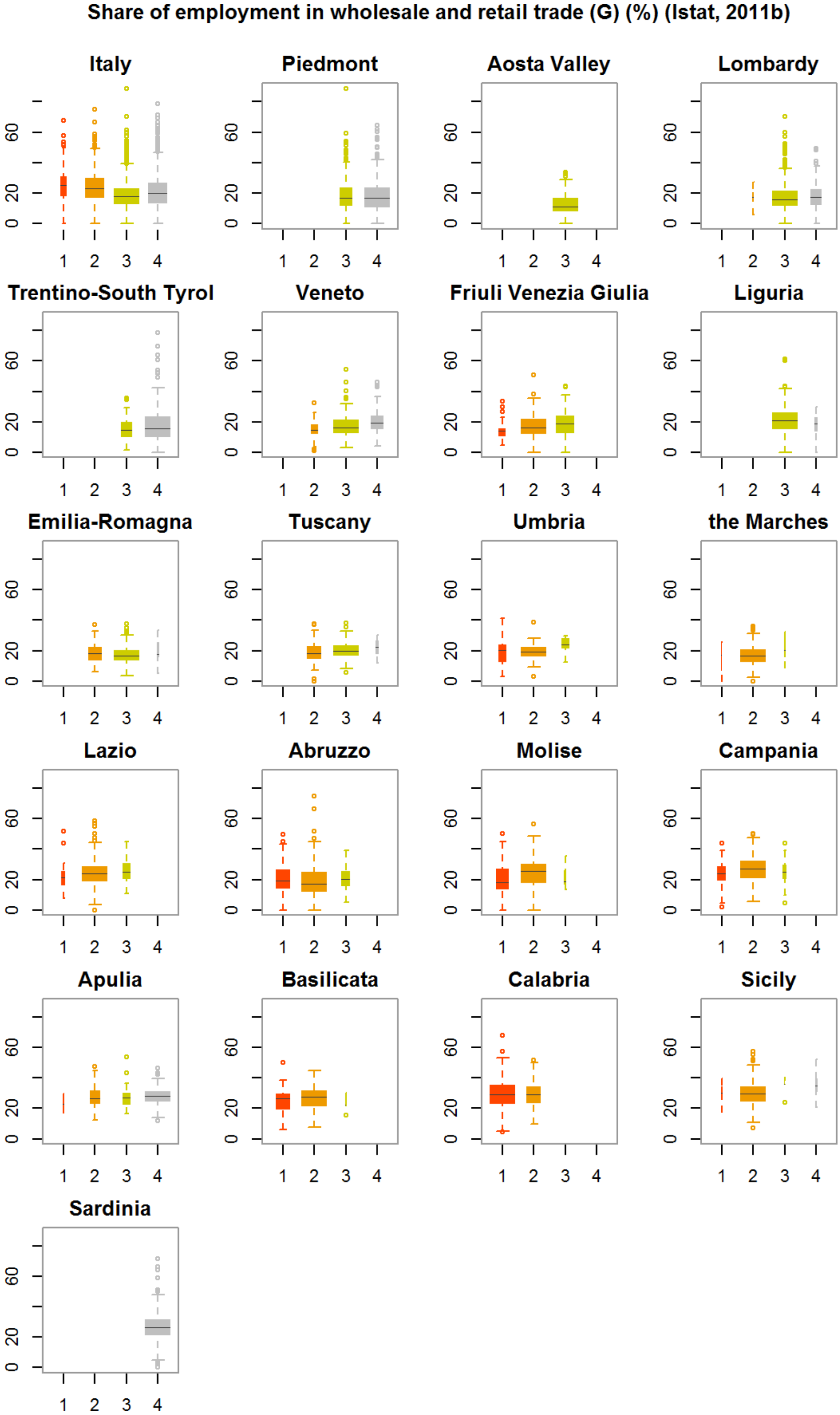
Source: authors' elaboration on Istat (2011b) data

Figure A.19 Share of employment in construction (division F) (%) (year 2011)



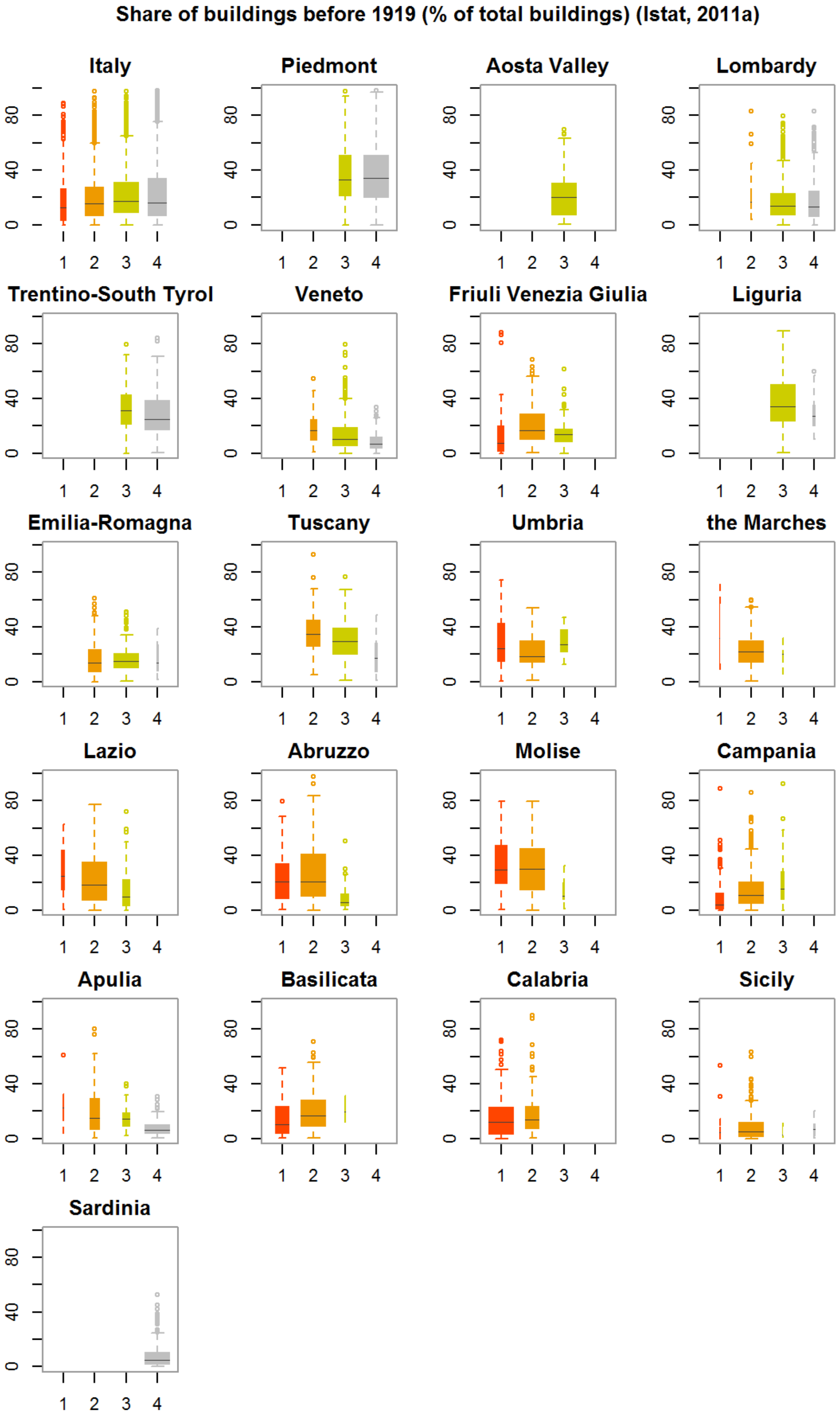
Source: authors' elaboration on Istat (2011b) data

Figure A.20 Share of employment in wholesale and retail trade; repair of motor vehicles and motorcycles. (division G) (%) (year 2011)



