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Identification of Metropolitan Areas in Spain and Italy

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Metropolitan areas concentrate the main share of population, production and consumption in OECD countries. They are likely to be the most important units for economic, social and environmental analysis as well as for the development of policy strategies. However, one of the main problems that occur when adopting metropolitan areas as units of analysis and policy in European countries is the absence of widely accepted standards for identifying them. This severe problem appeared when we tried to perform comparative research between Spain and Italy using metropolitan areas as units of analysis. The aim of this paper is to identify metropolitan areas in Spain and Italy using similar methodologies. The results allow comparing the metropolitan realities of both countries as well as providing the metropolitan units that can be used in subsequent comparative researches. Two methodologies are proposed: the Cheshire-GEMACA methodology (FUR) and an iterative version of the USA-MSA algorithm, particularly adapted to deal with polycentric metropolitan areas (DMA). Both methods show a good approximation to the metropolitan reality and produce very similar results: 75 FUR and 67 DMA in Spain (75% of total population and employment), and 81 FUR and 86 DMA in Italy (70% of total population and employment).

Keywords: metropolitan areas, polycentricism, commuting

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1. Introduction

Metropolitan areas concentrate the main share of population, production and consumption in OECD countries. They are likely to be the most important units for economic, social and environmental analysis as well as for the development of policy strategies.

The metropolitan area does not fit well with the administrative boundaries. Metropolitan areas change over the space and time reflecting the evolution of the economy and society. Its assimilation with the administrative city, region or province usually introduces severe drawbacks when the metropolitan area is only a part of this territorial unit or when it considerably exceeds the administrative boundaries[1].

Unfortunately, the discussion about the boundaries of the metropolitan area does not restrict to the accuracy of the indicators but rather affects the welfare of the residents when the definition of metropolitan area is transformed in policies affecting the basic pillars of competitiveness, social cohesion, environment and quality of life, and governance.

A second issue arises from the fact that the comparison between the metropolitan units identified in different countries is difficult as countries use different methodologies and in several countries no definition of metropolitan units has been carried out at all.

[1] An example of the first problem is the assimilation of the metropolitan area of Barcelona to the province: province data averages the results of the indicators and dissolves some of the potentialities and problems of the real metropolitan area. On the other hand, Milan and Madrid constitutes an example of the second case, where the limitations of data force the use of the province, too small to capture the real extension of both areas. In this case, the areas have expanded out of the administrative boundaries and we could erroneously conclude that there is a reduced presence of some activities or maybe their disappearance if they moved out of the administrative limits.

International institutions, more than others, have tried to find general methodologies to map metropolitan areas (OECD 2006; ÖIR, 2006) although it represents a difficult aim due to the existence of different territorial structures across countries.

This severe problem appeared when we tried to perform comparative research between Spain and Italy, using metropolitan areas as units of analysis: any official definition of metropolitan area was available and the few available approximations made by researches or institutions, when conceptually feasible, where not comparable. On the basis of these problems, the aim of the paper is to identify metropolitan areas in Spain and Italy using similar methodologies. The identified metropolitan units have three basic purposes. The first one is, to provide a general view of the characteristics of each country's metropolitan reality. The second is the comparison of the metropolitan processes of both countries. The third one is the identification of metropolitan units that can be used in subsequent analysis. This has been done centring on two functional approaches to the concept of metropolitan area. First, a general methodology applicable to most of the UE countries is used; in this case, the Functional Urban Area (FUR) methodology as proposed by GEMACA (1996). Second, the use of a native methodology specifically designed to deal with the specific characteristics of Spain and Italy, two very similar countries in terms of social, economic and territorial structures.

The research proposes two contributions. Firstly, there is a lack of detailed empirical comparative studies on the identification of metropolitan areas in different countries using similar methodologies. Second, the lack of official definitions as well as the scarcity of studies in Spain and Italy to identify metropolitan areas is perceived as a severe drawback that dissuades from the use of metropolitan areas as units of analysis in

both countries. This paper provides two sets of metropolitan areas, identified using rigorous approaches and replicable standards that can be used for other researchers in subsequent investigations.

The paper is structured as follows. The second section discusses the approaches used to identify metropolitan areas in OECD countries. The third section provides a review of the previous works of identification of metropolitan areas in Spain and Italy. The fourth section proposes two functional methodologies for the identification of metropolitan areas in Spain and Italy. The fifth section presents the results. The work ends with some concluding remarks.

2. General approaches to the definition of metropolitan areas

The identification of metropolitan areas can be carried out using three basic approaches (Espon 1.4.1 Report ÖIR, 2006):

1. The “administrative” approach identifies metropolitan areas on the basis of the status of previously definite legal or administrative units. It is conceptualised as an instrument for purposes of governance and control. The identification departs from local or provincial boundaries and applies some criteria to distinguish between metropolitan and non-metropolitan units (population thresholds, governmental decisions, historical reasons, etc.). Examples of the administrative criteria can be found in the OECD reports (OECD 2006) and in the empirical applications of the ESPON FUAs (Table 1).

2. The “morphological” approach identifies metropolitan areas as those continuous urban settlements that reach certain thresholds of density, dimension or degree of urbanization. The metropolitan area is conceptualised as a physical object, without referring to any relational consideration. Serra et al. (2002) provides an example of the application of this criterion (Table 1) and other example can be found in Rozenblat and Cicille (2003).

3. The “functional” approach defines metropolitan areas as economic and social entities and not as mere geographical areas (ÖIR, 2006 – p. 17). Administrative boundaries are not longer a priority criterion and the focus is shifted to the functional relations between the units that form the metropolitan area. Using this approach, a metropolitan area is defined as an area of interactions between a core or cores (which may be defined using morphological criteria as population or employment thresholds) and its hinterland of neighbour municipalities which show a significant relationship with the core (usually approximated with travel-to-work commuting flows). Examples of this criterion can be found in the FURs identified by the GEMACA group (1996) and the USA metropolitan areas (Table 1).

While the administrative approach is clearly inadequate to identify economically and socially integrated urban areas, the morphological approach presents the further problem of finding too small cities that difficultly could be called metropolitan areas. The functional approach appears to be a good and suitable method as it takes into account the socioeconomic relations between the several units which form the metropolitan area. If the aim of the analysis is the study of urban polycentricism or, in general, of the urban spatial structure, the functional approach seems to be the most

suitable. In the absence of symmetric information, it is possible to combine several criteria in order to apply the best option when available or an alternative otherwise, for instance in the definition of LUZ by Urban Audit (Table 1).

