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Measuring the long-distance accessibility of Italian cities

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ABSTRACT

Long-distance accessibility is a crucial element for economic development and for territorial cohesion. To be revealing, however, a measure of accessibility must not only consider the distance or travel time of a single mode, but should include the fares, the frequency and the interchanges of all available modes.

The paper aims to address whether and where there is an accessibility problem between Italian regions, through a comprehensive measure of accessibility covering the entire Italian territory. The measure used in the paper is potential accessibility, with an exponential decay impedance function. Different from similar studies, this one gives a more in-depth definition of impedance parameters due to the availability of a transport model that includes the entire Italian long-distance supply (roads, coaches, long-distance rail services, air services, and ferries). The opportunities at destination are proxied by population, and private and public sector employees.

The main outputs are detailed maps of accessibility that are significantly more realistic than using simple infrastructure indicators or single-mode measures. In addition, some policy conclusions are drawn in terms of past and future investment policies.

1. Introduction

The detailed geography of Italian transport is barely known. Long-distance transport studies, such as ones similar to Eddington (2006) for the UK, simply do not exist. Official documents and statistics are always very aggregate (CNIT, 2013; ISTAT, 2013), and seldom accompanied by charts. The last national planning exercise dates back to 2001 (Ministero dei Trasporti, 2001), and was based on a highly aggregate description of networks and demand, but not supported by models.[1]

In all of these documents there is a constant, which is to firmly focus only on the infrastructural side of transport, practically ignoring demand and services. This is clearly unsatisfying when planning public transport or when assessing the effects of market liberalisation measures. Nonetheless, the Italian Ministry of Transport does make decisions involving significant financial investment on country-connectivity. Decisions are usually based on single-scheme studies, barely coordinated with other concurrent and competing projects (Beria et al., 2012) and relying only on the *intuition* that part of the country has difficult access to the core areas. The limitations to this approach are evident, possibly resulting in biased decisions, over-investment, under-investment or simply inappropriate infrastructure design.

To overcome this unsatisfactory state, the paper aims to address whether and where there is a problem of long-distance accessibility to Italian regions, measured in a consistent way. While regional or local accessibility for Italy is sometimes studied (Lattarulo, 2009; De Montis et al., 2011; Cascetta et al., 2013) because more data is available at that scale and more interest is shown by the local authorities, the national dimension is barely known, with the relevant exception of Alampi and Messina (2011).

To do that, a detailed measure of potential accessibility for all of Italy has been built. The relative attraction power among cities is defined by population, private and public sector employees. Differently from most of previous applications, the impedance function is based on generalised cost instead of just travel time, thanks to a multimodal transport model that includes the entire Italian long-distance supply (roads, coaches, long-distance rail services, air services, and ferries). As most of the previous researches focus on single modes, the calculation of accessibility using multimodal measures is a challenging exercise (van Wee, 2016) and represents one of the main advancements of this work.

The paper is structured as follows. The next section will briefly introduce the geography of Italian transport, followed by Section 3, which revises the main accessibility indicators and comments on their meaning in terms of representativeness and consistency. Section 4

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[1] More in-depth, and sometimes also more detailed studies published by other subjects that are not connected to the Ministry of Transport are to be found (MCC, 2003; Banca d'Italia, 2011; Uniontrasporti, 2011), but the focus (infrastructure) and the data used (aggregated) are always the same.