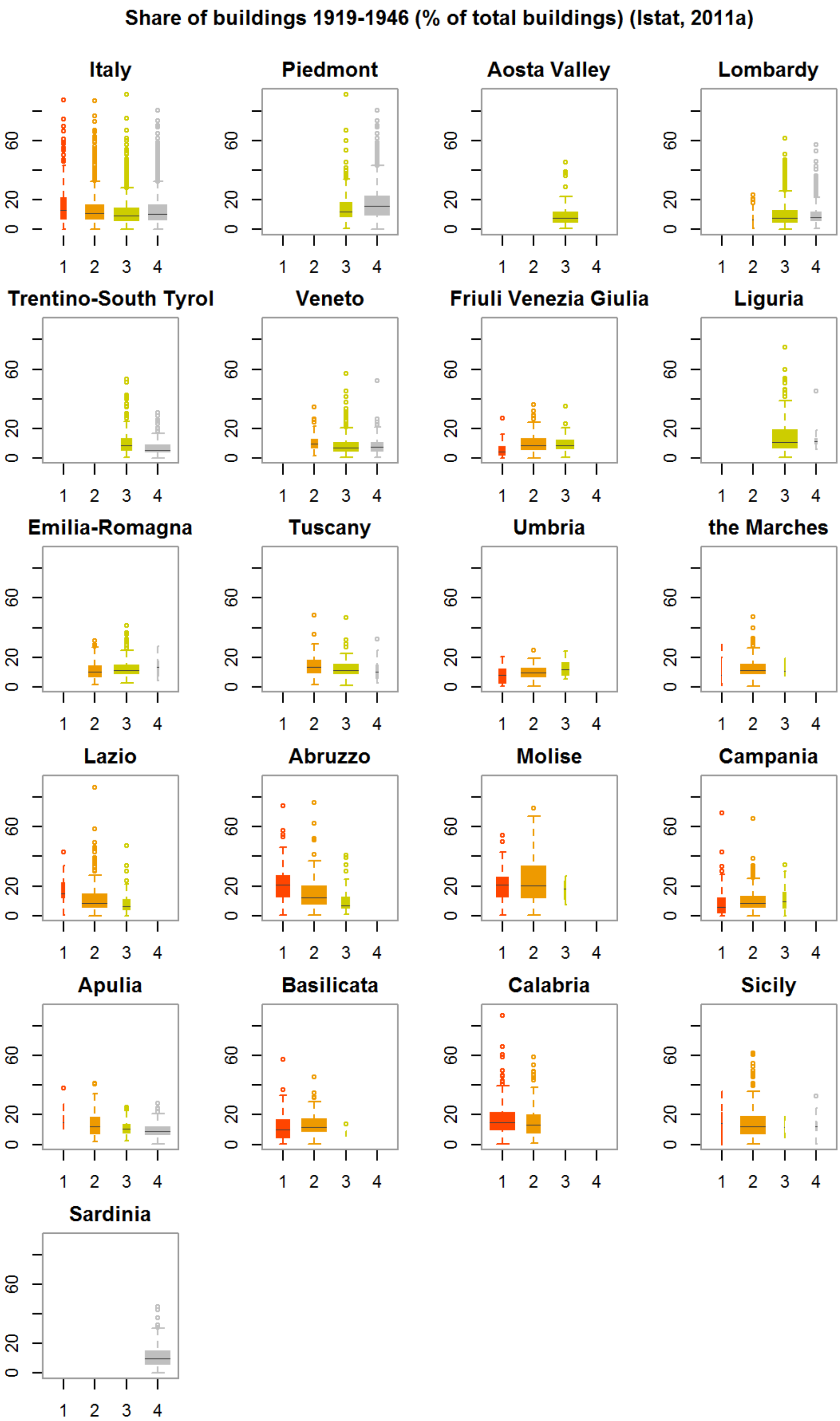
Source: authors' elaboration on Istat (2011b) data

Figure A.21 Buildings erected before 1919 (%) (year 2011)



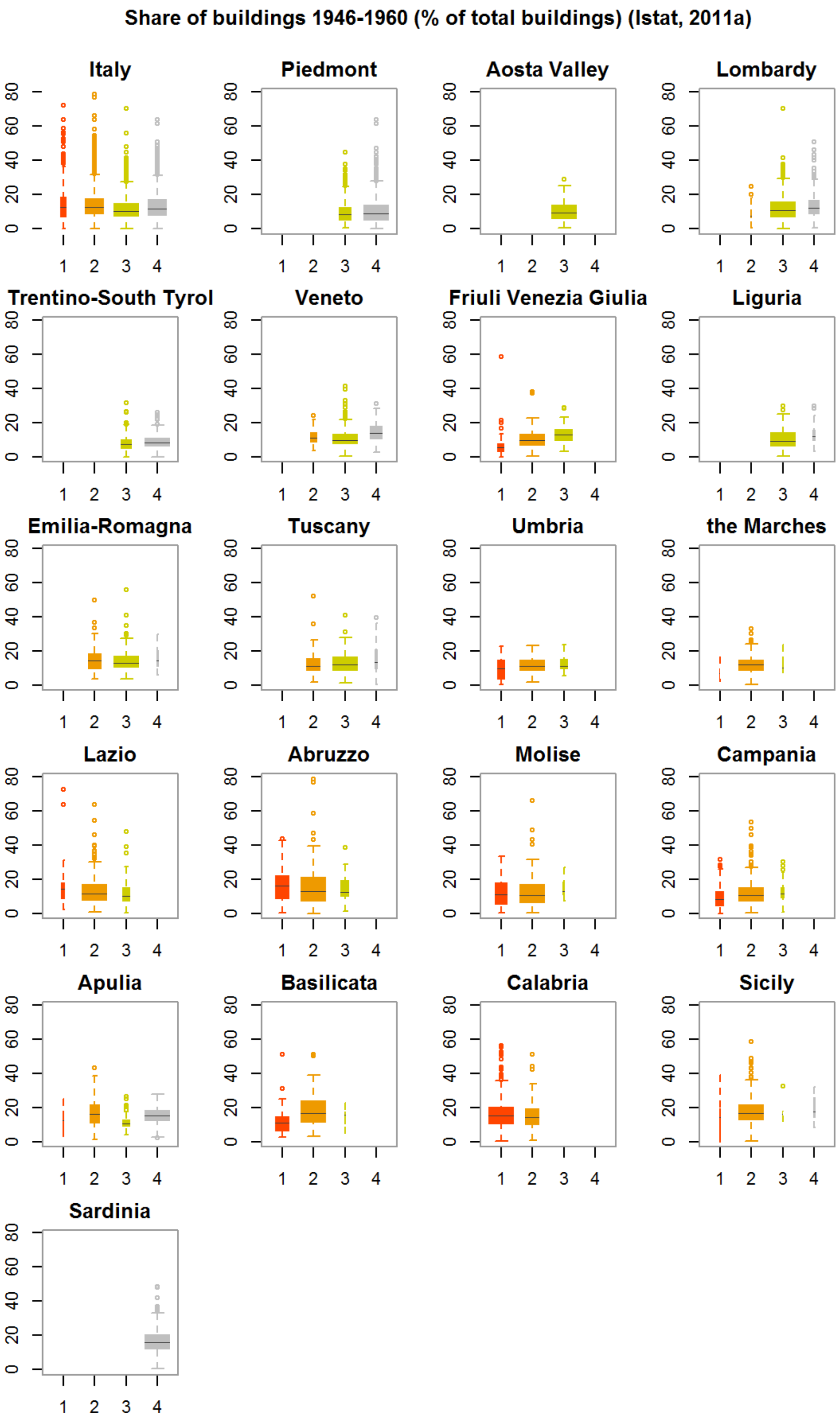
Source: authors' elaboration on Istat (2011a) data

Figure A.22 Buildings 1919-1946 (%) (year 2011)