3. Metropolitan areas in Spain and Italy: a review of the literature

3.1. Spain

The Spanish Constitution (art 141.3 and 152.3) confers to the regions the possibility, for sets of contiguous municipalities, to associate in territorial entities that are different from the region or the province they belong. The law of local corporations (LRBRL, art 43) asserts that metropolitan areas are local entities composed of municipalities of large urban agglomerations with social and economic linkages where the joint coordination and planning is necessary.

The first attempts aimed at identifying metropolitan areas in Spain concern to the Dirección General de Urbanismo of the Ministry of Housing (1965, 1967). The morphological criterion, inspired by Davis (1959), consisted in the identification of a central core of at least 50,000 inhabitants and a strong socio-economic relationship between the core and surrounding municipalities. The whole metropolitan area could have a population of at least 100,000 inhabitants, a density larger than 100 inhabitants/km^2, high rates of growth, and contiguity. Following these criteria, 26 areas were identified in 1960 (34% of the national population) and 24 in 1967 (36% of the national population)[2].

[2] A review about the identification of metropolitan areas in Spain from 1960 to 1980 is provided by De Esteban (1981).

A second approach, also from an institutional source, is found in the "III Plan de Desarrollo Económico y Social" (1972). The document proposes three criteria to identify metropolitan areas: statistic, economic development, and planning. The application of the statistical criterion to 1965, 1969 and 1985 provided 25, 30 and 32 statistical metropolitan areas respectively (De Esteban, 1981).

The Ministry of Housing (Ministerio de Vivienda 2000, 2005 and 2007) has recently elaborated other maps although more centred on the identification of "urban areas" than of the metropolitan ones. The procedure follows a morphological approach that departs from data of population, housing, territorial structure and urban dynamics, and the transportation network. The Spanish territory has 82 Large Urban Areas (with at least one municipality larger than 50,000 inhabitants) and 269 Small Urban Areas. The first has 9% of Spanish municipalities and 71% of total population of the country, and can be considered a proxy of the metropolitan phenomenon.

Serrano (2006), adopts a morphological approach to identify "urban areas and agglomerations" in Spain. This category contains those continuous areas formed by a "central" municipality of more than 75,000 inhabitants surrounded by a belt of municipalities so that the entire area has at least 100,000 inhabitants. The belt is determined using a distance-based criterion: 40 Km from the central city for the large areas, and 15 Km for the small areas. For the year 2001, he identifies 45 urban agglomerations which have 9% of the Spanish municipalities and 61% of the total population. The largest agglomerations are Madrid (41 municipalities and 5 million inhabitants), Barcelona (74 municipalities and 3.8 million inhabitants) and Valencia (63

municipalities and 1.56 million inhabitants). This methodology is quite simple, and only population and distance data are required. On the other hand, no justification is raised for the election of the distance thresholds and why they are the same for all the range of large or small urban areas. In fact, the small number of municipalities surrounding Madrid suggests the inaccuracy of this morphological criterion to take into account the socioeconomic structure of complex metropolitan areas.

Clusa and Roca (1997) provides an algorithm in two stages for the identification of the metropolitan area of Barcelona based on the former USA Federal Register (1990) procedure for the identification of metropolitan areas in New England. In the first step, they identify a central core as a municipality of more than 50,000 inhabitants plus those municipalities in which at least 15% of their resident employees commutes to this municipality. The hinterland is formed by those municipalities in which at least 15% of their resident employees commutes to the central core. As a difference from the USA procedure, Clusa and Roca iterate four times the criterion to form the hinterland, each time using the result of the previous iteration as the core. Contiguity criteria are used after the last iteration. As labour markets tend to be self-contained, the choice of four iterations is based on the fact that after the third iteration the number of municipalities included is very small and in subsequent iterations tend to nil. The area identified using this procedure for the year 1991 has 145 municipalities and 4.2 million inhabitants.

This criterion has been latterly applied to the entire region of Catalonia by Trullén and Boix (2000) and Boix and Galletto (2004) who identifies five metropolitan areas and their evolution since 1986. Roca et al. (2005) extended the procedure to identify the metropolitan areas of the seven largest cities in Spain in 1991 and 2001. The results for

2001 remark the size of Madrid (608 municipalities and a population of 5.6 millions) and Barcelona (227 municipalities and a population of 4.5 millions). With more than one million inhabitants they also identify Valencia (152 municipalities and a population of 1.7 millions), Seville (60 municipalities and a population of 1.4 millions) and Bilbao (104 municipalities and a population of 1.1 millions).

Other attempts to identify metropolitan areas in Spain have been carried out at a regional level. The administrative approach prevails when Public Administrations approach the metropolitan area (e.g. Madrid is usually assimilated to the province and Valencia to the county). The morphological approach prevails in Lejarza and Lejarza (2002) for Valencia, and Sánchez (1998) for Zaragoza. Functional approaches have been applied to Barcelona by Esteban (1995) and Salvador et al. (1997), and to Andalusia by Feria and Susino (2005). Rubert (2005) applies a pool of methodologies to the MA of Castellon.

Focusing with more details in the functional approaches, Esteban (1995) and Salvador et al. (1997) applies the FUR methodologies (Cheshire and Hay 1989; GEMACA 1996) to identify the boundaries of the metropolitan area of Barcelona. The latter is similar to the FUR procedure proposed in the next section, and using 1991 data produces a FUR composed of 131 municipalities and 4.1 million inhabitants.

Feria and Susino (2005) employ a functional approach based on absolute and relative cut-offs of population and commuting flows. Following this approach, each metropolitan area must have a central city of at least 100,000 inhabitants. The hinterland is composed by those municipalities which send to the central city at least 15% of their

resident employees or where the commuting received from the central city exceeds of 15% of the local jobs. In both cases, the minimum flow must reach 100 commuters. As this procedure performs better on centralized structures, the authors propose that the relative threshold could be also reached by iterating, although in this case they require a minimum value of 500 commuters. Contiguity criteria are applied to obtain the final shape of the metropolitan areas. The procedure identifies 8 metropolitan areas in Andalusia, where the most important are Seville (40 municipalities and 1.29 inhabitants) and Malaga-Marbella (29 municipalities and 1 million inhabitants).

