



## DAY-TIME POPULATION FOR STUDY AND WORK

### **Methodological note**

#### 1 The day-time population<sup>1</sup>

The day-time population (Popolazione Insistente - PI) in municipality j is defined according to [1] as the set of resident individuals, dynamic individuals per study/work (LUS) and city users (CU) entering j, net of dynamic individuals per study/work and city users leaving j:

$$PI_{j} = Resident \ pop.j + \left(\sum_{\substack{i=1\\i\neq j}}^{n} LUS \xrightarrow{\rightarrow}_{ij}\right) - \left(\sum_{\substack{i=1\\i\neq j}}^{n} LUS \xleftarrow{}_{ij}\right) + \left(\sum_{\substack{i=1\\i\neq j}}^{n} CU \xrightarrow{\rightarrow}_{ij}\right) - \left(\sum_{\substack{i=1\\i\neq j}}^{n} CU \xleftarrow{}_{ij}\right)$$
[1]

Since the population residing in municipality j can be calculated as:

$$Resident \ pop.j = NO\_LUS_j + LUS \underset{jj}{\leftrightarrow} + \left(\sum_{\substack{i=1\\i\neq j}}^n LUS \underset{ij}{\leftarrow}\right) + \left(\sum_{\substack{i=1\\i\neq j}}^n CU \underset{ij}{\leftarrow}\right)$$
[2]

[1] can be written as follows:

$$PI_{j} = NO\_LUS_{j} + LUS \underset{\substack{jj \\ i \neq j}}{\leftrightarrow} + \left(\sum_{i=1}^{n} LUS \underset{ij}{\rightarrow}\right) + \left(\sum_{i=1}^{n} CU \underset{i\neq j}{\rightarrow}\right)$$
[3]

*j*=1,..n;

(n= number of municipalities; *i*=municipality of origin; *j*=destination municipality;

<sup>&</sup>lt;sup>1</sup> See the in-depth analysis and definitions in the Glossary.

where:

*NO\_LUS<sub>j</sub> Static individuals without work/study activities*: individuals resident in municipality *j* who isn't a worker according to administrative registers, who do not attend preschool/primary/secondary school and who are not enrolled in university courses (e.g. children who do not attend preschool, pensioners, housewives, unemployed).

 $LUS \underset{jj}{\leftrightarrow} \underline{Dynamic individuals with mobility within j for study or work}$ : workers, students or academics with residence/fiscal domicile coinciding with municipality of work/studyl j. Mobility is within this municipality.

 $LUS \rightarrow Dynamic individuals with incoming mobility in j for study or work: workers, students or university students with residence/fiscal domicile in a municipality other than the one of work/study. Mobility is incoming in the municipality of study/work j, outgoing from the municipality of residence/domicile i.$ 

 $LUS \leftarrow_{ij}$  <u>Dynamic individuals with outgoing mobility from j for study or work</u>: workers, students

or university students with residence/fiscal domicile in a municipality other than the one of lavoro/studio. Mobility is incoming in the municipality of study/work *i*, outgoing from the municipality of residence/domicile *j*.

 $CU \rightarrow \underline{Incoming \ city \ users}$ : Individuals with residence/fiscal domicile in a municipality *i* different from the destination municipality *j* to which they move for tourism, health, sport, etc. Mobility is inbound to *j*. Frequency is occasional.

 $CU_{\underset{ij}{\leftarrow}}$  <u>Outgoing city users</u>: individuals with residence/fiscal domicile in *j*, with outgoing mobility for tourism, health, sport, etc. Mobility is outgoing from *j*. Frequency is occasional.

At national level, the day-time population on the national territory includes residents in Italy, non-residents working or studying in Italy, and non-residents in Italy but present for occasional reasons (e.g. tourists). It excludes Italian citizens resident abroad who do not work or study in Italy.

Each type of individual (dynamic, static, etc.) has been defined according to the type of activity carried out, the place of residence (or domicile) and the frequency of movement. Scheme 1 shows the types of population identified and their characteristics.