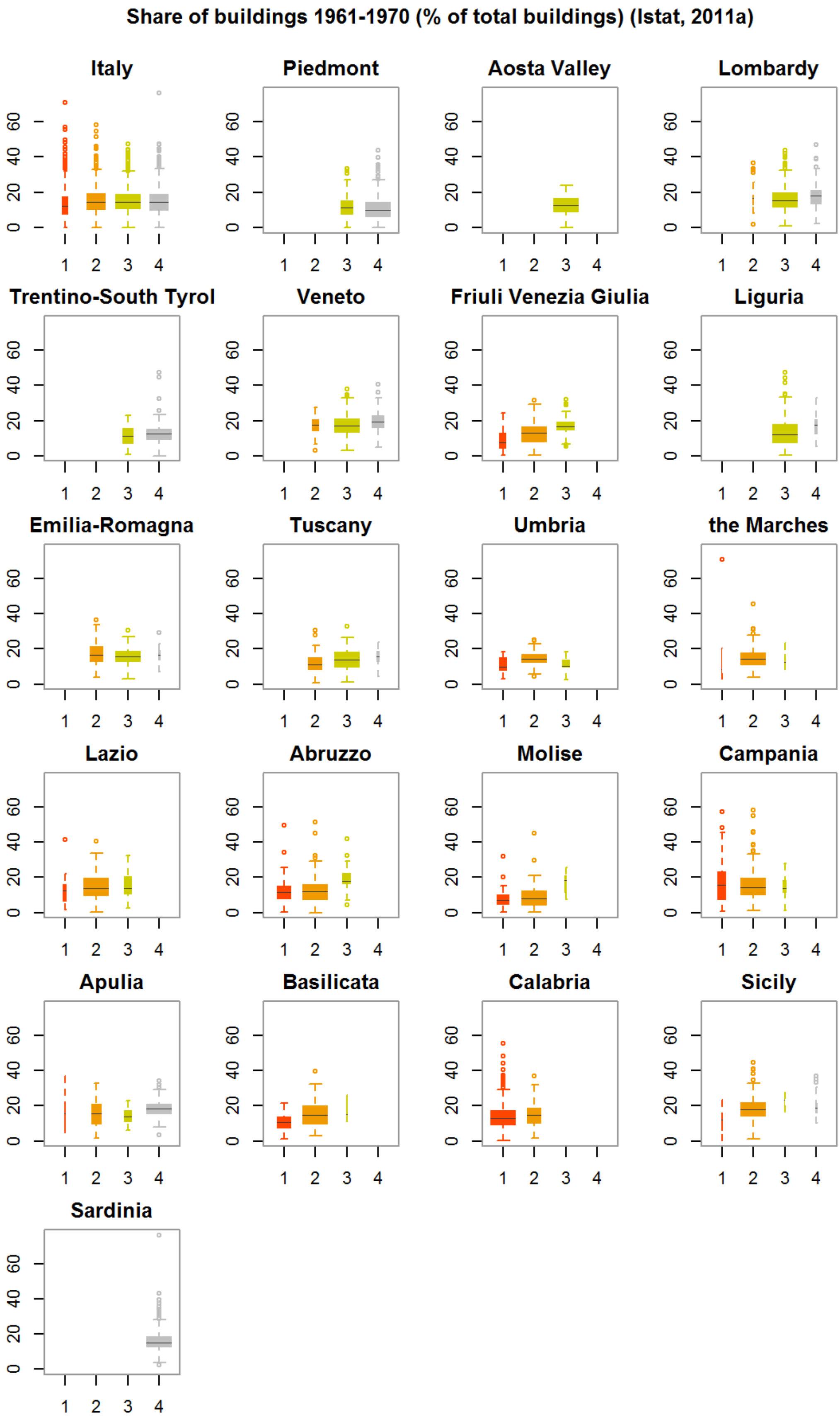
Source: authors’ elaboration on Istat (2011a) data

Figure A.23 Buildings 1946-1960 (%) (year 2011)



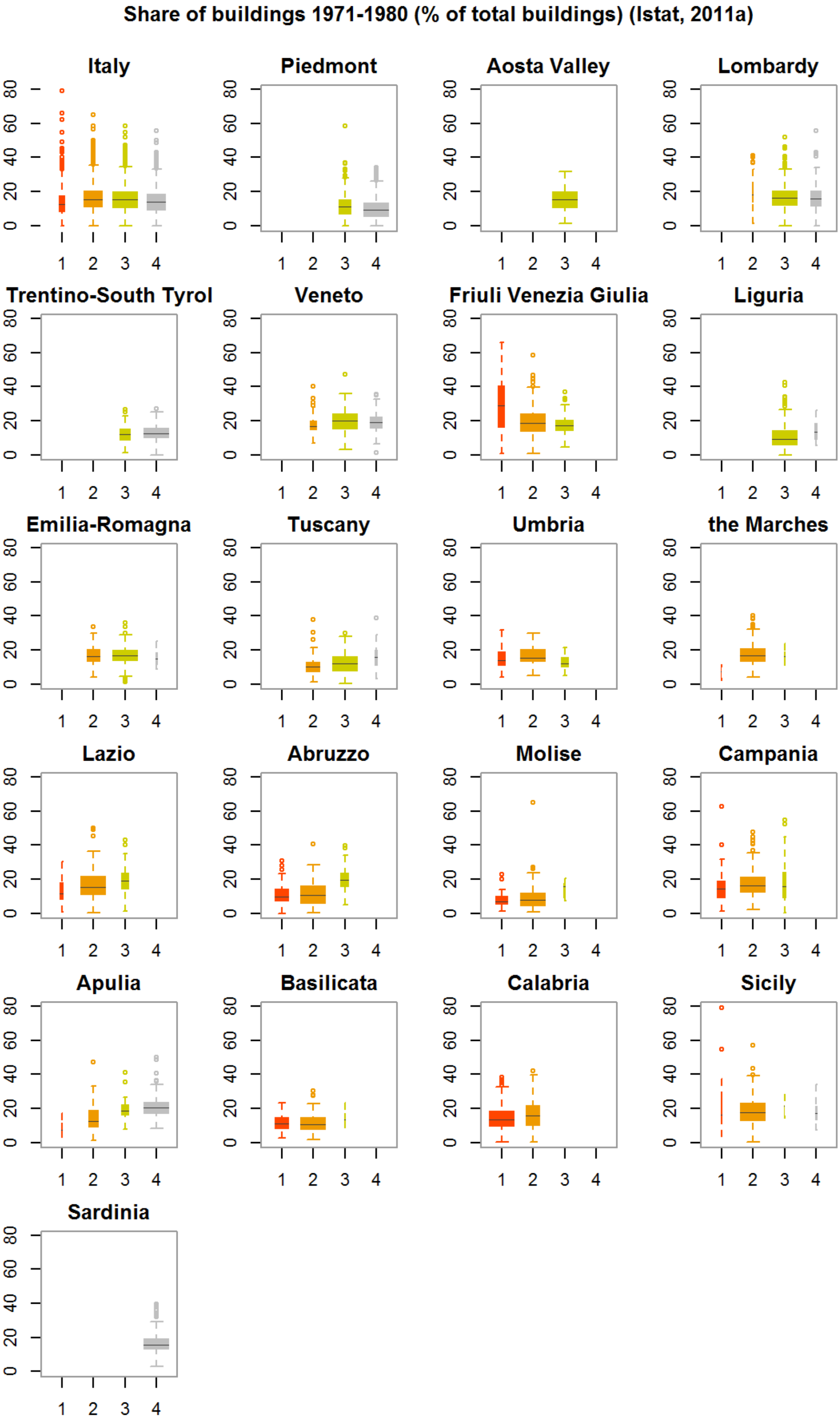
Source: authors' elaboration on Istat (2011a) data

Figure A.24 Buildings 1961-1970 (%) (year 2011)