From an international point of view, the OECD identifies three metropolitan regions above 1.5 million inhabitants in Spain (Madrid, Barcelona and Valencia). Urban Audit (2006) finds 18 Large Urban Zones, where Madrid (5.4 million inhabitants) and Barcelona (4 million inhabitants) are the larger metropolitan units. Rozenblat and Cicille (2003) differentiate 22 Spanish large European agglomerations. ESPON (2006) identifies 100 Functional Urban Areas, where Madrid is the only above 5 million inhabitants and Barcelona, Valencia and Seville have above 1 million inhabitants.

3.2. Italy

Italian Metropolitan Areas are an institution provided by the national law n. 142 of 1990. The law provides a general criterion to guide the identification of metropolitan areas, where each pivotal municipality has to be strongly integrated from an economic, social or cultural point of view. The act fixes 9 metropolitan areas while other 5 have been introduced by regional laws. Despite the importance of the urban and metropolitan fact in Italy, there are only very few works aimed to the identification of metropolitan

areas.

Cafiero and Busca (1970) adopt a morphological approach based on a threshold of density and spatial contiguity. These criteria have been also utilised by Svimez (1983; 1987) and Cecchini (1988), who identify 39 metropolitan areas. Their main limitation is the choice of the thresholds of density and dimension and the results do not seem to fit well to different territorial situations. For example, the metropolitan area of Milan seems to be too big if compared with the small area obtained for Rome.

Marchese (1989, 1997) identifies 32 metropolitan areas following a morphological procedure in two steps. First, he selects all contiguous municipalities which show a certain threshold of employment density and then he divides these continuums in four groups on the basis of their dimension. In the second step, he selects those sets of contiguous municipalities that can be considered metropolitan areas on the basis of the existence of centrality factors, as high rank services for families and firms.

Vitali (1990) identifies “urban areas” using a morphological approach similar to the one used by Serrano (2005) for Spain. Vitali departs from the basis that each province’s capital is the centre of a larger “area of attraction”. Around each centre, a circle is drawn to delimit the area of attraction, using a radius of 10, 15 or 20 Km, depending on the dimension of the centre. The three groups of urban areas identified have the same geographical extension and shape (circular).

The ISTAT-IRPET (1989) provides the most significant attempt to identify large urban units using a functional approach. It departs from the previously identified local labour

markets which are subsequently aggregated in Functional Labour Regions. For 1981 Census data, ISTAT-IRPET (1989) identifies 995 local labour markets which combines in 177 Functional Labour Regions. Recently, the Italian government has proposed to apply a threshold of population to the 2001 local labour markets to identify the so called Local Metropolitan Systems (Consiglio dei Ministri, 2006 – p. 228). Although they can provide a feasible approach for small and medium metropolitan areas, local labour markets are clearly inappropriate for the largest metropolitan areas as Milan or Rome, formed by several local labour markets.

The annual report of ISTAT (2007 and 2008) offers other approaches to the identification of "urban areas" and "functional regions" starting from the 2001 local labour markets. The "Rapporto Annuale 2006" (ISTAT 2007, p. 137-147) provides 32 labour markets with characteristics of Larger Urban Zones coming from the third Urban Audit report. Moreover, there are other 46 local labour markets defined as urbanized but that are not considered in the Urban Audit 3 project. The "Rapporto Annuale 2007" (ISTAT 2008, p. 149-153) identifies 41 metropolitan regions as those local labour markets which combines morphologically urban characteristics and urban functions. These metropolitan regions cover 34.7% of the national population.

4. FUR and DMA functional methodologies

The general approaches exposed in section 2 suggest the use of functional methodologies when data are available. Two approaches are proposed to identify functional metropolitan areas: the GEMACA II (1996) which is applicable to most of

the UE countries, and an improvement of the Clusa and Roca (1997) iterative methodology.

4.1. Functional Urban Regions (FUR)

The concept of FUR was used for the first time by Berry (1967) for the USA. In Europe it was introduced by Cheshire and Hay (1989). The main reason for the use of this concept was to identify comparable urban units across Europe, as some years before had done Hall and Hay (1980) by introducing the close concept of Daily Urban System (DUS). Despite their name evoke the concept of a region, FURs are metropolitan areas (Cheshire and Hay, 1989) and the methodology for their identification follows a functional approach, as their boundaries are determined on the basis of economic relationships (Davoudi, 2008). The procedure employed follows the works by GEMACA (1996 and 2001) for the North-West Europe Urban System:

1. A “core” composed by one or more contiguous municipalities with a density of at least 7 jobs per hectare and with no less than 20,000 jobs;

2. A “hinterland”, which consists of all the contiguous municipalities where at least 10% of the resident employees commutes with the core. Municipalities that are completely surrounded by the FUR are also included.

4.2 Dynamic Metropolitan Areas (DMAs)

A second methodology to map metropolitan areas is introduced as an alternative to the FURs. It is based on Clusa and Roca (1997) and Roca et al. (2005) adaptation of the USA Federal Register's methodology (1990) and, similar to the FUR, the metropolitan area is composed by a central core and a hinterland. The main difference is that the initial relative threshold of commuting for the formation of the core and the hinterland is more exigent although it is iterated to take advantage of the trend of labour markets to be self-contained. In addition, we introduce a previous step to better differentiate between central and non-central cities and to take into account the polycentric nature of some of these areas. The complete procedure is named Dynamic Metropolitan Area (DMA):

1. The first stage of the DMA algorithm is aimed to determine the "central core" of the metropolitan area, formed by the "central cities" and their primary belt. A central city must have at least 50,000 inhabitants. The "central core" is formed by a central city and the surrounding municipalities that commute at least 15% of their resident employees with the central city[3].

2. In the second stage, as a difference from the USA procedure, the hinterland is formed in four iterations. In the first iteration we include those municipalities for which at least

[3] After 1991, the Federal Register has introduced several changes in the identification of the core and has increased the commuting threshold to 25% in order to hold back the growth of the statistical units. It is noted that its primary assignment is not to identify metropolitan areas but rather to provide manageable statistical units. However, as our purpose is different, we prefer to base our procedure in the former 1990s methodology due to the fact that: (1) the 2001 version eradicates cities and towns in favour of counties and reduces its applicability to Spain and Italy; (2) based on previous works, the 15% threshold is considered to produce good results.