	Type of individual	Activity	Place of Residence/ Domicile	Location of activity	Direction of movement	Frequency of movement	Symbology
1	Dynamic within <i>j</i>	Study or work	j	j	↔ jj Inside area j	Daily, periodic (not occasional)	LUS ↔ jj
2	Dynamic incoming to j	Study or work	Other than j	j	$\overrightarrow{j}_{ij}$ Inbound into <i>j</i> from <i>i</i>	Daily, periodic (not occasional)	LUS→ ij
3	Dynamic outgoing from j	Study or work	j	Diverso da j	ij Outgoing from j towards i	Daily, periodic (not occasional)	$LUS \leftarrow_{ij}$
4	Static in <i>j</i>	Neither work nor study	j	-	-	-	NO_LUS <sub>j</sub>
A	City users incoming into j	Tourism, sporting, religious, cultural events, etc.	Other than j	j	$\overrightarrow{ij}$ Inbound into <i>j</i> from <i>i</i>	Occasional	$CU \xrightarrow{ij}$
в	City users outgoing from j	Tourism, sporting, religious, cultural events, etc	j	<>j	ij Outgoing from j towards i	Occasional	CU← ij

Scheme 1 - Types of individual in the day-time population with respect to j and their characteristics

#### 2 The information system on Day-time population

The information system is implemented by the integration of individual micro-data from administrative sources and statistical registers in the field of demographic, social security and tax, and which coverage is at national level. Since similar sources are not available for tourism and travel fields in general, the information system includes types 1 to 4 of the target population (see Scheme 1) and excludes types A and B (city users)<sup>2</sup>. The procedures developed make

<sup>&</sup>lt;sup>2</sup> Information on tourism is however available from some ISTAT sources, including travel and holiday survey, RACLI survey, Satellite account on tourism, Survey on accommodation establishments.

possible to identify people with administrative signals for work or school/university enrolment, locate them and distinguish between residents and non-residents<sup>3</sup>.

The minimum territorial detail is the Municipality: the Day-time Population can, therefore, be calculated for any aggregation of municipalities.

The production process of the database has been engineered in order to guarantee a more timely release and the possibility to carry out automatic controls during processing. The data in this experimental statistics derive from the prototype of the *Day-time Population information system*, which underwent a validation process, on the basis of which a close consistency with the official statistics used as benchmarks were proved.

#### 3 Some outputs

The outputs are contained in the Statistical Annex, that consists of six tables (absolute values and indicators), each of which is dedicated to a particular partition of the territory. These are illustrative tables about the informative potentiality contained in the system.

To select the territorial domains has been taken into account user demand, as well as data quality parameters, the robustness of measurements and the constraints imposed by the rules of GDPR. There is, also, a table dedicated to university cities, because of their particular nature as attractors of flows of young people. No releases will be made for lower territorial levels until the limits of the experimental measurement of aggregates are exceeded.

The data in the statistical appendix, concern:

- Italy;
- Municipalities with over 100,000 inhabitants;
- Metropolitan cities;
- The twenty-one main Labour Market Areas (Sistemi Locali del Lavoro SLL) defined as "Main urban realities"<sup>4</sup>;
- Functional Urban Area (FUA)<sup>5</sup>: functional urban areas, consisting of the city and its daily commuting area;
- University Cities <sup>6</sup>.

In addiction, there is an additional table regarding the origin/destination matrix of dynamic individuals (with study/work/university signals).

<sup>&</sup>lt;sup>3</sup> Individuals irregularly present on the territory are not included, as they cannot be inferred by the administrative sources used as input.

<sup>&</sup>lt;sup>4</sup> These Labour Market Areas, identified in the ISTAT volume "Forms, levels and dynamics of urbanisation in Italy", are based on the following criteria: belonging to a metropolitan city, population of the local system of over 500 thousand inhabitants or population of the municipality capital of the area of over 200 thousand inhabitants.

<sup>&</sup>lt;sup>5</sup> The Functional Urban Area consists of the city and its daily commuting area, formally known as the "Larger Urban Zone" (LUZ larger urban zone).