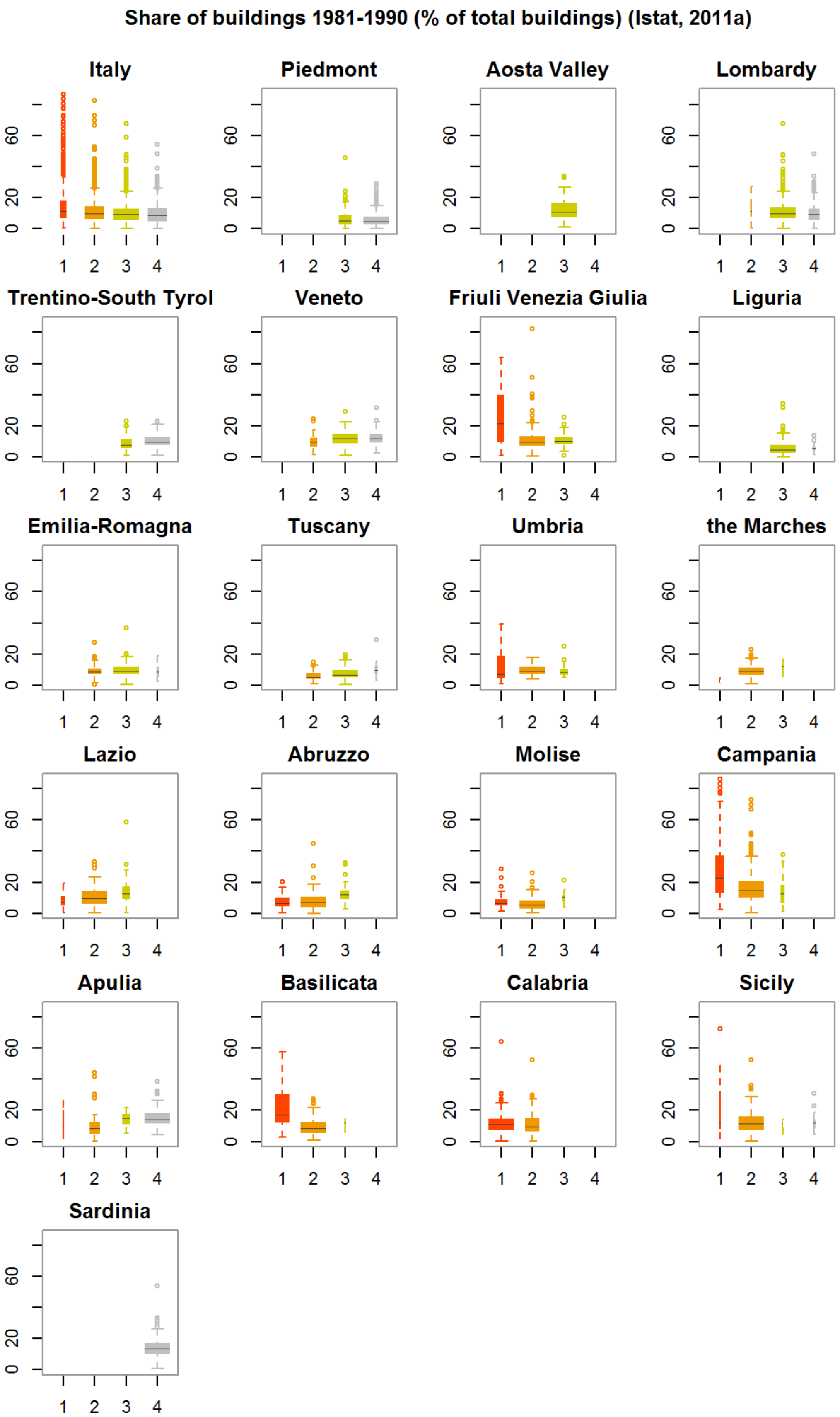
Source: authors' elaboration on Istat (2011a) data

Figure A.25 Buildings 1971-1980 (%) (year 2011)



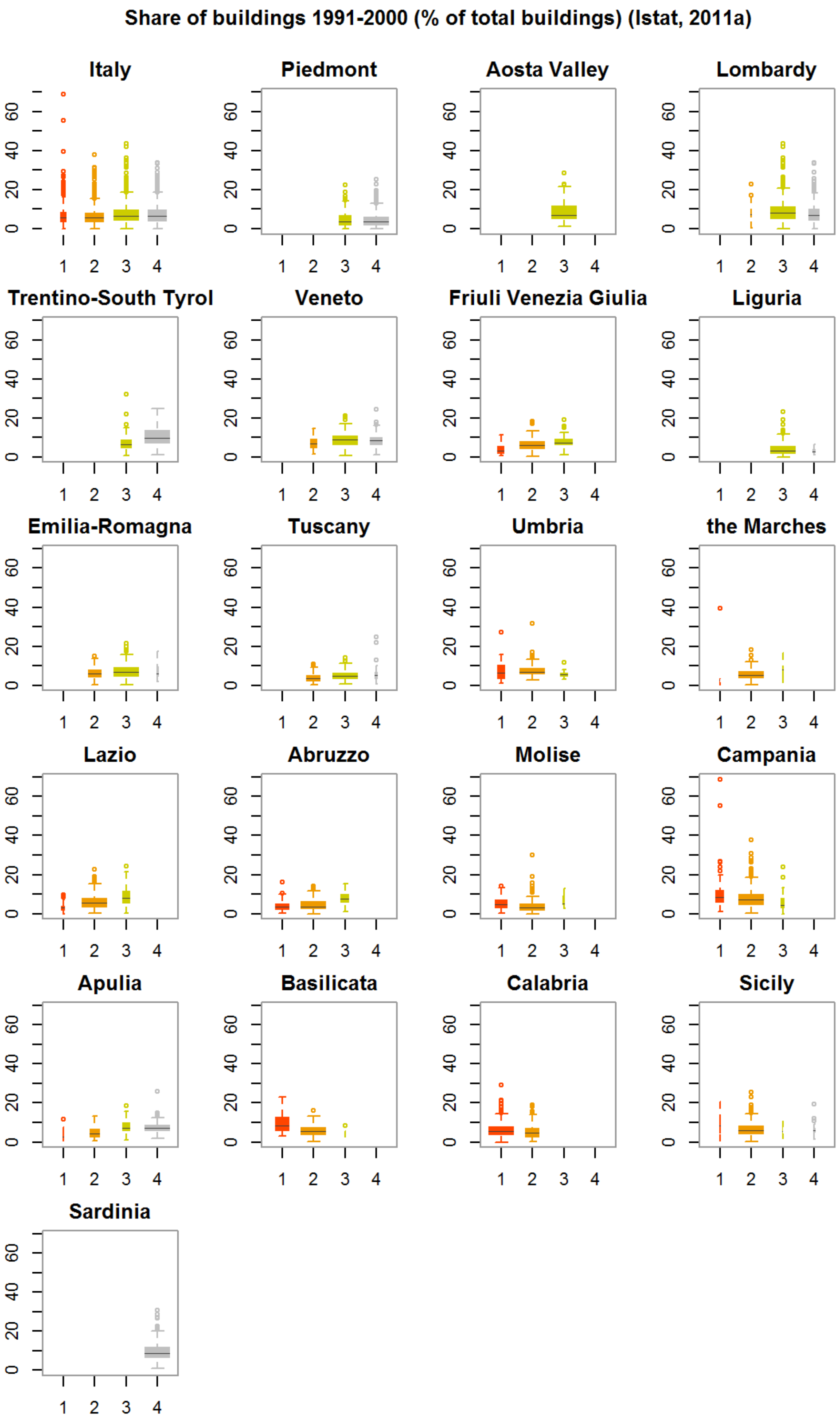
Source: authors' elaboration on Istat (2011a) data

Figure A.26 Buildings 1981-1990 (%) (year 2011)



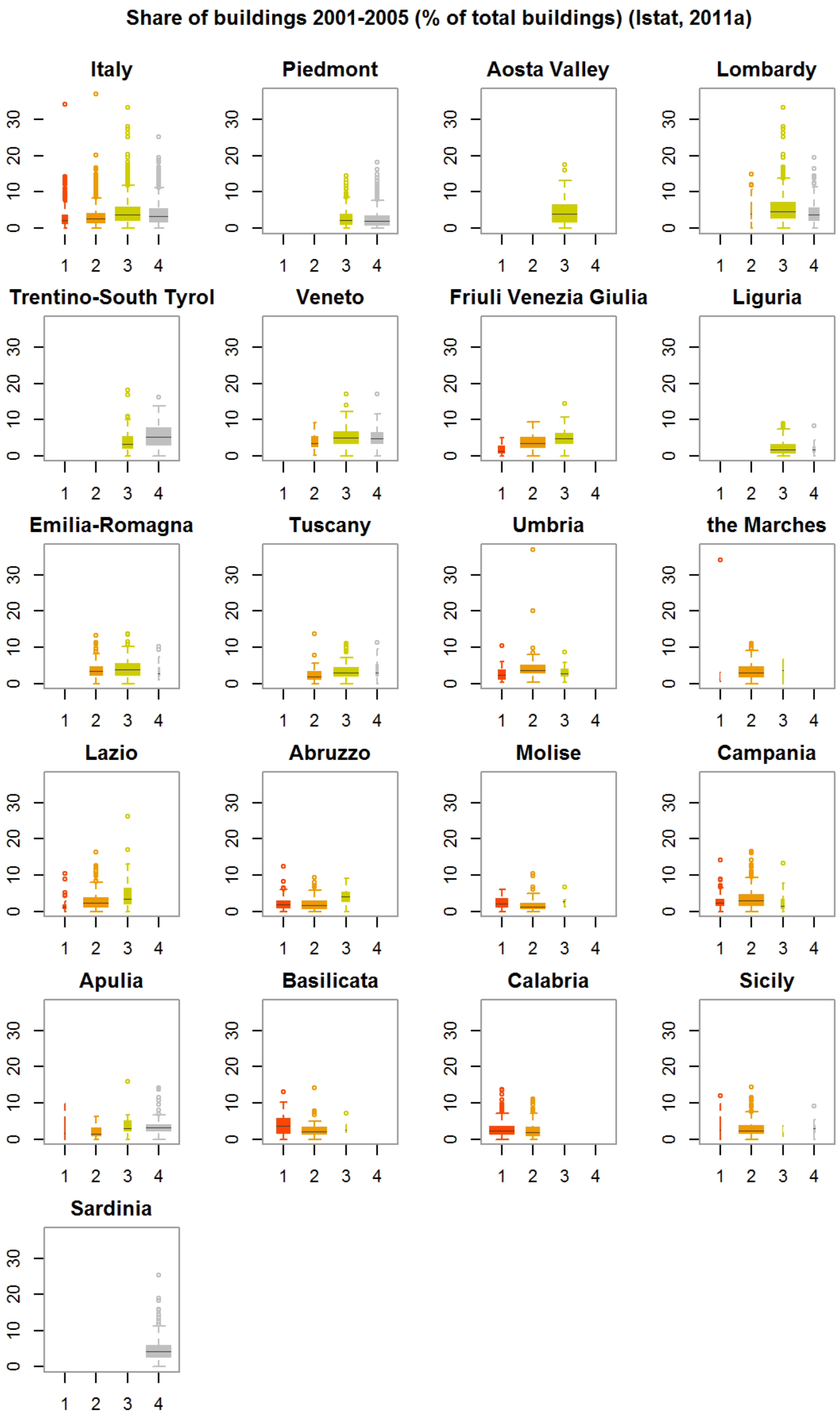
Source: authors' elaboration on Istat (2011a) data