15% of their resident employees commutes to the central core. This criterion is applied other three times using as “core” the result of the previous iteration, so that: hinterland 1 = core + municipalities commuting 15% of their resident employment to the core; hinterland 2 = hinterland 1 + municipalities commuting 15% of their resident employment to the hinterland 1, etc. Contiguity criteria are used after the last iteration, so that all the isolated municipalities completely surrounded by other that belong to a MA are included, while those that are not contiguous are excluded.

However, in the large metropolitan areas is usual to find several contiguous and non-contiguous cities with more than 50,000 inhabitants so that it is difficult to differentiate a central city from a second-order subcentre or to avoid the assignation of the subcentres of a polycentric metropolitan area to different areas. To separate first-order centres (central cities) from other large municipalities, we propose a pre-application of the procedure so that:

1. The percentages of commuting between all the potential central cities are calculated. If one of these cities sends more than 15% of its total commuting to another one, the first is considered a sub-centre of the latter. If both cities send reciprocally more than 15% of their total commuting, then both have to be intended as a unique central core of the same metropolitan area.

2. A recursive pre-application of the core-hinterland steps is proposed in order to differentiate central cities from the remaining second-order subcentres. Thus, if in some of the four iterations a potential central city reveals as city of the core or the hinterland of another metropolitan area, this city is removed from the list of central cities and the

pre-application starts again until it separates all the central cities from the second order subcentres larger than 50,000 inhabitants.

4.3. Consolidation of FURs and DMAs

Following the Federal Register (1990), contiguous FURs or DMAs can be aggregated in a single area if some conditions are respected. To simplify these conditions, we consider that two areas must be aggregated in an only metropolitan area if some of them have a flow of commuters from one to another of more than 10% of their total resident employees. If the percentage is close although lower to the 10%, the integration is done if there is other robust evidence that the areas are economic and socially integrated.

4.4. Names of the FURs and DMAs and classification by intervals

For simplicity, the name of the FUR or DMA corresponds to the name of the largest city.

Following the suggestion by the Federal Register (1990) and GEMACA (2001), we propose to divide the FURs and DMAs in four intervals regarding the total size of the areas:

1. Level A, formed by the MAs larger than 1 million inhabitants
2. Level B, formed by the MAs between 250,000 and 1 million inhabitants
3. Level C, formed by the MAs between 100,000 and 250,000 inhabitants
4. Level D, formed by the MAs with less than 100,000 inhabitants.

5. Application and results

Most data for the identification of metropolitan areas in Spain and Italy (population, employment and commuting) come from the 2001 national Censuses elaborated by the Spanish Institute of Statistics (INE) and the Italian Institute of Statistics (ISTAT). Land data has been obtained from the national property registers. Cartographical basic layers used for GIS (municipalities and regions) come from INE and ISTAT.

5.1. Functional Urban Regions

The FUR procedure allows to identify 65 FURs in Spain. They have 51% of municipalities (4,200), 76% of population (31 millions) and 77% of employment (16.3 million jobs). There are 5 level A FURs (above 1 million employees) which have 13% of Spanish municipalities, 35% of national population and 38% of employment (Table 2). Madrid is the largest FUR, with 575 municipalities, 5.9 million inhabitants and 2.6 million employees. Barcelona has 174 municipalities, 4.3 million inhabitants and 1.9 million employees. Valencia has 150 municipalities, 1.7 million inhabitants and 700,000 employees, Seville has 57 municipalities, 1.3 million inhabitants and 480,000 employees, and Bilbao has 87 municipalities, 1.06 million inhabitants and 420.000 employees.

There are 23 level B FURs (between 250,000 and 1 million inhabitants). They have 20.5% of Spanish municipalities, 28% of population and 27% of employment. There are 26 level C FURs (between 100,000 and 250,000 inhabitants) which have 14.6% of

Spanish municipalities, and 10.5% of population and employment. Finally, the 11 level D FURs have 3.8% of municipalities, and 2% of population and employment.

Regarding their spatial distribution, FURs are distributed across all the country. However, the largest FURs regarding their extension tend to be localised in the centre-north of the country whereas the most populated tend to concentrate in the upper-right part of the country (Figure 1).

In Italy, 81 metropolitan areas have been identified following the FUR procedure. They contain 43% of municipalities (3,475), 67.6% of total population and 71.5% of employment. There are 6 level A FURs, which have 14.4% of Italian municipalities, 30.5% of national population and 32.4% of total employment. The largest FUR is Milan, with 499 municipalities, 5.2 million inhabitants and 2.4 employees. Rome is the second one, with 239 municipalities, 4.3 million inhabitants and 1.5 million employees. Naples, Turin, Florence and Palermo have respectively 125, 215, 51 and 43 municipalities, as well as 3.5, 2, 1.2 and 1 million inhabitants. Naples has 778,000 employees, Turin 826,000, Florence 528,000 and Palermo 224,000.

There are 34 level B FURs that represent 15% of Italian municipalities, 26% of population and 27.4% of total Italian employment. The 38 level C FURs have 12.8% of municipalities, 10.7% of population and 11.1% of national employment. The 3 level D FURs have 0.6% of municipalities, 0.4% of Italian population and 0.6% of employment.

Italian FURs are distributed quite uniformly across the Italian territory even if in the northern-east part of Italy a higher density of FURs can be observed. Many urban areas are identified in particular along the “Via Emilia” and the Po Valley, while in the south the FURs tend to be more spatially separated (Figure 1).

5.2. Dynamic Metropolitan Areas

The DMA procedure identifies 67 DMAs in Spain. They have 49% of Spanish municipalities (4,000), 76% of population (31 millions) and 77% of employment (16.3 million jobs). There are 5 level A DMAs, which have 13% of Spanish municipalities, 35% of national population and 38% of employment (Table 2). Madrid is the largest DMA, with 548 municipalities, 5.8 million inhabitants and 2.6 million employees. Barcelona has 209 municipalities, 4.5 million inhabitants and 2 million employees. Valencia has 129 municipalities, 1.7 million inhabitants and 700,000 employees. Seville has 60 municipalities, 1.4 million inhabitants and 480,000 employees. Bilbao has 108 municipalities, 1.1 million inhabitants and 430.000 employees.

There are 24 level B FURs which have 20.6% of Spanish municipalities, 28% of population and 27% of employment. There are 24 level C FURs which have 12% of Spanish municipalities as well as 9.7% of national population and employment. Finally, the 14 level D FURs have 3.2% of municipalities and 2.5% of population and employment.

