THE URBAN TRANSITION OF ITALIAN MUNICIPALITIES: CAN CONNECTIVITY PLAY A ROLE?

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ABSTRACT

This study investigates the demographic landscape by analyzing urbanization, migration dynamics, and the impact of connectivity. Leveraging detailed Italian municipal-level data on population structure and migration patterns, and considering Italy's unique north-south demographic disparities, the research reveals distinct patterns in migration movements, especially emphasizing the growing appeal of non-urban settings. This study explores how improved connectivity bridges the urban-rural gap considering internet speeds as a key factor influencing migration dynamics. Our study contributes nuanced perspectives to migration studies and informs policy discussions, advocating for inclusive strategies that leverage technological advancements to foster balanced urban development and mitigate geographical disparities. It offers a robust foundation for understanding the intricate dynamics of migration, urbanization, and digital connectivity in modern societies, with Italy serving as a compelling case study.

BACKGROUND

Scholars have examined the interlinked trajectories of urbanization and demographic transition (Bocquier and Costa, 2015; De Vries, 2013; Dyson, 2011; Zelinsky, 1971), concluding that populations experiencing advanced phases of demographic transition are also more likely to achieve high levels of urbanization (Davis, 1965; de Vries, 2013; Dyson, 2011).

A large variability has been detected across countries and over time (Jiang and O'Neill, 2018). Authors debate to what extent the share of the urban population recently achieved by some African

countries (Farrell, 2017) may be compared to the changes experienced by industrialized countries in the past centuries (Davis, 1965; Cohen, 2004). Among the most disputed arguments is the role played by internal mobility and international migration as demographic components of population changes in rural areas and cities. Rowe et al. (2019) assessed how interactions between migration intensity and effectiveness of spatial settlements vary by urbanization level, from the initial stage, driven by rural-to-urban mobility to more recent counter-urbanization tendencies, characterized by urban-to-rural movements. Bell et al. (2015), Sánchez and Andrews (2011), and Champion et al. (2018) measured mobility intensities and revealed differences in trends. Some countries experienced a decrease while others maintained stability or even saw an increase (Bell et al. 2017). Recent cross-sectional data analyses (Charles-Edwards et al. 2017; Rodríguez-Vignoli, 2017) have confirmed transformations in the geography of mobility and migration, corresponding to distinct phases of urbanization. In certain periods of urbanization, factors such as housing market prices in urban centres and improvement in services and infrastructures in rural areas have contributed to the achievement of counter-urbanization phases (Sander, 2014, 2018; Stawarz et al., 2020). The decision to live in urban or rural areas is an individual choice that might be influenced by demographic and spatial patterns (Goujon et al., 2021; Ghio et al., 2022). Younger populations are often drawn to cities due to the concentration of services and job opportunities. By contrast, families with children may find sub-urban areas appealing because of greener surroundings and more affordable housing options. These differences may trigger different urbanization and suburbanization pathways (Monnat and Chandler, 2017): the spatial assimilation theory argues that integration starts when minority members move up to socio-economic ladders (Massey and Denton, 1985).

However, **policy attention has primarily focused on the governance of international migration, often overlooking other components of urbanization, such as rural-to-urban mobility** and natural change. These factors play a crucial role in shaping urban growth for several territories (Chen et al., 1998). Davis (1965) described the main drivers of urban population growth, distinguishing internal migration (the increase of movers towards the urban areas) from natural change (the surplus of birth over deaths becomes greater in urban areas) and potential reclassification effects. Menasche-Oren and Bocquier (2021) claim that, since the earliest phase of urban transition, the role of migration diminishes as the share of urban population increases. Against this theoretical background, the lack of harmonized data and completeness in time series availability has often limited empirical analyses to the national level. For instance, Rees et al. (2017) measure the impact of internal migration at the national level to gauge the role of migration in shaping changes in populations, while Billari (2022) derives the Migration Share of Turnover (MST) by examining the numbers of immigrants and emigrants and the components of national population changes during the reference period.