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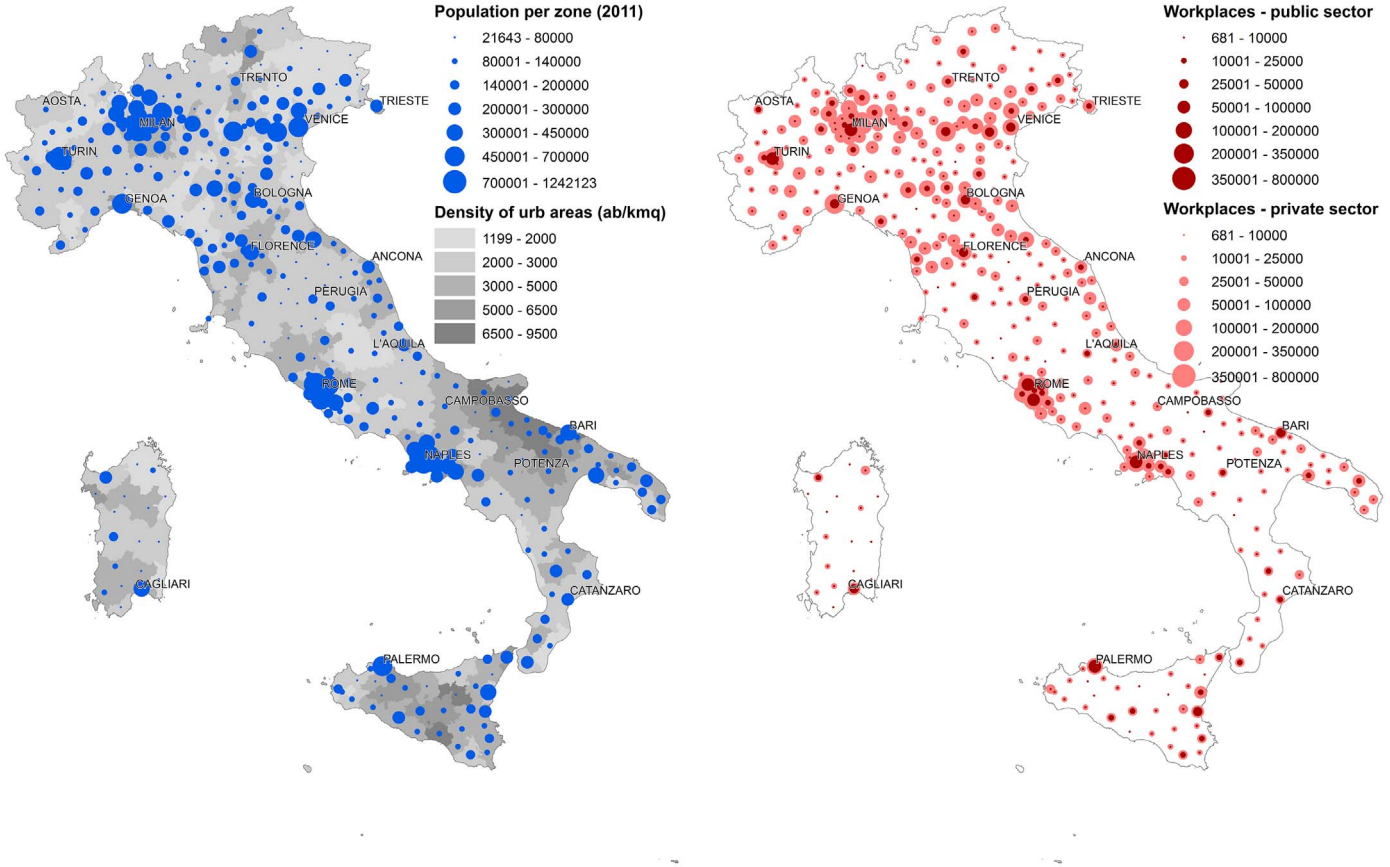

Fig. 1. Demographics of Italy. Left: population per zone and population density based on urbanised areas. Right: workplaces per zone, private and public sector. Source: our elaborations on 2011 census data.

introduces the methodology and the data used, while Section 5 computes the accessibility for Italy according to the chosen definition and includes a sensiticity analysis. Based on these results, which are partially counter-intuitive because they reveal the complexity of the geography of such a large-scale transport system, the Section 6 will provide some policy indications and Section 7 will conclude.

2. The geography of the Italian transport system

2.1. Population and cities

The Italian population is almost totally urbanised. Urban areas, however, present very different characteristics and densities.

Fig. 1, left, illustrates the areas where most of the population is concentrated, namely the conurbations of Milan, Rome and Naples, also characterised by high densities. Venice, Bologna and Florence areas present lower densities, but relatively large populations. The other main cities (Turin, Palermo, Bari, and Catania) are more isolated.

The pattern of workplaces, as shown in Fig. 1, right, presents some differences. Workplaces are more concentrated in the north, where there is also a lower incidence of public sector employment. This entails a more concentrated pattern of work trips to provincial and regional capital cities, while manufacturing in the north tends to be spread outside of core cities.

2.2. Transport supply

The Italian infrastructure network comprises some 19,000 km of railways, more than 180,000 km of supra-local roads (Uniontrasporti, 2011) and several other local and urban roads. In addition, there are a hundred airports, 37 of which are used for commercial traffic, as well as 16 commercial ports (out of more than 200 other ports). Rail and main roads are unevenly distributed along the country. In the northern regions the network structure is reticular, while in the peninsular part mainly follows coastlines.

The infrastructure alone is not sufficient to explain how the Italian transport system "works". With the exception of private transport, the quantity and characteristics of services determine the level of supply.

A minimum level of rail supply exists over the entire country, with the exception of mountainous areas. The capillarity of such systems, however, is low and usually only the main settlements are served. Rail services and network connectivity are higher in the North than in the rest of the country. In central and southern Italy, and along the international corridors across the Alps, supply is almost completely concentrated on the main lines (Beria et al., 2015).

Focusing on long distance trains (Fig. 2), regional differences decrease, but services are limited to fewer main lines. Many secondary lines and stations do not have any long-distance service, thus reducing the penetration of rail in medium and low-density territories.

The coach services network is a totally different scenario. Coaches are concentrated in the south and in a handful of individual cities in the centre-north (Beria et al., 2014), as shown in Fig. 3, left. This network is a legacy from the past, when coaches were just a complement to absent or ineffective rail services. However, this is changing rapidly with the ongoing liberalisation process (Grimaldi et al., 2017).

Finally, Fig. 3, right, shows the supply of domestic flights in terms of daily frequencies (Mon-Fri average). Rome Fiumicino is the main Italian airport, but this dominance makes the rest of central Italy devoid of other airports. The main southern cities have a comparable supply (Catania is the largest), complemented by a few secondary airports. The situation in the north is more complex, due to high fragmentation. Milan is the main example, with three airports of comparable dimension whose catchment areas partially overlap. This definitely increases the air accessibility of the served territories, but reduces the frequencies