The application of the DMA procedure to Italy identifies 86 urban areas. They have 48.9% of Italian municipalities (3,962), 69.4% of total national population (39.6 millions) and 73.4% of employment (14.2 million jobs). There are 6 level A DMAs, which have 16.7% of the Italian municipalities (1,355), 30.7% of population and 32.7% of employment (Table 2). The rank of the first DMAs is the same as in the FUR case. Thus, Milan is the biggest metropolitan area, with 597 municipalities, 5.3 inhabitants and 2.4 million employees. Rome is the second, with 200 municipalities, 4.2 million inhabitants and 1.5 million employees. Naples has 119 municipalities, 3.4 million inhabitants and 757,000 employees. Turin has 341 municipalities, 2.2 million inhabitants and 896,000 employees. Florence has 59 municipalities, 1.3 million inhabitants and 580,000 employees. Finally, Palermo has 39 municipalities, 1 million inhabitants and 222,000 employees.

Regarding the other dimensional classes of metropolitan areas identified with the dynamic procedure, there are 31 level B DMAs which have 19.9% of the Italian municipalities, 26.2% of the population and 28.6% of the total national employment. The 40 level C DMAs have 11.2% of municipalities and population and 10.8% of total employment. Finally, the 9 level D DMAs have 1.1% of total municipalities and 1.3% of national population and employment.

5.3. FUR, DMA and NUT 3

It is noticeable that FUR and DMA methodologies produce very similar results regarding the total figures and their distribution among levels in both countries. The spatial patterns of distribution are also very similar. In Spain, the different criteria for

the identification of the cores provide the basis for the inclusion as FUR of some smaller local labour markets as Vic, Arona or Avila whereas these cities do not comply with the DMA initial criterion. On the other hand, due to the iterative procedure, DMA produces more clearly definite boundaries in both countries and facilitates the consolidation in more compact metropolitan areas of Jerez-Cadiz and Badajoz-Caceres-Merida in Spain, and Sassuolo and Modena in Italy.

However, there is strong difference between metropolitan areas (FURs and DMAs) and NUT 3 (provinces) in both countries. NUT 3 is too small to characterize Madrid, Rome and Milan although it is usually too large to catch the rest of metropolitan areas. In the case of Madrid and Milan, the metropolitan area expands to other six provinces where Madrid basically absorbs the neighbourhood province of Guadalajara and Milan absorbs Lodi. Only in rare cases (Álava and Valladolid in Spain, and Taranto and Pescara in Italy) the metropolitan areas are close to the administrative boundaries.

6. Conclusions

The aim of the research is to identify metropolitan areas in Spain and Italy using comparable methodologies in order to give evidence about the metropolitan processes in each country, to provide a comparison between the metropolitan configurations of both countries and to generate metropolitan units to be used in other researches. For these purposes, FUR and DMA functional methodologies has been used. Some conclusions have been made:

Firstly, there is a high level of metropolitanization of both countries. The results show 65 FURs and 67 DMAs in Spain which have about 50% of municipalities, 76% of population and 77% of employment. In Italy there are 81 FURs and 86 DMAs which have between 43 and 49% of municipalities, 70% of national population and about 72% of national employment. These results remark the relevance of metropolitan areas as socioeconomic units of analysis and their importance for the design and implementation of policy strategies.

Secondly, almost a half of the metropolitan population and employment concentrates in the largest metropolitan areas of the country, those above one million inhabitants. In terms of FUR or DMA, there are five large metropolitan areas in Spain (Madrid, Barcelona, Valencia, Seville and Bilbao) which have about 35% of national population and 38% of employment. In Italy there are 6 largest metropolitan areas (Milan, Roma, Naples, Turin, Florence and Palermo) which have about 30% of national population and 32% of employment. These results suggest that these metropolitan areas are keystones to be considered for the implementation of economic policies and to face globalization and competitiveness.

Thirdly, both methodologies used to identify metropolitan areas produce very similar results. This can be explained because the lower commuting shares of the FUR procedure tend to converge to the iterative results of the DMA algorithm. This unexpected coincidence reinforces the feasibility of the commuting thresholds in both procedures and the validity of the metropolitan units identified to be used in further researches.

Metropolitan areas (both FURs and DMAs) clearly diverge from the administrative boundaries (regions or provinces). As a matter of fact, the points highlighted in this section should help to focus on the discrepancy between the administrative level of governance and the functional urban organization of the territory.

Bibliography

Boix, R. (2006): “Las áreas metropolitanas en España”, *XXXII Reunión de Estudios Regionales*, Ourense 16-28 de Noviembre de 2006.

Boix, R. y V. Galletto (2006): "Sistemas locales de trabajo y distritos industriales marshallianos en España", *Economía Industrial*, nº 359, p.165-184. ISSN: 0422-2784.

Castañer, M.; Vicente, J.; Comas, E. and Boix, G. (1998), “Assaig de definició de l’àrea urbana de Girona”, *Documents d’Anàlisi Geogràfica*, núm. 33, Universitat Autònoma de Barcelona, Servei de Publicacions, p. 81 – 90.

Clusa, J. y J. Roca (1997): “El canvi d’escala de la ciutat metropolitana de Barcelona”, *Revista Econòmica de Catalunya*, nº 33, p.44-53.

Cheshire, P. and D.G. Hay, Urban Problems in Western Europe: an Economic Analysis, Hyman, 1989.

Comisaría del Plan de Desarrollo Económico y Social (1972): III Plan de Desarrollo, monografía de “Desarrollo Regional”, Presidencia del Gobierno. Madrid.

Davoudi, S. (2008), “Conceptions of the City-region: A critical review”, *Journal of Urban Design and Planning*, forthcoming.

ESPON (2006): ESPON Atlas: Mapping the structure of the European territory. Federal Office for Building and Regional Planning, Bonn, Germany.

Federal Register (1998): “Alternative Approaches to Defining Metropolitan and Nonmetropolitan Areas; Notice”, Volume 63, Number 244, December 21, pp. 70525-70561.

Federal Register (2000): “Standards for Defining Metropolitan and Micropolitan Statistical Areas; Notice”, Volume 65, Number 249, December 27, pp. 82228-82238.