The aim of the paper is to measure the contribution of international migration and internal mobility at the local level to empirically establish the role of these demographic components in shaping the population distribution across local administrative units (municipalities). The results from this analysis are expected to improve our understanding of the spatial configuration of urban and rural settlements, shedding light on the extent to which urbanization dynamics interplay with population changes. In this vein, we also account for the disparity in connectivity as the contextual factor that, after the COVID-19 pandemic, has been recognized as a potential determinant of residential mobility (OECD, 2021).

Digital technologies have revolutionized people's lives and the widespread diffusion of the internet has had strong social and political implications (Castels, 2002). In this context, we posit that connectivity, in the sense of being able to have physical access to high-speed internet, might be a driver for population change reducing and overcoming the geographical divide between rural and urban cities. Studies conducted in US and Germany found that broadband access significantly increases female labour force participation (Dettling, 2017), the share of women reporting home- or part-time working, and untimely demographic decisions such as the choice to have another child (Billari, Giuntella, and Stella, 2019). According to the authors, access to high-speed internet allows women to reconcile work and motherhood more easily, which in turn promotes fertility. In this vein, we want to investigate the extent to which, in a context like Italy characterized by a significant geographical (north-south) and urban-rural divide, rural municipalities with improved internet access have seen changes in their demographic patterns.

THE CASE OF ITALY

Compared to other European countries, Italian society is characterised by strong family ties and a relatively weak social welfare system, which appear to favor immobility and discourage the Italian young generations from leaving their parents' homes (Dalla Zuanna, 2001). Nevertheless, net migration of the 20−24 age group shows a negative balance in the Italian southern municipalities and a positive one in northern municipalities (Ghio et al., 2022.b), but with a wide distribution across territories.

In addition to an urban-rural divide, the demographic landscape in Italy has historically been marked by significant geographical imbalances. Despite the low fertility rate and a negative natural balance, most northern regions have exhibited population growth in the last two decades, driven

by a positive migratory balance, while southern regions have faced a negative growth trend (Benassi et al, 2022). In this context, we aim to document the urban transition and population change across Italian macro-areas (corresponding to the European Union NUTS1 classification). Since the period of economic boom (1960s), both internal mobility and international migration have played crucial roles in shaping Italian society (Bonifazi, 2013; Golini, 1974). Internal mobility from the South toward the North and Central regions (Impacciatore and Strozza, 2016) on one side, and significant international migration flows towards the other European countries, North and South America (Golini, 1987) on the other side. However, the measurement of migration has often been affected by the lack of harmonized definitions and gaps in in time-series completeness. For instance, between 1926 and 1958, the Italian National Statistical Institute (ISTAT) gathered information on emigrations using coupons attached to passports applied to identify labor emigrants, while local authorities registered emigrants by the reasons of migration (Golini 1987, 2000).

DATA AND MEASURES

We use official figures provided by the ISTAT, which include age-specific population stocks and demographic components, births, deaths, migration, and mobility flows, available. These data are available at the municipal level and cover the period from 2011 to 2020. Data allow us to further distinguish between internal movements (i.e., movements within Italy, to/from another Italian municipality) and external movements (i.e., migrations to/from abroad). Datasets on population and migration flows were released following the requirements of ad-hoc data provision. The Degree of Urbanisation (DEGURBA[1]) classification established by the Eurostat has been

[1] Detailed information on how the degree of urbanisation is built can be found here https://ec.europa.eu/eurostat/web/degree-of-urbanisation/background

employed to categorize municipalities into three classes: “cities” (densely populated areas where at least 50% of the population lives in urban centers, which we will refer to as “urban” areas), “rural areas” (thinly populated areas where more than 50% of the population lives in rural grid cells) or “towns and suburbs” (for simplicity we will refer to these as “intermediate” areas).

Connectivity is assessed using internet download speeds sourced from Ookla's geolocated data, which reflects the actual Internet speeds experienced by users in each Italian municipality. Information on fixed internet network performance from 2019 is accessible through Ookla’s Open Data Initiative[2]. Data on internet performance before 2019 (specifically from 2016 to 2019) were obtained by the authors through a customized data provision agreement. We will categorize municipalities based on their internet speed into three groups: i) low-speed internet (i.e., no broadband or download speeds up to 6 Mbps); ii) medium-speed broadband service (up to 24 Mbps); and high-speed internet (25 Mbps and over)

METHODS

To measure the population change and its components we rely on a measure of population turnover discussed by Billari (2022).