Figure A.27 Buildings 1991-2000 (%) (year 2011)



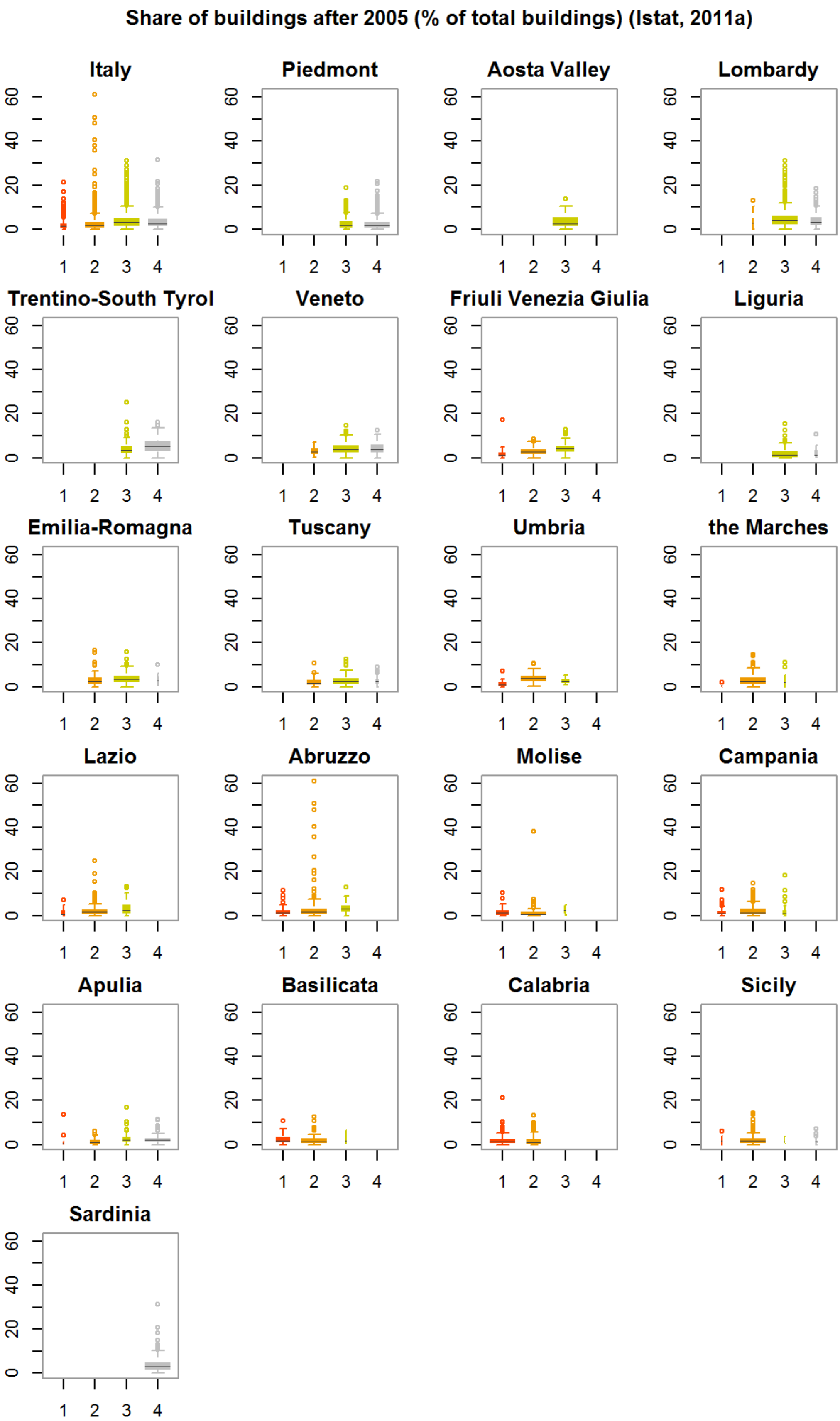
Source: authors' elaboration on Istat (2011a) data

Figure A.28 Buildings 2001-2005 (%) (year 2011)



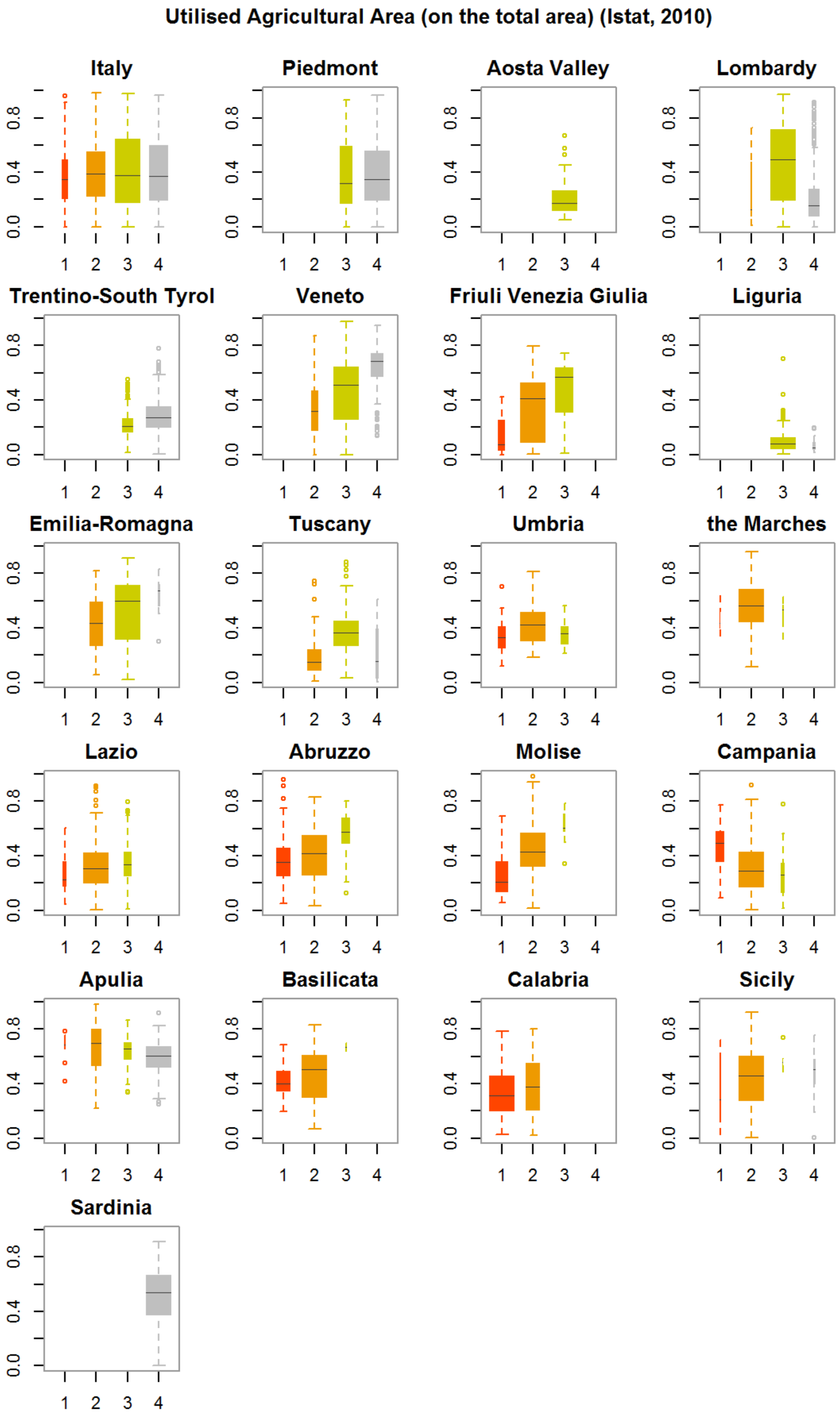
Source: authors' elaboration on Istat (2011a) data