<sup>&</sup>lt;sup>6</sup> Only non-telematic universities.

#### Glossary

#### Worker

For the purposes of the day-time population is an individual resident or non-resident who, according to the analysis of the administrative information available, is occupied on December.

#### Primary and secondary school student

For the purposes of the day-time population is an individual resident or non-resident who, according to the analysis of the administrative information available, is enrolled and attending a primary or secondary school.

#### **University Student**

For the purposes of the day-time population is an individual who is enrolled at university level. Working students are counted in the universe of workers, assuming that their main activity is working.

#### Attraction index

The attraction index (I\_ATTR) is the ratio between the flows entering the area and the total flows generated by the territorial domain in question. It quantifies the capacity of the territory to attract incoming flows.

# $I\_ATTR = \frac{Incoming dynamics}{Dynamics within the area + incoming dynamics + Outgoing dynamics}$

This index can be calculated both respect to the entire national territory and respect to its own area. For example, the attraction index for the Labour Market Areas (SLL) of Rome with respect to Italy is the ratio between the dynamics entering the SLL from the whole of Italy and the sum of the components: dynamics inside the SLL, dynamics entering from the whole of Italy and dynamics leaving with destination Italy. Instead, the attraction index for the SLL of Rome respect to its own area is the ratio between dynamics entering the SLL from another municipality of the same SLL and the sum of the internal dynamics of the SLL, the incoming dynamics from another municipality of the same SLL and the outgoing dynamics with destination to another municipality of the same SLL.

#### Self-containment index

The self-containment index (I\_AutoCont) represents the capacity of an area to contain the population flows that it originates and therefore to satisfy the demand for study and work that is produced within it. It is the ratio between the number of movements within an area and those generated in the same area (flows that are exhausted within the area and flows that leave the area itself).

#### I\_AutoCont = Dynamics inside Dynamics within the area + Outgoing dynamics

This index can also be calculated with reference to the specific area or to the entire national territory.

#### **Coexistence index**

The coexistence index (I\_COE) is the ratio between the daytime population and the resident population in the territorial domain of interest. It quantifies the imbalance between the population using the territory and the resident population.

 $I\_COE = \frac{day-time \ population}{resident \ population}$ 

#### Metropolitan city

The metropolitan city is one of the local authorities present in the Italian Constitution, in article 114, after the 2001 reform (Constitutional Law no. 3/2001). Law no. 56 of 7 April 2014 on "Provisions on metropolitan cities, provinces, unions and mergers of municipalities" regulates its establishment in place of the provinces as a large area body. The institution of the Metropolitan City is part of a more complex reform plan with which the Italian legislator has revised the local government system, the latter once again confirmed as a multi-level system, but with different representation for each individual institutional pole: on the one hand, the levels of government with direct representation, i.e. Provinces, Metropolitan Cities and Unions.

#### Labour Market Areas

Labour Market Areas (sistemi locali del lavoro - SLL) represent a territorial grid whose boundaries, regardless of the administrative articulation of the territory, are defined using the daily home/work travel flows (commuting) recorded during the general population and housing censuses. Since each Labour Market Area is the place where the population resides and works and where most of the social and economic relations take place, the home/work trips are used as a proxy for the existing relations in the territory<sup>7</sup>.

#### **Functional Urban Area**

The European Commission, in collaboration with the OECD, has developed a harmonised definition of a city, which enables it to collect comparable statistical information on cities at an international level. The European Commission and the OECD have established technical criteria on the basis of which cities and their commuting zones, i.e. commuting areas linked to them in

<sup>&</sup>lt;sup>7</sup> <u>https://www.istat.it/it/informazioni-territoriali-e-cartografiche/sistemi-locali-del-lavoro</u>.

a "functional" way, can be identified. The whole of a core city and its commuting zone therefore constitutes a territorial aggregate defined as a functional urban area (FUA) (Dijkstra and Poelman 2012). Functional urban areas are, therefore, constitute of a densely populated urban centre and a surrounding commuting zone, not necessarily contiguous, but closely integrated from an employment point of view with the former.