For each municipality (k) in a specific year (*t)*, *Population Turnover Rate* (PTR) is defined as the algebraic sum of:

- crude annual birth rate (*b*),
- death rate (*d*),
- (internal) within-country in-mobility rate (*i*) (i.e., number of individuals who moved in the municipality *k* from another Italian municipality divided by total population),

[2] Information on Ookla network performance tests and the Open Data Initiative is available here https://www.ookla.com/ookla-for-good/open-data.

- across border im-migration (external im-migration *j*) (i.e., considering those arrived in municipality *k* from abroad),
- (internal) within-country out-mobility (*o).* (i.e., those who moved out of municipality *k* to move to another Italian municipality)
- and across border out-migration (external out-migration *m*) (i.e., those who moved out of municipality *k* to go abroad)

$$PTR_{k,t} = b_{k,t} + d_{k,t} + (i_{k,t} + j_{k,t}) + (o_{j,t} + m_{k,t})$$

While the numerical value of PTR cannot be interpreted per se, it must be seen in relative terms. The PTR can be interpreted as the speed of population change (Billari, 2022). Municipalities with a higher PTR have seen changes in their demographic landscape faster than municipalities with lower levels of PTR.

Based on PTR, it is possible to calculate the so-called *Migration Share of Turnover* (MST)

$$MST_{k,j} = \frac{(i_{k,t} + j_{k,t}) + (o_{k,t} + m_{k,t})}{PTR_{k,t}}$$

The MST is bounded between 0 to 100 and represents the proportion of population turnover attributable to in-flow and out-flow population movements. In municipalities with an MST above 50, population movements have a greater impact than birth and death in explaining demographic change. We can further distinguish between "MST internal" where we consider only internal movements (*i* and *o)* and "MST external" where we focus solely on movements to and from abroad (*j* and *k*).

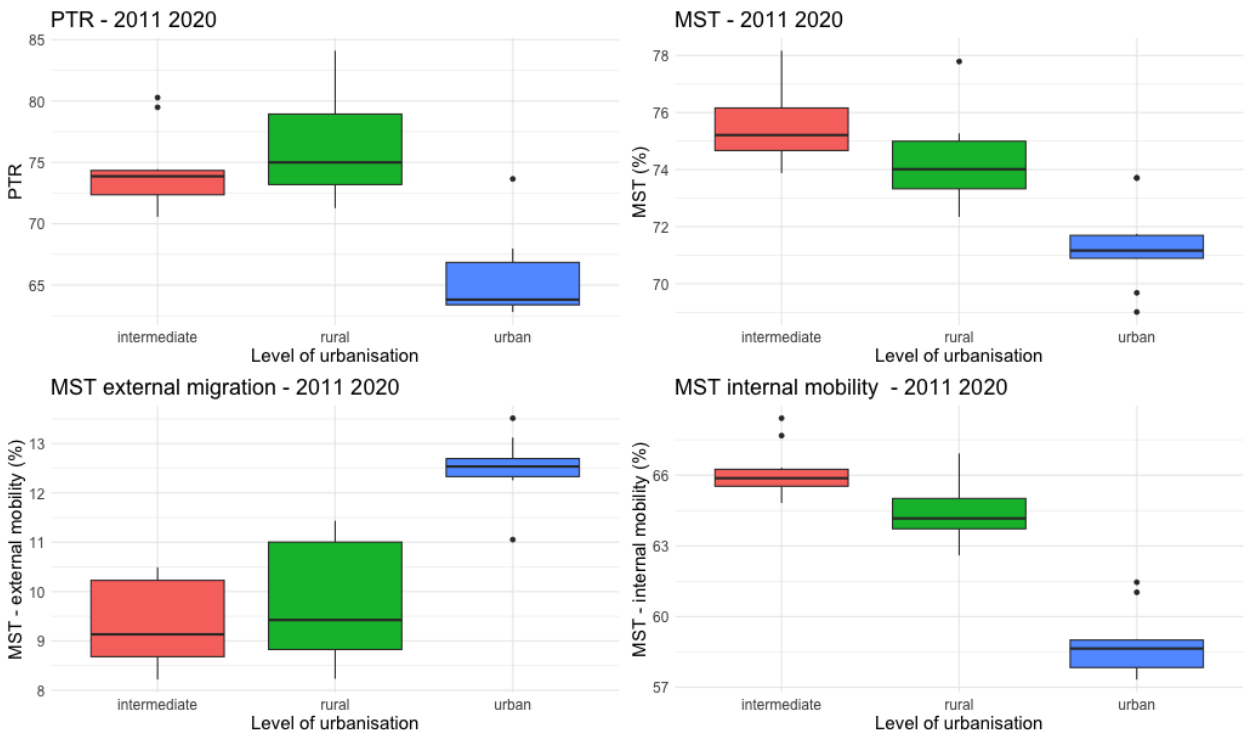
The analysis comprises two main steps. In the first discovery phase, we describe the levels of PTR and MST municipalities in Italy over the last decade, by the degree of urbanization. Subsequently, we will examine the extent to which the PTR/MST of a municipality is associated with its level of connectivity and assess the heterogeneity of this relationship based on the degree of urbanisation.