Figure A.29 Buildings after 2006 (%) (year 2011)



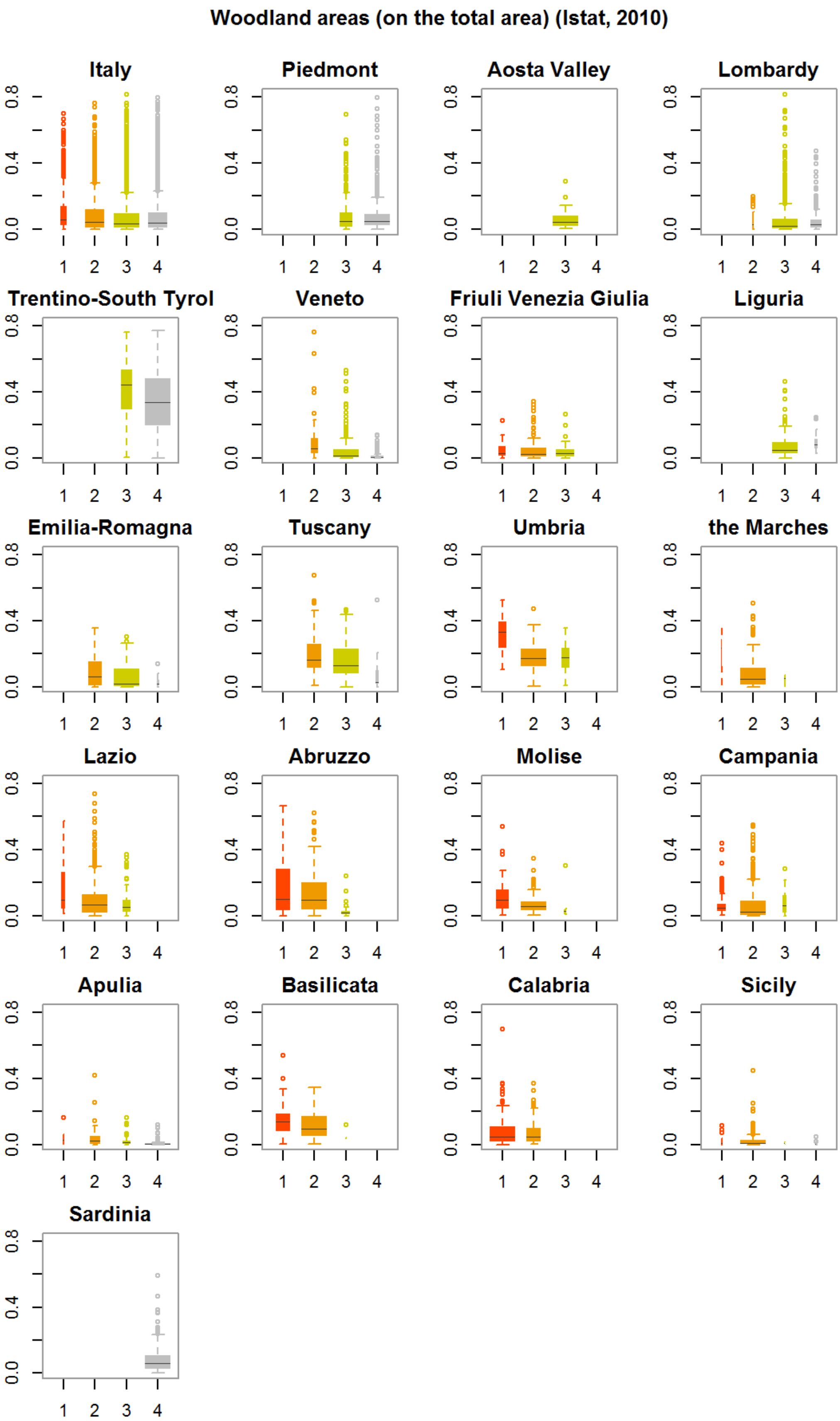
Source: authors’ elaboration on Istat (2011a) data

Figure A.30 Utilised Agricultural Area (share on the total municipality area) (year 2010)



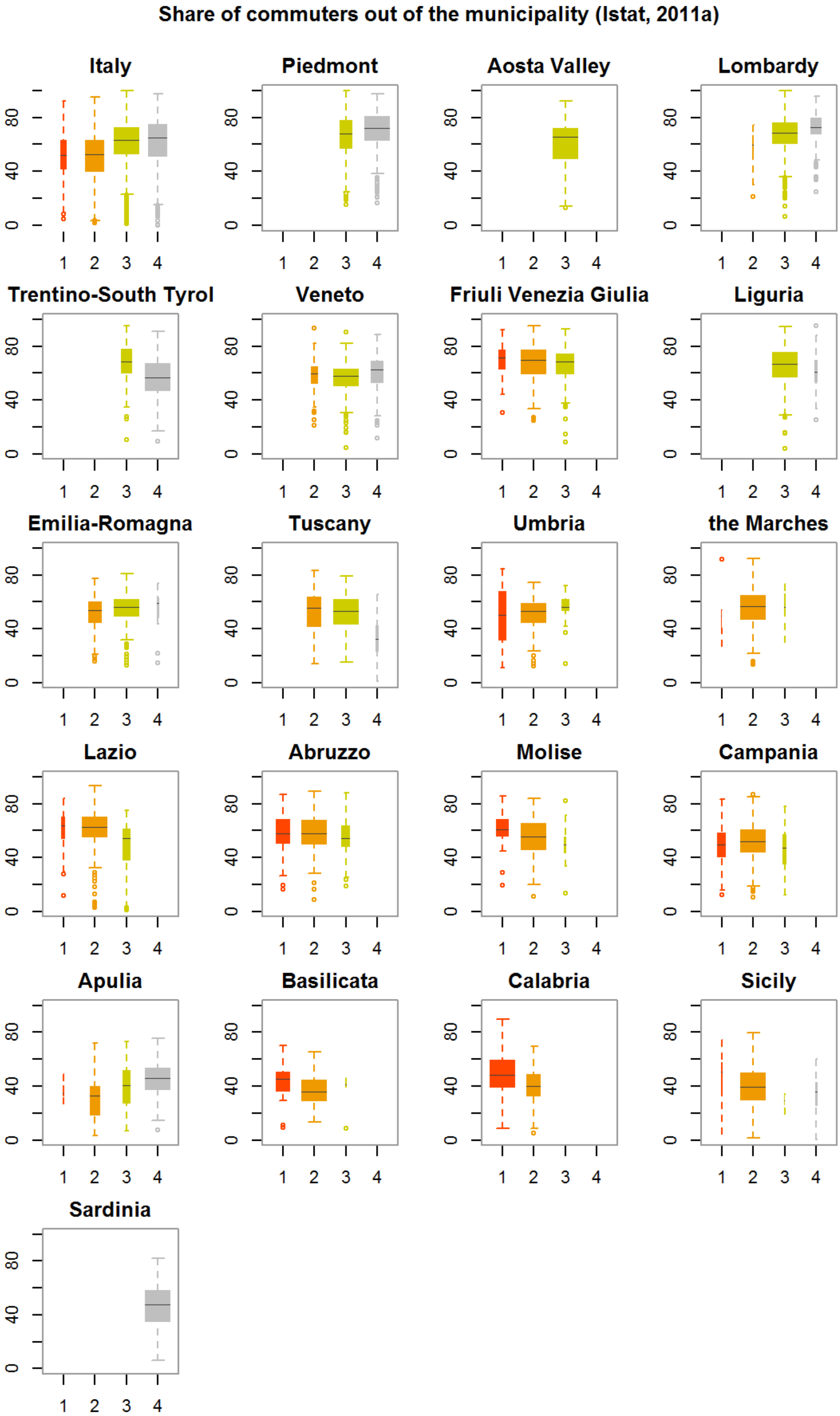
Source: authors' elaboration on Istat (2010) data