Feria, J.M. (2000): “Pautas Estructurales Diferenciadas de Movilidad en las Áreas Metropolitanas Andaluzas”, en M. Castañer, J. Vicente y G. Boix (eds.) *Áreas urbanas y movilidad laboral en España*. Universitat de Girona, Girona. pág. 121-138.

Feria, J.M. y J. Susino (2005): Movilidad por razón de trabajo en Andalucía. Dimensiones básicas y organización espacial. Instituto de Estadística de Andalucía.

GEMACA II: http://www.iaurif.org/fr/savoirfaire/reseaux/gemaca.htm

ISTAT (2007): Raporto Annuale: La situazione del paese 2006. ISTAT, Roma.

ISTAT (2008): Raporto Annuale: La situazione del paese 2007. ISTAT, Roma.

ISTAT-IRPET (1989): I mercati locali del lavoro in Italia. Franco Angeli, Milán.

Ministerio de Vivienda (1965): Áreas metropolitanas en España en 1960. Dirección General de Urbanismo. Madrid.

Ministerio de Vivienda (1967): Las áreas metropolitanas en general em España. Secretaria General Técnica. Madrid.

Ministerio de Vivienda (2000): Atlas estadístico de las áreas urbanas en España. Madrid.

Ministerio de Vivienda (2005): Atlas estadístico de las áreas urbanas en España 2004. Madrid.

OECD (2006): Competitive cities in the global economy. OECD Territorial Reviews, OECD, Paris.

Roca, J.; Burns, M. y M. Moix (2005): "Las áreas metropolitanas españolas. Evolución 1991-2001", en Centro de Política del Suelo y Valoraciones (mimeo).

Rozenblant, C. et P. Cicille (2003): Les villes éuropeénnes: analyse comparative. Datar.

Rubert, J.J. (2005): "El distrito industrial de la cerámica y la estructura urbana de Castelló", en Ana María Fuertes (Dir.) "El distrito industrial de la cerámica". Fundación Davalos-Fletcher.

Salvador, N.; Mora, C. y E. Salvat (1997): "La regió urbana funcional de Barcelona en el context europeu", *Revista Econòmica de Catalunya*, nº 33.

Sánchez, Y. (1998): "Interpretación del hecho metropolitano en Zaragoza", *Geographicalia* (1996), 33.

Serra, J.; Otero, M.; y R. Ruiz (2002): Grans aglomeracions metropolitanes Europees. IRMB.

Serrano Martínez, J.M. (2006): "Aglomeraciones y áreas urbanas en España, dimensión y tendencias: Breves precisiones", *Lurralde: Investigación y Espacio*, nº 29.

Sorribes, J. (1999): Las áreas metropolitanas. Análisis teórico y experiencia comparada. Universidad de Valencia, Valencia.

Trullén, J. y R. Boix (2000): “La ampliación del área metropolitana de Barcelona y su creciente interacción con las áreas metropolitanas de Tarragona, Lleida y Girona. Avance de resultados”. Ajuntament de Barcelona (mimeo).

Urban Audit.: http://www.urbanaudit.org/

Table 1. Empirical application of methodologies for the identification of metropolitan areas in the UE and USA

Identification method	Description of the method	Source and kind of data	Advantage	Disadvantages	On the whole
OCDE's Metropolitan regions (2006)	NUT3	Administrative definition	- Simple method, it doesn't need an algorithm of identification - Availability of many typologies of data - Stable units of analysis during the time	- Socio-economic dynamic doesn't coincide with administrative definition - Static unit of analysis in time and space	- On the whole, the province seems to identify a too wide territory for metropolitan areas, except for some of the biggest ones
Functional Urban Areas (FUAs) ESPON 2006	A Functional Urban Area (FUA) is composed by a *core* and by a neighbour area that is economically integrated with the *core*. Due to the difficulties associated to the identification FUAs tend often to be approximated with NUT3 with more than 20,000 inhabitants.	- Various sources: normally census data on population, employment and commuting at a municipal and NUT3 level. - When a NUT3 is adopted, a simple administrative definition is used. When a FUA is actually determined it consists most of the time on a functional approach.	- Few information needed.	- Space static units of analysis - There has not been identified a method applied to every country, so the method applied can be administrative, morphological or functional. As a matter of fact, few times the identified area correspond with the area of expansion of economic flows.	- On the whole, the method utilised is not clear neither univocal. The project 1.1.1 propose a methodology that however cannot be applied to many countries due to a lack of available data, including Italy and Spain. The biggest unit of Espon (MEGAs) are often similar to provinces and take with them all the above mentioned problems of administrative units.
Functional Urban Regions (GEMACA II)	Neighbouring municipalities with an employment density of more than 7 jobs per hectare (*core)* plus the ring of contiguous municipalities that have more than 10% of their commuters travelling towards the above-identified *core*.	Census data on population, employment and commuting at a municipal level.	- Dynamic unit of analysis in time. - Easy and clear methodology that could be applied to almost every European country. There should be some problems for those countries that have municipalities units particularly big.	- There are some ambiguities on which kind of land to use (urban land, municipal land, etc.) - It is very sensitive to the urbanisation pattern. - In polycentric or contiguous metropolitan areas, the direction of the expansion of densities doesn't have to follow the direction of economic interaction.	- This methodology seems to work well. However, in some cases, it identifies metropolitan area not enough big to catch the polycentric organization of a big urban system. Despite the integration of the *core* with an urban ring, not always the methodology understands that neighbour FURs constitute a single city, especially when the identification is carried out for planning or transport policies purposes.
Urban Areas (Serra et al. 2002)	Urban *Core* with at least 100,000 inhabitants and with a density higher than 1,500 inhab./Km^2. At the *core* must be added all the contiguous municipalities with a	- Population and municipal surface data. - Morphological approach.	- Dynamic unit of analysis on time. - Very easy to identify and few data requested. - It is possible a	- It doesn't take at all into account the relations between the different parts of the metropolitan	- Very easy to use and few data are needed. However, due to its pure morphological approach, it seems not to be adequate