To do so, we will employ a local multiscale process (GWR geographically weighted regression) at the municipality level. Unlike conventional regression models, GWR allows us to explore potential spatial nonstationarity in relationships (see for instance Fotheringham, Charlton, and Brunsdon, 1996). In our cases, we will use GWR to investigate the relationship between connectivity and population change while considering the complex spatial in Italy, both in terms of the north-south and urban-rural dynamics.

PRELIMINARY RESULTS

Urban areas show significantly lower levels of Population Turnover (see Figure 1) concerning rural or intermediate municipalities with a PTR. In all three typologies, population movements account for more than 70% of the total population change with urban municipalities once again showing relatively lower levels. However, when distinguishing between internal and external population movements (bottom panels in Figure 1), we can clearly see two different trends. Urban cities are characterized by migratory movements to and from abroad (bottom left panel), while instead rural and intermediate areas see the predominant role of internal movements.

Figure 1. *Levels of Population Turnover and Migration Share by degree of urbanisation*.



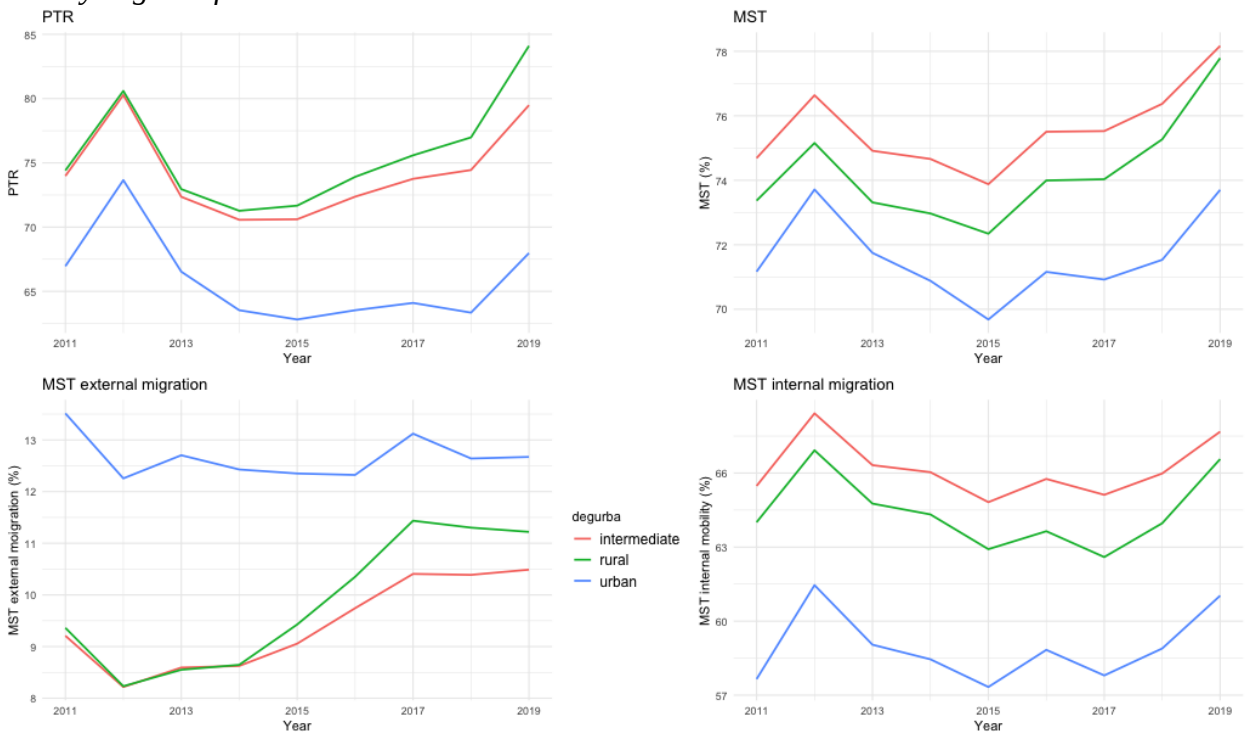
Note: Authors' elaboration based on ISTAT data. By external migration, we consider both in-migration from abroad and out-migration to abroad. By internal mobility, we consider both in-mobility from another Italian municipality and out-mobility towards another Italian municipality.