Figure A.31 Woodland areas (share on the total municipality area) (year 2010)



Source: authors' elaboration on Istat (2010) data

Figure A.32 Woodland areas (share on the total municipality area) (year 2011)



Source: authors' elaboration on Istat (2010) data

Annex 4: Industrial districts

Table A.2 Industrial districts: number of municipalities, population and employment by seismic zone

Industrial district name	1st Specialisation	NUTS 2 Region of the District's Capital City	NUTS 3 Region of the District's	Number of Municipalities (by					Population (by seismic zone)					Employment (by seismic zone)				
				Total	#1	#2	#3	#4	Total	#1	#2	#3	#4	Total	#1	#2	#3	#4
Adria	Textile & clothing	Veneto	RO	12				12	91853				91853	26933				26933
Albino	Textile & clothing	Lombardy	BG	16			16		73385			73385		23224			23224	
Arezzo	Jewellery & musical instruments	Tuscany	AR	6		3	3		129943		109871	20072		45323		38342	6981	
Ariano Irpino	Food Industry	Campania	AV	24	21	3			81033	78683	2350			14435	14214	221		
Arzignano	Leather & foot-wear	Veneto	VI	15		1	14		98670		1452	97218		44493		278	44215	
Ascoli Piceno	Textile & clothing	the Marches	AP	19		19			120247		120247			31655		31655		
Asola	Textile & clothing	Lombardy	MN	15			15		35028			35028		8932			8932	
Badia Polesine	Textile & clothing	Veneto	RO	16			3	13	48203			5592	42611	12600			895	11705
Barletta	Textile & clothing	Apulia	BT	5		3	2		292748		136854	155894		55715		25673	30042	
Bassano del Grappa	Household goods	Veneto	VI	27		8	19		188465		51435	137030		66308		16763	49545	
Battipaglia	Chemicals & plastics	Campania	SA	5		5			85743		85743			17235		17235		
Bergamo	Mechanicals	Lombardy	BG	123			123		802731			802731		289804			289804	
Bibbiena	Household goods	Tuscany	AR	11		11			36044		36044			10380		10380		
Borgo San Lorenzo	Leather & foot-wear	Tuscany	FI	7		7			55301		55301			14771		14771		
Borgo Valsugana	Household goods	Trentino-South Tyrol	TN	22			22		34659			34659		8871			8871	
Borgomanero	Mechanicals	Piedmont	NO	42				42	122463				122463	39903				39903
Breno	Metallurgy	Lombardy	BS	21			21		42730			42730		12127			12127	
Brescia	Mechanicals	Lombardy	BS	37		8	29		445346		258400	186946		173088		106648	66440	
Buccino	Food Industry	Campania	SA	11	7	4			26441	15353	11088			4064	2508	1556		
Busto Arsizio	Textile & clothing	Lombardy	VA	53				53	623023				623023	201807				201807
Cagli	Textile & clothing	the Marches	PU	7		7			22434		22434			5253		5253		
Cairo Montenotte	Mechanicals	Liguria	SV	25			5	20	43923			4317	39606	12980			735	12245
Canelli	Mechanicals	Piedmont	AT	17				17	25256				25256	7489				7489
Carpi	Textile & clothing	Emilia-Romagna	MO	3			3		93301			93301		28949			28949	
Casalmaggiore	Household goods	Lombardy	CR	19			19		44822			44822		11727			11727	
Casarano	Leather & foot-wear	Apulia	LE	7				7	74874				74874	15056				15056
Castel Goffredo	Textile & clothing	Lombardy	MN	6			6		24783			24783		10004			10004	
Castel San Giovanni	Metallurgy	Emilia-Romagna	PC	13			6	7	38134			6491	31643	9756			1239	8517
Castelfiorentino	Leather & foot-wear	Tuscany	FI	4			4		42100			42100		11360			11360	
Castelfranco Veneto	Mechanicals	Veneto	TV	8		2	6		102159		19955	82204		37139		6042	31097	
Cerea	Household goods	Veneto	VR	8			1	7	46776			2205	44571	14244			496	13748
Città di Castello	Paper & Polygraphs	Umbria	PG	4		4			56075		56075			16255		16255		
Cittadella	Textile & clothing	Veneto	PD	14			14		116130			116130		44707			44707	
Cividale del Friuli	Household goods	Friuli-Venezia Giulia	UD	18	2	15	1		46031	1515	43896	620		15011	131	14654	226	
Civita Castellana	Household goods	Lazio	VT	16		6	10		68759		28603	40156		13793		6767	7026	
Civitanova Marche	Leather & foot-wear	the Marches	MC	4		4			73265		73265			26314		26314		
Clusone	Chemicals & plastics	Lombardy	BG	20			20		39453			39453		11157			11157	
Como	Textile & clothing	Lombardy	CO	99				99	535951				535951	169689				169689
Conegliano	Mechanicals	Veneto	TV	9		7	2		99446		82770	16676		37158		30902	6256	
Corato	Food Industry	Apulia	BA	2			2		73734			73734		13720			13720	
Cremona	Food Industry	Lombardy	CR	38			36	2	142417			131405	11012	40829			38129	2700
Darfo Boario Terme	Mechanicals	Lombardy	BS	25			25		82516			82516		28725			28725	
Desenzano del Garda	Mechanicals	Lombardy	BS	8		8			85380		85380			29696		29696		
Empoli	Textile & clothing	Tuscany	FI	6			6		105156			105156		35158			35158	

Industrial district name	1st Specialisation	NUTS 2 Region of the District's Capital City	NUTS 3 Region of the District's	Number of Municipalities (by					Population (by seismic zone)					Employment (by seismic zone)				
				Total	#1	#2	#3	#4	Total	#1	#2	#3	#4	Total	#1	#2	#3	#4
Faenza	Mechanicals	Emilia-Romagna	RA	7		7			91178		91178			27697		27697		
Fano	Household goods	the Marches	PU	12		12			105017		105017			34297		34297		
Feltre	Mechanicals	Veneto	BL	9		6	3		44982		37957	7025		10918		9984	934	
Fermo	Leather & foot-wear	the Marches	FM	12		7	5		77358		67622	9736		22573		20121	2452	
Fiorenzuola d'Arda	Mechanicals	Emilia-Romagna	PC	12			12		54193			54193		16046			16046	
Firenzuola	Mechanicals	Tuscany	FI	2		2			6016		6016			1637		1637		
Fonni	Food Industry	Sardinia	NU	2				2	4420				4420	663				663
Forlì	Household goods	Emilia-Romagna	FC	9		9			167675		167675			57196		57196		
Gioia del Colle	Food Industry	Apulia	BA	2			2		34604			34604		6053			6053	
Giulianova	Food Industry	Abruzzo	TE	5			5		67881			67881		18142			18142	
Grumello del Monte	Chemicals & plastics	Lombardy	BG	21			21		82045			82045		31452			31452	
Guastalla	Mechanicals	Emilia-Romagna	RE	4			3	1	39811			30642	9169	14138			10990	3148
Isola della Scala	Household goods	Veneto	VR	9			3	6	52610			13966	38644	15962			5441	10521
Langhirano	Food Industry	Emilia-Romagna	PR	7		2	5		24494		2150	22344		7434		407	7027	
Lecco	Mechanicals	Lombardy	LC	85			69	16	325312			307309	18003	105800			101190	4610
Legnago	Mechanicals	Veneto	VR	10				10	51889				51889	17675				17675
Lucca	Paper & Polygraphs	Tuscany	LU	5		1	4		148801		3645	145156		51203		989	50214	
Lugo	Food Industry	Emilia-Romagna	RA	9		9			121906		121906			33523		33523		
Lumezzane	Mechanicals	Lombardy	BS	14			14		77033			77033		24124			24124	
Macerata	Leather & foot-wear	the Marches	MC	12		12			111305		111305			34213		34213		
Macomer	Textile & clothing	Sardinia	NU	11				11	25492				25492	4926				4926
Manerbio	Metallurgy	Lombardy	BS	14			14		71646			71646		20534			20534	
Martina Franca	Textile & clothing	Apulia	TA	3				3	74094				74094	17644				17644
Martinsicuro	Textile & clothing	Abruzzo	TE	9		4	5		60477		13905	46572		20806		5296	15510	
Matelica	Textile & clothing	the Marches	MC	15	2	13			31727	2014	29713			7605	524	7081		
Minervino Murge	Textile & clothing	Apulia	BT	2		2			16088		16088			2135		2135		
Mirandola	Mechanicals	Emilia-Romagna	MO	9			9		85818			85818		28395			28395	
Monselice	Mechanicals	Veneto	PD	23				23	100651				100651	29647				29647
Montagnana	Household goods	Veneto	PD	8				8	28262				28262	8172				8172
Montebelluna	Leather & foot-wear	Veneto	TV	9		6	3		91948		66194	25754		32605		24934	7671	
Montecatini-Terme	Leather & foot-wear	Tuscany	PT	13		1	12		135570		1700	133870		40307		445	39862	
Montegiorgio	Leather & foot-wear	the Marches	FM	20		20			35888		35888			11908		11908		
Montegranaro	Leather & foot-wear	the Marches	FM	2		2			21224		21224			8508		8508		
Montesarchio	Textile & clothing	Campania	BN	14		14			69239		69239			11462		11462		
Montichiari	Mechanicals	Lombardy	BS	9		2	7		82587		42055	40532		25318		12877	12441	
Morbegno	Mechanicals	Lombardy	SO	36			15	21	60365			35022	25343	18932			9445	9487
Nizza Monferrato	Mechanicals	Piedmont	AT	19			3	16	26578			1644	24934	6491			253	6238
Novafeltria	Mechanicals	Emilia-Romagna	RN	8		8			18993		18993			4596		4596		
Novara	Chemicals & plastics	Piedmont	NO	33				33	212983				212983	61116				61116
Noventa Vicentina	Textile & clothing	Veneto	VI	16			8	8	48980			22959	26021	15364			7988	7376
Oderzo	Household goods	Veneto	TV	12			12		77911			77911		30759			30759	
Omegna	Mechanicals	Piedmont	VB	18				18	42679				42679	12174				12174
Ortona	Food Industry	Abruzzo	CH	6		4	2		33956		6460	27496		8151		1405	6746	
Orzinuovi	Textile & clothing	Lombardy	BS	20			20		69657			69657		20695			20695	
Osimo	Textile & clothing	the Marches	AN	3		3			45493		45493			15553		15553		