	density higher than 250 inhab./ Km^2.		European comparison between unit identified in this way.	area. So it is difficult that this unit of analysis coincide with an actual economic integrated area.	to catch economic integrated areas.
Larger Urban Zones (LUZ) (Urban audit, 2006)	- Urban *core* plus all the municipalities that present more than 15% of total commuters travelling towards the core. - When there are not available statistical information, NUTS3 can be used as a proxy.	- Census data: flows of work commuters, employed resident people, jobs and resident population. - When there is enough statistical information it is a functional approach, while in the case of NUTS3 only an administrative approach.	- Dynamic method both in time and space. - It takes into account socio-economic relations between municipalities. - Easy method - Possibility of a European comparability of the units of analysis.	- The identified urban areas are usually too small, often limited to the central city of a bigger metropolitan area. - Due to the dimensions of the unit identified, the methodology cannot catch the polycentric spatial organization of cities.	- After having applied this methodology in for some countries, it emerges that the identified units are even smaller than Local Labour Market Areas (LLMAs) (Boix and Galletto, 2004; 2006). These units have the problem that tend to separate sub-centres of the same metropolitan area.
Metropolitan areas of USA's Census Bureau	The *central core* is made of a municipality of more than 50,000 inhabitants and of other municipalities that send to the first municipality at least 15% of their resident employed population. The urban ring have to be built adding to the *central core* the municipalities in which more than 15% of employed resident people work in the *central core* and with a density of at least 62inhab./km2. Alternatively, the conditions to add ring municipalities are a density of 37 inhab./km2 and at least 30% of resident employed population that work in the *central core*. In this way are applied both contiguity and consolidation criteria.	- Census data. Commuting to work flows, resident employed population and jobs and resident population. - Surface area at the municipal level.	- Dynamic method both spatially and temporally. - It takes into account socio-economic relations. - Use of high quality data (census data) - Possible European comparability - Use of consolidation criteria - I is possible to classify areas in different levels.	- Metropolitan areas with this method could be too small to be suitable for planning, transportation purposes or to catch polycentrism. However they are usually bigger than LUz - There is one interaction only between the *central core* and the urban ring since the aim of the method is that of build statistical areas and not to identify the real city.	- This method seems to work well, but it still doesn't solve the problem of the study of polycentrism and doesn't seems to be enough suitable for the planning of infrastructures and mobility.

Table 2. Metropolitan areas in Spain and Italy. Main results. Total values

a) Functional Urban Regions

IMAs	Nº Areas	Municipalities	Population	Resident employment	Jobs
SPAIN					
Level A	5	1,043	14,436,219	6,180,480	5,855,612
Level B	23	1,666	11,412,405	4,438,068	4,144,658
Level C	26	1,185	4,251,746	1,676,858	1,599,778
Level D	11	306	869,903	348,329	344,746
Total Spanish FURs	65	4,200	30,970,273	12,643,735	11,944,794
Total Spain		8,108	40,847,371	16,329,713	15,267,762
ITALY					
Level A	6	1,172	17,361,480	6,417,324	6,287,542
Level B	34	1,217	14,794,555	5,559,483	5,319,846
Level C	38	1,036	6,124,900	2,336,696	2,161,557
Level D	3	50	250,452	104,770	109,621
Total Italian FURs	81	3,475	38,531,387	14,418,273	13,878,566
Total Italy		8,101	56,995,744	20,993,732	19,410,556

b) Dynamic Metropolitan areas

IMAs	Nº Areas	Municipalities	Population	Resident employment	Jobs
SPAIN					
Level A	5	1,049	14,506,823	6,219,367	5,901,741
Level B	24	1,672	11,326,179	4,409,462	4,076,418
Level C	24	990	3,951,546	1,568,868	1,503,717
Level D	14	258	1,091,995	402,086	376,690
Total Spanish DMAs	67	3,969	30,876,543	12,599,783	11,858,566
Total Spain		8,108	40,847,371	16,329,713	15,267,762
ITALY					
Level A	6	1,355	17,479,230	6,510,073	6,344,778
Level B	31	1,614	14,956,574	5,779,957	5,557,697
Level C	40	905	6,358,585	2,308,902	2,099,106
Level D	9	88	766,873	281,186	242,642
Total Italian DMAs	86	3,962	39,561,262	14,880,118	14,244,223
Total Italy		8,101	56,995,744	20,993,732	19,410,556

Source: elaboration from INE (Spain) and ISTAT (Italy) Census Data, 2001

Table 3. Metropolitan areas in Spain and Italy. Main results. Percentages

a) Functional Urban Regions

IMAs	Municipalities	Population	Resident employment	Jobs
SPAIN				
Level A	12.9%	35.3%	37.8%	38.4%
Level B	20.5%	27.9%	27.2%	27.1%
Level C	14.6%	10.4%	10.3%	10.5%
Level D	3.8%	2.1%	2.1%	2.3%
Total Spanish FURs	51.8%	75.8%	77.4%	78.2%
Total Spain	100%	100%	100%	100%
ITALY				
Level A	14.5%	30.5%	30.6%	32.4%
Level B	15.0%	26.0%	26.5%	27.4%
Level C	12.8%	10.7%	11.1%	11.1%
Level D	0.6%	0.4%	0.5%	0.6%
Total Italian FURs	42.9%	67.6%	68.7%	71.5%
Total Italy	100%	100%	100%	100%