When examining these indicators over time (see Figure 2), we observe a very similar trend for rural and intermediate municipalities. The speed of population change measured by PTR increased almost linear after a flex in 2012 until 2019. Population change in urban settings remains relatively low throughout the entire period under observation.

The role of migratory movements become more and more relevant in explaining population change over time, especially after the 2016 migratory crisis in Italy. Distinguishing between internal and external movements reveals an interesting pattern. While in urban settings, the share of turnover due to migratory movements remains relatively stable over time, for non-urban municipalities, the share of population change due to in- and out-migration increases over time, closing the gap with the values observed for urban municipalities. This might be interpreted as an increasing appeal for

non-urban settings even for migrants. Until now, the favorite destination for migrants from abroad had been the big cities.

Figure 2. *The evolution of Population Turnover Rate and its component due to Migration over time by degree of urbanisation.*



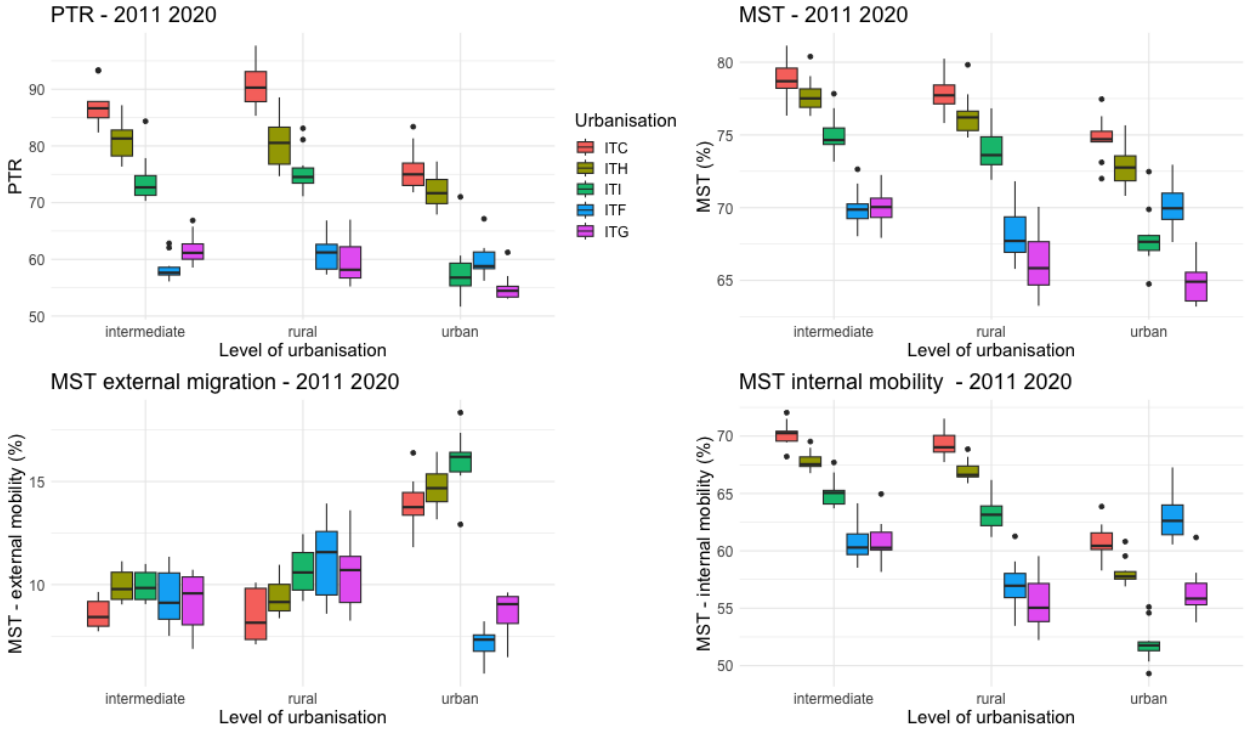
Note: Authors' elaboration based on ISTAT data. Rural municipalities in green. Urban in blue. Intermediate in red. By external migration, we consider both in-migration from abroad and out-migration to abroad. By internal mobility, we consider both in-mobility from another Italian municipality and out-mobility towards another Italian municipality.