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				Total	#1	#2	#3	#4	Total	#1	#2	#3	#4	Total	#1	#2	#3	#4
Padova	Mechanicals	Veneto	PD	52			11	41	664591			99184	565407	242931			38865	204066
Pavullo nel Frignano	Household goods	Emilia-Romagna	MO	4			4		29798			29798		8258			8258	
Pergola	Mechanicals	the Marches	PU	11		11			31981		31981			9100		9100		
Pesaro	Household goods	the Marches	PU	8		8			128485		128485			46093		46093		
Piancastagnaio	Leather & foot-w ear	Tuscany	SI	4		3	1		14337		11884	2453		4321		3880	441	
Pieve di Cadore	Mechanicals	Veneto	BL	9		1	8		15125		423	14702		3832		67	3765	
Pieve di Soligo	Household goods	Veneto	TV	9		9			45802		45802			15406		15406		
Pistoia	Textile & clothing	Tuscany	PT	4		2	2		129197		92302	36895		35064		24668	10396	
Poggibonsi	Household goods	Tuscany	SI	8			8		77591			77591		26064			26064	
Poggio Rusco	Textile & clothing	Lombardy	MN	13			13		34365			34365		8254			8254	
Porto Sant'Elpidio	Leather & foot-w ear	the Marches	FM	2		2			42292		42292			15420		15420		
Portogruaro	Household goods	Veneto	VE	11			10	1	87189			75396	11793	24410			20685	3725
Prato	Textile & clothing	Tuscany	PO	9		5	4		273390		47525	225865		99922		17469	82453	
Putignano	Textile & clothing	Apulia	BA	3			2	1	65708			46368	19340	17600			12989	4611
Recanati	Jew ellery & musical instruments	the Marches	MC	8		8			78874		78874			27504		27504		
Reggio nell'Emilia	Mechanicals	Emilia-Romagna	RE	19		1	18		327534		3377	324157		121600		1106	120494	
Rivarolo Canavese	Mechanicals	Piedmont	TO	49			3	46	90234			1929	88305	24065			346	23719
Rovigo	Mechanicals	Veneto	RO	16				16	87339				87339	27115				27115
Salò	Mechanicals	Lombardy	BS	21		21			96773		96773			26760		26760		
San Bonifacio	Mechanicals	Veneto	VR	26		4	20	2	142963		10758	128100	4105	43731		2414	40344	973
San Donà di Piave	Mechanicals	Veneto	VE	9			9		86255			86255		26434			26434	
San Giorgio di Nogaro	Household goods	Friuli-Venezia Giulia	UD	23			23		84909			84909		22509			22509	
San Marco dei Cavoti	Textile & clothing	Campania	BN	5	5				11599	11599				1898	1898			
San Miniato	Leather & foot-w ear	Tuscany	PI	6			6		101349			101349		35145			35145	
Sannazzaro de' Burgondi	Chemicals & plastics	Lombardy	PV	24			18	6	52974			46695	6279	13179			12312	867
Sansepolcro	Textile & clothing	Tuscany	AR	5		5			28308		28308			8284		8284		
Sassocorvaro	Household goods	the Marches	PU	14		14			19620		19620			5786		5786		
Schio	Mechanicals	Veneto	VI	18			18		106036			106036		33330			33330	
Senigallia	Textile & clothing	the Marches	AN	9		9			81795		81795			23926		23926		
Sinalunga	Household goods	Tuscany	SI	6		2	4		37557		12770	24787		10964		4151	6813	
Solofra	Leather & foot-w ear	Campania	AV	3		3			31875		31875			7041		7041		
Storo	Household goods	Trentino-South Tyrol	TN	12			12		14483			14483		4162			4162	
Stradella	Food Industry	Lombardy	PV	34			34		47923			47923		11076			11076	
Suzzara	Mechanicals	Lombardy	MN	6			6		53090			53090		13815			13815	
Tempio Pausania	Household goods	Sardinia	OT	5				5	23266				23266	4980				4980
Teramo	Textile & clothing	Abruzzo	TE	21		19	2		110994		96475	14519		28318		23590	4728	
Thiesi	Food Industry	Sardinia	SS	16				16	17712				17712	2166				2166
Todi	Food Industry	Umbria	PG	7		7			37854		37854			9690		9690		
Tolentino	Leather & foot-w ear	the Marches	MC	11		11			36400		36400			10948		10948		
Treviso	Textile & clothing	Veneto	TV	21			21		297510			297510		104116			104116	
Umbertide	Food Industry	Umbria	PG	3		3			20326		20326			6533		6533		
Urbania	Textile & clothing	the Marches	PU	5		5			13999		13999			4266		4266		
Urbino	Household goods	the Marches	PU	4		4			29630		29630			8981		8981		
Valdobbiadene	Mechanicals	Veneto	TV	12		12			47536		47536			15763		15763		
Valenza	Jew ellery & musical instruments	Piedmont	AL	13			5	8	33363			3646	29717	10728			430	10298
Vestone	Metallurgy	Lombardy	BS	18		11	7		25162		19000	6162		9312		6955	2357	
Viadana	Household goods	Lombardy	MN	6			6		33129			33129		12197			12197	
Vicenza	Jew ellery & musical instruments	Veneto	VI	23			23		264546			264546		97174			97174	
Vigevano	Leather & foot-w ear	Lombardy	PV	28			3	25	159548			70923	88625	40397			19520	20877
Vignola	Mechanicals	Emilia-Romagna	MO	10		1	9		87302		11012	76290		30662		4878	25784	
Villafranca di Verona	Food Industry	Veneto	VR	7			4	3	88624			68726	19898	29506			22844	6662
Vilminore di Scalve	Mechanicals	Lombardy	BG	4			4		4311			4311		1248			1248	
			Italy	**2121**	**37**	**452**	**1007**	**625**	**13326320**	**109164**	**3439662**	**6490261**	**3287233**	**4214370**	**19275**	**1056348**	**2125499**	**1013248**