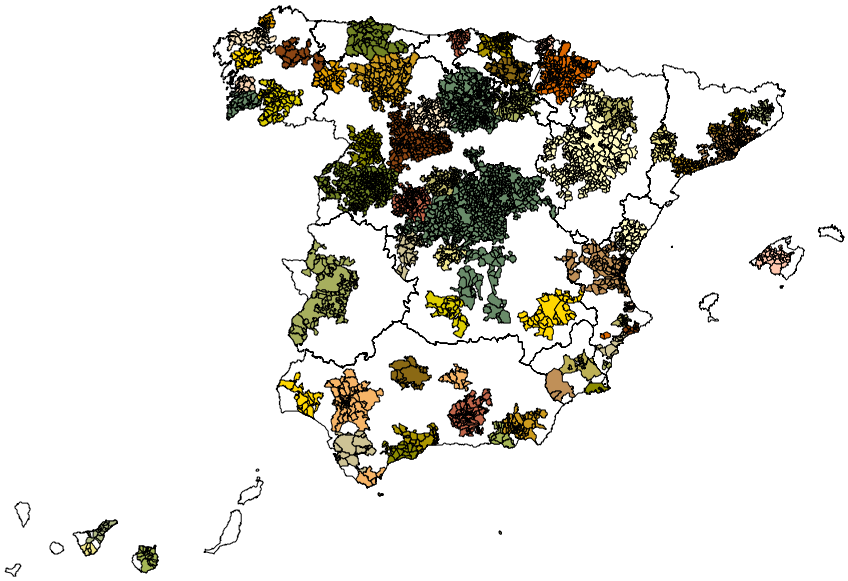
b) Dynamic Metropolitan areas

IMAs	Municipalities	Population	Resident employment	Jobs
SPAIN				
Level A	12.9%	35.5%	38.1%	38.7%
Level B	20.6%	27.7%	27.0%	26.7%
Level C	12.2%	9.7%	9.6%	9.8%
Level D	3.2%	2.7%	2.5%	2.5%
Total Spanish DMAs	49.0%	75.6%	77.2%	77.7%
Total Spain	100%	100%	100%	100%
ITALY				
Level A	16.7%	30.7%	31.0%	32.7%
Level B	19.9%	26.2%	27.5%	28.6%
Level C	11.2%	11.2%	11.0%	10.8%
Level D	1.1%	1.3%	1.3%	1.3%
Total Italian DMAs	48.9%	69.4%	70.9%	73.4%
Total Italy	100%	100%	100%	100%

Source: elaboration from INE (Spain) and ISTAT (Italy) Census Data, 2001

Figure 1. Functional Urban Regions

a) Spain



b) Italy

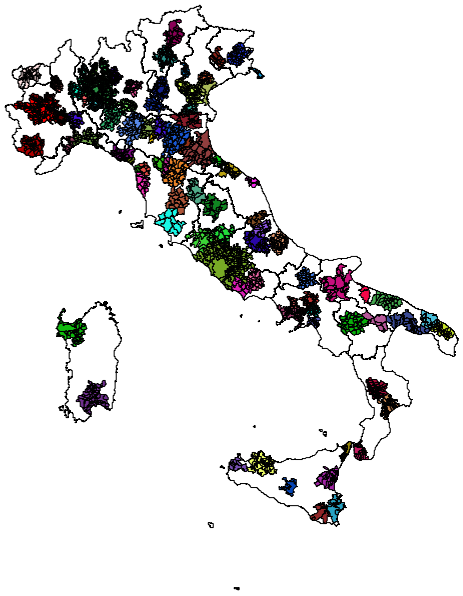
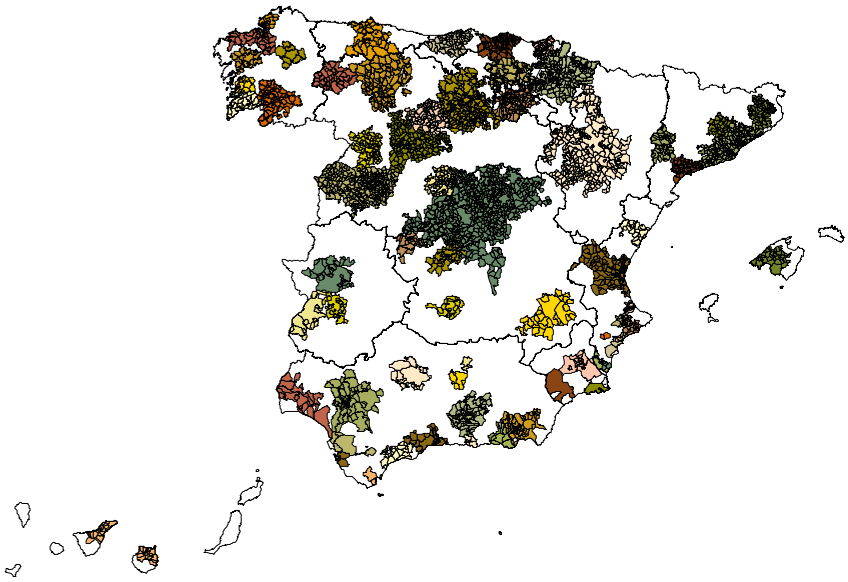


Figure 2. Dynamic Metropolitan Areas

a) Spain



b) Italy

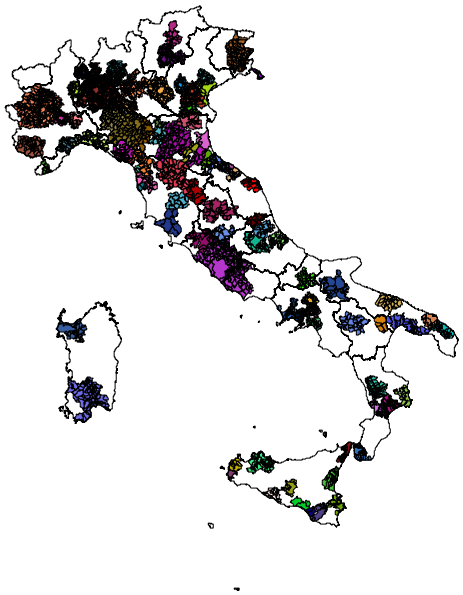
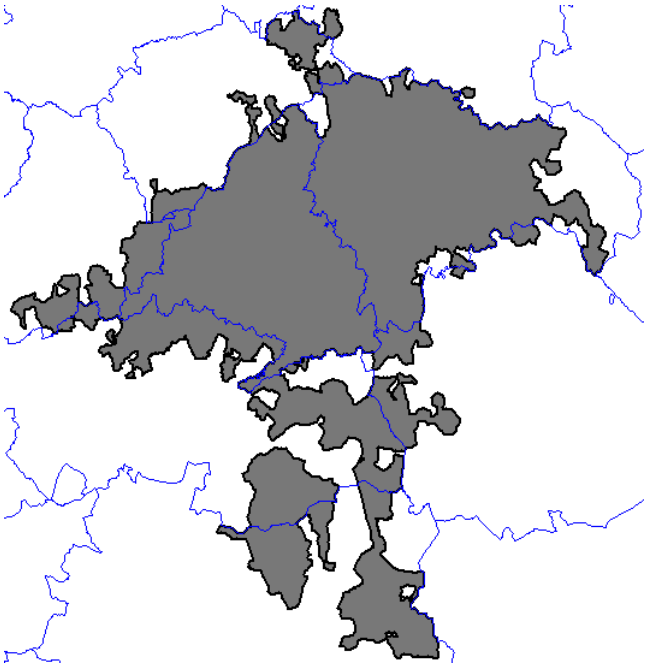


Figure 3. FUR and NUT 3 (Provinces). Detail for Madrid and Milan

a) Madrid



b) Milan