North-South Divide

The north-south differences in demographic patterns remain evident, even when accounting for the level of urbanization (Figure 3). Particularly in rural and intermediate settings, the population change in the southern and island regions is significantly lower than that observed in the rest of the country.

The north-south divide becomes even more pronounced when we focus on the role of external migration in urban municipalities (see Figure 3, lower left panel). While moving to and from abroad accounts for less than 10% of the total population turnover in the south and islands, this value doubles in the northern regions. On the other hand, when examining internal movements (see Figure 3 lower right panel), in the south we still observe relatively high levels of mobility from urban cities, likely toward other urban cities in the norther part of the country.

Figure 3. *The Population Turnover Rate and its component due to Migration over time by degree of urbanisation and macro-areas.*



Note: Authors' elaboration based on ISTAT data. Macro Areas. ITC North-West in red. ITH North-East in olive. ITI Center in green. ITF South in blue. ITG Islands in pink. By external migration, we consider both in-migration from abroad and out-migration to abroad. By internal mobility, we consider both in-mobility from another Italian municipality and out-mobility towards another Italian municipality

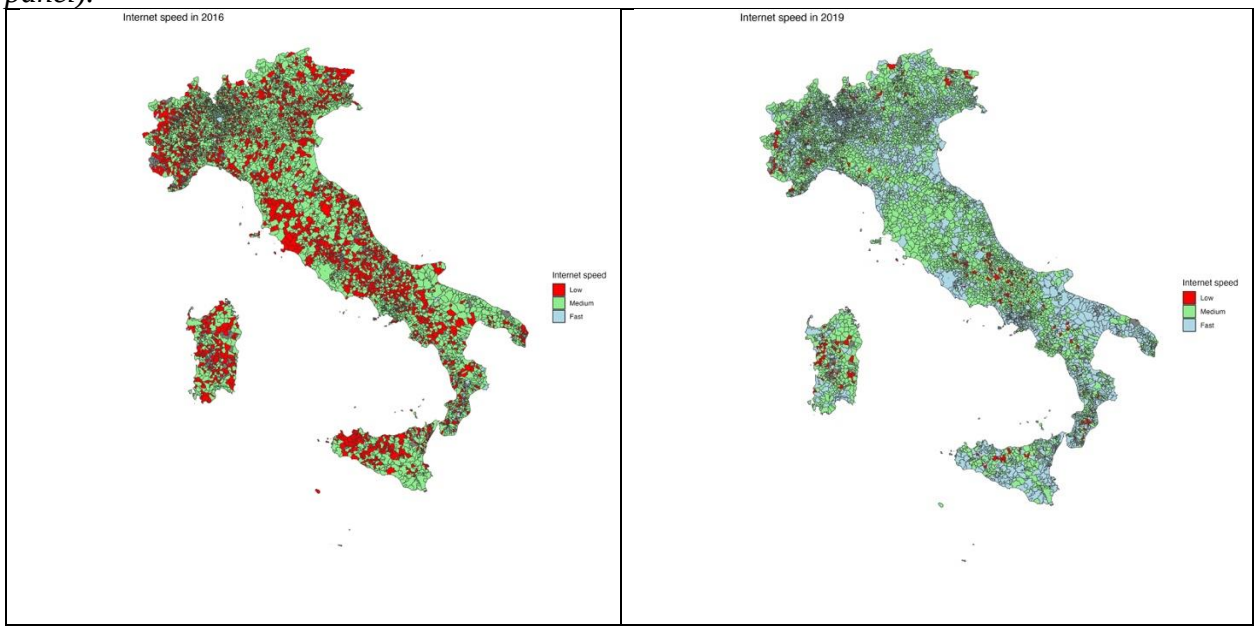
Internet Speed in Italy

Connectivity has seen a sharp improvement in Italy over the last few years (Figure 4). In 2016 in more than 35% of the municipalities, residents had access to "slow" internet – defined as an average download speed below 6 Mbps, and in 70 not even a broadband (below 1 Mbps) – on the other hand, only 68 municipalities had a "fast" broadband. In 2019 however, only 21 municipalities remained with a "slow" level of connectivity with more than 30% having access to a fast, or very fast (above 100 Mbps) internet.

Despite such relevant changes in the level of connectedness, a strong urban-rural divide remains. Nowadays (see Figure 4 right panel), municipalities with no broadband or very low internet speed are only in the rural part of the country.

Using spatial autoregressive models, we will leverage such temporal and geographical heterogeneity to estimate the contribution of the level of connectivity to (the speed of) demographic change (PTR levels) and migration patterns (MST).

Figure 4. *Average internet speed in Italian municipalities in 2016 (left panel) and 2019 (right panel).*



Note. Authors' elaborations based on Ookla data on fixed internet download speed. In red the municipalities with an average Mbps below 6 ("slow internet"), in green a Mbps between 6 and 24 (basic/medium broadband speed), in light blue above 25 (fast broadband)

ABRIDGED CONCLUSIONS AND NEXT STEPS

In countries experiencing advanced demographic transition, mobility and migration can be seen as crucial factors in mitigating the effects of aging. Yet, the lack of data comparability and the absence of robust comparative metrics have posed significant challenges in understanding the spatial impact of migration dynamics on population changes. In this paper, we sought to address these gaps by utilizing official statistics on populations and migration flows at the municipality level in Italy. Additionally, we will explore the role of connectivity, specifically internet speed availability, as a potential mechanism for reducing the gap between urban and rural areas, particularly in developed countries. Italy serves as a significant case study with several rural areas that still face challenges due to their remoteness from facilities and networks. Nevertheless, the well-established migration and mobility patterns of gains in the north and losses in the south of Italy may have been influenced by connectivity. There is limited evidence regarding the persistence of these patterns and how they may be reflected in counter-urbanization tendencies. Expanding connectivity to achieve an inclusive society has been at the heart of the policy agenda in all countries. Our study aims to contribute empirical evidence to the policy debate, shedding light on how connectivity can reshape spatial concentration and urban development.

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SUPPLEMENTARY MATERIALS

Figure S.1. *The evolution of Population Turnover and Migration Share of Turnover since 2010 by degree of urbanisation and macro-areas.*

Note: Authors' elaboration based on ISTAT data. Macro Areas. ITC North-West in red. ITH North-Eeast in olive. ITI Center in green. ITF South in blue. ITG Islands in pink. The change in pattern observed in 2020 in any municipality typology is simply due to a change in the way Italian National Office reports population count.

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